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Final Environmental Impact Stateme
the Continued Operation of the Pantex Plai
Associated Storage of Nuclear Weapon Compo

Volume I–Main

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Washington,

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RESPONSIBLE AGENCIES:

Lead Federal Agency: U.S. Department of Energy (DOE)
Cooperating Federal Agency: U.S. Department of the Air Force

TITLE:

Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components, located in Carson County, Texas (DOE/EIS–0225)

CONTACTS:

For further information on this Environmental Impact Statement (EIS) call 1–800–788–0306, fax 1–800–822–5499, or contact:

Ms. Nanette D. Founds
Pantex EIS Project Manager
EIS Project Office
U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87185–5400
(505) 845–4212

For further information on the U.S. Department of Energy NEPA process call 1–800–472–2756 or contact:

Ms. Carol Borgstrom
Director
Office of NEPA Policy and Assistance (EH–42)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
(202) 586–4600

ABSTRACT:

This document assesses the potential environmental impacts over approximately 10 years of continued operation of Pantex Plant, including foreseeable projects and activities. For Pantex Plant, this document assesses the alternatives of No Action, Relocation of the storage of plutonium components (pits) resulting from nuclear weapon disassembly activities at Pantex Plant to another site, and the Proposed Action (Preferred Alternative) of continuing operations and increasing the quantity of pits in interim storage at Pantex Plant. For the Pit Storage Relocation Alternative, this document also assesses the potential environmental impacts to three DOE candidate sites and one Department of Defense candidate site that could be selected for the relocation of the nuclear component storage activities from Pantex Plant. Evaluations of site infrastructure, land resources, geology and soils, water resources, air quality, acoustics, biotic resources, cultural resources, socioeconomic resources, intrasite transportation, waste management, human health, aircraft accidents, and environmental justice for Pantex Plant and the candidate sites are included in the assessment. The intersite transportation of nuclear and hazardous materials is also assessed.

PUBLIC COMMENTS:

In preparing the Final EIS, DOE considered comments received by mail, fax, e-mail, handed in at hearings, or transcribed from telephone messages. In addition, interactive public hearings were held in April, May, and June 1996 at the following locations where comments and concerns identified during discussions were transcribed: Amarillo, Texas; North Las Vegas, Nevada; North Augusta, South Carolina; Albuquerque, New Mexico; and Richland, Washington.

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List of Acronyms and Abbreviations

CWA	Clean Water Act
CY	Calendar Year
DAF	Device Assembly Facility
DCG	Derived Concentration Guidelines
D&D	Decontamination and Decommissioning
DEIS	Draft Environmental Impact Statement
DNA	Defense Nuclear Agency
DNL	Day-Night Average Sound Level
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of Interior
DOT	Department of Transportation
DPTRA	Defense Programs Transportation Risk Analysis
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ER	Environmental Restoration
ERAD	Explosive Release Atmospheric Dispersion
ERPG	Emergency Response Planning Guidelines
ES&H	Environment, Safety, and Health
ESL	Effects Screening Level
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEIS	Final Environmental Impact Statement
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Act
FFTF	Fast Flux Test Facility
FICA	Federal Insurance Contributions Act
FM	Farm-to-Market Road
FMEF	Fuels and Materials Examination Facility
FPPA	Farmland Protection Policy Act
FWS	Fish and Wildlife Service
FY	Fiscal Year
GAd	Gross Alpha—dissolved
GAs	Gross Alpha—suspended

GBd	Gross Beta—dissolved
GBs	Gross Beta—suspended
GPS	Global Positioning System
HAP	Hazardous Air Pollutant
HE	High Explosive(s)
HEPA	High Efficiency Particulate Air
H-Gear	Weapons-Specific Handling Gear
HHS	Health and Human Services
HVAC	Heating, ventilation, and air conditioning
HLW	High-Level Waste
HPCAF	Health Physics Calibration and Acceptance Facility
HW	Hazardous Waste
HWTPF	Hazardous Waste Treatment and Processing Facility
ICM	Interim Corrective Measure
ICRP	International Commission on Radiological Protection
IHE	Insensitive High Explosive
ILS	Instrument Landing System
IO	Isolated Occurrence
ISC	Industrial Source Complex
ISCLT2	Industrial Source Complex Long Term, Version 2
ISCST2	Industrial Source Complex Short Term, Version 2
IST	In-Service Training
JCO	Justification for Continued Operation
JTA	Joint Test Assembly
KAFB	Kirtland Air Force Base
LANL	Los Alamos National Laboratory
LCF	Latent Cancer Fatality
LDR	Land Disposal Restrictions
L_{eq}	Equivalent Sound Level
LLNL	Lawrence Livermore National Laboratory
LLMW	Low-Level Mixed Waste
LLW	Low-Level Radioactive Waste
LWR	Light Water Reactor
MACCS	Melcor Accident Consequence Code System
MACT	Maximum Achievable Control Technology
MCAF	Materials Compatibility Assurance Facility
MCL	Maximum Contaminant Level

MDL	Method Detection Limit
MELTER	Model of the Thermal Response of Cargos Transported in the Safe-Secure Trailer Subject to Fire Environments for Risk Assessment Applications
MEOI	Maximally Exposed Offsite Individual
MOBILE 5a	Mobile Source Emission Factor Model, Version 5a
MOU	Memorandum of Understanding
MR	Modified Richmond
MSA	Metropolitan Statistical Area
MTU	Mobile Treatment Unit
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
ND	No Damage
NDEF	Nondestructive Evaluation Facility
NDRC	National Defense Research Committee
NE	Northeast
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFA	No Further Action
NHPA	National Historic Preservation Act
NHW	Nonhazardous Waste
NIOSH	National Institute for Occupational Safety and Health
NLR	Noise Level Reduction
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NTS	Nevada Test Site
OB/OD	Open Burning/Open Detonation
O&I	Operations & Inspection
OMB	Office of Management and Budget
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
OSTP	Old Sewage Treatment Plant
OU	Operable Unit
PA	Programmatic Agreement

PBX	Plastic Bonded Explosives
PEIS	Progammatic Environmental Impact Statement
PIDAS	Perimeter Intrusion Detection and Alarm System
PL	Public Law
PPOA	Pollution Prevention Opportunity Assessment
PP/WM	Pollution Prevention/Waste Minimization
PRG	Preliminary Remediation Goal
PRA	Probabilistic Risk Assessment
PSD	Prevention of Significant Deterioration
QA/QC	Quality Assurance/Quality Control
RAMS	Radar Airspace Monitoring System
R&D	Research and Development
RBC	Risk Based Concentrations
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RHWSF	RCRA Hazardous Waste Staging Facility
RIMS II	Regional Input-Output Modeling System
RMMA	Radioactive Materials Management Areas
ROD	Record of Decision
ROI	Region of Influence
RRS	Risk Reduction Standard
RTG	Radioisotopic Thermoelectric Generator
S&D	Storage and Disposition
SAC	Steel Arch Construction
SAR	Safety Analysis Report
SARA	Superfund Amendments and Reauthorization Act
SARP	Safety Analysis Report for Packaging
SCDHEC	South Carolina Department of Health and Environmental Control
SDWA	Safe Drinking Water Act
SF	Slope Factor
SHPO	State Historic Preservation Office
SNL	Sandia National Laboratories
SNM	Special Nuclear Material
SPF	Standard Project Flood
SRS	Savannah River Site
SSM	Stockpile Stewardship and Management
SST	Safe Secure Tractor Trailer

STAR	Stability Array
START II	Strategic Arms Reduction Treaty
STP	Site Treatment Plan
SVOC	Semivolatile Organic Compound
SWDA	Solid Waste Disposal Act
SWEIS	Site Wide Environmental Impact Statement
SWMU	Solid Waste Management Unit
T&E	Threatened and Endangered
TAC	Texas Administrative Code
TACB	Texas Air Control Board
TBEG	Texas Bureau of Economic Geology
TCP	Traditional Cultural Property
TDCJ	Texas Department of Criminal Justice
TDH	Texas Department of Health
TDS	Total Dissolved Solids
TNRCC	Texas Natural Resources Conservation Commission
TOX	Total Organic Halogen
TPWD	Texas Parks and Wildlife Department
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSD	Transportation Safeguards Division
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
TTU	Texas Tech University
USDA	U.S. Department of Agriculture
UST	Underground Storage Tank
U.S.	United States
U.S.C.	United States Code
UTL	Upper Tolerance Limit
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound
VOR	Very High Frequency Omni-Directional Radio Range
VORTAC	Very High Frequency Omni-Directional Radio Range with Tactical Air Navigation
VSI	Visual Site Inspection
WAC	Waste Acceptance Criteria
WM PEIS	Waste Management Programmatic Environmental Impact Statement
WSA	Weapons Storage Area

WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant
XTX	Extrudable Explosive

STAR
START II
STP
SVOC
SWDA
SWEIS
SWMU
T&E
TAC
TACB
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TCP
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CHEMICALS AND UNITS OF MEASURE

Be	beryllium
BGY	billion gallons per year
BOD	Biological Oxygen Demand
°C	degrees Celsius
Ca	calcium
Ci	Curie
CCl_4	carbon tetrachloride
CO	carbon monoxide
CFC	chlorofluorocarbons
CFC-12	dichlorodifluoromethane
CFC-113	trichlorotrifluoroethane
cm	centimeter
Cs	cesium
D	deuterium
d	day
dB	decibel
dBA	decibel A-weighted scale
dBC	decibel C-weighted scale
DCE	1, 2-dichloroethylene
DDT	dichlorodiphenyltrichloroethane
DU	depleted uranium
°F	degrees Fahrenheit
ft	feet
ft^2	square feet
ft^3	cubic feet
ft^3/s	cubic feet per second
g	gram
gal	gallon
gpd	gallons per day
g/sec	gram per second
H	hydrogen
H^3	tritium
ha	hectare

HCFC-22	chlorodifluoromethane
HCl	hydrochloric acid
HEU	highly enriched uranium
HF	hydrogen fluoride
HMX	high melt explosive
hr	hour
Hz	Hertz
in	inch
K	kelvin
kg	kilogram
km	kilometer
km^2	square kilometers
km/hr	kilometers per hour
kV	kilovolt
kVA	kilovoltampere
kW	kilowatt
kWh	kilowatt hour
lb	pound
lb/hr	pounds per hour
lb/yr	pounds per year
L	Liter
Li	lithium
LX	press-moldable HMX
M	million
m	meter
m^2	square meters
m^3	cubic meters
mCi	millicurie (one-thousandth of a Curie)
mCi/g	millicurie per gram
mCi/ml	millicurie per milliliter
mg	milligram (one-thousandth of a gram)
mg/L	milligram per liter
MGD	million gallons per day
MGY	million gallons per year
mi	miles
ml	milliliter
MOX	mixed oxide

SO_2	sulfur dioxide
SO_x	sulfur oxides
sq	square
Sr	strontium
T	tritium
TATB	triaminotrinitrobenzene
TCA	1, 1, 1-trichloroethane
TCE	trichloroethene
Th	thorium
TNB	trinitrobenzene
TNT	trinitrotoluene
TOC	total organic compounds
TOX	total organic halogen
U	uranium
UL	Underwriter's Laboratory
yd	yard
yd^3	cubic yards
yr	year
µCi	microcurie (one-millionth of a Curie)
µCi/g	microcuries per gram
µg	microgram (one-millionth of a gram)
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
µm	micron or micrometer (one-millionth of a meter)
µohms/cm	micromhos per centimeter

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METRIC CONVERSION CHART

TO CONVERT INTO METRIC			TO CONVERT OUT OF METRIC		
IF YOU KNOW	**MULTIPLY BY**	**TO GET**	**IF YOU KNOW**	**MULTIPLY BY**	**TO GET**
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Area					
sq. inches	6.4516	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.092903	sq. meters	sq. meters	10.7639	sq. feet
sq. yards	0.8361	sq. meters	sq. meters	1.196	sq. yards
acres	0.40469	hectares	hectares	2.471	acres
sq. miles	2.58999	sq. kilometers	sq. kilometers	0.3861	sq. miles
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.45385	kilograms	kilograms	2.2034	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons
Temperature					
Fahrenheit	Subtract 32, then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

METRIC PREFIXES

PREFIX	SYMBOL	MULTIPLICATION FACTOR	PREFIX	SYMBOL	MULTIPLICATION FACTOR
exa-	E	1 000 000 000 000 000 000 = 10^{18}	deci-	d	0.1 = 10^{-1}
peta-	P	1 000 000 000 000 000 = 10^{15}	centi-	c	0.01 = 10^{-2}
tera-	T	1 000 000 000 000 = 10^{12}	milli-	m	0.001 = 10^{-3}
giga-	G	1 000 000 000 = 10^{9}	micro-	µ	0.000 001 = 10^{-6}
mega-	M	1 000 000 = 10^{6}	nano-	n	0.000 000 001 = 10^{-9}
kilo-	k	1 000 = 10^{3}	pico-	p	0.000 000 000 001 = 10^{-12}
hecto-	h	100 = 10^{2}	femto-	f	0.000 000 000 000 001 = 10^{-15}
deka-	da	10 = 10^{1}	atto-	a	0.000 000 000 000 000 001 = 10^{-18}

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CHAPTER 1

Introduction

CHAPTER 1
INTRODUCTION

This chapter provides background information to facilitate a general understanding of operations conducted at Pantex Plant, the circumstances that resulted in the preparation of this Environmental Impact Statement (EIS), and the types of analyses that are presented in subsequent chapters. Chapter 1 begins with an overview of Pantex Plant, including a brief history and description of its current mission. Following this overview is a discussion of the evolution of this EIS, the decision making process, significant issues addressed in the EIS, related environmental studies, interagency cooperation, and agency consultations for implementing the alternatives. The chapter concludes with a summary of the subjects covered in other chapters of this EIS.

1.1 INTRODUCTION

The Department of Energy (DOE) (the Department) is the Federal agency responsible for ensuring the safety, reliability, and effectiveness of the Nation's nuclear deterrent. The Department's Stockpile Stewardship and Management Program integrates the expertise and capabilities of three national laboratories, four plant sites, and a field testing site to accomplish this mission. Pantex Plant is an essential element in the program and its continued operation and associated storage of nuclear components are the subjects of this Environmental Impact Statement (EIS). A major aspect of this EIS is to assess the environmental impacts of increasing the number of plutonium components (called "pits") that are to be placed in interim storage as a result of ongoing weapons dismantlement operations.

This chapter provides the foundation for understanding the nature of Pantex Plant and its specific missions, the decisions that the Department faces, and the facts that bear upon these decisions. The chapter begins with a site description and a discussion of the history and mission of Pantex Plant. This is followed by a summary of the origin of this study and changes that have occurred as the EIS has evolved. Subsequent sections address the decision making process and decisions that are to be made, public involvement in identification of issues through the scoping process, the interagency cooperation in the development of this EIS, and agency consultations for implementing the alternatives.

1.2 PANTEX PLANT OVERVIEW

Pantex Plant is located in the Texas Panhandle, approximately 27 kilometers (17 miles) northeast of Amarillo, Texas (Figure 1.2–1). Pantex Plant is bounded on the north by Texas Farm-to-Market Road (FM) 293, on the east by FM 2373, and on the west by FM 683. To the south, DOE-owned property extends to within 1.6 kilometers (1 mile) of United States (U.S.) Highway 60 (Figure 1.2–2).

Pantex Plant Site consists of land owned and leased by DOE. DOE owns approximately 3,683 hectares (9,100 acres) at Pantex Plant proper and 436 hectares (1,077 acres) of detached property, called Pantex Lake, approximately 4 kilometers (2.5 miles) northeast of the main plant site. Pantex Plant operations near its southern boundary require DOE to lease approximately 2,347 hectares (5,800 acres) of land between the plant and U.S. Highway 60 from Texas Tech University (TTU), primarily for safety and security buffer areas. DOE also leases a small facility at the Amarillo International Airport for its own

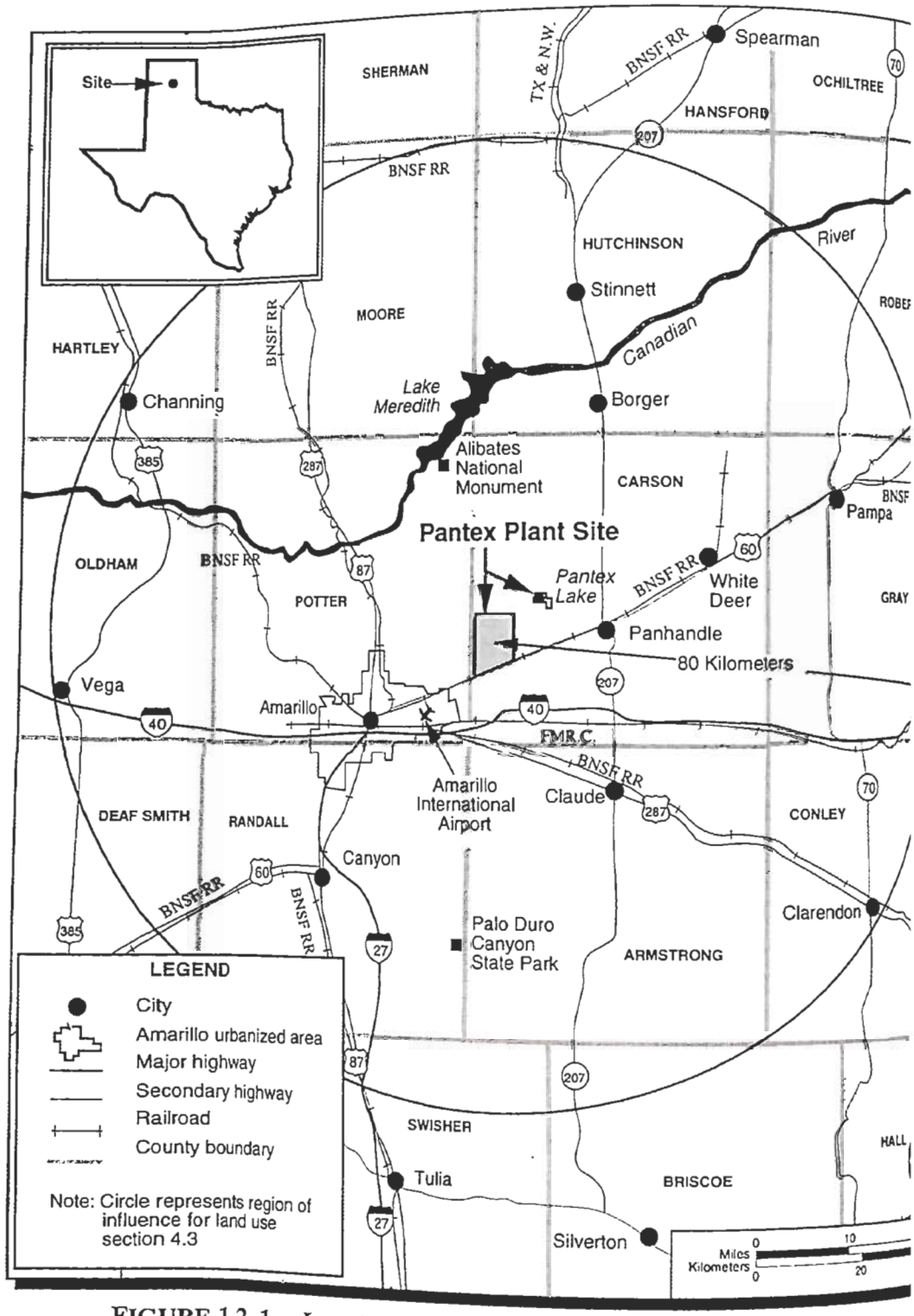
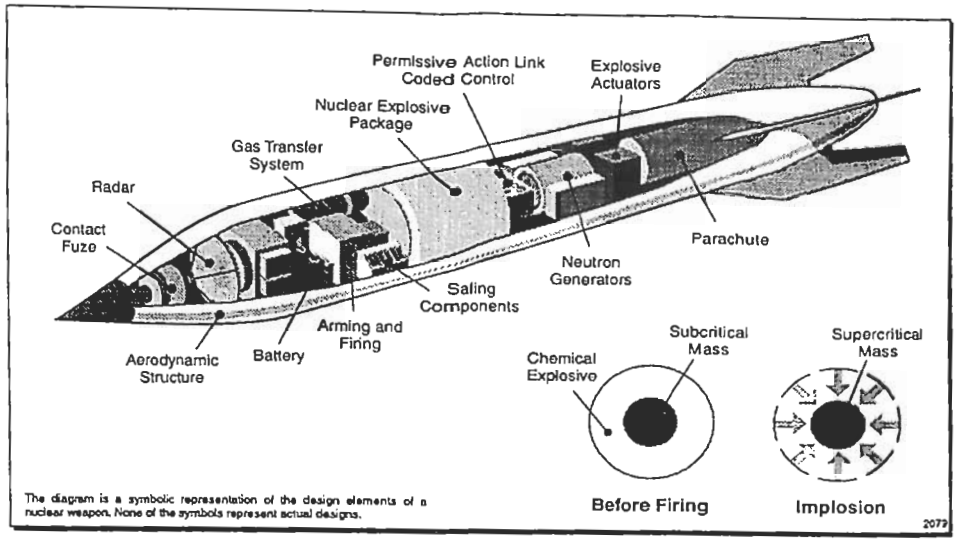


FIGURE 1.2–1.—*Location of Pantex Plant Site in the Texas Panhandle.*

:lear explosions are duced by initiating and taining nuclear chain ctions in highly compressed terial that can undergo both ion and fusion reactions. ost modern nuclear weapons a nuclear package with two emblies: the primary embly, which is used as the tial source of energy; and the condary assembly, which ovides additional explosive ergy release. The primary sembly contains a central re, called the "pit", which is rrounded by a layer of high plosive. The "pit" is typically mposed of plutonium-239 and her materials.



Primary Detonation

The primary nuclear explosion is initiated by detonating the layer of chemical high explosive that surrounds the pit which in turn drives the pit material into a compressed mass at the center of the primary assembly. This implosion process is illustrated in the inset of the diagram.

Boosting

In order to achieve higher explosive yields from primaries with relatively small quantities of pit material, a technique called "boosting" is used. Boosting is accomplished by injecting a mixture of tritium (T) and deuterium (D) gas into the pit. The deuterium and tritium are stored in high-pressure reservoirs until the gas transfer system is initiated. The implosion of the pit and the onset of the fissioning process heat the D–T mixture to the point that the D–T atoms undergo fusion. The fusion reaction produces large quantities of very high energy neutrons which flow through the compressed pit material and produce additional fission reactions.

Secondary Activation

The energy released by the primary explosion activates the secondary assembly. The secondary assembly is composed of lithium deuteride and other materials. As the secondary assembly implodes, lithium in the isotopic form lithium-6 is converted to tritium by neutron interactions. The tritium product in turn undergoes fusion with the deuterium to create the thermonuclear explosion.

Nonnuclear Components

Nonnuclear components include contact fuzes, radar components, aerodynamic structures, arming and firing systems, gas transfer systems, permissive action link coded controls, neutron generators, explosive actuators, safing components, batteries, and parachutes.

FIGURE 1.2.2–1.—*Nuclear Weapons Design.*

components in weapon-like configurations that are delivered to the Department of Defense (DOD) for flight testing under field conditions. In these JTAs, the physics package, consisting of the cased HE and nuclear materials components of the nuclear weapon, is replaced with electronic equipment that monitors the desired test functions and simulates the unit mass.

As previously mentioned, Pantex Plant would continue to maintain the capabilities necessary to assemble new nuclear weapons in the future.

Disassembly of Nuclear Weapons

Weapons returned to Pantex Plant for disassembly are received, inspected, and staged in magazines at Zone 4 West preparatory to beginning the actual disassembly process. The disassembly of nuclear weapons is performed within the bays and cells of Zone 12. Disassembly includes the following activities:

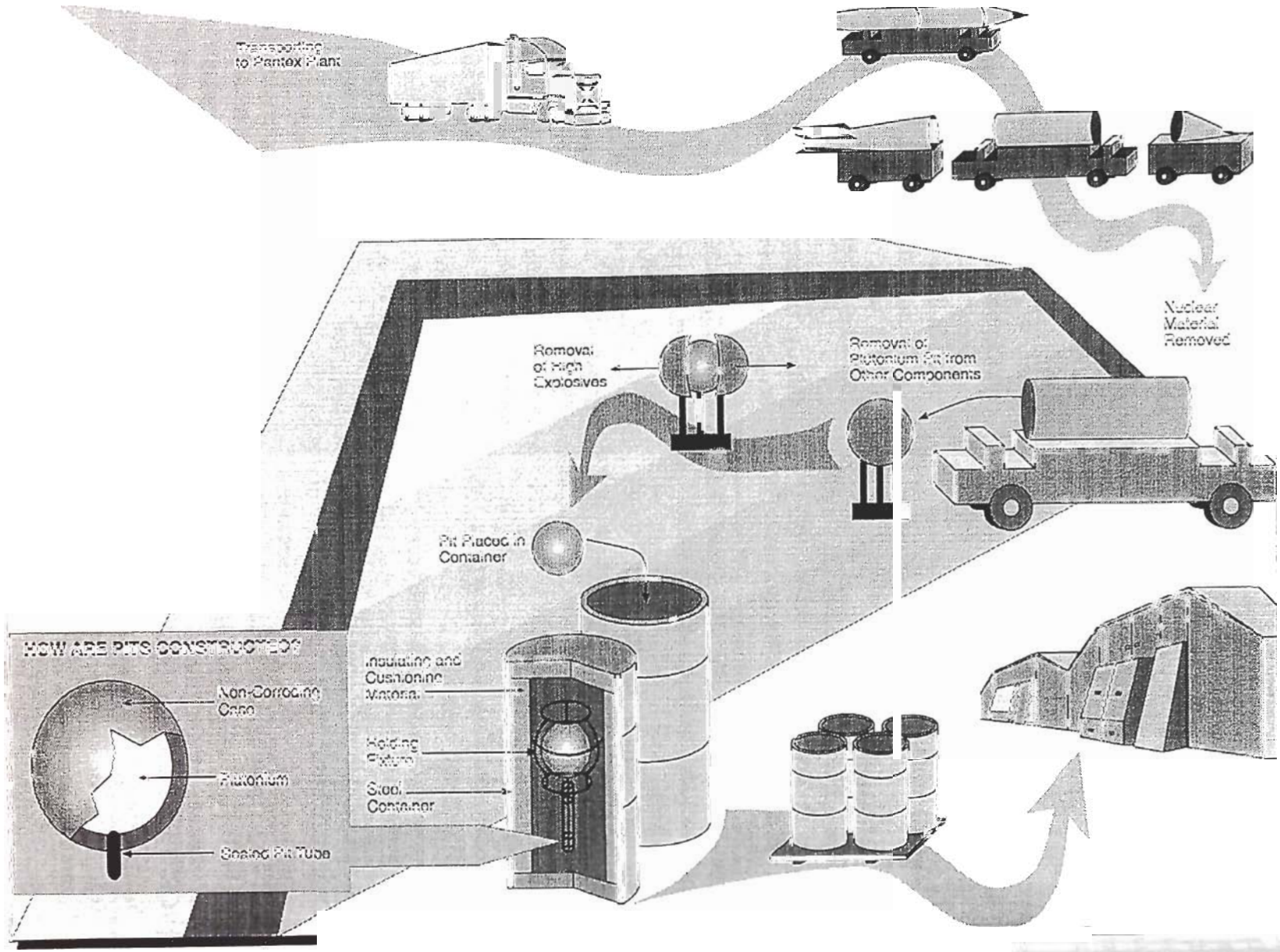
- Weapons staging in Zone 4, which includes inspection and verification after receipt from DOE.
- A variety of specialty operations (e.g., X-ray examinations, leak testing, coding, packaging, painting, verification, etc.) in special purpose bays.
- Mechanical disassembly operations in bays.
- Nuclear disassembly operations in cells.
- Demilitarization and sanitization of weapon components, which includes grinding, crushing, and open-air burning.
- Packaging and shipping HEU and tritium components to Oak Ridge Reservation (ORR) and Savannah River Site (SRS).
- Interim storage of pits at Pantex Plant.
- Segregation of waste products into non-hazardous, hazardous, low-level radioactive, and low-level mixed waste categories.

Final package dismantlement begins in an assembly/disassembly bay by performing a series of verification steps to ensure that the weapon is in a safe condition and internal components are intact. The steps include tritium monitoring, electrical system test, gamma spectrometry safeguards verification, and a radiographic verification of the weapon status system.

Next, warheads are removed from the final package container and the mechanical assembly is separated. The mechanical weapon disassembly entails removing the components for arming, fusing, and firing systems; the neutron generators; the gas transfer system; and the outer weapon case.

Finally, the physics package dismantlement is accomplished in an assembly/disassembly cell by opening the case, removing the HE/pit subassembly and other components, and separating the HE main charge from the nuclear pit. The physics package may require a radiographic inspection for an evaluation before disassembly. The balance of the weapon dismantlement function involves managing the various weapon parts such as mechanical, gas transfer, and electrical components. These parts may be recertified and staged for reuse, shipped to the originating vendor site for evaluation or disposition, or demilitarized and sanitized at Pantex Plant. A diagrammatic representation of the weapons dismantlement process is shown in Figure 1.2.2.1–1.

Many nuclear weapon components and items cannot be considered for discard or disposal until demilitarization and sanitization activities are performed. Demilitarization and sanitization are manufacturing activities used to remove classified and other nuclear proliferation-sensitive information. These activities include thermal shock, thermal treating, machining, granulation, melting, mechanical crushing, fluid jet machining, chemical dissolution, grinding, cutting, or chipping and actuation.


Transporting to Pantex Plant
Nuclear Material Removed
Removal of High Explosives
Removal of Plutonium Pit from Other Components
Pit Placed in Container
Insulating and Cushioning Material
Holding Fixture
Steel Container
HOW ARE PITS CONSTRUCTED?
Non-Corroding Case
Plutonium
Sealed Pit Tube

Modification and Maintenance of Nuclear Weapons

Weapons remaining in the stockpile that require maintenance or modification are returned to Pantex Plant. Modification and maintenance activities can range from replacement of limited life components to almost total rebuilds for the purpose of retrofitting or upgrading the weapons (e.g., for improved safety or enhanced security features).

Stockpile Evaluation

Stockpile evaluation involves the disassembly and evaluation of pre-selected weapons returned from DOD. The main purpose of stockpile evaluation is to determine the reliability of the weapon system based on the test results of a representative sample of each weapon system in the stockpile. The weapons returned for evaluation are divided into two categories, laboratory tests and flight tests. Following evaluation, some of the weapons are rebuilt and returned to the stockpile. As part of the laboratory tests, select weapon systems are exposed to variable temperatures for prolonged time periods to simulate environmental conditions that the weapons could be subject to during their lifetimes. This type of test is referred to as aging studies. Aging studies are conducted in environmental chambers located in Buildings 12–94 and 12–104A. Currently, these environmental chambers are not in use. Prior to use, these environmental chambers will be subject to review under NEPA and site safety management systems.

Quality Assurance Testing of Weapons Components

To maintain the reliability of the Nation's nuclear weapons stockpile, a certain number of preselected weapons from each type of weapon are returned to Pantex Plant each year for component surveillance testing and evaluation. Weapons are evaluated in a selective dismantlement process whereby certain components are physically removed from the weapon, assembled into specified test configurations, and subjected to electrical and/or explosives testing.

Research and Production of High Explosives and Weapons Components

Pantex Plant researches the physical and chemical characteristics of the used parts in nuclear weapons. Highly specialized explosive main charges and initiation systems are required for a weapon to produce a nuclear explosion. Research at Pantex Plant includes the use of insensitive HE for increased safety as well as refinement of HE manufacturing methods and safety procedures. Pantex Plant performs HE synthesis, formulation, machining, extrusion, testing, process development, and analytical operations in performing its HE research and development and production missions. These operations are performed in Zone 11 or Zone 12 using HE materials stored in Zone 4 East.

The products of manufacturing operations are explosive main charges, small explosive components, and other highly specialized explosive materials. Main charge subassemblies are emplaced in the physics package of a nuclear explosive during the weapon assembly process. Various small explosive subassemblies and pellets are produced from explosives, metal or plastic components, electrical components, hardware, assembly materials, and small explosive components that are manufactured offsite. Punch and die pressing, laser welding, explosive extrusion loading, and mechanical assembly of HE are some of the functions carried out at Pantex Plant. Currently, most explosives components are made for modification, random testing, and maintenance of stockpile weapons.

In March 1994, a formal literature search was conducted to investigate treatment/processing methods for HE other than OB/OD. The review identified processes currently in use (e.g., OB/

chemical treatment), as well as those in stages of development. A Best le Control Technology (BACT) analysis emissions from explosives treatment at Plant Burning Ground was conducted cumented in a DOE letter to the Texas Resources Conservation Commission C) dated October 15, 1993. The BACT concluded that controlled open thermal nt with existing administrative controls ited BACT.

ubsequent study, the alternatives were ined to be either technically infeasible ntex Plant explosives or economically ble on a cost-per-unit mass of air nts that could be controlled (Radian). The alternative emerging explosive ent technologies were identified as: ced thermal treatment methods (i.e., salt destruction, supercritical water ion, and advanced plasma incineration), cal/biological treatment methods (e.g., hydrolysis, chemical/electrochemical ion, and biological oxidation), and sives recovery/reuse technologies (e.g., l fluid extraction, explosives as emental fuels, and solvent recovery).

1994, the development of refined dures for HE chemical treatment has nted the further investigation of a base lysis treatability study program to be d in Building 11–36. Though the most nonly generated HEs resulting from antlement processes are HMX based, this bility study can accommodate other types E (e.g., RDX, TNT, HNS, TATB, and some eir respective formulations).

native methods to open burning-open ation of HE are summarized in appendix Recycling and commercial use of Pantex t explosives are currently utilized to reduce ing Ground activities.

Interim Storage of Pits

Once the pit is removed from the weapon, stored at Pantex Plant as an interim meas The term "interim storage" does not refer specific timeframe, but rather to the interv time which will occur until a Record of Deci (ROD) is made on long-term storage and site and facilities selected in that ROD are r to receive the pits. The decision on the site facilities for long-term pit storage will be b on analyses in the *Long-Term Storage Disposition of Weapons-Usable Fi Materials Programmatic Environmental Im Statement* (S&D PEIS) (DOE/EIS-0229).

As of August 1996, approximately 9,000 had accumulated at Pantex Plant as a resu dismantlement activities. Pantex Plant ha authority to provide interim storage for 12,000 pits. Decisions regarding interir storage beyond this level will be made result of this EIS. Pantex Plant has a suffi number of magazines to safely accomm 20,000 pits. Eighteen Modified Richmond 42 SAC magazines have been identifie storage of pits. Each Modified Richı magazine can accommodate up to 440 pit each SAC magazine can hold up to 392 The designation of 60 magazines provide more than 20,000 storage spaces to allo operational flexibility. Some of the e magazine capacity may be used for stagi weapons or components. The *Environn Assessment for Interim Storage of Plut Components at Pantex* (DOE/EA–0812) 1994w) provides a more complete discuss the SAC and Modified Richmond magazir well as a general description of pit s configurations (DOE 1994w).

The pits removed from weapons are cu packaged in AL–R8 storage containers. containers were previously used for transportation and storage. DOE discon using them for transportation in 1990, an are currently used solely for interim stor pits. A new, more robust storage and tra

container, known as AT–400A, is being developed and tested for transportation and long-term storage. Scheduled for use beginning in 1997, the container design incorporates upcoming, more stringent regulatory requirements for transportation. The design of the AT-400A package will meet the latest Type B package certification testing requirements. The AL–R8 and AT–400A containers are further described in volume II, appendix F.

The pit storage containers would be stored in a multiple stacking configuration of containers placed horizontally on steel pallets. Pallets for this configuration have been designed to ensure structural integrity and stability in a maximum credible earthquake scenario. The pallets are placed in storage using a commercially available rotating turret forklift. The forklift has been modified to provide special shielding that reduces operator exposure to extremely low levels of radiation. This electric forklift would be used for storage, retrieval, and inventory operations.

Automated Guided Vehicles (AGVs) have also been developed to place pits in storage facilities and to assist in taking inventories using bar code readers. The use of AGVs virtually eliminates any need for humans to enter any pit storage facilities.

Operations in the storage facilities include periodic inventory and inspections. Inspections coincide with planned inventory activities (generally every 18 months) and consist of a visual inspection of facility conditions and container surfaces, as well as removal of selected containers for surveillance tests. Container integrity is further evaluated via inspection (using both destructive and nondestructive evaluation techniques) of the container surfaces (for corrosion), weld integrity, and integrity of insulation and plastic parts. Both the shielded forklift and the AGVs can carry a bar code reader, camera, and gamma spectrometer to allow inventory and inspection to be performed without operator exposure to radiation.

Transportation of Weapons and Components

Pantex Plant is involved in the transportation of many different types of hazardous materials. These include nuclear explosives, nuclear components, HE components and materials, tritium, industrial chemicals, and other hazardous materials. Typical vehicles and equipment used in transport operations include forklifts, hardened trailers, Safe Secure Tractor Trailers, flatbed trailers, vans, trucks, pallet jacks, and tow motors. Approximately 30,000 transfers of radiological and explosive materials occur each year at Pantex Plant. In addition, Pantex Plant ships and receives radiological components or materials to and from other sites. To ensure the safety of operations, drivers are carefully trained, certified, subjected to physical examinations, and routinely screened for drugs and alcohol. Further information on transportation is provided in sections 4.12 and 4.16 of this volume of the EIS.

Decontamination and Decommissioning

Pantex Plant is currently planning to streamline operations and reduce maintenance and operating costs by consolidating operations into fewer buildings. At this time, no plans have been made for the decommissioning of any facilities at Pantex Plant. The designation of facilities is pending decisions regarding the future of Pantex Plant being made in the *Stockpile Stewardship and Management Programmatic EIS* (SSM PEIS) (see section 1.7).

Facilities at the plant are potentially historic resources in terms of both their age and their role in the Cold War. In accordance with the Pantex Plant Cultural Resource Management Plan being developed, the plant will consult with the Texas State Historic Preservation Office prior to initiation of any decontamination

and decommissioning activity to ensure that no historic facilities are inadvertently destroyed. Separate *National Environmental Policy Act* (NEPA) (42 U.S.C. 4341) documentation will be prepared when plans are developed for specific decontamination and decommissioning projects.

1.2.2.2 *Environmental Protection Activities*

The Environmental Protection Program is continuously improving Pantex Plant's ability to ensure that missions are performed in a safe and environmentally protective manner. Currently, the program consists of nine elements:

- Public communication, to inform and involve stakeholders on issues of concern.
- Oversight, to work closely with State agencies in verifying and addressing impacts of facility operations to the environment.
- Quality assurance, to ensure integration of quality assurance practices in environmental protection.
- Compliance, to integrate environmental protection into production line and planning activities.
- Pollution prevention and waste minimization, to encourage waste elimination, waste minimization, air emissions reduction, material substitution, recycling, alternative disposal method studies, energy conservation, and water conservation.
- Environmental monitoring, to document emissions and effluents.
- Cultural resources, to identify and manage archeological and historic resources at Pantex Plant.
- Natural resources, to improve management of lands, surface water and playa wetlands, groundwater, soils, air qual and flora and fauna at Pantex Plant.

Each of these elements is discussed in detai the *1994 Environmental Report for Pan Plant* (DOE 1995b). The DOE Amarillo A Office is initiating the development of resource stewardship strategy to guide fu planning and management of all environme resources at Pantex Plant.

Because of the extent of current and planned investigations and corrective actions, environmental restoration program is descri separately in the section that follows.

1.2.2.3 *Environmental Restoratio*

Environmental restoration activities inv determining the nature and extent contamination, and performing remediatio needed, in compliance with all approp regulatory requirements.

In 1989, the U.S. Environmental Protec Agency (EPA) conducted a *Reso Conservation and Recovery Act* (RCRA) U.S.C. 6901, et seq.) facility assessment identify solid waste management units fr which hazardous constituents may migrate. total of 144 solid waste management units w originally identified at Pantex Plant. Th have been organized into 14 groups corrective action. To evaluate compliance w provisions of the RCRA permit, DOE cond assessments and audits, and TNRCC and E conduct independent inspections. environmental restoration activities at Pa Plant will continue until all remediation wo accomplished in accordance with regula requirements, regardless of decisions w may be made on other aspects of the pla mission (see section 4.5 in this volume appendix I in volume II for further details).

Pantex Plant was placed on the Natio Priorities List in 1994 under the *Comprehen*

Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. 9608). Pantex Plant is currently in the process of negotiating an agreement with EPA and TNRCC to integrate both RCRA and CERCLA requirements into a comprehensive site-wide strategy. The majority of environmental restoration activities are expected to be completed by the year 2000.

Although this EIS does not provide project-specific NEPA documentation for these CERCLA projects, overall effects of these projects are included in this EIS for complete assessment and full disclosure of the cumulative impacts of all operations at Pantex Plant.

1.2.2.4 *Waste Management Activities*

The types of wastestreams generated and managed by Pantex Plant include low-level radioactive waste (LLW), low-level mixed waste (LLMW), hazardous waste (HW), nonhazardous waste (NHW), and recyclable materials. See volume II, appendix G for a discussion of recyclable materials. Three drums of transuranic (TRU) waste were generated in 1993 as a result of an incident during weapons dismantlement. The waste is stored in an appropriately monitored facility awaiting shipment to an approved offsite management facility. No TRU waste is generated on the site as a result of normal operations.

LLW generated, processed, and stored at Pantex Plant is regularly transported to the Nevada Test Site (NTS) for disposal. Building 12–42 provides processing capabilities for LLW.

LLMW generated, processed, and treated is generally stored onsite until it can be shipped offsite for disposal. Building 11–9 and the Burning Ground provide onsite treatment capabilities for LLMW. In 1994, 32.6 cubic meters (42.6 cubic yards) of LLMW was transported to a commercial disposal facility in Utah. In 1996, 70 cubic meters (91 cubic yards) of LLMW were disposed at the same facility. Another shipment in September 1996 further reduced LLMW inventories by a total of 50 percent. Additionally, Pantex Plant is capable of treating and processing (such as compaction and repackaging) hazardous waste including LLMW in tanks and containers.

HW generated, processed, and stored at Pantex Plant is transported by commercial vendors for disposal. The Burning Ground burns HE and HE-contaminated wastes in accordance with regulatory permits.

NHW generated is managed through both onsite and offsite facilities. NHW, including oils and debris, are shipped offsite for disposal. Ordinary trash is either recycled (e.g., aluminum and paper) or shipped to the Amarillo Landfill through commercial vendors for disposal. Construction debris is disposed onsite in a landfill located in Zone 10.

Other types of waste, including asbestos, polychlorinated biphenyls, and medical wastes, are generated, processed, and stored prior to disposal through commercial vendors specifically licensed to manage each waste.

Sanitary and industrial wastewater is treated onsite in the Waste Water Treatment Facility. Industrial wastewater from production and manufacturing of HE components is filtered in Buildings 12–43 and 11–50. All wastewater discharges are disposed of onsite (section 4.6.1.1).

Pantex Plant has a continuing program of pollution prevention and waste avoidance initiatives. These include source reduction, process changes, material substitution, and administrative policies that not only reduce waste and pollution, but also result in cost savings for taxpayers. In 1996, the Pollution Prevention and Waste Minimization (PP/WM) program at Pantex Plant received the President's "Closing the Circle" Award for

achievements in recycling and waste prevention. This program saved approximately $4.5 million of taxpayer money in 1995. Appendix G in volume II presents details of the program.

The *Environmental Information Document* provides a detailed description of waste streams and waste management practices and facilities (Pantex 1996). The *Federal Facility Compliance Act* Agreed Order and approved Site Treatment Plan-Compliance Plan contain detailed descriptions of waste treatability groups and waste management milestones.

Waste treatment, storage, and disposal operations are contingent on programmatic decisions resulting from the WM PEIS.

1.2.2.5 *Facility Construction and Upgrade*

Several operations essential to the assembly, disassembly, and maintenance of weapon systems are currently housed in outmoded facilities. To continue Pantex Plant's mission, it is necessary to shift these operations to other existing and newer facilities or to construct new facilities that would maximize worker safety and allow for greater efficiency in meeting all regulatory requirements. An average of one or two new construction projects are funded annually. In 1995, Pantex Plant received $26.4 million for construction and equipment. The *Programmatic Information Document* provides more detail on future construction/modification projects (Pantex 1996b). Those projects that are at a stage of development where sufficient detail is known to perform a NEPA analysis are discussed in this EIS (see volume II, appendix H). As plans for other projects become more detailed and ready for the decision making process, NEPA review will be conducted prior to authorization.

1.3 Evolution of this Environmental Impact Statement

The operations of Pantex Plant were ex previously in a site-wide EIS (DOE/EIS- published in 1983 (DOE 1983a). The sc operations at Pantex Plant included the s of pits prior to transfer to other DOE si processing. A new site-wide EIS was planning stage, but had not been schd when pit transfer activities were suspend operational reasons and, later, disarm commitments. The *Environmental Asses for Interim Storage of Plutonium Comp at Pantex* (DOE/EA–0812) assessed the im of interim storage (DOE 1994w).

Prior to the release of this Environ Assessment, the Secretary of Energy adv the schedule for the planned Pantex Plan and committed the Department to co alternate sites for interim storage (Letter Additionally, the Secretary of Energy dir that the S&D PEIS be prepared to analy long-term storage of plutonium in all fo including pits, and the ultimate disposition the material. Additional details on the evol of the S&D PEIS are provided in section 1.

Volume I, chapter 2 of the SSM PEIS disc in detail the national security po responsibilities, strategies, and directives p on DOE. For the reasonably foreseeable fu the START II protocol is most useful in he define a specific time period to bound reasonably foreseeable future.

The START I Treaty and the START II pro only control the number of strategic nu weapons that can be loaded on treaty-spec and verified strategic missiles and bomb These nuclear weapons are limited to 6,00 the START I Treaty and 3,500 by the STAR protocol. The treaties do not control the stockpile or the composition of strategic nonstrategic nuclear weapons. The

stockpile will be larger than 6,000 under START I and 3,500 under START II since the stockpile includes retaining weapons for nonstrategic nuclear forces, including DOD operational spares and spares to replace weapons attrited by DOE surveillance testing.

1.4 THE DECISION MAKING PROCESS AND DECISIONS TO BE MADE

This Pantex Plant EIS provides both DOE and the public with information on the potential environmental impacts associated with the Proposed Action and Alternatives. This EIS covers all current and reasonably foreseeable facilities and activities at Pantex Plant, interim storage requirements for pits from weapons dismantlement, and the transportation of classified components shipped from Pantex Plant. This EIS was also scoped to address alternate locations for interim pit storage (i.e., until longer-term storage decisions are made and implemented). Accordingly, it also addresses potential environmental impacts at NTS, SRS, Hanford Site, and Kirtland Air Force Base (KAFB) should one of these installations be chosen as an alternative site for the interim storage of up to 20,000 pits.

There are two additional DOE NEPA documents that address the storage of pits. The SSM PEIS addresses the long-term storage of pits that will be needed for national security requirements (strategic reserve pits). The S&D PEIS addresses storage of all pits, including pits that have already been, or later may be, declared surplus to national security requirements, and the approach for dispositioning surplus pits.

The Proposed Action in this EIS was designed specifically to encompass the interim storage of pits from weapons dismantlement until such time as longer-term decisions regarding storage and disposition could be made and implemented. The Preferred Alternative for the interim storage of pits in this EIS is to continue to store them at Pantex Plant. The Preferred Alternative in the Draft SSM PEIS provides for the long-term storage of strategic reserve pits at whatever site is selected for the assembly/disassembly function in the future weapons complex; the Draft SSM PEIS identifies Pantex Plant as the preferred site for that function.

The Draft S&D PEIS analyzed a number of alternatives and suboptions for the storage of pits and other forms of surplus material pending disposition, but it did not identify a Preferred Alternative for the storage of pits. Several alternative sites, including Pantex Plant, were analyzed for the mission of storing surplus material pending disposition. The Draft S&D PEIS contemplated the possible transfer of surplus material to Pantex Plant for storage around the year 2004, after upgrades to existing storage facilities in Zone 12 had been completed. The Rocky Flats Environmental Technology Site (RFETS) was identified in the Draft S&D PEIS as one source of this surplus material.

The Final S&D PEIS will include an alternative that is a refinement of the Draft S&D PEIS alternatives described above. Under this alternative, pits could be transferred from RFETS to Pantex Plant as early as 1997 and stored temporarily in existing Zone 4 facilities until the upgraded facilities in Zone 12 are available. The environmental impacts associated with transferring surplus pits from RFETS to Pantex Plant, including the impacts of their storage at Pantex Plant, will be included in the Final S&D PEIS. The potential addition of RFETS pits at Pantex Plant would not exceed the storage limit of 20,000 pits proposed and analyzed in this EIS. Moreover, surplus RFETS pits that could come to Pantex Plant would have the same characteristics, as analyzed in the S&D PEIS, as pits currently or previously stored at Pantex Plant. (Refer to sections 1.7.2 and 1.7.3 for more information on the SSM PEIS and the S&D PEIS, respectively.) If this alternative were selected in the ROD for the S&D PEIS, surplus pits already at Pantex Plant would

continue to be stored there pending disposition and, in addition, surplus pits from RFETS would be transferred to Pantex Plant in the near term for storage, also pending disposition.

At this time DOE projects that the Records of Decision (RODs) for both the SSM PEIS and the S&D PEIS will be issued in late 1996 or early 1997, at or about the same time as the ROD for this EIS, and that decisions on the longer-term storage of pits will be made in the RODs of the two PEISs. As described above, if DOE selects the Pantex Plant storage alternatives in the SSM PEIS and the S&D PEIS, strategic reserve pits would be stored at Pantex Plant indefinitely and surplus pits (including the pits currently at RFETS) would be stored at Pantex Plant until DOE implements decisions regarding their disposition. The ROD for this EIS will take into consideration the decision-making process for the PEISs when making a decision on the interim storage of pits.

However, if there is a significant delay in RODs for either PEIS, or if DOE does not make a decision on the long-term storage of pits in those RODs, then a decision will be needed on the location of interim storage of pits, uninformed by a decision on long-term storage. In any event, this EIS was completed with the analysis of interim storage alternatives, including addressing the issues and comments received from the public on this EIS, to support a decision relating to the storage of pits until a long-term storage decision has been made and implemented.

DOE encourages interested parties to comment, during the period between issuance of the Final PEISs and issuance of the RODs, on the Preferred Alternative for the SSM PEIS and the alternatives for the S&D PEIS as they affect the storage of pits at Pantex Plant.

The DOE decision-making process for the interim storage of pits will consider the analysis presented in this Final EIS along with mission requirements, costs, other technical factors, the national interest, and public input. Secretary of Energy will then issue a ROD, ROD may be issued no sooner than 30 days the Final EIS. The ROD will explain all fact including environmental impacts, that considered in reaching its decision. The R will specify the alternative or alternatives are considered to be environment preferable.

If the selected alternative is different from environmentally preferred alternative, the R will present the rationale for the Departme selection. Specifically, the ROD will docur the decision as to how operations at Pa Plant would be conducted, at which si interim pit storage should be performed an what quantity, and what mitigative meas should be taken. As discussed in section 3.1 ROD may combine aspects of var alternatives in the decision.

If mitigation measures are adopted as part o agency's decision, these will be summarize the ROD, as applicable, and included Mitigation Action Plan. The Mitigation Ac Plan would explain how and when mitiga measures will be implemented. The Mitiga Action Plan must be in place prior to taking action that is the subject of a mitiga commitment.

1.5 COMMENT PERIOD, PUBLIC HEARINGS, AND THE ANALYS OF COMMENTS

In March 1996, the Department publishec *Draft Environmental Impact Statement fo Continued Operation of Pantex Plant Associated Storage of Nuclear We Components*. A Notice of Availability o Draft EIS was published in the *Federal Reg* (61 FR 15232) on April 5, 1996. The com period for the Draft EIS began on April 5, 1 and originally was to end on July 5, 1 However, at the request of stakeholders i Amarillo, Texas area, the ending date

extended to July 12, 1996, for a comment period of 98 days. Any comments received after that date were included to the extent practicable.

During the comment period, public hearings were held in Amarillo, Texas; North Las Vegas, Nevada; North Augusta, South Carolina; Albuquerque, New Mexico; and Richland, Washington. In addition, a separate Technical Exchange Meeting was held in Amarillo, Texas, with representatives of the State of Texas, City of Amarillo, Panhandle Water Conservation District No. 3, the University Consortium (Texas Tech University, Texas A&M University, University of Texas, and West Texas A&M University), Amarillo Economic Development Corporation, Pantex Plant Citizens Advisory Board, and members of the public.

All public meeting comments were combined with comments received by all other means (e.g., hand-ins, faxes, letters, e-mail, etc.) during the public comment period. All comments were categorized by subject area and were considered for potential changes or additions to the EIS. For further information, see volume III of this EIS.

1.6 Changes Since the Issuance of the Draft EIS

Since the March 1996 issuance of the *Draft Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components*, there have been several changes in information, regulatory status, and related EISs, as well as a revision of the Draft DOE Standard for Aircraft Crash Analysis. In addition, comments from agencies, organizations, and the public requested elaboration and additional assessment of numerous issues. These changes are reflected in this Final Pantex Plant EIS.

New and updated information has been included in the discussions for almost all environmental resources. The new information includes a different pit repackaging concept and a reduced scope for the proposed Hazardous Waste Treatment and Processing Facility (HWTPF). The new pit repackaging concept is still at a very early planning stage and is not detailed in this Final EIS. However, the foreseeable impacts have been bounded to the extent possible in the infrastructure, waste management, and human health sections. Appendix H includes discussion of both a large and a small version of the HWTPF. Since the Draft EIS, the smaller version has become the preferred alternative for this facility. The impacts of the larger version are still discussed in the appropriate sections of the EIS in order to bound the impacts. None of the new or updated information results in a significant difference in the impacts assessed.

The regulatory status of several permits has changed since the Draft EIS. The new permitted levels and resulting changes in operations have been taken into account in the assessment of impacts.

Updated information regarding related EISs has been added in the Summary, section 1.4, section 1.7, and in the discussions of cumulative impacts where appropriate. The information was updated in this EIS as a result of advances in the decision-making process in the related EISs.

The methodologies for assessing the risk of an aircraft crash and for assessing the cumulative impacts have changed to a degree since the Draft EIS. The aircraft crash methodology has been in development throughout the preparation of the Draft and Final EIS. The July 1996 Draft was used for this Final EIS. The assessment of cumulative impacts, which has been changed to more accurately reflect the potential impacts, is discussed in more detail in section 4.21 of volume I of the Final EIS.

The changes due to comments received during the comment period are detailed in volume III of the Final EIS and discussed briefly in the Summary.

Site, Idaho National Engineering Laboratory, Rocky Flats Environmental Technology Site, SRS, LANL, and ORR. The S&D PEIS is considering four alternatives for the long-term storage of fissile material: No Action, Upgrade Storage Facilities, Consolidate Plutonium at one site, and Collocate Plutonium and HEU at one site. The S&D PEIS is currently examining for long-term storage the same four DOE interim storage sites considered in this EIS as well as ORR. The Pantex Plant EIS includes a discussion of the cumulative impacts of locating a potential storage facility at Pantex Plant, and incorporates and summarizes relevant information from the S&D PEIS.

The Draft S&D PEIS analyzed, as part of its storage alternatives, transfer of RFETS surplus material, including pits, to Pantex Plant. The Draft S&D PEIS considered, as an alternative, the storage of surplus material, including both surplus pits from disassembled weapons and material from RFETS, in existing buildings in Zone 12 at Pantex Plant. These buildings would require upgrades before they could be used for storage, however, and the S&D PEIS estimated that the upgrades could be completed by the year 2004. The environmental impacts of this action were discussed for cumulative purposes throughout Chapter 4 in the Draft Pantex EIS.

The Final S&D PEIS will include an alternative involving the transfer of pits from RFETS to Pantex Plant that is a refinement of the alternatives presented in the Draft S&D PEIS. Under this alternative, materials would be removed from RFETS as soon as practicable in order to assist in the cleanup of that site. Pits now at RFETS could be transferred to Pantex Plant as early as 1997 and stored in Zone 4, in the same facilities as pits from disassembled weapons, until the upgraded facilities in Zone 12 are ready. Other fissile materials at RFETS, in the form of metals and oxides, would be transferred to the Savannah River Site under this alternative.

If this alternative were selected in the ROD for the S&D PEIS, surplus pits already at Pantex Plant would continue to be stored there pending disposition and, in addition, surplus pits from the RFETS would be transferred to Pantex Plant in the near term for storage, also pending disposition. The total number of pits that could potentially be stored at Pantex Plant, including those brought from RFETS, would not exceed the storage limit of 20,000 pits proposed and analyzed in this EIS. Moreover, surplus RFETS pits that could come to Pantex Plant would have the same characteristics, as analyzed in the S&D PEIS, as pits currently or previously stored at Pantex Plant.

The Final S&D PEIS will contain environmental analyses of the various elements of this alternative including: intersite transportation of the pits from RFETS to Pantex Plant; packaging operations both at RFETS and Pantex Plant; storage of the pits, first in Zone 4, and then in Zone 12; and intrasite transportation from Zone 4 to Zone 12. The environmental impacts of this action have been added to the cumulative impact discussion in Chapter 4 of this Final EIS. These impacts would occur sooner, but would be smaller than the impacts of the Collocation Storage Alternative.

The Collocation Storage Alternative and the Evolutionary Light Water Reactor Disposition Alternative from the S&D PEIS are discussed in this Pantex Plant EIS, because those alternatives, if they occurred at Pantex Plant, could potentially have the greatest impacts to the Pantex Plant Site. It is important to note that these are conservative bounding impacts.

The Final S&D PEIS will designate a preferred alternative for the storage of fissile materials. Furthermore, for disposition, the PEIS will contemplate further site-specific tiered NEPA documentation, as appropriate, before any specific site is selected. If different alternatives or a site other than Pantex Plant were selected in the ROD (and tiered RODs) for the S&D PEIS, then impacts to Pantex Plant from storage and disposition would be reduced and might not occur.

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CHAPTER 2

Purpose and Need for Action

CHAPTER 2
PURPOSE AND NEED FOR ACTION

The main focus of chapter 2 is a description of the purpose and need for Department of Energy action at Pantex Plant. Following that discussion is a description of the scope of this EIS.

PURPOSE AND NEED FOR AGENCY ACTION

DOE needs to continue to fulfill its responsibilities as mandated by statute, Presidential direction, and Congressional authorization and appropriation. DOE's goal, or purpose, in meeting this need is to do so in a manner that enhances the protection of human health and the environment while preventing a break in DOE's ability to perform its responsibilities.

2.1 PURPOSE AND NEED FOR ACTION

The requirement for DOE to provide for nuclear weapons operations is provided in Section 91 of the *Atomic Energy Act* of 1954 as amended (42 U.S.C. 2121). That act authorized the Atomic Energy Commission (predecessor to DOE) "to engage in the production of atomic weapons... to the extent that the express consent of the President has been obtained, which consent and direction shall be obtained at least once each year." The consent and direction of the President are given each year in a Presidential Decision Directive. This directive is based on the annual Nuclear Weapons Stockpile Memorandum jointly prepared and agreed upon by the Department of Defense, National Security Council, and DOE. The Nuclear Weapons Stockpile Memorandum specifies the nuclear weapon stockpile levels for current and future years and is the driver for associated production and retirement of all nuclear weapons. DOE then issues the Production and Planning Directive to direct the Nuclear Weapons Complex, which includes Albuquerque Operations Office, to execute the directed workload. Annual appropriations to carry out the Presidential directives are then provided through the combined action of the House of Representatives, the Senate, and the President. It is DOE's responsibility to meet the stockpile management requirements.

The Department's nuclear weapons stockpile management requirements at Pantex Plant include the assembly, disassembly, modification, and maintenance of nuclear weapons; monitoring of the weapons stockpile; production of high explosive(s) (HE) components for nuclear weapons; quality assurance evaluation and testing of weapon components; and research and development activities supporting nuclear weapons.

Recent Presidential directives have sharply reduced the number of weapons required in the nuclear weapons stockpile. This has resulted in a large increase in the number of nuclear weapon components that must be disposed or stored. Pantex Plant is currently the only site at which weapon disassembly operations are performed and is the primary location for interim storage of pits removed from weapons. In accordance with the approved Finding of No Significant Impact (59 FR 3674, January 26, 1994) regarding interim storage levels, Pantex Plant is currently authorized to provide interim storage of up to 12,000 pits. Other nuclear weapon components are currently shipped to other sites, as depicted in Figure 2.1–1.

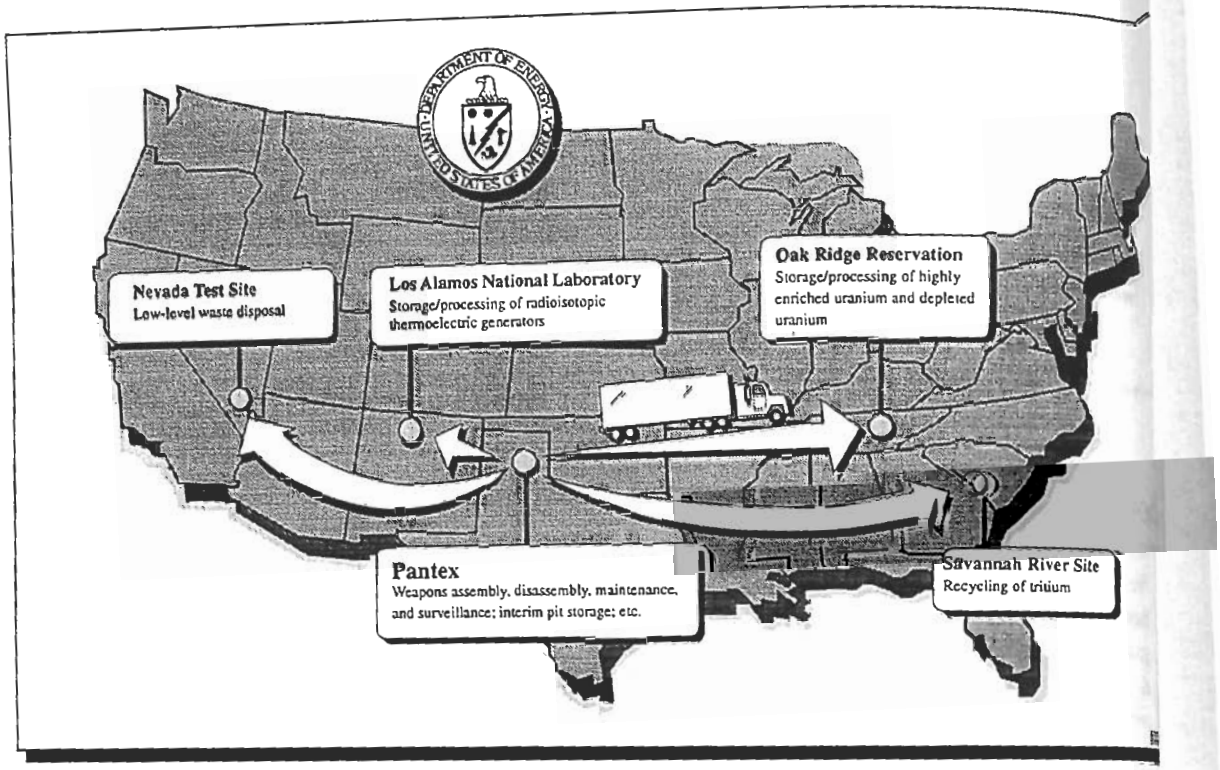

FIGURE 2.1–1.—*Sites That Receive Nuclear Components or Materials from Pantex Plant.*

DOE must fulfill assigned responsibilities for stockpile stewardship and management and must respond to Presidential direction on requirements for the nuclear weapons stockpile. DOE must respond to the military services returning weapons as a result of changes to the nuclear weapons stockpiles and provide storage for components as a result of dismantlement. There is a need at this time to update the Department's evaluation and understanding of environmental impacts associated with ongoing operations at Pantex Plant and evaluate any additional or changed impacts associated with an increase in dismantlement and near-term storage of nuclear components from the dismantlement process.

2.2 SCOPE OF THIS ENVIRONMENTAL IMPACT STATEMENT

The scope of this EIS includes the assessment of impacts relative to each area of the human and natural environment potentially affected operations performed at Pantex Plant. complete list of the resource areas investig in this EIS is provided in volume I, chapte The analysis concentrates on issues relate the proposal as identified through internal public scoping. Activities that could potenti result in adverse impacts are associated with

- Ongoing operations, including inte pit storage, at Pantex Plant.
- Transporting pits to and storing them an interim basis at an alternate site.
- Transporting classified compon between Pantex Plant and other sites.

The EIS analysis assumes that the combi activities of assembly, disassembly, modifications would not exceed 2,000 weap per year. For assessment of environme impacts, the EIS examines impacts acros reasonable range of operations by assess

impacts of activity levels for 2,000, 1,000, and 500 weapons per year.

These numbers of weapons per year represent a reasonable, but conservative estimate of work that may be required at Pantex Plant based on current policy directives, and allow a set of defined tasks to be accurately analyzed. The operations on each of the weapons in these defined sets is assumed to be extensive (i.e., representative of full assembly or disassembly). Actual workload and range of tasks to be performed on each weapon processed at the plant may vary, but individual tasks are well understood, and impacts of actual operations are expected to be encompassed by this conservative analysis. Accordingly, over 2,000 weapons per year may be worked on at Pantex Plant without exceeding the environmental impacts identified in this conservative, bounding analysis. The operations on 2,000, 1,000, and 500 weapons per year should not be considered to be specific limits.

As shown in Figure 2.1–1, some nuclear components removed from weapons and nuclear materials are shipped to other sites. Therefore, this EIS considers the impacts of continuing to transport such components to those sites. Whenever appropriate, this EIS incorporates the information and analyses of other NEPA documents.

This EIS includes an assessment of activities over a period of approximately 10 years or until programmatic decisions regarding the nuclear weapons complex, including long-term storage and disposition of weapons components and materials, can be implemented. The scope of activities at Pantex Plant includes mission operations, routine maintenance, facility upgrades and modifications, planned new facilities, and transportation activities. Key areas of Pantex Plant that support these missions are:

- Zone 12, where assembly, disassembly, and surveillance operations are performed and nonnuclear components are staged.
- Zone 11, where HE research and production is performed and nonnuclear components are staged.
- Zone 4 West, where nuclear weapons and classified components are staged and pits are stored on an interim basis.
- Zone 4 East, where HE is stored and nonnuclear components are staged.
- The Burning Ground, where HE materials are burned.

These areas are shown on Figure 1.2–2. Other activities that are included in the EIS are environmental protection, pollution prevention, environmental restoration, waste management, and agricultural operations on the site.

The scope of activities at other sites is related only to interim storage of pits and transport of other weapons components from Pantex Plant to these sites.

There are several other ongoing DOE programs that could have impacts on Pantex Plant. Five of these programs for which NEPA documents have either been prepared recently or are in the process of preparation are identified in volume I, chapter 1. The potential impacts of these programs on Pantex Plant have been included in the cumulative impact sections of this EIS to the extent information was available. Impacts of possible relocation of operations from Pantex Plant are discussed in this EIS, as this is one of the options considered in the *Stockpile Stewardship and Management Programmatic EIS* (DOE/EIS-0236). Cumulative impacts also address the incremental effects of the action added to other past, present, and reasonably foreseeable future actions undertaken by Pantex Plant or other agencies in the specific Region of Influence identified for each environmental resource area.

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CHAPTER 3
THE PROPOSED ACTION AND ALTERNATIVES

Chapter 3 describes the Proposed Action, which is the Department's Preferred Alternative, and the alternatives to that Proposed Action. These alternatives include "no action" and the relocation of interim pit storage from Pantex Plant to one of four candidate sites. Following that discussion is a summary of the method whereby the Department identified candidate sites for receiving some or all of the plutonium pit storage function. Also addressed are alternatives that were considered but eliminated from detailed study in this EIS. Chapter 3 concludes with a summary comparison of the environmental impacts of the Proposed Action and Alternatives. Detailed discussions of these environmental impacts are presented in chapter 4 (for Pantex Plant) and chapter 5 (for the four candidate sites).

RANGE OF ALTERNATIVES

ALTERNATIVES

: Preferred Alternative involves all of the 'erent weapons activities historically formed at Pantex Plant, storage of up to 000 pits at the plant, and the possible ›lementation of six new projects.

: No Action Alternative involves all of the 'erent weapons activities historically formed at Pantex Plant, storage of up to)00 pits, and the implementation of only viously funded projects. With this 'rnative, dismantlement would cease e a storage level of 12,000 pits has been ieved.

Relocation of Interim Pit Storage 'rnative involves all of the different 'pons activities historically performed at .tex Plant, relocation of storage of 8,000 20,000 pits to another site, and the ;ible implementation of six new projects.

ernatives considered in this EIS are the ɜd Action, the No Action Alternative, : Relocation of Pit Storage Alternative terim pit storage only). These are ed in sections 3.1.1 through 3.1.3. The Department's Preferred Alternative is the Proposed Action.

The Proposed Action involves continuing operations at Pantex Plant, increasing the pit storage limit from 12,000 pits up to 20,000 pits, and the construction of several new projects. These new projects, outlined in appendix H, are analyzed at a project-specific level of detail. For each of these projects, there is a range of reasonable alternatives that include, as a minimum, a Proposed Project (i.e., implementing the proposed change) and not implementing the proposed project.

The No Action Alternative involves continuing operations with the limitation of ceasing weapon dismantlement after a storage level of 12,000 pits is reached. No new projects are included with this alternative. DOE also understands that the No Action Alternative does not satisfy the purpose and need for action for weapon disassembly or goals for enhanced management of wastes.

In the March 1996 Pantex Plant Draft EIS, the proposed construction of the Hazardous Waste Treatment and Processing Facility (HWTPF) was considered necessary for improving waste operational efficiency and safety and meeting regulatory requirements established in the Agreed Order. With offsite disposal shipments

of mixed waste in 1994 and two shipments in 1996, as described in section 4.13.2.3 of this volume, and changes contained in the August 1996 Federal Facility Compliance Act (FFCA) Compliance Plan Annual Update document, construction of the HWTPF is no longer considered a regulatory requirement. DOE's purpose and need for enhanced efficiency and safety of its current mixed waste, low-level radioactive waste, and hazardous waste operations remain and are discussed in greater detail in volume II, appendix H. Without the HWTPF, waste treatment and processing capabilities are greatly limited.

The Pit Storage Relocation Alternative involves continuing the operations at Pantex Plant, construction of several new projects, and relocating the storage of some or all of the pits to another site. The candidate sites for relocation of interim pit storage provide a range of geographical, operational, and environmental alternatives.

The types and numbers of weapons operations performed at Pantex Plant in any year are principally defined by the Stockpile Memorandum. The Memorandum is set by the President and authorized and funded by Congress. In order to fully encompass the operations of Pantex Plant, different levels of all of the types of operations that Pantex Plant can and has performed are assessed.

Because future stockpile requirements cannot be accurately predicted, this EIS examines the impacts of activity levels for operations on 2,000, 1,000, and 500 weapons per year (see section 2.2). Additional information about activities associated with stockpile management missions is in the Pantex Plant *Programmatic Information Document* (DOE 1996b).

Weapons disassembly operations and weapons assembly operations result in roughly equivalent impacts and are the dominant contributors to the impacts resulting from plant operations. Therefore, the mix of weapons operations that is assessed for each alterna dominated by these operations. For the Action Alternative, the operations mi dominated by assembly operations, once disassembly operations limitation of 12,000 in storage is reached.

The activity levels of operations on 2, 1,000, and 500 weapons per year representative levels of Pantex Plant activ The 2,000 weapons level represents recent current levels of activity. The 1,000 weap level represents the level that will most li occur in the near future, if there are no chan in current directions in the Stock Memorandum. The 500 weapons represents the minimum level of act required at Pantex Plant to maintain all c mission capabilities. An activity level ran from 330 to 680 weapons per year is evalu in the SSM PEIS. This is based on remaining stockpile in the year 2005 beyond, after the successful disassembly o to 20,000 weapons.

In the Record of Decision that will fo completion of this EIS, the Secretary of Ene will consider the environmental impacts of a alternative along with mission requirem technical factors, and the public interest. balancing these considerations, the Secre could decide to implement all or part of alternative. Likewise, the Secretary may dec to include a particular aspect of an alternativ a decision to implement another alternative. example, the Secretary could decide implement the No Action Alternative, include the construction of the HWT described in the Proposed Action.

3.1.1 Proposed Action

DOE proposes to continue nuclear weap stockpile management operations and rela activities at Pantex Plant; continue the inter storage of pits at Pantex Plant; contin transportation of nuclear components to Savannah River Site (SRS), the Oak Ri

rvation (ORR), and Los Alamos National ratory (LANL); and implement projects acility upgrades at Pantex Plant consistent fulfilling these missions for approximately ears. Specifically, the Proposed Action des:

Continued operation of Pantex Plant, including activities associated with the following stockpile management missions:

— Assembly of nuclear weapons.
— Disassembly of nuclear weapons.
— Modification and maintenance of nuclear weapons.
— Quality assurance testing of weapons components (surveillance).
— Research and production of high explosives (HE) and weapons components.

ise future stockpile requirements cannot curately predicted, the Proposed Action include impacts of activity levels for ions on 2,000, 1,000, and 500 weapons ar.

Management of nuclear weapons components and materials as follows:

— Increasing the maximum quantity of pits in interim storage at Pantex Plant from 12,000 to 20,000.
— Continuing to transport highly enriched uranium (HEU) and depleted uranium components from Pantex Plant to ORR for storage or processing and staging those components pending shipment.
— Continuing to transport tritium from Pantex Plant to SRS for storage and recycling and staging these reservoirs pending shipment.
— Continuing to transport radioisotopic thermoelectric generators (RTGs) from Pantex Plant to LANL for heat source removal and storage. Some RTGs from disassembled weapons would be retained at Pantex Plant as spares for future use in weapons maintenance, modification, or replacement, as required.
— Continuing to transport a few selected pits per year from Pantex Plant to LANL for surveillance, inspection, and testing.
— Continuing demilitarization and sanitization of components (including demilitarization and sanitization of HE), equipment, and related materials, and burning of HE and HE-contaminated wastes at the Burning Ground in accordance with applicable Federal and State regulations.
— Continuing to dispose of other items resulting from mission operations in accordance with regulatory requirements.

- Performing environmental protection and environmental restoration activities. Environmental protection activities include the management and stewardship of resources as previously noted in section 1.2.2.2. Restoration activities include site characterization to define the nature and extent of contamination, evaluating potential corrective measures, coordinating with State and Federal regulatory agencies, and performing corrective measures.
- Continuing routine Pantex Plant activities such as waste management, infrastructure and building maintenance, operations and equipment relocation and consolidation, routine modifications to buildings, general landscaping, cooperative agreements with universities, technology transfer activities, transportation of materials, and similar support activities.
- Continuing the transportation of nuclear weapons, nuclear components, HE materials, wastes, and other materials to and/

or from Pantex Plant. Additional information describing onsite transportation activities is provided in section 4.12 of this volume of the EIS.

- Performing all required facility upgrades, modifications and replacement of facilities, and new proposed projects that are foreseeable at Pantex Plant, as described below:
  - A new HWTPF that would accommodate management of low-level, hazardous, and mixed waste. The facility activities would include DOE developed technologies capable of mixed waste treatment.
  - Modifications of existing facilities to provide a Pit Reuse Facility in Zone 12. This facility would allow nonintrusive modification of certain pits in order to enhance their safety and allow their future reuse.
  - Construction of a new Gas Analysis Laboratory in Zone 11 to replace a structure of World War II vintage. The facility would provide new analytical laboratory space with the requisite environmental controls for sensitive gas analysis equipment.
  - Construction of a new Materials Compatibility Assurance Facility in Zone 11 to replace a structure of World War II vintage. The facility would be used for the environmental aging and compatibility testing of nonnuclear weapon components.
  - Construction of a new Nondestructive Evaluation Facility in Zone 12 to replace a structure of World War II vintage. The facility would house operations such as radiography, ultrasonic analysis, digital imaging, penetrant testing, laser sampling, radiometry, and computer tomography of nonnuclear weapon materials.
  - Construction of a new Metrology and Health Physics Calibration and Acceptance Facility in Zone 12. facility would provide the capa and capacity to perform health p ics calibration and product ac tance control in support of disassembly/assembly progr The Health Physics Labor would provide necessary calibra and maintenance support for ra logical instrumentation and mon The Product Acceptance Co Laboratory would provide the ca bility for calibration and suppo product acceptance testing equipment.
  - Operations involving an AT-400A repackaging system using exis bays in Zone 12 are planned.

  These projects are further describe volume II, appendix H, except for the repackaging operation, which described in sections 4.3, 4.13, and of this volume.

Figure 3.1.1–1 shows the proposed locati these projects, and Table 3.1.1–1 pres relevant data for each project. This provides the project-specific NEPA anal sufficient for decisions on whether implement each of these projects. There are other projects underway which have alre been through the NEPA process and have b determined to be in a class of actions that wo have no significant environmental impacts (. categorically excluded). Consequently, the projects, described below, are not analyzed detail in this EIS:

- A Plutonium Resource Center that w approved by Congress and began ope tion in fiscal year 1995. The center being developed to study environmen impacts of plutonium storage and fu uses of plutonium. It occupies space an existing commercial building in City of Amarillo. No radioactive mate als are handled or stored in the resou

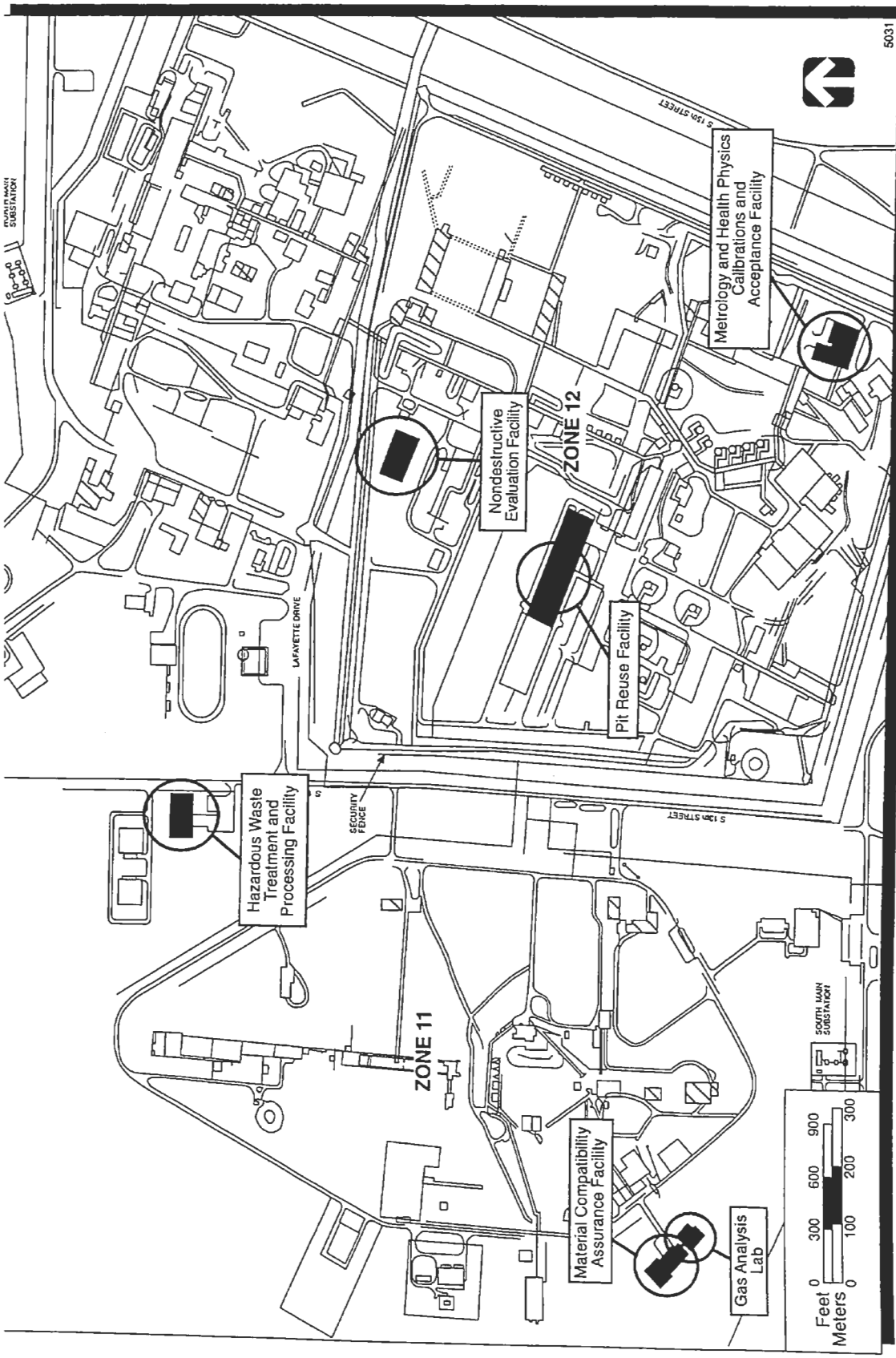

FIGURE 3.1.1-1.—*Location of Proposed Projects at Pantex Plant.*

existing capability

- Weapons disassembly operations would cease when 12,000 pits have been placed in interim storage at Pantex Plant. Note, however, that all other stockpile management operations would continue. Because current mission requirements are dominated by dismantlement, a significant drop in the activity level would be expected to occur when dismantlement ceases. However, with the No Action Alternative, Pantex Plant still has the requirement to support the stockpile with other operations, including weapons production, modification, and surveillance activities. Because future stockpile requirements cannot be accurately predicted, the No Action Alternative includes impacts of operations on 2,000, 1,000, and 500 weapons per year.
- Only 12,000 pits from weapons disassembly would be placed in interim storage at Pantex Plant. No pits would be transferred to another site for storage.

It should be noted that the No Action Alternative would allow only partial fulfillment of the Pantex Plant mission, by limiting the amount of weapon disassembly, and would not fully satisfy the purpose and need for agency action discussed in chapter 2.

3.1.3 Relocation of Interim Pit Storage Alternative

With the Relocation of Interim Pit Storage Alternative, only the interim pit storage functions would be transferred to another site. The options detailed below describe how some or all of the pits currently or potentially stored at Pantex Plant would be stored at another site. With this alternative, all weapons operations (e.g., disassembly, assembly, etc.) would continue to be performed at the plant. The new projects (HWTPF, Pit Reuse Facility, Gas Analysis Laboratory, Materials Compatibility Assurance Facility, Nondestructive Evaluation Facility, and Metrology and Health Physics Calibration and Acceptance Facility) are needed to maintain the capability of the plant to perform weapons operations efficiently. Therefore, they are included in this alternative. Additionally, all other functions described in the Proposed Action, including the impacts of operations on 2,000, 1,000, and 500 weapons per year, were assessed for this alternative. This alternative examines the environmental impacts, at Pantex Plant and other sites, of relocating interim pit storage from Pantex Plant to other sites.

Specific features of interim pit storage relocation options are described below:

- Option 1—Relocating interim storage of up to 20,000 pits from Pantex Plant to one of the following candidate sites: Nevada Test Site (NTS), about 104 kilometers (65 miles) northwest of Las Vegas, Nevada; SRS, 19 kilometers (12 miles) south of Aiken, South Carolina; and Kirtland Air Force Base (KAFB), just southeast of Albuquerque, New Mexico.
- Option 2—Relocating interim storage of up to 8,000 pits to one of the following candidate sites: NTS; Hanford Site, just north of Richland, Washington; SRS; and KAFB.

With this alternative, the number of pits stored at Pantex Plant could conceivably be increased beyond 12,000 initially. Once the rate of pit shipments to an alternate site is sufficient to handle the number of pits generated by disassembly operations, the backlog of stored pits would begin to be transported and the number of pits stored on site would decrease. The maximum number of pits stored at Pantex Plant with this alternative would depend on the time needed to implement any required upgrades at the alternate site and the availability of a new container certified by the DOE under the requirements found in 10 CFR 71. Once the alternate site is operational and containers are available, shipments would begin.

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2007.
- Capable of storing a minim
pits.

:ano WSA was confirmed to be in the nable range of alternatives and the impacts iated with interim pit storage at this site are zed.

:quent to the actions of the Nuclear ons Council staff, the Seneca Army Depot laced on the 1995 Base Realignment and re (BRAC) list. Because of this, the Army OD could not make a determination as to vailability until the BRAC list was ved. The list was approved September 29, and Seneca Army Depot was approved osure in accordance with the procedures ished by the *Defense Base Closure and nment Act of 1990* (Public Law 101–510). :ordance with these procedures and the randum for Federal Agencies, dated nber 29, 1995, Subject: Notice of ability of Excess Real Property at Seneca Depot, Romulus, New York, it was ined that Seneca Army Depot would not as a viable alternative within the Pantex EIS, because DOE cannot fulfill a key requirement in stating that none of its gs and property can satisfy the purpose ich the base is sought. The requirement ring nuclear weapons components can be plished with DOE's current holdings. ore, Seneca Army Depot was not ered further as an alternative pit storage n.

Alternatives Considered but Eliminated from Detailed Study

onsidered three other action alternatives re eliminated from detailed study in this hese action alternatives were:

Relocation of Pantex Plant operations.

Shutdown of Pantex Plant.

Relocation of storage for HEU, depleted ranium, tritium, and RTGs.

Each of these is discussed below in sections 3.1.5.1–3.1.5.3.

3.1.5.1 *Relocation of Pantex Plant Operations*

The original Notice of Intent (NOI) (59 FR 26635) for preparation of this EIS included the possibility of relocating some or all of Pantex Plant operations as part of the Relocation Alternative. Upon further review, it was determined that the relocation of operations from Pantex Plant within the time period of this EIS would not meet the purpose and need for DOE to maintain minimum disruption of weapons disassembly operations. As discussed in the Amended Notice of Intent (60 FR 32661), the SSM PEIS evaluated the relocation of Pantex Plant operations. This EIS incorporates by reference and summarizes impacts of relocating operations as identified in the SSM PEIS. These impacts are discussed in qualitative terms in the cumulative effects sections of this EIS.

3.1.5.2 *Shutdown of Pantex Plant*

The original NOI (59 FR 26635) also mentioned an alternative of shutting down Pantex Plant operations as a means of evaluating environmental baseline conditions. However, Pantex Plant is the only facility currently capable of carrying out the requirements to assemble, disassemble, and perform quality assurance tests on the nuclear weapons and weapon components. These activities are required to maintain the safety of the nuclear weapons stockpile. The near-term shutdown of Pantex Plant before any other facility could fulfill these responsibilities would result in the interruption of these safety requirements. Therefore, as announced in the Amended NOI (60 FR 32661), the shutdown of Pantex Plant operations within the near-term scope of this EIS is considered unreasonable.

operations on 2,000, 1,000, and 500 weapons per year. The differences among the alternatives are in the number of pits that will be stored at Pantex Plant and the new projects that might be implemented.

Impacts to facilities and infrastructure, land resources, air quality, acoustics, cultural resources, socioeconomics, waste management, intrasite transportation, and environmental justice were determined to be similar for each of the alternatives. The main differences in impacts among the alternatives would involve the disturbance to soils and biotic resources due to construction of the new projects, radiation exposure to workers involved in the transfer of pits, and risks associated with aircraft accidents.

Table 3.2–2 presents a comparison of impacts among the candidate sites for the relocation of pit storage activities. Five facilities at four candidate sites were assessed for the storage of 8,000 or 20,000 pits.

For most of the environmental resources assessed in this EIS, there are no real differences in the impacts to the individual resources among the different candidate sites. This is due to the nature of the pit storage activities. The methods and procedures involved in the storage of pits have evolved and been refined at Pantex Plant to reduce the potential for impacts. This analysis assumes that the same methods and procedures would be used at each candidate site should it be chosen for pit storage. While the environments at each of the candidate sites are different, the storage methods minimize the impacts to those environments. The real differences among the candidate sites in regard to pit storage are the frequency and consequences associated with operational and external accidents.

Impacts that would result from pit storage operations at candidate sites on facilities and infrastructure, land resources, geology and soils, water resources, air quality, acoustics, biotic resources, cultural resources, socio-economic resources, and waste management would be negligible, primarily because no new construction of facilities would be required at any of the candidate sites. Further, normal operations, including handling and storage of pits, do not require substantial amounts of utility or resource use. There would be unavoidable exposures to radiation from handling of the pits during transfer to storage. There would also be additional impacts to Pantex Plant workers from loading the pits for transfer to the storage site, if one is chosen. Likewise, there is a potential for accidents involving forklifts during unloading and storage of pits. Such accidents would affect the workers, but would not result in any health risk to the public.

The risks associated with accidents are discussed in terms of their frequency of occurrence. This EIS uses the following definitions for frequency of occurrence:

- *Anticipated*—frequency of occurrence is less than 10^{-0} and greater than or equal to 10^{-2} per year (less than 1 in 100 chance of occurring per year).
- *Unlikely*—frequency of occurrence is less than 10^{-2} and greater than or equal to 10^{-4} per year (in between 1 in 100 and 1 in a 10,000 chance of occurring per year).
- *Extremely unlikely*—frequency of occurrence is less than 10^{-4} and greater than or equal to 10^{-6} per year (in between 1 in 10,000 and 1 in a 1,000,000 chance of occurring per year).
- *Not reasonably foreseeable*—frequency of occurrence is less than 10^{-6} per year (less than 1 in 1,000,000 chance of occurring per year).

TABLE 3.7-1.—Summary Comparison of Environmental Impacts at Pantex Plant-Continued

TABLE 3.2–1.—*Summary Comparison of Environmental Impacts at Pantex Plant*-Continued

PROPOSED ACTION ALTERNATIVES (Includes Storage of Up to 20,000 Pits)			NO ACTION ALTERNATIVE (Includes Storage of Up to 12,000 Pits)	PIT STORAGE RELOCATION ALTERNATIVE (Pantex Plant Impacts of Relocating 8,000 or 20,000 Pits [See Table 3.2–2 for Impacts to Other Sites])
2,000 WEAPONS LEVEL	1,000 WEAPONS LEVEL	500 WEAPONS LEVEL		
ACOUSTICS (SEE SECTION 4.8 IN MAIN TEXT)				
Except for airblast from high explosives detonation, noise levels from Pantex Plant activities would be below 65 dBA at the plant boundary. The detonations could be audible at a distance of 5 to 10 kilometers (3 to 6 miles). Due to the size of the site, noise from construction of the new facilities would not reach the public.			Same as the Proposed Action except no new facilities are proposed.	Same as the Proposed Action. Due to the size of the site, noise from construction of the new facilities would not reach the public.
BIOTIC RESOURCES (SEE SECTION 4.9 IN MAIN TEXT)				
The construction of the new facilities would result in loss of 15,900 m^2 (171,000 ft^2) of common plant and animal habitat.			No new facilities are proposed.	The construction of the new facilities would result in loss of 15,900 m^2 (171,000 ft^2) of common plant and animal habitat.
SOCIOECONOMIC RESOURCES (SEE SECTION 4.11 IN MAIN TEXT)				
For this weapons level, 3,800 direct jobs and 6,257 secondary jobs would continue. A total personal income of $564 million (in 1994 dollars) would continue to be added to the economy annually. Construction of the new facilities would temporarily generate 1,997 direct and	This weapons level would support 3,000 direct jobs and 4,925 secondary jobs. Personal income additions to the economy would be reduced to $445 million annually. Construction of the new facilities would temporarily generate 1,997 direct and	This weapons level would support 2,400 direct jobs and 3,950 secondary jobs. Personal income additions to the economy would be reduced to $356 million annually. Construction of the new facilities would temporarily generate 1,997 direct and	The socioeconomic impacts for the 2,000, 1,000, and 500 weapons levels would be the same as discussed for the Proposed Action. No new facilities are proposed.	The socioeconomic impacts for the 2,000, 1,000, and 500 weapons levels would be the same as discussed for the Proposed Action. Construction of the new facilities would temporarily generate 1,997 direct and

TABLE 3.2–1.—*Summary Comparison of Environmental Impacts at Pantex Plant*-Continued

PROPOSED ACTION ALTERNATIVES

PROPOSED ACTION ALTERNATIVES (Includes Storage of Up to 20,000 Pits)			NO ACTION ALTERNATIVE (Includes Storage of Up to 12,000 Pits)	PIT STORAGE RELOCATION ALTERNATIVE (Pantex Plant Impacts of Relocating 8,000 or 20,000 Pits [See Table 3.2–2 for Impacts to Other Sites])
2,000 WEAPONS LEVEL	1,000 WEAPONS LEVEL	500 WEAPONS LEVEL		
INTRASITE TRANSPORTATION (SEE SECTION 4.12 IN MAIN TEXT)				
Approximately 50 workers would be involved in these activities. This weapons level would have an estimated worker exposure of 61 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.024.[1] No impact to the public would result from intrasite transportation.	Approximately 50 workers would be involved in these activities. This weapons level would have an estimated worker exposure of 48 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.019.[1] No impact to the public would result from intrasite transportation.	Approximately 50 workers would be involved in these activities. This weapons level would have an estimated worker exposure of 41 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.016.[1] No impact to the public would result from intrasite transportation.	Approximately 50 workers would be involved in these activities. The No Action Alternative would have the following impacts for the three weapons levels: 2,000 weapons - worker exposure of 44 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.018.[1] 1,000 weapons - worker exposure of 31 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.012.[1] 500 weapons - worker exposure of 25 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.010.[1] No impact to the public would result from intrasite transportation.	Approximately 50 workers would be involved in these activities. The Pit Storage Relocation Alternative would have the following impacts for the two relocation amounts. These exposures include the impacts for the rest of the activities (equivalent to Proposed Action 2,000 weapons level). 20,000 pits - worker exposure of 344 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.14.[1] 8,000 pits - worker exposure of 174 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.07.[1] No impact to the public would result from intrasite transportation.

ary Comparison of Environmental Impacts at Pa

2,000 WEAPONS LEVEL	1,000 WEAPONS LEVEL	500 WEAPONS LEVEL	NO ACTION ALTERNATIVE (Includes Storage of Up to 12,000 Pits)	RELOCATION ALTERNATIVE (Pantex Plant Impacts of Relocating 8,000 or 20,000 Pits [See Table 3.2–2 for Impacts to Other Sites])
HUMAN HEALTH (SEE SECTION 4.14 IN MAIN TEXT)				
Approximately 330 workers would be involved in weapons-related activities associated with exposure to radiation. This weapons level would have an estimated worker exposure of 330 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.13.	Approximately 330 workers would be involved in weapons-related activities associated with exposure to radiation. This weapons level would have an estimated annual worker exposure of 165 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.07.	Approximately 330 workers would be involved in weapons-related activities associated with exposure to radiation. This weapons level would have an estimated worker exposure of 82 person-rem, and a group excess cancer fatality risk for 10-year exposure of 0.03.	The human health impacts for the 2,000, 1,000, and 500 weapons levels would be the same as the Proposed Action.	The human health impacts for the 2,000, 1,000, and 500 weapons levels would be the same as the Proposed Action. See Table S–2 (or 3.2–2) for impacts at the other sites.
AIRCRAFT ACCIDENT (SEE SECTION 4.15 IN MAIN TEXT)				
An aircraft accident capable of causing a release from a pit storage or weapons storage magazine is extremely unlikely (frequency of occurrence less than 10^{-4} but greater than or equal to 10^{-6}). A person in the vicinity of the plant has an approximately 3.0×10^{-12} increase in fatal cancer risk from potential aircraft crash plutonium dispersal accidents from pit storage magazines only.	The risks of an aircraft accident at Pantex Plant are dependent on the number of weapons or pits present at any time at the plant, not on the weapons level. The impacts for this weapons level would be equal to or less than those described for the 2,000 weapons level.	The risks of an aircraft accident at Pantex Plant are dependent on the number of weapons or pits present at any time at the plant, not on the weapons level. The impacts for this weapons level would be equal to or less than those described for the 2,000 weapons level.	The No Action Alternative would involve the storage of only 12,000 pits, which would require all 18 Modified Richmond magazines and 18 of the 42 SAC magazines. With fewer magazines used, the likelihood of an aircraft crash into a magazine containing pits is reduced by 44 percent.	The risks of aircraft accidents in Zone 4 are partly dependent on the pit storage level. 20,000 Pit Storage Relocation - With no pits stored at Pantex Plant, the likelihood of an aircraft accident capable of causing a release from a pit storage magazine is reduced to zero. 8,000 Pit Storage Relocation - The likelihood of an aircraft accident capable of causing a release from a pit storage magazine is the same as discussed for the No Action Alternative.

TABLE 3.2–1.—*Summary Comparison of Environmental Impacts at Pantex Plant*-Continued

PROPOSED ACTION ALTERNATIVES (Includes Storage of Up to 20,000 Pits)			NO ACTION ALTERNATIVE (Includes Storage of Up to 12,000 Pits)	PIT STORAGE RELOCATION ALTERNATIVE (Pantex Plant Impacts of Relocating 8,000 or 20,000 Pits [See Table 3.2–2 for Impacts to Other Sites])
2,000 WEAPONS LEVEL	1,000 WEAPONS LEVEL	500 WEAPONS LEVEL		
INTERSITE TRANSPORTATION OF NUCLEAR AND HAZARDOUS MATERIALS (SEE SECTION 4.16 IN MAIN TEXT)				
For the current baseline 10-year weapon shipment schedule, the public would receive an exposure of 2.0 person-rem with a corresponding excess cancer fatality risk of 9.0×10^{-4}. SST crew members would receive 1.6 person-rem with an expected number of excess cancer fatalities of 6×10^{-4}. For a 100-percent increase from the current shipment schedule, the public exposure would be 4.0 person-rem and excess cancer fatality risk would be 1.8×10^{-3}. SST crew members would receive 3.2 person-rem with an expected number of excess cancer fatalities of 1.3×10^{-3}.			Impacts would be the same as for the Proposed Action.	In addition to the impacts described for the Proposed Action, the following impacts would result with this alternative: 20,000 Pit Storage Relocation - Public would receive an additional exposure of 3.0 person-rem (maximum) for a total of 7.0 person-rem with a corresponding increase in excess cancer fatalities of 1.5×10^{-3} for a total number of expected excess cancer fatalities of 3.3×10^{-3}. 8,000 Pit Storage Relocation - Public would receive an additional exposure of 1.2 person-rem (maximum) for a total of 5.2 person-rem with a corresponding increase in excess cancer fatalities of 6.0×10^{-4} for a total number of expected excess cancer fatalities of 2.4×10^{-3}.
ENVIRONMENTAL JUSTICE				
Minority and low-income populations in the Pantex Plant Region of Influence would not be disproportionately affected.				

TABLE 3.2–2.—*Summary Comparison of Environmental Impacts of Pit Storage Operations at Pantex Plant and Alternative Pit Storage Relocation Sites*-Continued

PANTEX PLANT (PIT STORAGE IMPACTS ONLY—20,000 PITS)	ALTERNATIVE PIT STORAGE RELOCATION SITES			
	NEVADA TEST SITE	SAVANNAH RIVER SITE	HANFORD SITE	MANZANO WSA
	WATER RESOURCES			
Operations would not impact surface water or groundwater. The annual water demand would be negligible. The wastewater would not have a measurable effect on groundwater quality.				
	AIR QUALITY			
Impacts to air quality from normal pit storage operations would result entirely from vehicle emissions which would add negligible amounts to regional emissions.	Impacts to air quality from normal pit storage operations would result entirely from vehicle emissions.			Impacts to air quality from normal pit storage operations would result entirely from vehicle emissions. The emissions have been determined not to exceed the specified threshold levels for the Albuquerque-Rio Grande Intrastate Air Quality Control Region.
	ACOUSTICS			
Noise impacts from the pit transportation vehicles and the air conditioning and heating equipment associated with pit storage personnel would be minimal at any of the sites.				
	BIOTIC RESOURCES			
No impacts to sensitive species, their habitats, or wetlands are anticipated. No impacts to biotic resources would be expected.	No impacts to sensitive species, their habitats, or wetlands would be expected. DAF: Area of infrequent desert tortoise activity. No impacts would be expected.	No sensitive species, habitats, or wetlands would be disturbed. No sensitive species reside at P-Reactor. No impacts to biotic resources would be expected.	No sensitive species, habitats, or wetlands would be disturbed. No sensitive species reside at FMEF. No impacts to biotic resources would be expected.	A sensitive plant species and four springs are present within the perimeter of Manzano WSA. However, pit storage activities would not disturb the plants or the springs. No impacts to biotic resources

TABLE 3.2–2.—*Summary Comparison of Environmental Impacts of Pit Storage Operations at Pantex Plant and Alternative Pit Storage Relocation Sites*-Continued

PANTEX PLANT (PIT STORAGE IMPACTS ONLY—20,000 PITS)	ALTERNATIVE PIT STORAGE RELOCATION SITES			
	NEVADA TEST SITE	SAVANNAH RIVER SITE	HANFORD SITE	MANZANO WSA
	CULTURAL RESOURCES			
Pit storage activities would not disturb any of the resource sites. Therefore, no impacts would be expected.	DAF: Nine cultural resource sites have been identified, but were not recommended for NRHP eligibility. P-Tunnel: No historic resources have been found. Pit storage activities would not result in any direct impacts to cultural resources.	No cultural resources have been found in the vicinity of P-Reactor. Pit storage activities would not result in any impacts to cultural resources.	No cultural resources have been found in the vicinity of the FMEF. Pit storage activities would not result in any impacts to cultural resources.	Historic and prehistoric resources have been found within the Manzano WSA. Pit storage activities in the magazines would not result in any impacts to cultural resources.
	SOCIOECONOMIC RESOURCES			
While pit storage activities at Pantex Plant require security personnel, these personnel are also required for the other storage activities in Zone 4. The security requirements would not change with or without pit storage.	Pit storage activities would require 150 personnel (30 facility, 120 security). Impacts of this employment on each region's economy would be negligible.			

Table 3.2–2. Summary Comparison of Environmental Impacts of Pit Storage Operations at Pantex Plant and Alternative Pit Storage Relocation Sites-Continued

PANTEX PLANT (PIT STORAGE IMPACTS ONLY—20,000 PITS)	ALTERNATIVE PIT STORAGE RELOCATION SITES			
	NEVADA TEST SITE	SAVANNAH RIVER SITE	HANFORD SITE	MANZANO WSA
	HUMAN HEALTH			
The range of potential accidents is dominated by an aircraft accident capable of causing a release from a pit storage magazine. The likelihood of this incident is extremely unlikely (frequency of occurrence: less than 10^{-4} and equal to or greater than 10^{-6} per year). A person in the vicinity of the plant has an approximately 2.5×10^{-12} increase in fatal cancer risk from potential aircraft crash plutonium dispersal accidents from pit storage magazines only.	The range of potential accidents is dominated by the puncture of a pit at the DAF due to a forklift accident (frequency per single pit handling is extremely unlikely [10^{-4} to 10^{-6}]). The impacts of this accident would be 3.3×10^{-5} person-rem to the public in the vicinity of NTS, resulting in a risk of 1.1×10^{-15} excess fatal cancers/yr to an average member of the public.	The range of potential accidents is dominated by the puncture of a pit at the P-Reactor due to a forklift accident (frequency per single pit handling is extremely unlikely [10^{-4} to 10^{-6}]). The impacts of this accident would be 4.6×10^{-3} person-rem to the public in the vicinity of SRS, resulting in a risk of 3.0×10^{-15} excess fatal cancers/yr to an average member of the public.	The range of potential accidents is dominated by the puncture of a pit at the FMEF due to a forklift accident (frequency per single pit handling is extremely unlikely [10^{-4} to 10^{-6}]). The impacts of this accident would be 2.9×10^{-5} person-rem to the public in the vicinity of Hanford Site, resulting in a risk of 5.3×10^{-17} excess fatal cancers/yr to an average member of the public.	The range of potential accidents is dominated by the puncture of a pit at the Manzano WSA due to a forklift accident (frequency per single pit handling is extremely unlikely [10^{-4} to 10^{-6}]). The impacts of this accident would be 4.0×10^{-2} person-rem to the public in the vicinity of KAFB, resulting in a risk of 2.6×10^{-14} excess fatal cancers/yr to an average member of the public.
	AIRCRAFT ACCIDENTS			
An aircraft accident capable of causing a release from a pit storage magazine is extremely unlikely (frequency of occurrence: less than 10^{-4} and equal to or greater than 10^{-6} per year). A person in the vicinity of the plant has an approximately 2.5×10^{-12} increase in fatal cancer risk from potential aircraft crash plutonium dispersal accidents from pit storage magazines only.	The annual aircraft hit probability hazard frequency at the DAF at NTS is 1.5×10^{-6}. Due to the construction of the DAF, a breach of pit containers in storage from aircraft impact resulting in a release of Pu is not reasonably foreseeable (frequency of occurrence: less than 10^{-6} per year). The P-Tunnel would be immune from aircraft accidents.	The annual aircraft hit probability hazard frequency at the P-Reactor at SRS is 1.2×10^{-6}. Due to the construction of the P-Reactor, a breach of pit containers in storage from aircraft impact resulting in a release of Pu is not reasonably foreseeable (frequency of occurrence: less than 10^{-6} per year).	The annual aircraft hit probability hazard frequency at the FMEF at Hanford is 1.2×10^{-6}. Due to the construction of the FMEF, a breach of pit containers in storage from aircraft impact resulting in a release of Pu is not reasonably foreseeable (frequency of occurrence: less than 10^{-6} per year).	The annual aircraft hit frequency hazard frequency at Manzano is 8.8×10^{-5}. Due to construction of magazines designated for potential storage of pits, a breach of pit containers in storage from aircraft impact resulting in a release of Pu is not reasonably foreseeable (frequency of occurrence: less than 10^{-7} per year).

TABLE 3.2–2.—*Summary Comparison of Environmental Impacts of Pit Storage Operations at Pantex Plant and Alternative Pit Storage Relocation Sites*-Continued

PANTEX PLANT (PIT STORAGE IMPACTS ONLY—20,000 PITS)	ALTERNATIVE PIT STORAGE RELOCATION SITES			
	NEVADA TEST SITE	SAVANNAH RIVER SITE	HANFORD SITE	MANZANO WSA
	INTERSITE TRANSPORTATION OF NUCLEAR AND HAZARDOUS MATERIALS (TRANSPORTATION OF PITS ONLY)			
Storage of all pits at Pantex Plant (i.e., the Proposed Action) would not require additional intersite transportation. Therefore, there would be no additional impacts to the public at Pantex Plant.	The transportation of a maximum of 20,000 pits to NTS for storage would result in a cumulative dose of 2.0 person-rem to the public. This would result in 1.0×10^{-3} excess cancer fatalities from incident-free operations.	The transportation of a maximum of 20,000 pits to SRS for storage would result in a cumulative dose of 3.0 person-rem to the public. This would result in 1.5×10^{-3} excess cancer fatalities from incident-free operations.	The transportation of a maximum of 8,000 pits to Hanford Site for storage would result in a cumulative dose of 1.2 person-rem to the public. This would result in 6.0×10^{-4} excess cancer fatalities from incident-free operations.	The transportation of a maximum of 20,000 pits to Manzano WSA for storage would result in a cumulative dose of 0.5 person-rem to the public. This would result in 2.5×10^{-4} excess cancer fatalities from incident-free operations.
	ENVIRONMENTAL JUSTICE			
Normal operations would not have any offsite impact. Abnormal events would not disproportionately impact minority or low-income populations.	Normal operations would not have any offsite impact at any of the sites. Abnormal events would not disproportionately impact minority or low-income populations.			

DAF - Device Assembly Facility
FMEF - Fuels and Materials Examination Facility
MWh - Megawatt-hours
Pu - Plutonium
SRS - Savannah River Site
SST - Safe Secure Tractor Trailer
WSA - Weapons Storage Area

CHAPTER 4

Affected Environment and Environmental Consequences at Pantex Plant

CHAPTER 4
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES AT PANTEX PLANT

Chapter 4 provides information on the methods of analysis applied in this EIS and the results of analyses for Pantex Plant. The chapter begins with an introduction and a summary of the impact assessment methodologies that have been applied. The chapter continues with presentations of the affected environment at Pantex Plant and the impacts of the Proposed Action and Alternatives. These presentations are organized by type of resource (e.g., plant facilities and infrastructure, land resources, water resources, etc.) and other issue areas (e.g., intrasite transportation, waste management, intersite transportation, and environmental justice). Also addressed later in this chapter are irreversible and irretrievable commitments of resources, unavoidable adverse environmental impacts, relationships between short-term uses of the environment and long-term productivity, and cumulative impacts.

4.1 INTRODUCTION

The Council on Environmental Quality (CEQ) regulations for implementing NEPA direct Federal agencies to follow the standard format contained in 40 CFR Parts 1500–1508 for preparation of an EIS. However, the regulations allow Federal agencies to use different formats if "the agency determines that there is a compelling reason to do otherwise" (40 CFR 1502.10). Due to the complex, interwoven nature of the activities discussed in this EIS, the number of sites involved with these activities, and the inclusion of additional sites as possible alternatives for relocation of these activities, DOE has determined that a modified format would better serve the public interest and more efficiently satisfy the regulatory requirement for clear presentation of the Proposed Action, the Alternatives, and the associated environmental consequences.

In applying the standard format, agencies frequently use separate chapters for discussions of the affected environment and environmental consequences. This EIS, however, is formatted such that the affected environment for Pantex Plant and associated environmental consequences are contained in chapter 4, while the affected environment and environmental consequences associated with the other sites are contained in chapter 5. Furthermore, both chapters are internally formatted so that the discussion of each aspect of the affected environment at a site (e.g., water resources, air quality, transportation, etc.) is followed by discussions of the impacts to that aspect for the Proposed Action, No Action, and Pit Storage Relocation Alternatives, respectively. Subsequently, the cumulative impacts to that aspect of the environment and potential measures to mitigate adverse environmental impacts are discussed.

This chapter begins with a brief discussion of the methodologies used to characterize each aspect of the affected environment and assess potential impacts to that aspect. In accordance with the CEQ regulations, the affected environment is defined comprehensively to include the natural and physical environment and the relationship of people with that environment (40 CFR 1508.14). In the interest of presenting the reader with the relevant information in the most practical manner, the discussions in this chapter are limited to summaries of key information. Additional

information and discussions of analyses are contained in the appendixes.

Affected Environment

The descriptions of the affected environment provide a baseline for understanding the direct, indirect, and cumulative effects of the Proposed Action and Alternatives. The scope of the discussions varies by resource areas to ensure that all relevant issues are included.

For land resources and geology and soils, discussions include Pantex Plant Site and its surroundings, generally an area within 80 kilometers (50 miles) of Pantex Plant Site and referred to as the Region of Influence (ROI) for each resource. This information provides a basis for understanding both direct effects and the overall resource base that could be affected by the changes in the activity levels at Pantex Plant.

Ambient conditions are described for air quality, acoustics (noise), and water resources. Discussions focus on air quality and noise conditions at the site boundaries and the surface water bodies and groundwater aquifers that could be affected. This information serves as a basis for analyzing key air and water quality parameters to obtain results that can then be compared to regulatory standards. Biotic and cultural resources conditions are described for the area within the boundaries of Pantex Plant Site and also at Pantex Lake.

Socioeconomic conditions are described for the counties and communities that could be affected by regional population changes associated with the changes in the activity levels at Pantex Plant. The socioeconomic ROI is large enough to account for growth related to direct project employment as well as secondary jobs that may be induced by the changes in the activity levels at Pantex Plant. The socioeconomic ROI for Pantex Plant includes four counties: Carson, Armstrong, Potter, and Randall.

In addition to those natural and b environmental resources discussed abo affected environment sections include a of issues related to ongoing DOE activi Pantex Plant. These issues involve facilities and infrastructure, intrasi intersite transportation, waste managem radiological and hazardous chemical imp human health during normal operatio accidents, including risks from potential accidents.

Environmental Impacts

In accordance with CEQ regulatio environmental consequences disc provide the analytical detail for compari environmental impacts associated wi changes in the activity levels at Pantex Discussions are provided for environmental resource and relevant issue could be affected.

For comparison purposes, enviro concentrations of emissions and other po environmental effects are presented appropriate regulatory standards or guid However, compliance with regulatory stan is not necessarily an indication of significance or severity of the environ impact for NEPA purposes.

The purpose of the analysis of environ consequences is to identify the potenti environmental impacts. The environ assessment methods used and the fa considered in assessing environmental im are discussed in section 4.2, Impact Assess Methodologies, and in the approp appendixes. The potential for impacts to a resource or relevant issue is described i introduction to each section that fo (sections 4.3 through 4.17).

4.2 IMPACT ASSESSMENT METHODOLOGIES

The following is a brief description of the mpact assessment approaches used in this EIS or addressing potential impacts of Pantex Plant ontinued operations at different activity levels nd at candidate pit storage sites.

lant Facilities and Infrastructure

hanges to plant facilities and infrastructure are ssessed by comparing the support requirements f the Proposed Action and the Alternatives to te infrastructure capacities. These assess- ents focus on transportation, infrastructure, d utility systems.

and Resources

and use impacts are assessed based on the tent and type of land that would be affected d potential direct impacts resulting from the nversion or from the incompatibility of land e changes with special status and protected ds.

eology and Soils

e geologic setting, structural geology, and the l and sediment quality are discussed. The logic setting is composed of the omorphology and the stratigraphy of the ion. Structural geology includes regional logy, seismicity, and subsidence. Potential smic impacts are assessed based on the ations of capable faults and the history of the smicity in the region. The section on soil and iment quality includes discussions on soil es and the current environmental restoration cesses at Pantex Plant. Impacts to the soil lude any activities which would result in sion and taking soils out of production, ch is discussed in the Land Use section. acts from the soil would be contaminated potentially impacting human health. Soil s at Pantex Plant Site are described and a litative analysis is performed to assess the effects of potential contaminants of concern in soils at Pantex Plant Site.

Water Resources

Surface water impacts are assessed based on wastewater discharges from Pantex Plant activities. The assessment of water quality impacts from wastewater (sanitary and process) and stormwater runoff qualitatively address potential impacts to surface water and groundwater resources at Pantex Plant.

Impacts to floodplains are assessed based on whether any Pantex Plant activities, including construction of new facilities, would be located within floodplains.

Groundwater resource impacts are assessed based on the effects on aquifers, groundwater usage, and groundwater quality within the Pantex Plant ROI. Total groundwater use at Pantex Plant and projections of future usage determine the short- and long-term impacts associated with changing activity levels at Pantex Plant. Impacts of groundwater withdrawals on existing contaminant plumes because of construction and facility operation are also assessed.

Air Quality

The assessment of potential impacts to air quality is based on the comparison of impacts from the Proposed Action and Alternatives with applicable State, local, or National Ambient Air Quality Standards or the potential exceedance of Prevention of Significant Deterioration increments. The more stringent standards serve as the comparison criteria. The comparison of project toxic pollutants includes guidelines or standards adopted by the State of Texas. Air quality modeling was performed in order to assess the conservative maximum concentrations of individual pollutants that the workers or members of the public might experience. Air quality monitoring data collected by the Texas Natural Resources Conservation Commission

(TNRCC) has been used to help benchmark the model. However, the data does not correlate to the modeling on a one-to-one basis, as the placement and operation of air quality monitoring stations do not allow for a comprehensive assessment of the impacts of air emissions to the workers and the public.

Acoustics

Acoustic impacts are assessed qualitatively on the basis of the potential degree of change in noise levels at sensitive receptors with respect to ambient conditions. Blast noise from high explosives detonation is calculated using an airblast prediction model called BLASTO.

Biotic Resources

Potential impacts are assessed based on the degree to which various habitats or species could be affected by Pantex Plant operations. Where possible, impacts are evaluated with respect to Federal and State protection regulations and standards.

Impacts to wildlife are evaluated in terms of disturbance, displacement, or loss of wildlife. Results of biouptake of radionuclides are identified from monitoring data. Impacts are assessed based on the proximity of wetlands to Pantex Plant operations. Impacts resulting from wastewater discharge into a wetland are evaluated, recognizing the effluents would be required to meet Federal and State standards. A list of species potentially present at Pantex Plant Site was obtained from the U.S. Fish and Wildlife Service and appropriate State agencies, and was used in the process of assessing whether Pantex Plant operations would impact any plant or animal under section 7 of the *Endangered Species Act.*

Cultural and Paleontological Resources

Impacts on prehistoric and historic resources are assessed by considering whether continued operations at Pantex Plant could substantially add to existing disturbance of resources area, adversely affect National Regis Historic Places-eligible resources, or cau of, or destruction to, important pre resources. Impacts on Native Am resources are assessed by considering w Pantex Plant activities have the potent affect sites that are historically impor have a position in a Native American sy belief. Impact assessments for paleon resources are based on the numbers and resources that could be affected, as well quality of fossil preservation in a given de

Socioeconomics

The assessment of impacts on local and socioeconomic conditions and factors in changes in population, employment income in the ROI. The changes to these are projected on an annual basis beca exact schedule for changes in the activi are not currently known. The asse includes bounding cases for activity leve

Intrasite Transportation

The focus of this analysis is on the in transfer and handling of hazardous ma particularly the radiological effects fr transportation and handling of radio materials. Accidents involving the tra tation and handling of hazardous materia the potential of leading to human fa excess cancer fatalities, and serious e mental contamination. Radiological ex and excess cancer fatalities are calcul workers handling the material. Impacts public outside the Pantex Plant bounda not expected from intrasite transfe handling of radioactive materials.

Waste Management

The analysis addresses the waste type waste volumes generated from Pantex operations, including environmental res activities. Impacts are assessed in the co

site practices for treatment, storage, and disposal; associated capacities for the different waste types; and the applicable regulatory requirements.

Pantex Plant does not have existing onsite low-level waste disposal; the number of shipments required to transport low-level waste from Pantex Plant to the Nevada Test Site is thus part of the analysis. The risk associated with additional shipments is addressed in the Human Health section.

Human Health

The health effects are determined for Pantex Plant operations by identifying the types and quantities of material to which one is exposed, estimating exposures, and calculating the resultant health effects. The impacts on human health for workers and the public during normal operation and postulated accidents from various alternatives are assessed. Computer codes such as Melcor Accident Consequence Code System (MACCS) and Explosive Release Atmospheric Dispersion (ERAD) are used to simulate impacts. Atmospheric dispersion modeling using Industrial Source Complex Short-Term Model, Version 2 (ISCST2) was performed for the air quality analysis and the results are used in the evaluation of impacts to workers from hazardous chemicals. Data from continuous air monitoring stations are used to assess impacts from radiological emissions.

Public health impacts could result from exposure to radioactive or hazardous chemical materials released during operation. Experience from past and current operations that are similar to future operations is used to estimate the radiological health impacts to workers. Modeling is used to estimate the type and amount of material released and the associated radiological and chemical doses. These doses are converted to health effects using appropriate health risk estimators.

The relative consequences of postulated accidents in the evaluation of each alternative are assessed. The accident analysis involves less detail than a formal Probabilistic Risk Assessment by addressing bounding accidents (relatively low probability/high consequence) and a representative spectrum of possible operational accidents (relatively high probability of occurrence and low consequence). The technical approach for the selection of accidents is consistent with the DOE Office of NEPA Oversight *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statement* guidance, which recommends consideration of two major categories of accidents: within design basis accidents and beyond design basis accidents (DOE 1993).

Aircraft Accidents

One of the scenarios in the accident risk impact assessment is the potential for an aircraft-induced hazardous material dispersal accident. The likelihood and consequences of this accident scenario have been studied extensively since the start of nuclear explosive operations at Pantex Plant, and studies continue to this day. For purposes of this analysis, new data from a Radar Airspace Monitoring System has been used to determine the amount, type, and frequency of aircraft movements in proximity to Pantex Plant. A Draft DOE standard methodology (see appendix E) is used to estimate the likelihood of an aircraft impacting a critical facility at Pantex Plant. Human health risks from aircraft-induced radiological releases are assessed using the MACCS and ERAD computer codes. The resulting doses are converted to a predicted number of excess cancer fatalities.

Intersite Transportation

The intersite transportation assessment was based on the transport mode, weight of material, curies, proximity dose rates (transport index), type of package, number of shipments, and

more accurately reflect the impacts that could be expected if the decisions discussed in the documents were implemented.

In addition to the DOE programs, information on other Federal, State or local projects, including private developments, was sought through contacts with Federal and State regulatory agencies, the Amarillo Economic Development Corporation, the Panhandle Municipal Water Authority, and the City of Amarillo.

This effort yielded only one project (future closure of the Helium Plant) that would contribute to the cumulative impacts in the Pantex Plant ROI. The U.S. Bureau of Mines has been operating the Helium Plant in the Amarillo area since the early 1940s. On October 9, 1996, the President signed the *Helium Privatization Act of 1996*, directing helium operations to discontinue production and sale of refined helium no later than 18 months from the date of enactment (by April 1998). The impacts of this action are analyzed in section 4.11.5, because cumulative impacts of closing or downsizing this facility would be limited to socioeconomic impacts.

Context of Operations on 2,000, 1,000, and 500 Weapons

These workloads were used to determine a reasonably foreseeable impact of operating Pantex Plant. Because the dismantlement of a specific weapon system was not analyzed, a bounding impact per category of operation, i.e., dismantlement, assembly, surveillance (not by weapon type, nor by individual operations) was derived from historical data. Then the total impact was derived by scaling these data by number of weapons or, in some cases, by number of people. This is not a limitation to the number of personnel that can be hired. However, it does mean that the level and type of impacts to individual resource areas must remain within the envelopes as stated in the EIS.

This EIS is focused on deter from full-scale dismantlement and assembly of an entire imparted a conservative, ye foreseeable," estimation as to wh would be from operating Pantex of activity levels for operations on and 500 weapons was a tool estimates for total emission generation, risk, etc. The ana therefore envelope the impacts fro the plant without unnecessarily specific process decisions (see secti

To restate this conclusion, once im are determined, there may exi permutations on the number of we impact per weapon that fall within th impact levels. Specifically, this EIS state what processes are accomplis given ratio of particular processes. process is needed whereby work on o weapons is necessary, but the impacts within the impact envelopes, no supp EIS would be required. Ongoing asse would continue to be necessary to ens the level of impacts to the environment b drastically changed. The total num weapons operations would be ev because it is a key indicator as to whether additional NEPA documentation wo required. However, exceeding these n does not, by itself, mandate add Environmental Assessments or Understanding whether or not the additional impacts from specific proces required, but a simple checklist or scre analysis is typically the only docume necessary to confirm that no additional im would result from a process or set of proce On the other hand, if the analysis confirme impact parameters were surpassed, addi NEPA documentation would be required.

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TABLE 4.3.1.1–2.—*Mission Facilities Summary*[1]

MISSION	APPROX. # OF BLDGS.	EXAMPLE FACILITIES	APPROX. AREA m^2 (ft^2)	YEAR BUILT (average)
Assembly, Disassembly, QA Testing, & Maint. & Mod.	94	Assembly & Disassembly Bays, Assembly & Disassembly Cells, Production Support Laboratories, Tool & Component Warehousing, Weapon Staging Magazines	84,400 (908,000)	1966
HE Research and Development	124	HE Machining Bays, HE Pressing Bays, HE Formulation, HE Synthesis, Firing Sites, Production Support Laboratories, HE Storage Magazines	46,300 (498,000)	1955
Facility Operations	141	Maintenance and Craft Shops, Security, Medical, Fire Department, ES&H, Support Laboratories, Offices	76,600 (814,800)	1977
Pit Storage	22[2]	Magazines, Vaults, Staging Facilities	6,900 (74,200)	1949

[1]Table excludes tanks, chemical storage, ramps (concrete floor enclosed walkways between buildings), guard towers, uti structures (e.g., pump houses), and miscellaneous structures (e.g., bus stop hut).
ES&H - Environment, Safety, and Health
[2] Represents 18 Modified Richmond Magazines and Buildings 12–44 (Cell 8), 12–55, 12–58, and 12–116. Note 12-26 a pit vaults and Steel Arch Construction (SAC) magazines are listed as Component Warehousing and Weapon Staging Maga respectively.
HE - High explosive(s)
QA - Quality Assurance
Source: DOE 1994j:5-13 thru 5-16, 6-7 thru 6-10, 7-12 thru 7-14, 8-7, 8-8, 9-8, 14-7

Pantex Plant has a mature maintenance upgrade program supported with appropriate NEPA related documentation. Since 1990, Pantex Plant has initiated 354 environmental checklists and other NEPA related documents; 206 of the 354 were identified as facility upgrades, repairs, improvements, and maintenance related activities (Pantex 1996b:App D).

4.3.1.2 *Infrastructure*

Two categories of infrastructure, transportation access and utilities, are described below for Pantex Plant Site. Transportation access includes roads, railroad, and airport operations. Utilities include steam, electricity, natural gas, water, and wastewater treatment.

Roads

Access to the site is provided by the Texas to Market roads bounding the site on the east, and west and by U.S. Highway 60 kilometers (1 mile) to the south. Inter Highways 40 and 27 provide access to interstate highway system. Additionally kilometers (47 miles) of roads exist within plant boundaries (Figure 4.3.1.2–1) (Pa 1996:2.2).

Onsite transportation involves movement nuclear explosives, nuclear components components and materials, tritium, chemic and other hazardous materials, including w Nuclear explosives and components transported to and from Pantex Plant in S

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Secure Tractor Trailers by the Transportation Safeguards Division. Onsite transportation is accomplished with hardened trailers and Safe Secure Tractor Trailers as well as other conventional vehicles, which include flatbeds, trailers, vans, trucks, pallet jacks, forklifts, and tow motors. Onsite transport of materials is on paved roadways or enclosed ramps between buildings (Pantex 1996b:3.9). Additional discussion on transportation is provided in section 4.12, Intrasite Transportation, and section 4.16, Intersite Transportation of Nuclear and Hazardous Materials. The Traffic Section of the Packaging and Shipping Department is responsible for the receipt of commercial materials from offsite and for handling materials to be transported out of the plant. Building 16–19, Central Shipping and Receiving, handles commercial materials moving into and out of the plant (Pantex 1996a:5.5).

Railroads

A major rail center for the Burlington Northern Santa Fe Railroad, formerly known as the Atchison, Topeka, and Santa Fe Railroad, is located in Amarillo, Texas. The railroad passes along the southernmost portion of the Texas Tech University (TTU) property at Pantex Plant Site (Pantex 1996:9.5). An c the railroad extends through into Pantex Plant from the s 4.3.1.2–1). Except for occasic shipments, the site railroad t unused (Pantex 1996:9.5).

Airport

The Amarillo International Ai approximately 12 kilometer: southwest of Pantex Plant (Pa The airport is primarily used f aviation and is equipped fo commerce. Pantex Plant leases a at the airport for its own tran (Pantex 1996b:2.2). Mason and Transportation Department p necessary ground transportation.

Utilities

Utilities include steam, electricity, for fuel, water, and wastewater treat 4.3.1.2–1 provides current utility Pantex Plant system capacity, and o net capacity for fiscal year (FY) 199

Steam. Pantex Plant provides operations and facility heating. Build

TABLE 4.3.1.2–1.—*Utility Usage and Capacities at Pantex Plant*

UTILITY[1]	FY 94 USAGE	FY 94 PANTEX PLANT SYSTEM CAPACITY	FY 94 OFFSITE UT EXCESS CAPAC
Water	836M liters (221M gal)	1,893M liters (500M gal)	5,526M liters (1,460M
Wastewater Treatment	477M liters (126M gal)	829M liters (219M gal)	NA
Steam*	153M kg (337M lb)	596M kg (1,314M lb)	NA
Electricity	84,420 MWh	201,480 MWh	6,053,160 MWh
Natural Gas	14.6M m^3 (515M ft^3)	289M m^3 (10,220M ft^3)	Not Reported

*At 150 psi
M = million
NA - Not Applicable
[1]Approximately 1.8 million liters (0.47 million gallons) of petroleum, oil, and lubricants were used at Pantex Plant in 1994 These supplies, obtained from commercial vendors, are readily available and are not discussed further in this EIS.
[2] City of Amarillo offer of treated wastewater (for industrial use) for potential new Pantex Plant missions.
Sources: DOE 1995j:10; DOE 1991b:16

the plant's boilerhouse, contains four boilers and operates on natural gas (Pantex 1996a:App D; DOE 1994f:7). Two of the boilers each have the capacity to produce 22,680 kilograms (50,000 pounds) of steam per hour and the other two have the capacity to produce 11,340 kilograms (25,000 pounds) of steam per hour each (DOE 1995j:9). Steam heat is used where open flames, flammable liquids, and flammable gases pose a potential safety risk.

Electricity. Pantex Plant receives electrical energy from Southwestern Public Service Company. In 1994, the company had a peak of 3,370 megawatts, a system net capability of 4,061 megawatts, and an excess capacity of 691 megawatts or approximately 6 million megawatthours. In 1994, Pantex Plant consumed approximately 84,420 megawatthours of electricity. In 1995, consumption decreased to 80,500 megawatt hours (Pantex 1996:9.1). Two 115-kilovoltampere electrical substations are located onsite with a capacity of 23 megawatts (DOE 1995j:9). There are several generators, both fixed and portable, that provide standby power in the event of an interruption of normal service to critical systems.

Natural Gas. The Texas Panhandle is one of the major oil and gas producing regions in the country with considerable reserves. Natural gas is supplied to Pantex Plant by Anthem Energy (Pantex 1996:9.1). The natural gas is delivered through a 25-centimeter (10-inch) main supply line, which is capable of supplying 289 million cubic meters (10,220 million cubic feet), sufficient capacity for all future plant requirements (DOE 1995j:10). Tank 12–076 holds a reserve of 2,384,550 liters (630,000 gallons) of fuel oil for use, should interruption of the natural gas supply occur (DOE 1994j:12–1). In 1995, consumption decreased by 1.3 million cubic meters (46 million cubic feet) (Pantex 1996:9.1).

Water. Water for Pantex Plant is pumped from the Ogallala aquifer by five production wells located in the northeast portion of the site. A well and two reservoirs were completed in 1994. The plant pumped 836 million liters (221 million gallons) in 1994. Approximately 25 percent of the water pumped at Pantex Plant was used by TTU for irrigation (DOE 1995j:9). Net plant use was 617 million liters (163 million gallons) in 1995 (Pantex 1996:9.3). Water storage reservoirs are integrated into the water distribution system. Total storage capacity exceeds 20 million liters (5.2 million gallons) (DOE 1994f:6). The City of Amarillo has pledged 5,526 million liters per year (1,460 million gallons per year) of treated wastewater as part of potential plant expansion (DOE 1991b).

The Ogallala formation is capable of yielding adequate water for all current and foreseeable uses by Pantex Plant (PC 1994a:1). Additional discussion on the adequacy of groundwater resources is provided in section 4.6.1.2, Groundwater.

Wastewater Treatment. Pantex Plant has two types of wastewater treatment. The primary wastewater treatment operation is located just south of Playa 1. This system consists of a lagoon that is divided into an aerated section and a facultative (settlement and biotreatment) section. The water is disinfected with chlorine and discharged to Playa 1. Other wastewater treatments are operation specific. Examples are presented in Table 4.3.1.2–2. The wastewater treatment system is permitted to allow a daily average discharge of up to 2.5 million liters (0.65 million gallons). In 1995, wastewater volume decreased to 421 million liters (111 million gallons) (Pantex 1996:9.2). The FY 1996 Sewage Treatment Quality Upgrade will improve the plant's sanitary sewage system to assure wastewater standards are maintained (DOE 1995j:8). The upgrade was covered as a categorical exclusion (NEPA LIN–96–003–C) (Pantex 1996b:App D).

TABLE 4.3.1.2–2.—*Examples of Facility Specific Wastewater Treatment Op*

BUILDING NUMBER	BUILDING DESCRIPTION	PROCESS DESCRIPTION	CAPACITY	DIS MAN
11–29	Photo Lab	Electroplating and evaporation closed loop system for reprocessing rinsewater.	Information not available	Drumme silver rec
11–50	HE machining	HE-contaminated water, particle settling tank, and carbon filtration system.	57,000 liters (15,000 gallons) per month	Filtered w discharge
12–43	HE wastewater filtration	HE-contaminated water is passed through a 1-micron particulate filter and a carbon filter.	15,000 liters (4,000 gallons) per month	Filtered wa discharge t
12–121	HE machining facility	HE-contaminated water, particle settling tank, and carbon filtration system.	38,000 liters (10,000 gallons) per month	No discharg loop system. Scheduled o date is FY 19
Waste Water Treatment Facility	Two part lagoon system with chlorinator and pH adjuster	Sanitary wastewater treatment and industrial wastewater treatment.	76 million liters (20 million gallons) per month	Discharge to

Sources: Pantex 1996a:3.3; DOE 1994f:7; PC 1995d:1; Pantex 1996:14.7

Rights of Way and Easements. In addition to property owned by TTU, Burlington Northern Santa Fe Railroad owns parcels located between Highway 60 and TTU property along the Pantex Plant Site boundary. Anthem Energy and Southwestern Public Service Company have utility easements associated with utility operations. Carson County Farm to Market roads exist along the east, west, and north site boundaries (Pantex 1996:2.2; TNRCC 1995a).

4.3.2 Impacts of Proposed Action

4.3.2.1 *Impacts of Continued Operations*

Weapons-Related Activities

This section discusses the impacts on plant facilities and infrastructure from continued operations at Pantex Plant. With maintenance and upgrades, all plant and infrastructure would support the co activities and missions without any for capacity difficulties (DOE 1995j:1, 8, comparison of estimated utility resourc for continued operations at three weapon is provided in Table 4.3.2.1–1 (see sectio Projections indicate that sufficient cap exist should demand exceed expectations (DOE 1995j:1, 8, 10).

In 1994, Pantex Plant experienced a wor slowdown due to facility mainte Therefore, 1993 usage rates were chosen most recent representative year for the weapons per year operational level. In add the 1993 consumption rates were higher fo utilities with the exception of electricity (D 1994f:7; DOE1995j:10). The 1,000 weap level utility consumption rate is based

and as such will not require new construction nor extensive facility modifications. Utility usage for this operation would be minimal and well within the total usage described for the Proposed Action. The pit repackaging operations would not result in any impacts to land use, geology and soils, water resources, air resources, acoustics, biotics, cultural resources, socioeconomics, or environmental justice and, therefore, are not discussed in those sections. The intrasite transportation impacts have already taken the impacts for pit repackaging into account. The pit repackaging would involve waste management and would result in additional worker radiological exposures. These impacts are discussed in sections 4.13 and 4.14.

Environmental Restoration Activities

Environmental restoration activities are designed to maintain or improve the environment. Since 1989, environmental restoration activities have been assessing inactive sites through temporary field operations that, for the most part, require minimal usage of plant utilities and plant facilities (Pantex 1996:15.0). Heavy equipment such as drill rigs operate with self-sufficient power supplies while field sampling typically uses manual labor or portable power supplies. Portable toilets, fire protection, potable and nonpotable water, and temporary power and lighting are typically required and provided by the contractor (Pantex 1992:4-1, 9-1, Appendix B). By the year 2000, activities are expected to be reduced to monitoring and groundwater and soils management, such as bioremediation of soils and perched zone groundwater remediation. No new facilities would be needed for the environmental restoration activities.

Recycling restoration wastewater is currently under study. After 1999, 65,942 liters (17,420 gallons) could be reclaimed annually (Pantex 1996:14.5).

Waste Management Activities

Waste management activities consumption has been accounted for facility-wide totals presented in 4.3.2.1–1. Impacts of infrastructure s (closures, treatment, storage, and dispos discussed in section 4.13, Waste Managa

4.3.2.2 *Impacts of New Facilit Construction and Upg*

A comparison of site infrastructure and resource needs for the proposed construction and upgrades is provided i 4.3.2.2–1. As noted in this table, s utility capacity exists to handle the from these facilities. The Gas A Laboratory, the Materials Comp Assurance Facility, the Nondes Evaluation Facility, and the Metrolo Health Physics Calibration and Acc Facility represent an operational cons effort that would not increase utility us

The Pit Reuse Facility represents a p 0.18 percent increase in annual site consumption based on the addition o employees to a 3,800-employee baseli utilities except industrial water and ste industrial water or steam heat is ne support the Pit Reuse Facility. Th consumption increases would be minim the Pit Reuse Facility operations woul an existing facility (DOE 1995j:4, 5).

The Hazardous Waste Treatme Processing Facility (HWTPF) proje modernize, consolidate, and expand waste operations capabilities (Battelle This project is expected to infrastructure requirements by 0.13 based on the addition of five new em Industrial water usage is estimated to by 3.4 million liters (0.9 million gallo or 0.3 percent of 920 million liters (24 gallons) used in 1993. Discharges of i

would remain
described for
other weapons

weapon staging and special nuclear material staging. These storage operations, like pit storage, require access control, security, and electricity. Therefore, no reduction in infrastructure support or utility usage is anticipated as a result of relocating 20,000 pits.

4.3.4.2 *Impacts of Relocating 8,000 Pits*

Under the scenario of relocating 8,000 pits, overall infrastructure impacts would remain similar to those described for the Proposed Action. The storage of 12,000 pits would be satisfied from existing magazines at the plant site; no new building construction would be required, other than what is currently required. Increases in infrastructure requirements would not occur.

4.3.5 Cumulative Impacts

The cumulative impacts presented here include impacts of the continued operations at Pantex Plant combined with impacts associated with activities described in the WM PEIS, SSM PEIS, and S&D PEIS. Since the Pantex Plant EIS Proposed Action and the SSM PEIS No Action Alternative represent a continuum of operations, the impacts associated with any new mission or facility that could be implemented at Pantex Plant are discussed in the context of that continuum. The impacts from the WM PEIS program are combined with those of the Pantex Plant EIS Proposed Action. The impacts from the S&D PEIS are combined with those of the SSM PEIS No Action Alternative. A detailed discussion of this methodology is presented in section 4.2.

4.3.5.1 *Impacts of Alternatives in the Waste Management Draft Programmatic Environmental Impact Statement*

The WM PEIS Decentralized Alternative, which would generate the greatest impacts, would increase the electrical consumption by 3.33 megawatts. The existing total capacities of Pantex Plant and the local area utility system are adequate to handle this increase. Wastewater generation would increase by 43,660 liters (11,535 gallons) per day, The existing total capacity of Pantex Plant is adequate to handle this increase. Water usage would increase by 96,200 liters (25,416 gallons) per day. The existing capacity is adequate for this increase.

4.3.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. Under the No Action Alternative, no downsizing or modification of facilities would occur, and there would be no construction impacts. Due to the reduced workload expected, future infrastructure impacts are expected to be less than current impacts. Under the downsizing alternative, all construction activities would be modifications to existing facilities. Facilities would be consolidated and impacts would be expected to be less than current impacts. Under the relocation alternative, the facilities would undergo decontamination and decommissioning (DOE 1996b).

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TABLE 4.4.1.1–1.—*Application Rate for Agricultural Chemicals Typically Used at Pantex Plant*

HERBICIDES		INSECTICIDES	
MILO (SORGHAM)			
Bicep™	5.6 to 7.0 L/ha (2.4 to 3.0 qt/acre)	Lorsban 4E™	0.6 kg/ha (0.5 lb/acre)
Atrazine™	1.7 kg/ha + 2.3 L (1.5 lbs/acre + 1 qt) crop oil	Parathion	1.1 kg/ha (1 lb/acre)
WHEAT			
2,4-D	0.6 L/ha (1/2 pt/acre)	Cygon™	0.6 kg/ha (0.5 lb/acre)
2,4-D + Banvel™	1.2 L + 0.3 L/ha (1 pt + 4 oz/acre	Malathion	0.6 kg/ha (0.5 lb/acre)
Amine	0.6 L/ha (1/2 pt/acre)	Lorsban™	1.1 kg/ha (1 lb/acre)
Amber™	24 mL/ha (1/3 oz/acre)	Furadan™	1.1 kg/ha (1 lb/acre)
Ally	7 mL/ha (1/10 oz/acre)	Parathion	0.6 kg/ha (0.5 lb/acre)
		Di-Syston™	0.6 kg/ha (0.5 lb/acre)
FALLOW (SUMMER)			
Landmaster™	3.9 L/ha (54 oz/acre)	—	—
Landmaster™ + Banvel™	3.9 L + 0.3 1/ha (54 oz + 4 oz/acre)	—	—
2,4-D	1.2 L/ha (1 pt/acre)	—	—

Source: Pantex 1996:10.2

TABLE 4.4.1.1–2.—*Agricultural Chemicals for the 1996-1997 Growing Season at Pantex Plant*

CHEMICAL TRADE NAME	ACTIVE INGREDIENT(S)
Activator 90	—
Ally	Metsulfuron methyl
Amber	Triasulfuron
Arsenal	Imazapyr
Aatrex	Atrazine
Banvel	Dicamba
Landmaster	Glyphosphate and 2,4-dichlorophenoxyacetic acid (Amine form only)
Roundup Ultra	Glyphosphate
Tordon 22K	Picloram
Weedar 64	2,4-dichlorophenoxycetic acid, dimethylamine salt

Source: PC 1996o

Livestock Grazed on Pantex Plant

A large portion of the plant is used for grazing cattle. Stocker calves, which are calves that have been weaned and turned out to pasture, are the most typical livestock operation onsite. Cattle are moved to different areas according to the availability of forage. Grazing is allowed on the uplands and in Playa 4 and Pantex Lake.

Stocking rates at the plant are one animal unit per 2 to 4 hectares (5 to 10 acres) of rangeland, with calves being grazed from November to March on winter wheat (when the weather is conducive to forage production) (Pantex 1996:10.2).

Future Land Use at Pantex Plant

Future land and facility use at Pantex Plant will be managed by DOE through the Land and Facility Use Planning process (DOE P 430.1). This guidance for future site development and reuse is based on the shared long-term goals and objectives of Pantex Plant and stakeholders. The planning process allows for the holistic management of the Department's land and facilities through an integration of missions, ecology, economics, and regional cultural and social factors (DOE 1996h).

Future recommendations at the Plant combine agricultural, industrial/commercial, and open space uses. This includes resource management and livestock grazing. Land resources are expected to remain constant at the plant, with continued leasing of TTU land for security and safety reasons. Pantex Plant has a Site Development Plan that represents the plant upon completion of the projects outlined in the Technical Site Information Five Year Plan (Pantex 1996:10.5, DOE 1995j:8) (Figure 4.4.1.1–1).

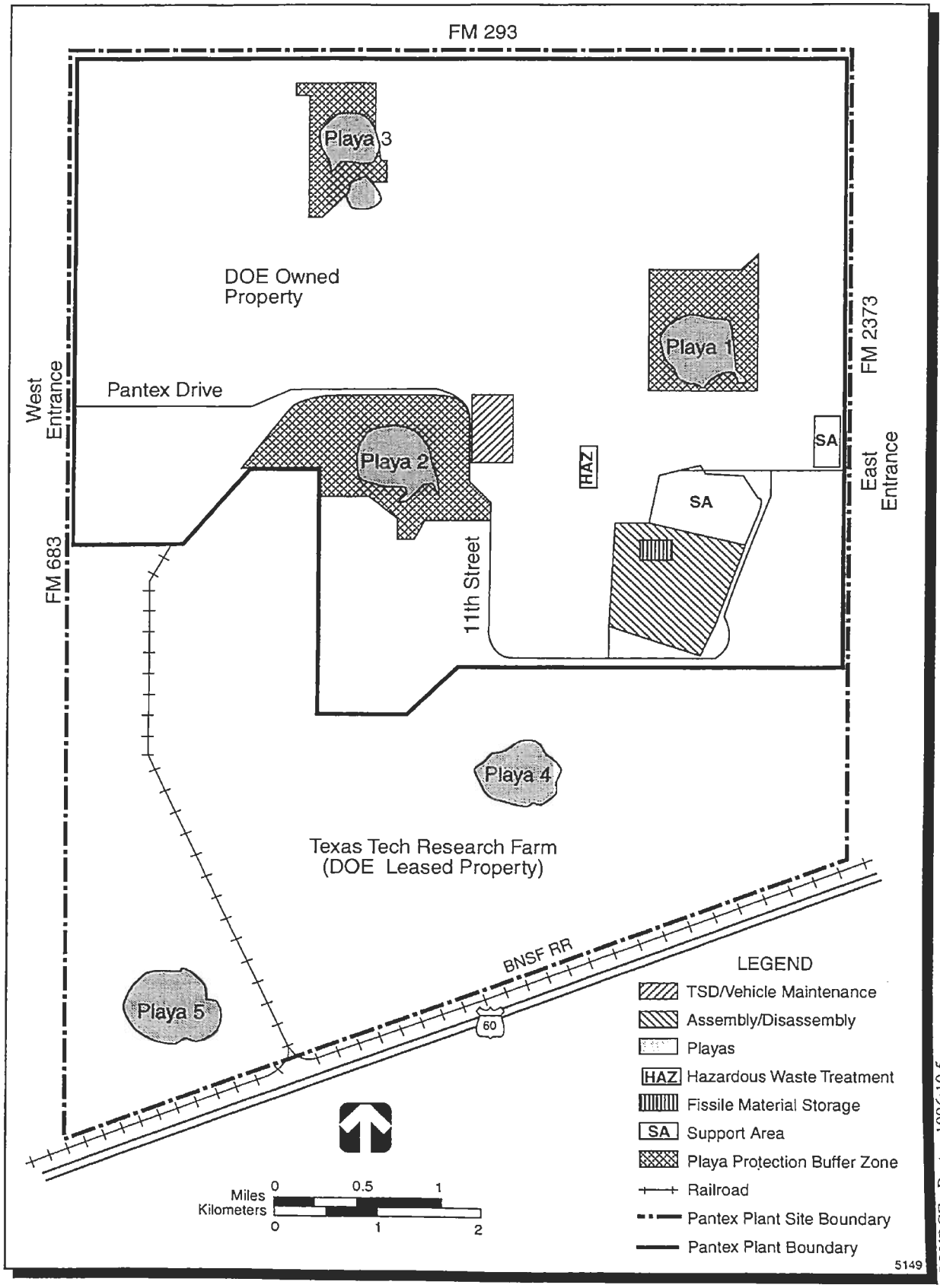
Management plans for the playas and surrounding areas are being implemented as a best management plan to protect cultural and natural resources. This will ensure surface water quality and facilitate compli quality requirements for air, water, an resources. The plan will also archaeological sites and ecological (DOE 1996e:81; Pantex 1996:10.5).

Four playas (including Pantex Lake) the DOE-owned portion of the site designated as wetlands. These wetl are of particular concern and are s protection under various statutes, re Executive orders and DOE orders. Th Guidance Document for Pantex Pla and the Management Plan for Management Unit: Phase One additional oversight for the protection Management plans for Playas 1, 2, DOE-owned land have been imp These plans will protect the p controlling intensive grazing and the p sensitive areas. The following act proposed for the approximate 0.4 (0.25 mile) radius buffer zone surroun playa on DOE-owned land:

- Cattle are excluded from Playa ment Units 1, 2, and 3.
- The farmed area within the bu will be planted in native grass entire ecosystem of the playa, wetlands and the prairie, will be ried, assessed, and allowed to from agricultural disturbances 1996:10.5).

4.4.1.2 *Land Use in the Regi Influence*

This section discusses land use with kilometer (10-mile) and an 80-kilom mile) radius of Pantex Plant. Urban la the Pantex Plant ROIs is dominated Amarillo Metropolitan Area, focusing City of Amarillo. Other towns in the Borger, Claude, Canyon, Pampa, P and White Deer, each with populatio 25,000. The ROIs are transected by



SOURCE: Pantex 1996:10.5

FIGURE 4.4.1.1–1.—***Future Land Usage Projection of Pantex Plant Site Development Plan.***

Highways 40 and 27; U.S. Highways 60, 87, and 287; State Highways 136, 207, and 217; and numerous Farm-to-Market roads.

Current Land Use Within a 16-Kilometer Radius of Pantex Plant

Residences are located throughout the 16-kilometer (10-mile) radius of the plant, with nearly half located to the east, in the town of Panhandle. Another major concentration of residences is located southwest of the plant, in Highland Park Village, which was once associated with the Amarillo Air Force Base. Washburn, located to the south of the Plant, has a somewhat smaller concentration of residences. Within this radius commercial land use is limited to the communities of Panhandle and Washburn, and the Amarillo International Airport. The Iowa Beef Processors Inc., Amarillo Plant, located 10.4 kilometers (6.4 miles) southwest of the center of Pantex Plant, and Fraser Industries, Inc., located 13.3 kilometers (8.3 miles) southwest of the center of the plant make up the area's industrial facilities. Two grain elevators are also located within this area, one to the northeast, the other to the east-southeast of the plant (Pantex 1996:10.3).

Farmland in the 16-Kilometer Region of Influence

Most of the land surrounding the plant is dryland or irrigated farmland, with farms averaging about 518 hectares (1,280 acres) in size. These farms primarily produce corn, wheat, and sorghum.

Data on 729 gardens within the 16-kilometer (10-mile) radius of the plant were obtained in 1995. These gardens usually contained tomatoes, pumpkins, green onions, peas, corn, okra, squash, cucumbers, leafy vegetables, root crops, and fruit trees. Whether these crops were sold at market was not determined. The largest garden in this area, 54.7 hectares (135 acres), belongs to the William P. Clements correctional facility and is maintained for produc inmates of that facility (Pantex 1996:1

Livestock in the 16-Kilometer Regio Influence

The herd size of beef cattle (expresse calf pairs/beef cattle) in the 16-kilom mile) radius of the plant averages 500 a less. As of January 1, 1994 the inventory for Potter and Carson count follows:

- Potter—43,000/5,000.
- Carson—63,000/5,000.

In a 1995 household survey, only two in this area indicated that they had da One individual reported 2,000 cows under a year old and not yet produ These cattle were being reared as re heifers for sale to other dairy farms. resident had six animals that were r for personal use (Pantex 1966:10.2 4.4.1.2–1 and 4.4.1.2–2 further d livestock located within a 16-kilo mile) radius of Pantex Plant.

Land Resources Within an 80-Kilo (50-Mile) Radius of Pantex Plant

Currently, land within the 80-kilo mile) radius area is predominately agriculture. The largest agricultu rangeland that is located along the River drainage to the north of Pante south along the tributary drainage River.

The second largest land use category and dryland crops. Commercial, industrial, institutional and pul comprise a small part of the total lan this. These areas are predominantly with the towns and cities of the regio of Amarillo, predominantly a reside the largest urban area in the region. industrial and commercial land

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TABLE 4.4.1.2–2.—*Beef Cattle in a 16-Kilometer (10-Mile) Radius of Pantex Plant*

SECTOR	DISTANCE[1] meters (yards)	APPROXIMATE HERD SIZE
N	2,196 (2,401)	100
	3,019 (3,301)	190
	3,831 (4,189)	488
	7,163 (7,833)	35
	9,275 (10,143)	70
	10,261 (11,221)	1,500
	13,502 (14,765)	1,300
NNE	2,293 (2,507)	190
	8,060 (8814)	600
	13,104 (14,330)	100
NE	6,697 (7,324)	2,000
	10,017 (10,954)	60
	11,364 (12,427)	60
	12,538 (13,711)	156
	14,137 (15,460)	150
ENE	6,664 (7,287)	75
	7,378 (8,068)	500
	10,305 (11,269)	24
	10,419 (11,394)	220
E	2,118 (2,316)	130
	8,772 (9,593)	260
	10,327 (11,293)	2,000
	10,350 (11,318)	368
	12,142 (13,278)	2,000
	14,804 (16,189)	300
	14,842 (16,231)	6
	15,375 (16,814)	400
ESE	6,062 (6,629)	85
	7,552 (8,259)	260
	15,195 (16,617)	30
SE	5,268 (5,761)	15
	10,316 (11,821)	150
	12,685 (13,872)	400
	14,746 (16,126)	400
	15,281 (16,711)	400

TABLE 4.4.1.2–2.—*Beef Cattle in a 16-Kilometer (10-Mile) Radius of Pantex Plant-Continued*

SECTOR	DISTANCE[1] meters (yards)	APPROXIMATE HERD SIZE
SSE	6,600 (7,217)	450
	7,254 (7,933)	51
	8,432 (9,221)	450
	9,321 (10,193)	300
	11,397 (12,463)	15
	14,019 (15,331)	8
S	7,129 (7,796)	66
	8,899 (9,732)	10
	11,488 (12,563)	25
	11,912 (13,027)	58
SSW	5,725 (6,261)	6,000
	7,174 (7,845)	5
	9,391 (10,270)	10
	12,742 (13,934)	75
	13,314 (14,560)	75
SW	5,050 (5,522)	18
	5,752 (6,290)	1
	6,110 (6,682)	2
WSW	3,339 (3,651)	66
	5,072 (5,546)	300
	5,445 (5,954)	100
	6,918 (7,565)	200
	10,996 (12,025)	3
	11,529 (12,608)	130
W	3,572 (3,906)	300
	5,888 (6,439)	700
	6,398 (6,997)	50
	6,424 (7,025)	100
NW	4,566 (4,993)	1,500
	14,225 (15,556)	10,000
NNW	8,489 (9,283)	3,500
	8,828 (9,654)	1,500
	9,014 (9,857)	600

[1]Distance from center of Pantex Plant
Source: Pantex 1996:10.2

TABLE 4.4.1.2–3.—*Grain Elevators Located Within the 80-Kilometer (50-Mile) ROI Surrounding Pantex Plant*

SECTOR	DISTANCE[1] meters (yards)	NAME	CITY/ COMMUNITY	CAPACITY (bushels)
N	69,045 (75,507)	Dumas Co-op	Morton	1,797,000
	69,375 (75,868)	Perryton Equity Exchange	Pringle	1,152,000
	78,929 (86,316)	Sunray Co-op	Capps Switch	1,955,000
NNE	—	—	—	—
NE	12,764 (13,958)	Robinson Grain Co., Inc.	Abell Switch	681,000
ENE	28,670 (31,353)	H.J. Hughes Grain Elevator, Inc.	Panhandle/Cuyler	346,000
	38,192 (41,766)	Wheeler-Evens Elevator Co.	White Deer	1,596,000
	39,042 (42,696)	Wheeler-Evens Elevator Co.	Hodges Corner	65,000
	49,588 (54,229)	Wheeler-Evens Elevator Co.	Kingsmill	462,000
	62,496 (68,345)	Wheeler-Evens Elevator Co.	Pampa	1,609,000
	73,692 (80,589)	Attenbury Grain Inc.	Hoover	582.000
E	18,501 (20,232)	Robinson Grain Co., Inc.	Panhandle	1,527,000
	19,389 (21,204)	H.J. Hughes Grain Elevator, Inc.	Panhandle	2,647,000
	52,009 (56,877)	Attenbury Grain Inc.	Grandview	111,000
ESE	7,841 (8,575)	H.J. Hughes Grain Elevator, Inc.	Lee Switch	239,000
	34,337 (37,551)	Attenbury Grain Inc.	Lark	1,504,000
	44,523 (48,690)	Attenbury Grain Inc.	Groom	942,000
	46,757 (51,133)	Wheeler-Evens Elevator Co.	Groom	1,867,000
SE	23,151 (25,318)	Robinson Grain Co., Inc.	Conway	1,086,000
	30,592 (33,455)	Attenbury Grain Inc.	Claude	3,511,000
	76,659 (83,834)	Attenbury Grain Inc.	Clarendon	287,531
SSE	62,263 (68,091)	Hereford Grain Co-op	Paloduro	124,000
S	17,891 (19,565)	Attenbury Grain Inc.	Washburn	718,348
	60,168 (65,799)	Dimmitt Agri Industries Inc.	Wayside	65,000
SSW	55,793 (61,015)	Attenbury Grain Inc.	Ogg Switch	512,000
	69,626 (76,143)	Grain Investors Inc.	Happy	1,452,000
	69,726 (76,252)	Attenbury Grain Inc.	Happy	2,926,000
SW	18,081 (19,773)	Attenbury Grain Inc.	Amarillo	5,615,000
	19,787 (21,639)	Continental Grain Co.	Amarillo	8,844,000
	21,831 (23,874)	Cargill Inc.	Amarillo	3,927,000
	28,827 (31,525)	Farmland Industries Inc.	Amarillo	3,226,000
	34,858 (38,120)	Great Plains Term Inc.	Amarillo	5,714,000
	51,076 (55,856)	Consumers Fuel Association Inc.	Canyon	522,478
	51,348 (56,154)	Consumers Fuel Association Inc.	Canyon	576,837
	63,111 (69,018)	Umbarger Co-op Elevators	Umbarger	475,000
	73,116 (79,959)	Farmers Elevators of Dawn Inc.	Dawn	4,616
	73,408 (80,279)	Farmers Elevators of Dawn Inc.	Dawn	2,081,290
WSW	35,514 (38,839)	Coldwater Industries, Inc.	Amarillo	146,464
	46,316 (50,651)	Attenbury Grain Inc.	Bushland	554,802
	46,595 (50,956)	Bushland Grain Co-op	Bushland	1,436,000
	57,873 (63,290)	Hereford Grain Co-op	Wildorado	806,000
	78,699 (86,065)	Hereford Grain Co-op	Ford	644,000
	78,878 (86,261)	Farmers Elevator of Dawn Inc.	Ford	30,000

TABLE 4.4.1.2–4.—*Crop Area Within an 80-Kilometer (50-Mile Radius) of Pantex Plant, in Acres*-Continued

SECTOR	CROP	0-8 km (0-5 mi)	8-16 km (5-10 mi)	16-24 km (10-15 mi)	24-32 km (15-20 mi)	32-40 km (20-25 mi)	40-48 km (25-30 mi)	48-56 km (30-35 mi)	56-64 km (35-40 mi)	64-72 km (40-45 mi)	72-80 km (45-50 mi)
SSE	Wheat	700	3,070	4,220	5,480	7,730	6,410	3,200	40	610	1,080
	Sorghum	350	1,540	1,730	2,100	2,960	2,460	1,230	10	140	220
	Corn	90	410	220	160	220	180	90	—	50	100
	Cotton	—	—	—	—	—	—	—	—	540	1,080
	Peanuts	—	—	—	—	—	—	—	—	20	30
S	Wheat	820	3,400	4,390	6,540	5,920	50	1,870	11,810	11,550	13,430
	Sorghum	410	1,710	1,720	2,460	2,190	20	670	4,320	3,250	3,550
	Corn	110	450	170	200	190	—	70	380	2,170	2,790
	Cotton	—	—	—	—	—	—	—	—	4,960	7,040
	Peanuts	—	—	—	—	—	—	—	—	10	40
	Soybeans	—	—	—	—	—	—	—	—	90	110
	Sugar Beet	—	—	—	—	—	—	—	—	220	290
SSW	Wheat	1,150	3,750	4,020	4,050	1,490	3,420	7,130	10,510	12,410	11,870
	Sorghum	560	1,420	1,330	1,320	480	1,110	2,320	3,420	3,840	3,180
	Corn	140	130	120	170	60	140	300	440	1,170	3,040
	Cotton	—	—	—	—	—	—	—	—	1,730	4,840
	Soybeans	—	—	—	—	—	—	—	—	30	120
	Sugar Beet	—	—	—	—	—	—	—	—	90	350
	Sunflowers	—	—	—	—	—	—	—	—	—	20
SW	Wheat	1,240	2,530	4,660	4,150	5,170	6,810	6,630	8,280	7,920	7,620
	Sorghum	490	850	1,560	1,350	1,680	2,210	2,160	2,730	2,890	3,100
	Corn	60	—	30	170	220	290	280	350	980	1,910
	Cotton	—	—	—	—	—	—	—	—	60	250
	Soybeans	—	—	—	—	—	—	—	—	—	10
	Sugar Beet	—	—	—	—	—	—	—	—	230	520
	Sunflowers	—	—	—	—	—	—	—	—	30	60
WSW	Wheat	1,370	3,400	2,140	270	2,930	7,580	9,500	10,690	9,050	11,750
	Sorghum	500	1,140	720	90	970	2,500	3,100	3,930	3,840	5,170
	Corn	30	—	—	—	60	180	—	1,460	2,290	3,310
	Cotton	—	—	—	—	—	—	—	110	190	280
	Sugar Beet	—	—	—	—	—	—	—	410	700	1,010
	Sunflowers	—	—	—	—	—	—	—	50	80	120
W	Wheat	1,040	420	200	—	—	—	—	800	5,780	9,120
	Sorghum	390	140	70	—	—	—	—	240	1,700	2,690
	Corn	30	—	—	—	—	—	—	—	—	—
WNW	Wheat	680	—	—	—	—	290	—	440	160	540
	Sorghum	280	—	—	—	—	200	—	130	50	150
	Corn	40	—	—	—	—	—	—	—	—	300
NW	Wheat	720	—	—	—	50	130	5,110	7,690	16,030	16,450
	Sorghum	330	—	—	—	16	30	1,050	1,580	3,410	3,800
	Corn	69	—	—	—	—	50	3,140	4,730	10,280	11,630
NNW	Wheat	990	340	—	—	—	—	—	4,640	16,760	21,850
	Sorghum	500	170	—	—	—	—	—	950	3,440	4,490
	Corn	130	40	—	—	—	—	—	2,850	10,290	13,420

Source: Pantex 1996:10.2

from the Ogallala aquifer or from the playas (Pantex 1996:10.1, 10.2).

Livestock

Table 4.4.1.2–5 shows the beef cattle feedlots, open range cattle, and dairy operations located within a 80-kilometer (50-mile) radius of the plant. The beef cattle industry in the Texas Panhandle has four distinct aspects that are affected by precipitation levels and the local and future market prices for beef. These are:

- Cow-calf operations on open range.
- Grazing of stockers on pasture.
- Feedlot operations.
- Slaughter and meat-packaging tions.

The number of calves grazed on wheat during the winter and spring varies signif based on how the weather affects wheat The number of cow-calf pairs/beef recorded in the January 1, 1994 inven Texas Agricultural Statistics for the within the 80-kilometer (50-mile) area follows: Armstrong, 63,000/5,000; B 17,000/9,000; Carson, 73,000/9,000; 283,000/11,000; Deaf Smith, 681,000/1 Gray, 114,000/9,000; Hansford, 251,000 Hartley, 213,000/6,000; Hutchinson, 7,000; Moore, 189,000/6,000; Oldham, 12,000; Potter, 51,000/6,000; Randall, 9,000; Roberts, 35,000/9,000; Sw

TABLE 4.4.1.2–5.—*Beef Cattle by County Within the 80-Kilometer (50-Mile) ROI Surrou Pantex Plant*

COUNTY	COUNTY TOTALS		FARMS WITH 100 HEAD OR MORE	
	FARMS	CATTLE	FARMS	CATTLE
Armstrong	154	39,840	67	36,638
Briscoe	40	5,368	14	4,474
Carson	209	62,257	104	61,045
Castro	18	18,324	11	18,045
Deaf Smith	115	123,075	74	121,398
Donley	131	26,049	35	22,383
Gray	179	72,760	69	69,156
Hartley	23	29,147	11	2,019
Hutchinson	124	65,943	52	63,760
Moore	147	153,876	90	151,831
Oldham	25	20,494	17	20,179
Potter	104	20,290	37	29,107
Randall	327	145,409	125	138,459
Roberts	26	9,675	16	9,265
Swisher	122	81,447	65	79,123

Source: Pantex 1996:10.2

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TABLE 4.4.1.2–7.—*Dairy Operations in an 80-Kilometer (50-Mile) Radius of Pantex Pl*

SECTOR[1]	DISTANCE[2] meters (yards)	NAME	NUMBER OF COWS	PRODUCTION lb (kg)/day
NE	11,586 (12,670)	Personal use	6	—
SSW	52,222 (57,110)	Hinders Dairy Inc.	300	17,500
SW	14,241 (15,574) 48,218 (52,731)	— New Quest	2,000 620	— 42,000
WSW	77,714 (84,988)	Hi Plains Dairy	100	4,000
WNW	64,966 (71,047)	Boys Ranch Dairy	42	850

[1]Only sectors containing dairies are listed.
[2]Distance from center of Pantex Plant
Source: Pantex 1996:10.2

Lake Meredith National Recreation Area, Palo Duro Canyon State Park, Buffalo Lake National Wildlife Refuge, Alibates Flint Quarries National Monument, Greenbelt Reservoir, Lake McClellan National Grasslands, and the city parks of Amarillo and Canyon. More information on these areas of special interest may be found in the Land Use chapter of the Pantex Plant *Environmental Information Document* (Pantex 1996:10.6).

Other Land Resources

All other land uses are classified as commercial, residential, industrial, institutional, and public lands and comprise only a small part of the total land uses within the ROI. The ROI has 134 primary and secondary schools as well as 6 institutions for higher learning. Amarillo is the medical center for the panhandle region, with 5 hospitals. Additional hospitals are located in the towns of Canyon, Borger, Pampa, and Dumas. The nine-county region also has a total of 27 nursing/convalescent homes that care for the needs of the elderly (Pantex 1996:10.4).

Pantex Plant maintains a full-time capability to respond to any medical, fire, or hazardous materials emergencies that may occur plant. Fire departments with full-time volunteer staff are located in the C Amarillo, and the towns of Borger, C Channing, Claude, Pampa, Panhandle, S Vega, and White Deer.

Commercial areas in the Amarillo metro area are located in the central business at major shopping centers and malls, a major streets in the form of strip develo

4.4.2 Impacts of Proposed Ac

4.4.2.1 *Impacts of Continued Operations*

Weapons-Related Activities

Impacts to land resources at Pantex Pl result of the weapons-related activities under the Proposed Action are expecte limited. Operations under the Propose would not appreciably change current l at Pantex Plant; therefore land resource not be adversely affected.

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to or less than those identified for the Proposed Action. Under the No Action Alternative discussed in section 3.1.2, no new facilities would be constructed. Activities associated with the No Action Alternative would not create any significant impact to land resources.

4.4.4 Impacts of Pit Storage Relocation Alternative

As discussed in section 3.1.3, the Pit Storage Relocation Alternative would involve relocation of pits from storage at Pantex Plant to storage at one or more alternate sites. Activities at Pantex Plant Site would remain similar to those identified for the Proposed Action, including the construction of six new facilities. Impacts on land resources would, therefore, be similar to those identified for the Proposed Action.

4.4.4.1 *Impacts of Relocating 20,000 Pits*

The interim storage of up to 20,000 pits at other DOE or Department of Defense sites would make the current storage facilities in Zone 4 available for other uses. No land use change is anticipated.

4.4.4.2 *Impacts of Relocating 8,000 Pits*

The interim storage of up to 8,000 pits at other DOE or Department of Defense sites would make some of the current storage facilities in Zone 4 available for other uses. No land use change is anticipated.

4.4.5 Cumulative Impacts

The cumulative impacts presented here include impacts of the continued operations at Pantex Plant combined with impacts associated with activities described in the WM PEIS, SSM PEIS, and S&D PEIS. Since the Pante EIS Proposed Action and the SSM PE Action Alternative represent a contin operations, the impacts associated with a mission or facility that could be impleme Pantex Plant are discussed in the context continuum. The impacts from the WM program are combined with those of the Plant EIS Proposed Action. The impacts the S&D PEIS are combined with those SSM PEIS No Action Alternative. A de discussion of this methodology is present section 4.2.

4.4.5.1 *Impacts of the Alternati in the Waste Managemen Programmatic Environmental Impact Statement*

In conjunction with the Proposed Action location of treatment and disposal faciliti described in the WM PEIS could increase use by a maximum of 10.6 hectares (26.3 a at Pantex Plant Site. Cumulative impact land resources would not be consid significant. Moreover, this land is alre DOE-owned. The new requirements would be in conflict with DOE plans and policies o plans and policies of the local governmen the Pantex Plant vicinity.

4.4.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives apply to Pantex Plant: No Action, Down Existing Capability, and Relocate Capabi Under the No Action Alternative, downsizing or modification of facilities wo occur, and there would be no change in land

Under the downsizing alternative, facilities would be consolidated and impacts would be expected to be less than current impacts. Under the relocation alternative, the Pantex Plant facilities would be decommissioned and no longer active.

4.4.5.3 *Impacts of Alternatives in the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*

The S&D PEIS is considering Pantex Plant for long-term storage of inventories of nonsurplus weapons-usable plutonium and highly enriched uranium (HEU), storage of inventories of surplus weapons-usable plutonium and HEU pending disposition, and disposition of surplus weapons-usable plutonium. For storage, the strategy for long-term storage of weapons-usable plutonium and HEU, as well as the storage site(s), would be decided. The storage alternatives include upgrading the existing plutonium storage facilities, consolidation of plutonium from other sites, and collocation of plutonium and HEU storage. Potentially, pits could be stored in Zone 12 for long-term storage. The Collocation Alternative is used for analysis purposes in this EIS as the bounding storage alternative.

Under the S&D PEIS Collocation Alternative, construction of new storage facilities would be required in order to store plutonium and HEU at Pantex Plant. Although the new construction would convert undeveloped land, the proposal would conform with the Pantex Site Development Plan. Therefore, direct effects to land use would be negligible. Land disturbance would be 89.5 hectares (221 acres) during construction and 87 hectares (214 acres) during operations.

For the disposition alternatives in the S&D PEIS, the emphasis at this stage in the NEPA decision process is on the strategy and technology mix rather than the actual site. The evolutionary Light Water Reactor (LWR) is used for analysis purposes in this EIS as the bounding disposition alternative. Implementation of this disposition alternative would require the construction and operation of a pit disassembly and conversion facility, plutonium conversion facility, mixed oxide (MOX) fuel fabrication facility, and one or more light water reactors. The bounding alternative also assumes that all of the facilities previously mentioned would be collocated at the same site (potentially Pantex Plant).

Land disturbance during construction would be 14 hectares (35 acres) for the pit disassembly and conversion facility, 36 hectares (90 acres) for the plutonium conversion facility, 121 hectares (300 acres) for the MOX facility, and 284 hectares (700 acres) for the evolutionary LWR. Land required for operations would be 12 hectares (30 acres) for the pit disassembly and conversion, 28 hectares (70 acres) for the plutonium conversion facility, 81 hectares (200 acres) for the MOX facility, and 138 hectares (341 acres) for the evolutionary LWR. The evolutionary LWR would be located on land which is in agricultural use in the northwest portion of Pantex, west of the Burning Ground and Zone 5. Construction of the evolutionary LWR would change current agricultural land use (DOE 1996j:S-11, S-130, 131).

Because this proposed action is not part of the Site Development Plan, a potential adverse direct impact to land use could occur. It should be noted that preconstruction activities for disposition would require about 5 years to perform the tiered NEPA analyses and to obtain necessary permits and designs. About another 5 years would be required for construction, startup, preoperational testing, and operational readiness review. Construction of completely new reactors could take longer (DOE 1996a:chapter 4).

4.4.6 Potential Mitigation Measures

Since no long-term adverse impacts to land resources have been identified relative to the Proposed Action, No Action, or the Pit S Relocation Alternatives, no mitigation me are needed.

4.5 GEOLOGY AND SOILS

4.5.1 Affected Environment

This section addresses the geology and soils in and around Pantex Plant. The geologic setting, including geomorphology, stratigraphy, and issues related to structural integrity, such as subsidence and seismology, is discussed. Also included are discussions of baseline soil and sediment quality on and in the vicinity of Pantex Plant.

4.5.1.1 *Geology*

Geomorphology

Pantex Plant is located in the Southern High Plains, a region of relatively flat topography containing many surficial depressions known as playa basins. Playa basins collect surface water runoff via natural and manmade drainage systems. Considerable attention has been given to the possible origin of playas. Researchers have proposed varied ideas concerning the origin of the typical, roughly circular, shallow playa basin. One idea is that the formation of these basins is the collective result of most of the cited origins (i.e., wind, erosion by streams, lake deposits, soil formation processes, dissolution of soil carbonate, salt dissolution and subsidence, and animal activities) all acting intermittently (Pantex 1996:3.4).

Playas have been identified as a source of recharge to the Ogallala aquifer (Scanlon 1994:94). Interplaya areas, such as unlined ditches, and natural drainage areas were also identified as significant additional groundwater recharge points (DOE 1995r:3-38). Investigations of the ditches and playas, related to the potential for contamination, are being performed through the Pantex Plant environmental restoration program (Pantex 1996:5.2).

Surface elevations at Pantex Plant (excluding the playa basins) range from approximately 1,076 meters (3,530 feet) in the southeast corner of Pantex Plant to 1,096 meters (3,596 feet) in the northwest corner of Pantex Plant (USGS, 1973). Erosion by water runoff is negligible at Pantex Plant in the inter-playa areas due to the relatively flat nature of the land surface and short drainage distance (less than 5 kilometers [3 miles]) into numerous local playas (see Figure 4.6.1.1–1 in section 4.6.1.1). The regional slope is about 1.5 to 1.9 meters per kilometer (8 to 10 feet per mile). Slopes within the playa basins reach up to 5 percent; thus, erosion could be more active within the playa basins. Pantex Plant lies within the "Dust Bowl" region of the 1930's. Wind erosion and deposition continue to be active processes. Current agricultural practices make the land surface more susceptible to wind erosion (Pantex 1996:3.4).

Stratigraphy

Figure 4.5.1.1–1 depicts a complete stratigraphic column of the Palo Duro Basin and Amarillo Uplift in the vicinity of Pantex Plant. The stratigraphy of the sediments and rocks beneath Pantex Plant is discussed in descending chronological order from more recent layers (surface deposits) to Permian-age layers (salt deposits). Pre-Permian rocks will not be discussed because they are not relevant to the affected environment.

The uppermost formation at Pantex Plant is the Blackwater Draw Formation. The Blackwater Draw Formation consists of a sheetlike body of windblown sand and silt having a number of buried soil horizons and ranges from 12 to 22 meters (40 to 75 feet) in thickness at Pantex Plant. Surface soils of the Blackwater Draw Formation consist of Pullman soils on the plains and Randall soils in the playas (Pantex 1996:3.3).

The Pullman soils are up to 1 meter (3 feet) thick and consist of unsaturated, silty clay loam,

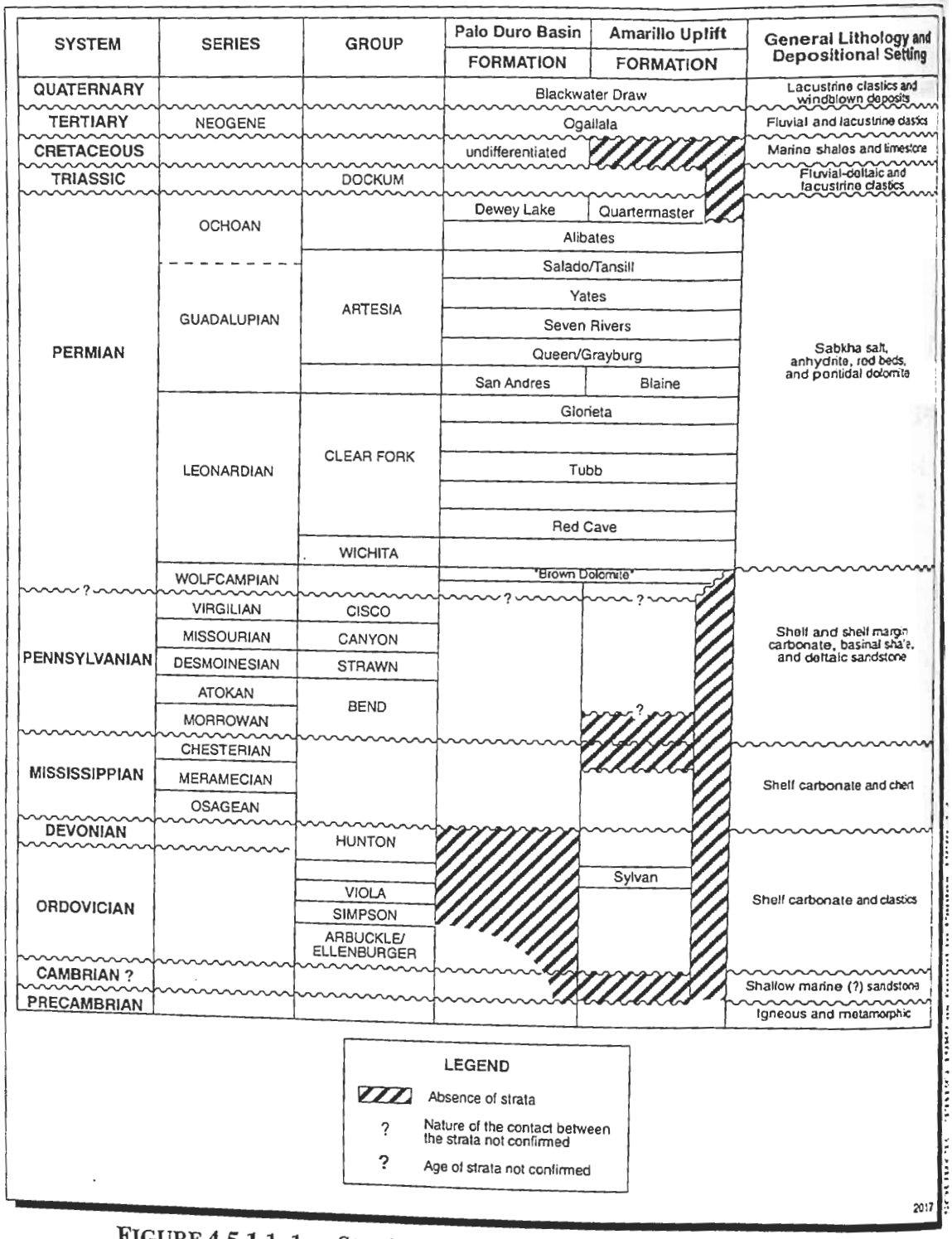

FIGURE 4.5.1.1–1.—*Stratigraphic Column of the Palo Duro Basin and Amarillo Uplift in the Vicinity of Pantex Plant.*

which is slightly permeable. These soils formed in fine-textured, calcareous sediments that probably originated from windblown material. Pullman soils have little or no relief except where they surround intermittent lakes or playas.

The Randall soils are up to 8 meters (25 feet) thick and consist of deep, very poorly drained, noncalcareous massive clay. These soils formed from sediment washed from the surface of surrounding soils within the individual playa watershed. During wet seasons, these soils may remain underwater for long periods of time (USDA 1962:14). Underlying these surface deposits (surface soils or playa basin deposits) is a 12- to 23-meter (40- to 75-foot) thick unit of unsaturated silty sand with caliche of the Blackwater Draw Formation (DOE 1994h:13).

Sediments of the Blackwater Draw Formation encountered in boreholes at the northeast corner and central south boundary of the plant show that these sediments contain numerous open tubules formerly occupied by plant roots. Buried soils within the Blackwater Draw Formation commonly contain fractures that bound soil aggregates. Both root tubules and fractures contain evidence (in the form of clay coatings, manganese stains, and calcium carbonate filaments) that these features have served as groundwater flow paths (Pantex 1996:3.3).

The Ogallala Formation underlies the Blackwater Draw Formation and is the primary water-bearing unit in the Southern High Plains. The Ogallala Formation consists of sediments derived from two distinctive depositional systems: the upper portion which consists of wind-blown deposits and the lower portion which consists of fluvial deposits. It is important to recognize that the Ogallala Formation is a sequence of related deposits rather than a single lithologic unit.

The Ogallala consists of mostly fine to coarse sand, gravel, and silt with some clay and is primarily unconsolidated. A caliche layer has formed in a 1- to 2-meter (3- to 6-foot) thick layer near the top of the formation. Ogallala thicknesses between 60 and 120 meters (200 and 4000 feet) are common in the Palo Duro Basin area with a maximum thickness of 250 meters (800 feet) occurring in the Panhandle Paleovalley northeast of Pantex Plant. There is little relief on the upper surface of the Ogallala, changes in thickness are related primarily to variations in the elevation of the pre-Ogallala surface. The pre-Ogallala surface was controlled not only by erosion but by salt dissolution as well.

The upper portion of the Ogallala Formation consists of 40 to 46 meters (130 to 150 feet) of fine-grained calcareous (calcium carbonate) wind-deposited sand. Many caliche concretions are present throughout this layer. All of these concretions are thin and discontinuous except at the top of the Ogallala Formation, where a relatively persistent caliche layer, called the Caprock caliche, is found (Pantex 1996:3.1).

The lower part of the Ogallala Formation is separated from the upper part by a relatively low permeability zone, 7 to 12 meters thick, referred to as the "fine-grained zone". Stratigraphic test wells drilled near the center and northeast corner of the site have revealed that the fine-grained zone consists of a series of coalescing and upward-fining sequences. It is important to note that the lateral extent of these sequences is unknown but varies from four sequences in the northeast corner of the plant to two sequences near the center of the plant (Pantex 1996:3.3).

Perched groundwater occurs in the discontinuous porous buried channel beneath Pantex Plant (refer to section 4.6.1.2). The position of the buried channel follows the geometry of the fine-grained zone, which was probably aligned along the regional subsurface

collapse related to salt dissolution that produced topographic lows beneath and within the Ogallala sediments. Figure 4.6.1.2–3 in section 4.6.1 illustrates a geologic cross section of the inferred lithologies beneath and in the vicinity of Pantex Plant.

The fine-grained zone is composed of a pink, clayey fine-grained sand which is relatively impermeable to water. The irregular top of the fine-grained zone is probably due to a combination of erosion and subsidence. Within the area of Zone 12 and its vicinity, the relief of the top of the fine-grained zone is at least 18 meters (60 feet). The perched zone is bounded below by the fine-grained zone; therefore, the perched zone may not be present in areas where the fine-grained zone is topographically high or absent (DOE 1995f:3).

The lower part of the Ogallala Formation consists of fluvial (stream or river) channel deposits composed of sands and coarse gravels and associated overbank deposits composed of fine sands and clay. These fluvial deposits accumulated in the lowlands. At the same time, wind-blown deposits were accumulating in the highlands. The fluvial sediments are believed to have derived from erosion of the Southern Rocky Mountains. At Pantex Plant, driller's lithology logs for wells penetrating the Ogallala show much lateral variation in the Ogallala deposits; wells only one-half mile apart often are not particularly easy to correlate in detail. Typically, correlations are limited to the upper interval, the fine-grained zone, and the lower interval. The nature of the depositional environments proposed for the Ogallala is such that only the sheets of windblown sediments should exhibit much lateral extent. It is important to note that the complex heterogeneity of the Ogallala Formation plays an important role in groundwater movement (Pantex 1996:3.3). Hydrologic aspects of the Ogallala Formation are discussed in section 4.6.1.2.

The Dockum Group underlies the O Formation and consists of silt sandstones, conglomerates, and claystone than 30 meters (100 feet) of Dockum strata are present below Pantex Plant. T the northeast portion of Pantex Plan Triassic Dockum strata have been erode the underlying Permian strata are in conta the Tertiary-age Ogallala Formation (F 4.5.1.1–1) (Pantex 1996:3.3).

Underlying the Dockum Group are the and Middle Permian layers, which composed predominantly of thick widespread deposits of salt. The Permian consists predominantly of oc accumulations of shale, limestone argillaceous limestone, and dolomite. The thickness of salt deposits under Pantex have been estimated to exceed 300 (1,000 feet) (Pantex 1996:3.3).

4.5.1.2 *Structural Integrity*

The structural integrity or stability o geological formations underlying Pantex is important to the geotechnical stabil buildings and other operational features utility structures) onsite. Two main geol processes are relevant to the Pantex vicinity: seismic activity and subsidence. S stability is not an issue at Pantex Plant due relatively flat surface topography.

Regional Geology

The underlying geology is made up of major basins in the Texas Panhandle; these the Anadarko and the Palo Duro basins. T basins are separated by a west-north trending uplifted area comprised of Amarillo Uplift and the Oldham-He Trend. The Anadarko Basin is asymme with the deepest portions and steepest occurring adjacent to the Amarillo U (Pantex 1996:3.2). The Amarillo Uplift is of the Pennsylvanian-age Ancestral Ro

TABLE 4.5.1.2–1.—*Modified Mercalli Intensity Scale of 1931 Abridged Version*[1]

INTENSITY	EFFECT
I	Felt by very few under specially favorable circumstances. (I)
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing. (I to II)
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibration like passing of truck. (III)
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 motorcars rocked noticeably. (IV to V)
V	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop. (V to VI)
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moves; a few instances of fallen plaster or damaged chimneys. Damage slight. (VI to VII)
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 motorcars. (VIII-)
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 motorcars disturbed. (VIII+ to IX)
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. (IX+)
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with their foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks. (X)
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 surfaces. Lines of sight and level distorted. Objects thrown upward into air.

[1]Equivalent intensities on the Rossi-forel scale, used prior to 1931 in the United States, are given in parentheses.
Note: Many of the criteria in the intensity scale result from the integrated effects of the total sequence of ground motion from an earthquake as experienced at a particular point. Duration is an important factor. Intensities are critically dependent both on distance from the source of earthquake waves and on the local ground conditions. On the other hand, magnitude is a number intended to quantify the size of an earthquake at its source, independent of other considerations. The two scales are difficult to correlate without detailed study of the local geological structure, rock mechanics, and instrument recordings of local earthquakes over an extensive period of time. These studies have not been conducted for the Amarillo region.
Source: Pantex 1996:3.5

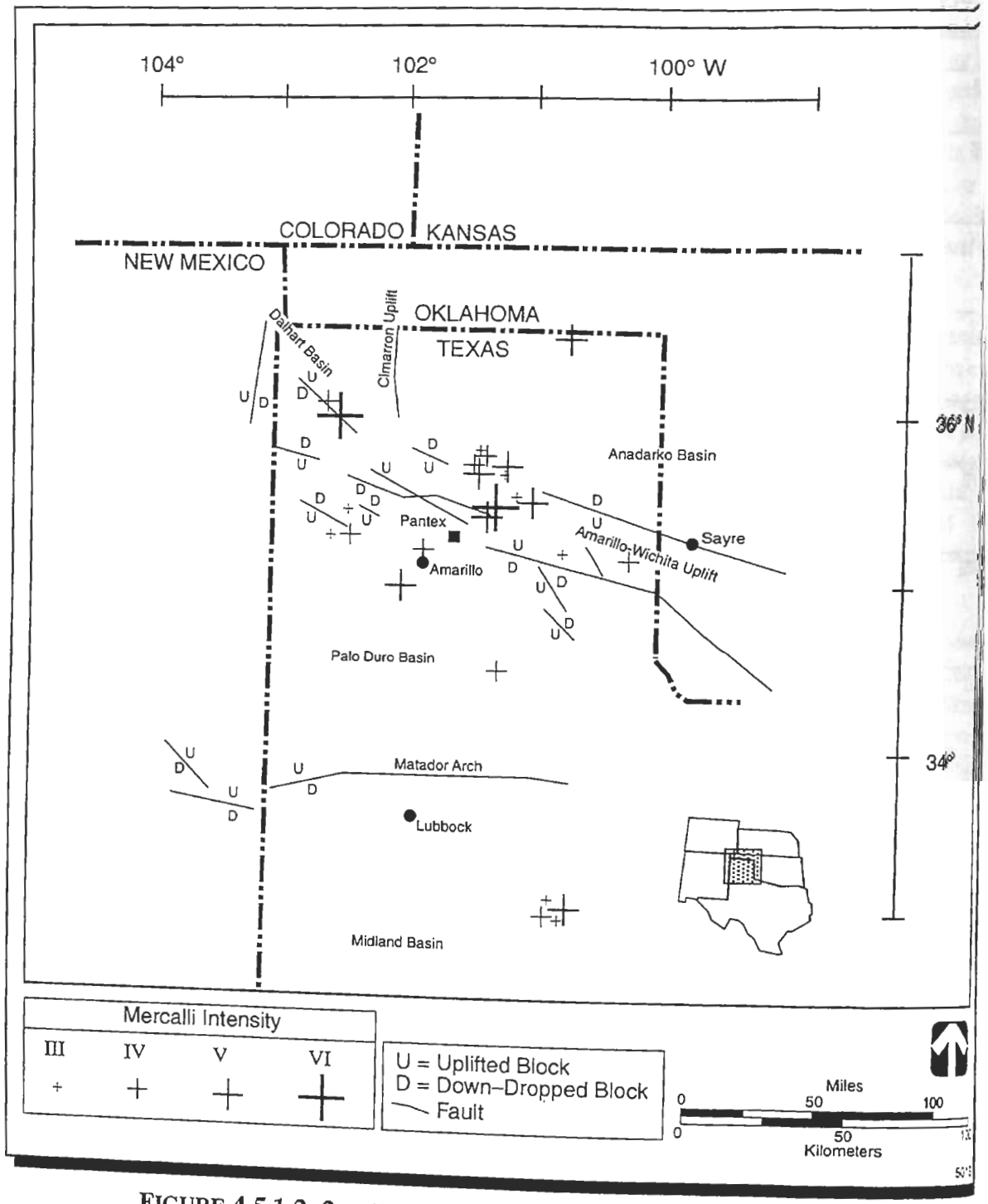

FIGURE 4.5.1.2–2.—*Earthquakes in the Texas Panhandle and Their Relation to Tectonic Features.*

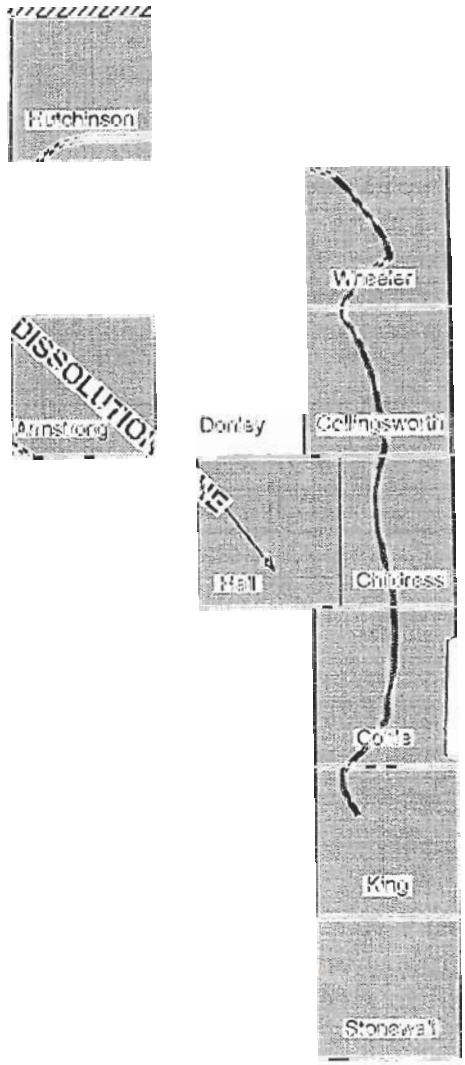
Hutchinson
Armstrong
DISSOLUTION
Donley
Hall
Collingsworth
Childress
Wheeler
Cottle
King
Stonewall

TABLE 4.5.1.2–2.—*Salt Present Beneath Pantex Plant in the Permian Formation*

FORMATION	NET SALT PRESENT
Dewey Lake	No salt.
Alibates	No salt.
Salado-Tansill	No salt, possibly experienced dissolution in the past.
Yates	No salt.
Seven Rivers	No salt, possibly experienced dissolution in the past, major salt unit elsewhere in Palo Duro Basin.
Queen-Grayburg	No salt.
Upper San Andres	Near the distal end (no salt) of zone of active dissolution. Adjacent formation salt is about 60 meters (200 feet) thick.
Lower San Andres	Near the proximal end (110 meters [350 feet] of salt) of zone of active dissolution. Adjacent formation salt is about 110 meters (350 feet) thick.
Glorieta	About 30 meters (100 feet) of salt.
Upper Clear Fork	About 73 meters (240 feet) of salt.
Tubb	Only a few evaporite layers.
Lower Clear Fork	About 91 meters (300 feet) of salt.
Red Cave	Some evaporite strata.
Wichita	No salt.
Wolfcamp	Limestone, shale, and dolomite with sands.

Source: Pantex 1996:3.3

soil association. The Pullman-Randall soil association consists of nearly level to gently sloping deep noncalcareous loamy soils. The Pullman soils occupy the interplaya areas at Pantex Plant and make up about four-fifths of the Pullman-Randall soil association. These soils consist of silty clay loam and are deep and well drained. The slopes range from 0 to 1 percent in the interplaya areas and 1 to 3 percent near the playas. Pullman soil has a high natural fertility, is slightly permeable, and has the ability to retain a moderate amount of water (Pantex 1996:7.1). This soil is classified as a Mollisol, which is noted by wide, deep cracks throughout the year (USDA 1981:ii). These cracks aid in groundwater recharge. The major land uses are grazing and dryland farmin 1984:268).

The Randall clay soils are generally foun bottom of the playas. They are so poorly drained but have high natural f very slight permeability, and high av water capacity except during droughts (1996:7.1). This soil is classified as a V which contains a large amount of clay cracks at some times of the year (1981:ii). Agriculturally, these soils hav potential (Foth 1984:280, 282).

Within the Pantex Plant region of in (ROI), land use is predominantly agric In the High Plans areas of both Cars

Potter counties, Pullman soils are the most extensive arable soils in Texas (Pantex 1996:7.1, 10.1). According to the 1992 Census of Agriculture, farming and ranching contributed nearly $300 million to the economy of the ROI. Extensive description of cropland, rangeland, and associated soils are provided in the Pantex Plant *Environmental Information Document* (Pantex 1996).

General Environmental Restoration Process

An environmental restoration (ER) or cleanup process is typically governed by the *Resource Conservation and Recovery Act* (RCRA) or the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) (in some cases, both) and their associated regulations. Both sets of regulations govern how environmental contamination is defined, characterized, and remediated. While there are regulatory differences, they generally follow a common process. This common process includes the following steps: initial assessment of suspected areas of contamination; a preliminary prioritizing of areas that should be characterized; planning and implementing a formal sampling and analysis program; drafting of recommendations based on the data as to how much remediation, if any, is needed for each area; review and approval of these recommendations by the regulator; feasibility studies for alternative methods of remediation; and implementation of remedial actions and post-remediation activities. The following is a description of the common process by which environmental contamination is characterized and remediated.

Initially, an assessment of a site or facility is performed. This assessment can be conducted by the facility's personnel or by personnel from the Environmental Protection Agency (EPA) and the State's regulatory agency. This assessment identifies places where hazardous materials (as defined by the appropriate regulations) are being, or could have been, released to the environment. This identification process starts with the review of the existing documentation, discussions with facility personnel, and onsite observations. Areas suspected of being contaminated are called solid waste management units (SWMUs) under RCRA and Operable Units (OUs) under CERCLA. These SWMUs or OUs can be single areas of suspected contamination or a grouping of such places.

After the identification of the SWMUs or OUs, priorities are set by the regulators concerning the timing of investigations and any immediate remediations that might be needed. A detailed and formal priority setting process can involve an investigation of the degree of threat to human health and the environment potentially posed by the suspected contamination. This investigation can include more detailed review of documentation, further discussions with current and past employees, and even some sampling of the SWMUs or OUs. The degree of threat posed by the SWMUs or OUs is determined by considering a conservative estimate of the level of contaminants suspected to be present and the potential pathways for exposure to the human environment. The SWMUs or OUs are then ranked according to the degree of perceived threat. Those SWMUs or OUs with a high ranking are usually designated for immediate remediation. The remainder can be slated for full investigation and sampling according to their perceived threat.

The investigative process involves the preparation and subsequent approval of work plans by the regulators and stakeholders. Sampling and analysis of the areas are then performed. At this point, the types and amounts of contamination present at the facility are fairly well characterized. This allows for reasonable projections as to the amount of cleanup activity that might ultimately be needed to accomplish the ER program goals. Based on the analysis of data, recommendations are made as to whether individual SWMUs or OUs need either immediate remediation, feasibility studies of different remediation methods, additional

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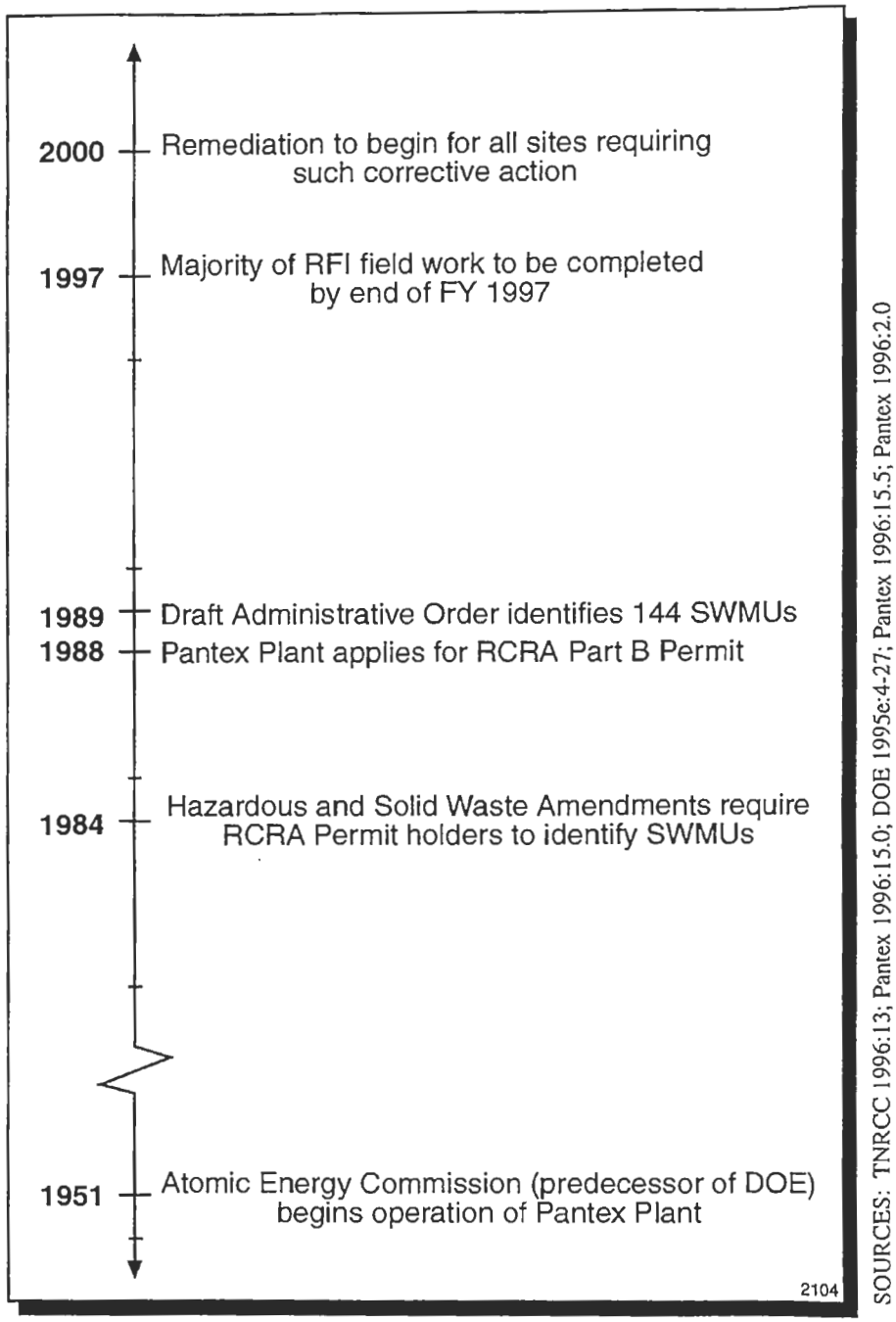


SOURCES: TNRCC 1996:13; Pantex 1996:15.0; DOE 1995c:4-27; Pantex 1996:15.5; Pantex 1996:2.0

FIGURE 4.5.1.3–1.—*Timeline Showing Important Dates for Pantex Plant Environmental Restoration Program.*

Of the 14 RCRA Facility Investigations (RFIs) ongoing at the plant, 12 have proceeded to the draft report stage. The rest of the RFIs have proceeded only as far as the sampling and analysis stage. At this point, the types and amount of contamination present at Pantex Plant is fairly well characterized, allowing projections to be made as to the amount of cleanup activity that might ultimately be needed to accomplish the ER program goals. Based on the levels of contamination that have been reported in the 12 draft RFIs and the range of contaminant levels that are being seen in the other investigations, many of the 144 SWMUs

are expected to be recommended for no further sampling or remediation (i.e., No Further Action (NFA)). While those recommendations are only in draft form and are subject to review and approval by the State of Texas, they indicate that the types and amounts of contamination at the plant are much less than initially estimated. Plans by the plant to initiate advance remedial actions are reflected in the current reduced estimates of impacts and waste projections that would result from the ER program.

Soil and Sediment Quality at Solid Waste Management Units

Past industrial operations at Pantex Plant have generated both solid and liquid wastes, including high explosive(s) (HE) materials, organic solvents, and metals.

In January 1989, EPA conducted a RCRA facility assessment to identify SWMUs, (defined as any unit from which hazardous constituents may migrate) that may require investigation and/or corrective action under the 1984 Hazardous and Solid Waste Amendments to RCRA. In September 1989, the draft Administrative Order of Consent, pursuant to Section 3008(h) of RCRA, was issued. The ER group identified 144 SWMUs, of which 113 SWMUs were organized into 14 groupings (see Figure 4.5.1.3–2, Figure 4.5.1.3–3, and Table 4.5.1.3–1).

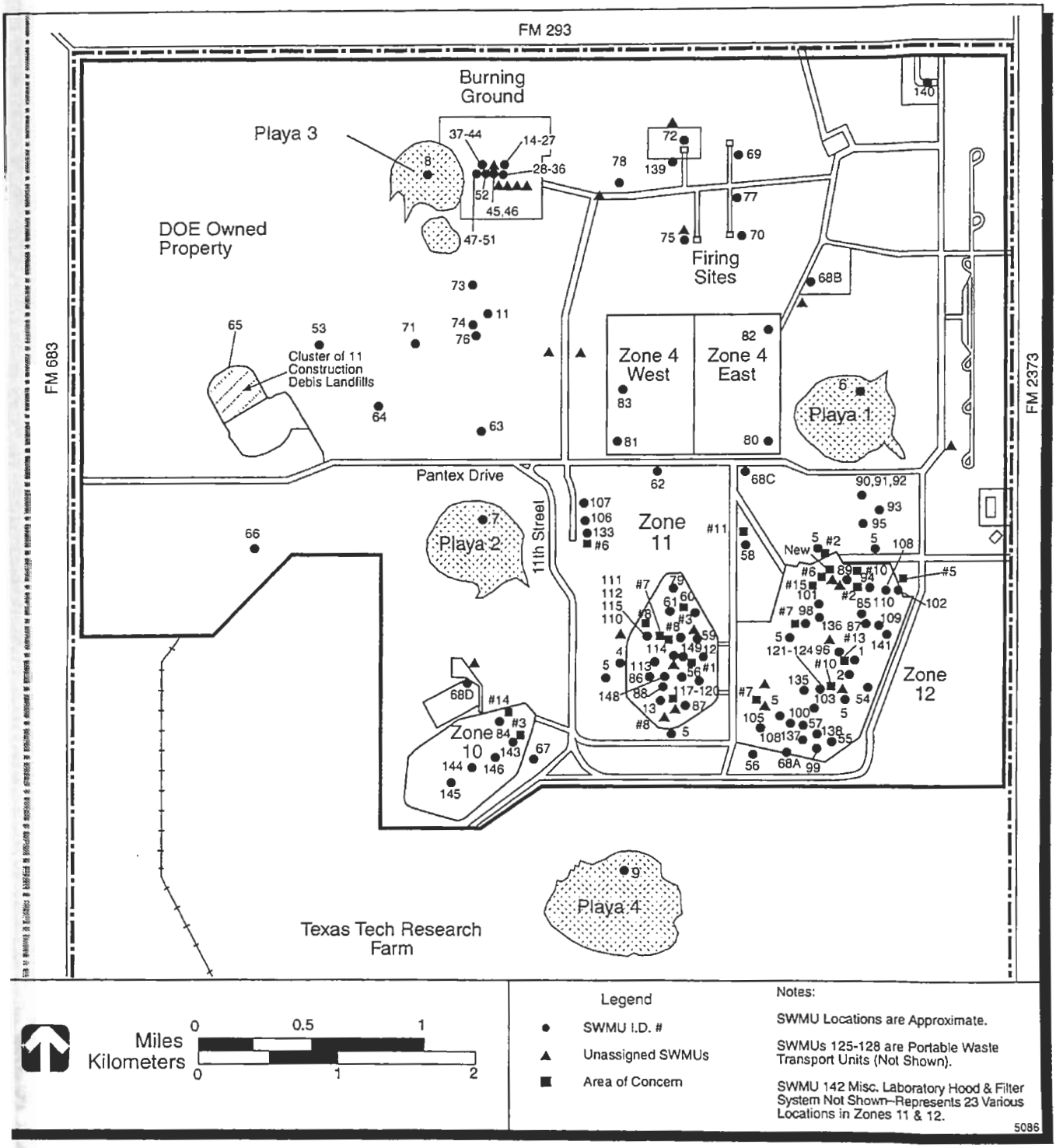
A site may be initially designated as a SWMU during the RCRA facility assessment based on process knowledge, visual observations, or even the recollection of a single employee regarding past accidents, spills, or operations, before confirming the presence of contaminants by collecting and analyzing samples from the site. NFA may be recommended for many of the SWMUs after sampling and analysis of the site confirms either low levels or probable absence of contamination due to natural degradation of the contaminants over time. In addition, NFA may also be recommended if contaminant levels are below appropriate TNRCC Risk Reduction Standards (RRS), which are discussed b later in this section.

RFIs are conducted by the ER group at Plant to determine whether haz constituents have been released in environment from the SWMUs or a concern. The 14 groupings are unde investigations on independent sch Thirty-one of the sites are either acti RCRA sites or sites that could not be and located in subsequent field surveys. sites are being reviewed to verify hazardous materials are present; then undergo administrative closure.

TNRCC has established three remediation performance standards (RR and 3) that are applicable to remedial undertaken in response to a release These risk reduction rules attempt to cleanup levels across the state while time delays and accelerating investigation and remediation of cont sites. The ER group at Pantex Pl compared analytical results from s sediment samples to TNRCC RRSs 1,2

RRS 1 requires removal and/or decontam of all waste, waste residues, leachi contaminated media to background unaffected by waste management or i activities. 30 TAC 335.554 (d) states th Practical Quantification Limit (PQL) is than background, then the PQL rather background shall be used as the clean provided that the person satisf demonstrates to the executive direc lower levels of quantification of a cont are not possible." The PQLs are ge defined as the lowest level (concen quantifiable among laboratories within limits during routine laboratory operati

RRS 2 requires removal and/or decontam of all waste, waste residues, leachi contaminated media to standards and such that any substantial present or futu



SOURCE: Pantex 1994a

FIGURE 4.5.1.3–2.—*Locations of Solid Waste Management Units of Potential Concern to Soil and Sediment Quality.*

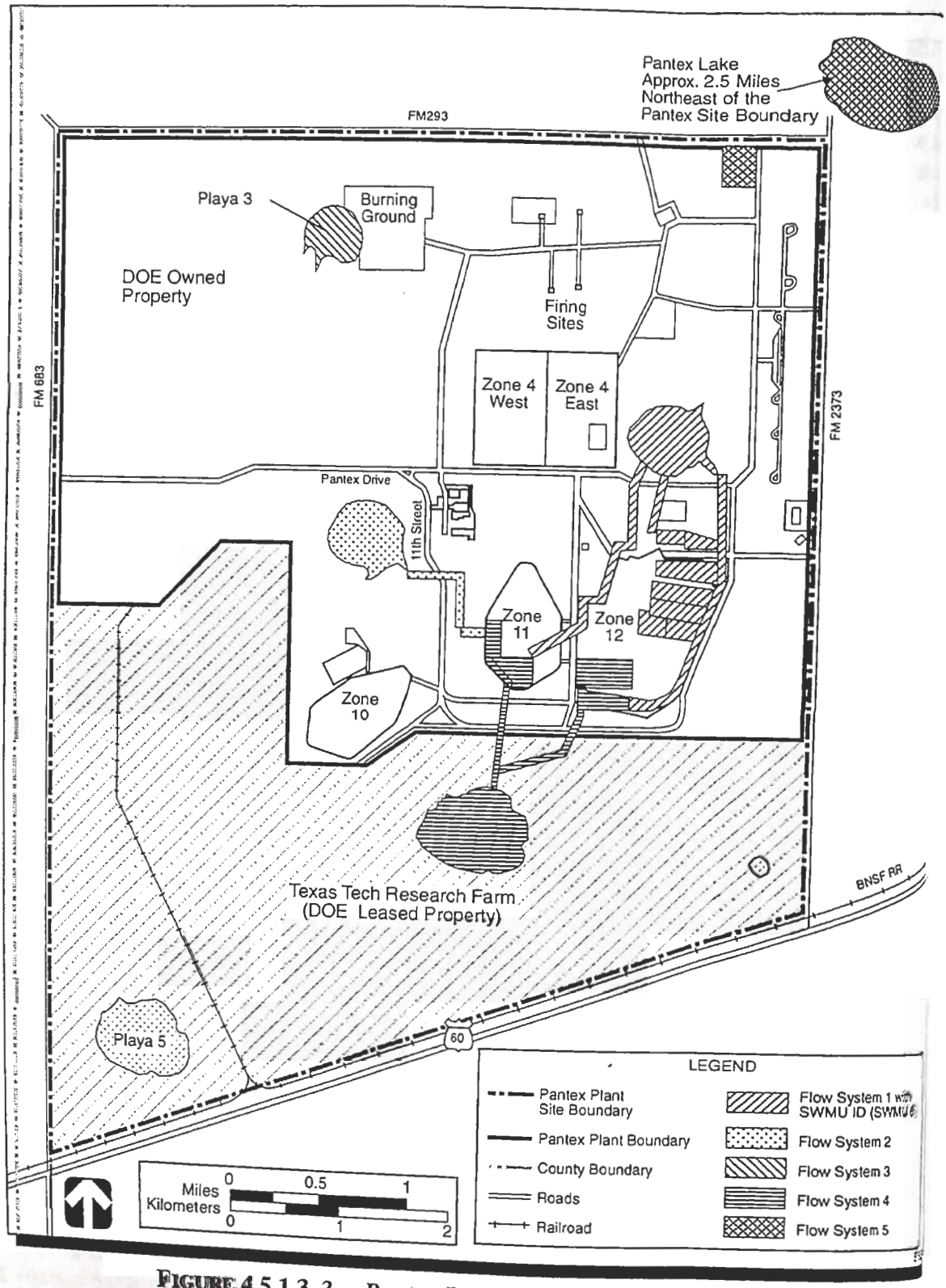


FIGURE 4.5.1.3–3.—*Pantex Ditches and Playas Flow Systems.*

TABLE 4.5.1.3–1.—*Summary of SWMU Groupings*

SWMU GROUPINGS		NUMBER OF SITES
AL–PX–01*	Burning Ground	37
AL–PX–02*	High Priority Potential Release Sites	8
AL–PX–03	Former Cooling Tower in Zone 12	1
AL–PX–04	Old Sewage Treatment Plant Sludge Beds	1
AL–PX–05	Fire Training Area Burn Pits	1
AL–PX–06*	Zone 12 Groundwater	1
AL–PX–07	Landfills	15
AL–PX–08*	Ditches and Playas	11
AL–PX–09	Firing Sites	7
AL–PX–10	Leaking USTs at Buildings 12–35 and 16–1	2
AL–PX–11	Miscellaneous High Explosive/Radiation Sites	8
AL–PX–12*	Miscellaneous Chemical Spills/Releases	8
AL–PX–13	Supplemental/Verification Sites	8
AL–PX–14	USTs at Other Locations	5
Other		31
Total		144

*More detailed information on these SMWU groupings is provided in appendix I (Table I.1.1–2).
USTs - Underground Storage Tanks
Source: Pantex 1996:15.0

to the human health or environment is eliminated.

RRS 3 requires that removal, decontamination, and/or control of all waste, waste residues, leachate, and contaminated media occur to levels and in a manner such that any substantial present or future threat to human health or the environment is eliminated or reduced to maximum extent practicable. Because of greater concentrations of contaminants that may be left at the site with RRS 3, an evaluation of the effectiveness of the proposed remedy must be submitted to TNRCC and approved before implementation of the remedy.

RRSs 1 and 2 are the goals for determining cleanup levels and as decision criteria for additional sampling needs at a site. The "cleanup" levels represent the concentrations below which any additional site characterization or remedial action initiatives would be for the purpose of satisfying objectives other than minimizing human health risks. For example, observations of a specific chemical hazard in excess of background (RRS 1) but within acceptable risk-based criteria (RRS 2) may be acted upon differently by DOE under differing site-specific conditions. The cleanup for contamination located at 1.5 to 3.0 meters (5 to 10 feet) below ground surface is to background (RRS 1), thus avoiding deed recording requirements with RRS 2 (30 TAC 335.560) and future liability relative to a potential changing land use classification. Conversely, for the same contaminant at the same concentration located at a depth of 1.5 to 30 meters (5 to 100 feet) below ground level, DOE is likely to accept the criteria outlined in RRS 2

in which technical feasibility and cost limitations preclude cleanup to background.

By virtue of 30 TAC 335.557 (3), the future land use designated at Pantex Plant is nonresidential. However, in areas subject to excessation, the land use may revert to residential, thereby requiring increased scrutiny of the site to determine if risk-based criteria for a residential scenario have been satisfied. The DOE risk managers will need sufficient characterization data regarding these sites to quickly determine the most prudent closure strategy to assume; i.e., cleanup to background or to some risk-based level established for residential or nonresidential uses. The decision criteria is generally determined by processes such as the one described above.

The RRSs are continually being revised as new information becomes available. Preliminary Remediation Goals (PRGs) are, therefore, currently accepted cleanup levels and may be revised as RRSs are revised. Further explanation on the methodology for applying the RRSs to RFIs being conducted at Pantex Plant can be found in the *Draft Final Risk Reduction Rule Guidance for Pantex Plant RCRA Facility Investigations* (DOE 1994z).

All RFI work plans have been approved, and field investigations have been initiated at all sites. RFI reports have been completed for five AL–PX groupings: AL–PX–01, AL–PX–02, AL–PX–06, AL–PX–08, and AL–PX–12 (see Tables 4.5.1.3–1 and I.1.1–1). These documents are in draft form and are currently being reviewed by TNRCC. Adequate data have been collected on many of the SWMUs to recommend either NFA or interim corrective measures (ICMs). ER of the SWMUs at Pantex Plant is ongoing concurrently with the generation of this document. The information presented below is the latest published data available. Five of the draft RFIs are at a stage where the data may be referenced in this EIS and are discussed further below. Additional data will be provided in the F information becomes available.

The Burning Ground (AL–PX located adjacent to the eastern consists of the former chemic evaporation pit, explosive burn burn trays, burn racks and fla cages, and demonstration fac 1995:iii, v). The site is used fo HE components and treat contaminated waste and contaminated liquids and solved

Disposal of residues from burni the site was discontinued in (Pantex 1994a:2-1). The highes of contaminants were found i however, contaminants have m the landfill's boundaries (Pan Primary contaminants are HE metals. Phase II of the RFI w November 1995, and a revised report has been submitted to TN contamination is generally limi 6 meters (20 feet) of soil, some compounds (VOCs) have bee deeper intervals (Pantex 1996 removal ICMs may be required a DOE may also recommend to TN situ remediation such as soil va and bioremediation based on fi (PC 1996b:3).

The Draft RFI Report for the Ba Assessment was completed in submitted to TNRCC in Augu following is a summary of the c potential concern identified in t this investigation that exceeded criteria. The contaminants includ pesticides, and semivolatile orga (SVOCs). HE compounds th decision criteria for soil includ TNB, and 2,4,6-TNT, HMX (su and 1,3-DNB (subsurface soil contaminant of potential concern dinitrotoluene, has been identifi

:DX had a range of concentrations exceeding ıe decision criteria (2.6 milligrams/kilogram ɔr surface and subsurface soil) in surface soils f 2.9 to 510 milligrams/kilogram and 2.6 to 64 ıilligrams/kilogram in subsurface soil.

even metal compounds were detected in soil amples at concentrations which exceed the ecision criteria. Nickel and vanadium oncentrations only exceeded the surface soil ecision criteria (0 to 2 feet [0 to 0.6 meters] in epth). Arsenic only exceeded the decision riteria in one subsurface soil sample. Barium, ɔpper, lead and mercury were detected in ırface and subsurface soil samples above ecision criteria. Barium had a range of ɔncentrations exceeding the decision criteria ɔr surface soils (200 milligrams/kilogram) of 00 to 2,440 milligrams/kilogram. Lead ‹ceeded the decision criteria for surface soils .5.7 milligrams/kilogram) ranging from 16 to 50 milligrams/kilogram. Mercury exceeded ıe decision criteria for surface soils (0.20 ıilligram/kilogram) ranging from 0.22 to 1.7 ıilligrams/kilogram.

ɔur pesticides (aldrin, alpha-BHC, dieldrin, ıd gamma-BHC) were identified in the soil .at exceed the decision criteria. SVOCs ‹ceeding the decision criteria for soil include ɜnzyl alcohol and bis-(2-ethylhexyl) phthalate JSCOE 1995). Sampling of soil at the Burning round is also conducted on an annual basis. hese sampling results are discussed in the soil ıd sediment sampling subsections that follow.

ıe High Priority Potential Release Sites group ıL–PX–02) consists of five SWMUs, one area concern (AOC), and three firing sites. Phase ınd II fieldwork has been completed. The nine tes were split into two separate RFI reports. ıe two Draft Final RFI reports were submitted the TNRCC for review in September 1994 ıd March 1995, respectively (Pantex 96:15.4).

ıemical constituents detected in the soil and diment at SWMUs north of Pantex Drive include minor amounts of HEs, metals, VOCs and SVOCs. Elevated levels of lead were detected east of Playa 3 and north of Zone 4 at Firing Site 22. Low concentrations of metals and common anions were detected in soils of the inactive, lined, solar evaporation pond located in Zone 11. Elevated levels of lead and chromium were detected in soils on the northeast side of Building 12–68 (an electroplating facility on the east side of Zone 12). Low concentrations of metals were detected in soils near Building 12–59's subsurface leaching system. Lead, VOCs and SVOCs were detected in soils at the former solvent disposal pit located in the northeastern corner of Zone 12.

In 1995, ICMs were conducted on the Building FS–16 surface impoundment and sump, FS–22 container, and Building 12–68 concrete sump. Contaminants included chromium and HE. Confirmation sampling indicated cleanup action attained RRS 2 levels, and Pantex Plant has recommended this grouping to TNRCC for NFA. No additional cleanup is anticipated for this SWMU grouping (Pantex 1994a:3-1 through 3-4, PC 1996b:2).

The Former Cooling Tower (AL–PX–03) was used for the HE machining operations water cooling from 1950 to 1964. The unit was dismantled in the early 1970's, and now only a concrete slab remains. Results from the Phase I analysis revealed low levels of metals, VOCs, SVOCs, nitrogen series (as nitrate and nitrite), and HE in the near-surface and subsurface soils. Barium, lead, and hexavalent chromium were detected in concentrations exceeding background but were below RRS 1 levels. The RFI report prepared and submitted to TNRCC on October 15, 1993 recommended NFA. Subsequent to this investigation, ancillary piping, which may have led to the cooling tower, was discovered. Thus, additional characterization work has been initiated to characterize and evaluate the need for further action (Pantex 1996:15.4; Pantex 1994a:4-1, 4-2; PC 1996b:2). Treatability Study fieldwork

started in May of 1996. Soils will be analyzed for total and hexavalent chromium. Treatability/remediation activities will continue into 1997 (Pantex 1996:15.4).

The Old Sewage Treatment Plant (OSTP) Sludge Beds (AL–PX–04) were operational from 1942 until 1987. The OSTP received wastewater from Amarillo Air Force Base, the Amarillo International Airport, Bell Helicopter Plant, and Pantex Plant. The Phase I field work was completed, and low levels of metals and VOCs were detected in the sludge beds and in the subsurface soils. Pantex Plant recommended NFA to TNRCC in September 1993, based on the remote location of the OSTP sludge beds, lack of a continuing source, depth to groundwater, low concentrations of contaminants detected (below RRS 2 levels) and the limited aerial extent of contamination (Pantex 1994a:5-1). Regulatory approval is pending (Pantex 1996:15.4).

The Fire Training Area Burn Pits (AL–PX–05) were used by the Pantex Plant Fire Department as a fire training area. Various solvents, chemicals, and fuels were ignited and extinguished in the training process. Concentrations of zinc, dioxins/furans, fluorine, naphthalene, phenanthrene and 2-methyl-naphthalene were detected in sediment and soil samples. Phase I fieldwork was completed in 1993. Contamination was found to be localized and confined to the upper 1.5 meters (5 feet) of soil (Pantex 1996:15.4, Pantex 1994a:6-1). The ICM was performed in July 1995, and the upper 0.6 meter (2 feet) of soil has been removed and backfilled with clean topsoil (Pantex 1996:15.4). A request for NFA was submitted to TNRCC based on confirmation sampling results that indicated Risk Reduction Level 2 was achieved in the remaining 0.9 meter (3 feet) of soil (Pantex 1996c:52, 53). The Draft Final ICM Closure Report was submitted to TNRCC in November 1995 (Pantex 1996:15.4).

Zone 12 Groundwater group (AL–PX–06) comprises all perched groundwater contamination below Pantex Plant. De characteristics and current remedial ac for Zone 12 Groundwater are discuss section 4.6, Water Resources, and in app C. Primary contaminants are RDX, H chromium, and solvents. A dual p groundwater extraction/soil vapor extra treatability system has been installed implemented to determine the feasibili several remediation options including pump treat, soil vapor extraction of the vadose dewatered zones, and oxygen augmentatio the vadose and dewatered zones. Th groundwater analytical results are showing than detection limits for HE. With approv the TNRCC, the treated groundwater is b reinjected in an upgradient monitoring we aid in the containment of the groundw contaminant plume and increase the effic of the recovery system. Injection began in 1996. Currently, initial results indicate th system is injecting 158,987 liters per (42,000 gallons per day) of treated water the injection well (Pantex 1996:15.4, Pa 1994a:7-1).

The Draft RFI for Zone 12 Groundwater completed in November 1995 and submitt TNRCC for approval. The purpose of the report is to describe the nature and extent releases of hazardous constituents to Zone Groundwater at Pantex Plant and to ge sufficient data to support the Correc Measures Study. Potential sources contamination to Zone 12 Groundw identified in the draft RFI include the Burn Ground, Landfill 3, Flow Systems I an Leaking Underground Storage Tanks (USTs Buildings 12–35 and 16–1, and Miscellane HE/Radiation Sites (see appendix D) (Aug 1995a).

Landfills group (AL–PX–07) has been use dispose of sanitary and industrial wastes a plant since 1942. Twenty-three landfills throughout Pantex Plant with a majority located in Zones 11 and 12. Fifteen of t landfills are included in this group (Pa

1996:15.4). Figure 4.5.1.3–4 illustrates landfills currently under RCRA Facility Investigation (RFI). VOCs were detected in soils above and adjacent to some of the landfills at various concentrations, up to levels where remediation must be considered. Asbestos and VOCs were detected in soil samples of Landfills 1 and 3 (Pantex 1994a:8-1 to 8-8). Characterization data indicate that NFA is recommended on all landfills except Landfill 3. However, maintenance caps will be placed as needed over selected landfills as a proactive measure to prevent potential water infiltration. Preliminary data packages for Phase I fieldwork were submitted to TNRCC for review in December 1994.

The landfills have been separated into three different groupings: Group I, Landfills 4 and 11; Group II, Landfills 5, 6, 7, 9, 10, 12, and 15; and Group III, Landfills 1, 2, 3, and 13, Original Abandoned Zone 10, and Sanitary Landfills. A recommendation for NFA for Group I Landfills was submitted to the TNRCC on June 28, 1995. A Draft Final RFI recommending NFA for all Group II Landfills was submitted to TNRCC on January 15, 1996. A Draft Final RFI for Group III Landfills is scheduled to be submitted to TNRCC by June 28, 1996. The Draft Final RFI for Group III Landfills will recommend NFA for many of the landfills; Landfill 3 may require additional corrective measures (Pantex 1996:15.4). In situ treatment is being evaluated as a potential option for remediation of residual HE contamination found at Landfill 3 (PC 1996b:1).

The Ditches and Playas group (AL–PX–08) consists of five playas (Playas 1, 2, 3, 4, and Pantex Lake) and their associated network of man-made ditches. The ditches receive treated wastewater effluent and stormwater runoff from buildings in Zone 11 and 12. Playa 3 receives stormwater runoff from the Burning Ground, and Playa 4 receives stormwater runoff from the south ends of Zones 11 and 12. In the past, Pantex Lake received wastewater effluent from the OSTP. Playa 4 is currently permitted to receive industrial discharges and stormwater runoff from Pantex Plant (Pantex 1996:15.4). Pantex Lake receives neither industrial discharges nor stormwater runoff from Pantex Plant.

This group has been divided into Flow Systems which are described in Table 4.5.1.3–2. Surface and subsurface soils were collected from various locations throughout the Flow Systems. Table 4.5.1.3–2 is a summary of the types of contaminants identified from analytical results which exceed the decision criteria (Pantex 1994a:9-1, 9-2). An expedited ICM to remove the hotspots within the ditch SWMUs began in June 1996 (Pantex 1996:15.4). Phase II fieldwork (completed in January 1995) involved collection of surface and subsurface soils from various locations throughout flow systems 1 through 5. Proposed ICMs would lower contaminant concentrations in the ditches. The ICMs scheduled for the summer of 1996 include site-specific removals, in situ remediation, and natural attenuation. A baseline risk assessment is being prepared to evaluate the applicability of Risk Reduction Level 3 closure for those sites that are not candidates for ICMs (Pantex 1996c:53).

Of these five flow systems, only flow systems 1 and 4 have been identified as areas suspected of affecting Zone 12 Groundwater (Argonne, 1995a:3-10). Flow System 1 is divided into four subareas: Flow Pathways 1A, 1B, 1C, and Playa 1 area. Contaminants which exceeded the PRGs in Flow Pathway 1A include an HE (HMX), some inorganics (antimony, lead and selenium), SVOCs, one pesticide (dieldrin), and PCBs. Contaminants exceeding the PRGs in Flow Pathway 1B include various inorganics due to historical discharges from Zones 11 and 12 (mercury exceeded the PRG by 28 to 810 percent at six sampling locations), VOC, SVOCs, and pesticides (including aldrin, 4-4'-DDT, and dieldrin). Contaminants which exceeded the PRGs in Flow Pathway 1C include HE (HMX and RDX), various inorganics, SVOCs, pesticides (4-4'-DDT and chlordane),

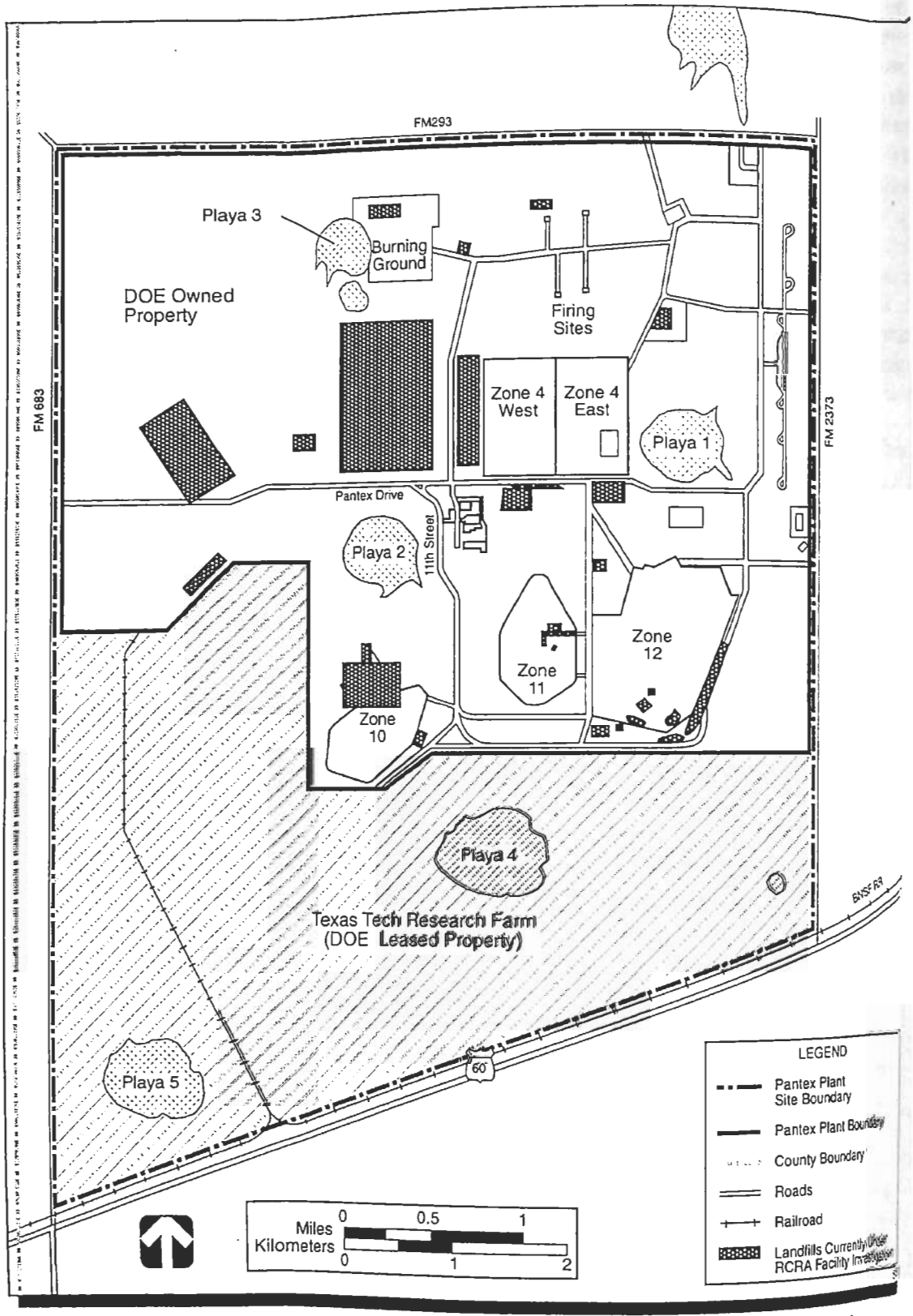


FIGURE 4.5.1.3–4.—*Landfills Currently Under RCRA Facility Investigation.*

conducted to confirm that protective levels have been attained and NFA will be required. Additional hotspot removal will be conducted until the remediation goals have been achieved. FS–6 and FS–15 contaminant levels were below RRSs and have been proposed to TNRCC for NFA (Pantex 1996:15.3, 15.4; PC 1996b:1).

The Leaking USTs group (AL–PX–10) is comprised of two gasoline release sites near Buildings 12–35 and 16–1. The USTs were used to store gasoline, diesel, and used motor oil. Five USTs were removed in 1988 from Building 12–35, and two USTs were removed from Building 16–1 in 1989. The Draft Final Corrective Action Plan, submitted to TNRCC in October 1994, proposed NFA based on the fact that contaminant levels were below remediation goals. Benzene levels below the site in the perched aquifer exceed RRS and will be addressed in the Zone 12 Groundwater assessment (Pantex 1996:15.4; PC 1996b:2).

The Miscellaneous Explosive/Radiation Sites group (AL–PX–11) consists of 12 sites, including a temporary explosives burning site, radioactive residue storage, a subsurface leaching bed, trinitrotoluene settling pits, two buildings where explosives were filtered from wastewater, and the soil surrounding an explosive fabrication building. Analytical results from soil samples taken in 1985 near the temporary explosive burning site indicate the following: low concentrations of silver and pesticides at 0, 3, and 4 meters (0, 9, and 14 feet); total organic compounds of 22,600 parts per million at the surface. All radioactive waste staged below ground at Pantex Plant was retrieved and disposed of at an approved DOE burial ground. The decontamination of this site consisted of the removal of the buried radioactive waste, as well as any soil that may have been contaminated by the buried material.

Soil samples were taken before and after site cleanup. Tritium, uranium, and plutonium-239 were detected below the trench before cleanup. Soil analyses subsequent to the cleanup revealed low levels of the same radio (Pantex 1994a:12-1 to 12-2; Pantex 199 The vertical and lateral extent of contam are currently being evaluated. Building and 12–24 North are being evaluated f situ explosives treatability demons Recent data indicate that ex contaminants may be degrading natural result of microbial action. Studies are proposed to define the degradation mech and the potential to enhance the process (P 1996c:54).

Twenty-four sites have been identified at Plant where spills or releases of chemical occurred and are referred to as AL-P Miscellaneous Chemical Spills and Re Sites. These sites are located within Zone 11, and 12 and areas west of Zone 11. 4.5.1.3–3 summarizes the contaminant concern (COCs) identified in the so AL–PX–12. No signs of contamination found at the main electrical substation No. 2), and TNRCC granted an NFA on the in September 1993. The primary COCs for remaining sites include metals, solv pesticides/PCBs, and HE. Characterizatio are currently under evaluation. Prelim results indicate that contaminant level below RRS 2 and NFA will be required 1996b:1; Pantex 1996c:54; Pantex 1996:1

Supplemental Verification Sites (AL-PX consists of eight inactive SWMUs, incl five landfills, a barren area where herbi were applied, parallel depressions, and the pistol range. The pistol range is st operation and was removed from the program. The Zone 10 abandoned landfill also removed from this grouping and addr the AL–PX–7 Landfills investigations. D fuel residuals, hydrocarbon compounds dioxins were all detected below RRSs in areas where herbicides were applied near Plant Low levels of VOCs, SVOCs, and pestici were detected in the depressions in Zone below RRSs. Phase I fieldwork was comp in 1993. All sites within this grouping are

TABLE 4.5.1.3–3.—*Summary of Contaminants of Concern Identified in the Soil at AL–PX–12 and Recommendations*

SWMUs/ AOCs	COCs FOR SURFACE SOILS	COCs FOR SUBSURFACE SOILS	RECOMMENDATIONS
Zone 10 SWMUs Scrap Salvage and Storage Yard (SWMU #84)	**SVOC-** Benzo(b)fluoranthene **Pesticides/PCBs-** Aldrin, Dieldrin, PCBs (total)	**Pesticides/PCBs-** Aldrin, Dieldrin, PCBs (total) **Metals-** Chromium (total), Chromium VI	Additional characterization of PCBs to further define the surface extent.
Former Waste Drum Storage Area (SWMU #143)	**SVOCs-** Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene **Pesticides-**Aldrin, Dieldrin Toxaphene PCBs (Total) **Metals-**Cadmium, Lead*	**Pesticides/PCBs-**Aldrin, Dieldrin PCBs (Total)	This area has not been characterized to background for several analytical groups, including pesticides, PCBs, and metals. Further sampling is recommended to define the extent of constituents identified as COCs.
Battery Storage Areas Former Battery Storage Area (SWMU #103)	**Metals-**Cadmium, Lead*	**Metals-**Selenium	Extent of contamination has been defined. No additional site characterization is recommended.
Battery Storage Area (AOC #14)	**Metals-**Lead*	None identified.	Extent of contamination has been defined. No additional site characterization is recommended.
Overflows From Building 11-36 Collection Sump (SWMU #113)	**HEs-**1,3,5-Trinitrobenzene, 2,4,6-Trinitrotoluene **Metals-**Arsenic, Lead*	**SVOCs-** Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene Di-benzo(a,h)anthracene **Metals-**Arsenic, Cadmium, Mercury, Lead*	Additional site characterization is recommended. However, it is recommended that further action be deferred until after operations cease, at which time further characterization will occur and efforts will not be duplicated.
Transformer Leak and PCB Spills Transformer Leak (AOC #1)	**Pesticides/PCBs-** Aldrin, Heptachlor epoxide, PCBs (Total)	**Pesticides/PCBs-**Aldrin, Dieldrin, PCBs (Total)	Additional surface soil samples to define the lateral extent of PCBs are recommended.
Main Electrical Substation (AOC #2)			NFA has been granted by the TNRCC and was not considered further in the RFI/Corrective Measures Studies process.
Electrical Equipment Boneyard (AOC #5)	**Pesticides/PCBs-** Aldrin, Chlordane, Dieldrin, PCBs (Total)	None identified.	Extent of contamination has been defined. No additional site characterization is recommended.

TABLE 4.5.1.3–3.—*Summary of Contaminants of Concern Identified in the Soil at AL-PX-2 Recommendations*-Continued

SWMUs/ AOCs	COCs FOR SURFACE SOILS	COCs FOR SUBSURFACE SOILS	RECOMMENDATIONS
Capacitor Bank Rupture in Zone 12	PCBs (Total)	None identified.	Extent of contamination has been defined. No additional site characterization recommended.
Former Boiler House Areas (AOC #3) Boiler House in Zone 10	**Metals**-Lead*	None identified.	Extent of contamination has been defined. No additional site characterization recommended.
Boiler House in Zone 11	**SVOCs**-Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Di-benzo(a,h)anthracene **Metals**-Mercury, Lead*	None identified.	Additional surface soil analysis using EPA Method 1312 for Synthetic Precipitation Leaching Procedure is recommended to define the lateral extent.
Sulfuric Acid Spills (AOC #7) Oleum Tank at Building 11-36	**HE**-RDX	None identified.	It is recommended that AOC #7 be considered for NFA, as there is no evidence of a significant release.
Sulfuric Acid Tank near Building 12-4	None identified.	None identified.	This site is recommended for NFA.
Sulfuric Acid Pit at Building 12-64	None identified.	**SVOCs**-Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene	It is recommended that this site be considered for NFA, as there is no evidence of a significant release.
Various Solvent Leaks (AOC #8) Drum Storage at Pad 11-12/ 11-13	**HE**-2,4,6-Trinitrotoluene **Pesticides/PCBs**-Aldrin, Dieldrin, PCBs (Total)	**Pesticides/PCBs**-Aldrin, Dieldrin, PCBs (Total)	It is recommended that this site be considered for NFA, as there is no evidence of a significant release.
Drum Storage near Building 11-17	**Pesticides/PCBs**-PCBs (Total), Chlordane, Dieldrin	**Pesticides/PCBs**-Aldrin, Dieldrin, PCBs (Total)	It is recommended that this site be considered for NFA, as there is no evidence of a significant release.
Drum Storage near Building 11-22	**Pesticides/PCBs**-Aldrin, Dieldrin, PCBs (Total)	**Pesticides/PCBs**-Aldrin, Dieldrin, PCBs (Total)	It is recommended that this site be considered for NFA, as there is no evidence of a significant release.
Drum Storage near Building 11-36	**SVOC**-Di-benzo(a,h)anthracene **Pesticides/PCBs**-Aldrin, Dieldrin, PCBs (Total)	**Pesticides/PCBs**-Aldrin, Dieldrin, PCBs (Total)	Extent of contamination has been defined. No additional site characterization recommended.

considered by the TNRCC for NFA based on the fact that contaminant levels were below remediation goals (Pantex 1996:15.4; Pantex 1996c:55).

AL–PX–14, the USTs at other RFI locations, consists of areas in Zone 12 where five USTs containing diesel fuel and waste oil were removed. Total petroleum hydrocarbons were detected above TNRCC cleanup level of 500 milligrams per kilogram in surface soils at UST–9. All other soil samples collected and analyzed in this unit were within acceptable concentration levels. Phase I fieldwork to remove contaminated soil has been completed and NFA has been recommended for all but UST No. 9. Additional fieldwork will be conducted on this UST, and an in situ treatability demonstration is being conducted (Pantex 1996c:55).

Annual Soil and Sediment Sampling

This section discusses the results of routine and nonroutine (special request) surface soil surveillance at Pantex Plant. The routine soil surveillance program plays an important role in assessing the potential environmental impacts of operations at Pantex Plant. Soil surveillance provides a direct measure of environmental contamination because soil accumulates contaminants that are deposited from the air over time. Thus, soil surveillance allows evaluation of long-term trends. This sampling program is conducted on an annual basis and is separate from the ER programs which deal specifically with SWMU sampling conducted under RCRA and CERCLA as discussed in the previous section.

The following is a summary of the 1994 annual sampling results along with an independent review of these results. The *1995 Environmental Report for Pantex Plant* (Pantex 1996) was released in June 1996. The results from the 1995 annual sampling were reviewed and compared to the 1994 results. A summary of the comparison of sampling resul included in this section.

Soil quality sampling was conducted i 17 offsite and 31 onsite soil sur locations at the Burning Ground; Firing 5, and 10; and Playas 1, 2, and 3 (appendix I). One of the offsite sampling at Bushland, approximately 55 kilom miles) west of Pantex Plant and is co the control sample. These sample generally collected from playa bottom inter-playa uplands. The soil sample analyzed for radionuclides, metals, exp and VOCs; results are presented in appe and summarized below.

Soil samples for radionuclides were colle Firing Sites 4, 5, and 10; the Burning G Playas 1, 2, and 3; and offsite locatio samples were analyzed for uraniu uranium-238, plutonium-239/240, and tri

The average 1994 concentrations of plut 239/240 were comparable to B averages, indicating that no plutonium-2 contamination from Pantex Plant opera detectable in area soils. Uranium-238 most prevalent radionuclide present in the at Pantex Plant. Soils at Firing Site 5 exh the highest radionuclide activity, whi attributed to HE test firings with components. Firing Sites 4, 5, and 10 h low uranium-234 to uranium-238 ratio (less), indicating DU contamination in areas.

The Burning Ground, Playas 1 and 3, a and Bushland locations have uranium-2 uranium-238 ratios near 1.0, indicating th DU contamination has occurred in locations. Playa 2 had a uranium-2 uranium-238 ratio of 0.59, which may in DU contamination. Historical averag uranium-238 and uranium-234 measu Bushland were 0.74 picocuries per gra 0.58 picocuries per gram, respectively. 1994 averages for radionuclide activity

locations were generally below the historical averages.

Soil samples at the Burning Ground, Playa 3, and Bushland were analyzed for tritium. The average concentrations for tritium were low (0.27 or less) at all locations (Pantex 1996:16.1).

Soil samples for metals were collected at the Burning Ground, Playa 3, and offsite locations. The samples were analyzed for aluminum, boron, cadmium, chromium, cobalt, copper, magnesium, manganese, molybdenum, mercury, nickel, silver, and zinc. All metals were below TNRCC RRS (cleanup levels) and EPA Region III-Risk Based Concentrations (RBCs) with the exception of manganese, which was above RBCs for residential soil. However, manganese concentrations were within the upper limit of background for surface soil (600 milligram/kilogram), with the exception of P3-SS-01 which was slightly higher (640 milligram/kilogram) (DOE 1995b:12-17). All the metals listed above were below industrial standards. RBCs were used for comparison because cleanup levels for manganese do not exist. RBCs are not enforceable standards.

Soil samples for explosives were collected at the Burning Ground, Playa 3, and offsite locations. The samples were analyzed for HMX, RDX, pentaerythritoltetranitrate, and trinitrotoluene. The majority of samples did not have detectable amounts of explosives. Samples that were above detection limits were all below cleanup levels and RBCs (DOE 1995b:12-20, 12-21).

Soil samples collected at Playa 3 and offsite locations were analyzed for VOCs. VOCs were not found at levels above the minimum detection limits (DOE 1995b:12-6). The results of the soil sampling at Pantex Plant and offsite locations do not indicate that deposition of emissions from the Burning Ground activities have substantially impacted the soils.

Average 1995 tritium concentrations were statistically greater than 1994 averages, but were similar to that observed in the control locations. Both uranium 234 and uranium 238 at the Burning Ground were statistically less than the 1994 average concentrations for the same sites. Uranium-234 and uranium-238 at the playa locations were similar to the 1994 ranges of concentrations for the same sites. As in the past, uranium-238 concentrations at the firing sites were higher than concentrations of other radionuclides at Pantex Plant. These higher levels are attributed to the use of DU during test firings of explosives, which ceased in 1986.

The firing sites are scheduled to undergo investigation and remediation under the ER program, and remedial activities have already begun in the area of Firing Site 5. Monitoring data for 1995 are within historic ranges for uranium-238 and uranium-234 at the three firing site areas where samples were collected. Average 1995 concentrations of plutonium-239/240 at all onsite and offsite locations were equivalent to historical and control location averages, indicating no detectable plutonium contamination from Pantex Plant in area soils (Pantex 1996c:12.0).

Results in 1995 for metals at onsite locations were within the expected ranges of concentrations for their soil types, with the exceptions of boron at BG–SS–05, manganese at several Burning Ground locations (BG–SS–01, BG–SS–06, BG–SS–07, BG–SS–08, and BG–SS–09), and zinc at BG–SS-01 (Pantex 1996c:12.0).

Overall soil monitoring results for 1995 were within the observed ranges of concentrations for uncontaminated soil and comparable to historical results and those for the control locations. Boron, manganese, zinc, HMX, and total xylene concentrations in the area of the Burning Ground were higher than those at the control locations and the range of concentrations for native uncontaminated soil.

However, all observed concentrations were less than those considered to indicate environmental risk. Concentrations of these compounds will be carefully monitored to document any trends during 1996 (Pantex 1996c:170).

4.5.2 Impacts of Proposed Action

4.5.2.1 *Impacts of Continued Operations*

Weapons Related Activities

Pantex Plant is located on the northern portion of the Southern High Plains on relatively flat topography. Although erosion is an active process along the northern, eastern, and western margins of the Southern High Plains, it occurs at a rate of only 0.11 meters (0.36 feet) per year. This rate would result in a 1.1-meter (3.6-foot) retreat of the Southern High Plains over 10 years. Weapons-related activities which are mostly confined to Zone 12 and Zone 4 do not result in soil erosion. Some soil erosion occurs as a result of agricultural activities on Pantex Plant Site, but these impacts are considered minimal and similar to the rate experienced in the Southern High Plains in general.

Salt dissolution is another active process in the High Plains area. However, no surficial expression of sinkholes or fractures associated with salt dissolution have been identified in Carson County (Gustavson 1981:10). Potential impacts due to subsidence (resulting in sinkholes and/or surface rupture) are considered negligible, because salt dissolution is a slow process relative to human activities (Gustavson 1980).

There are no capable faults identified beneath Pantex Plant. Holocene faulting, however, has occurred on one portion of the Amarillo Wichita-Uplift structure (the Meers fault in Oklahoma) and may have occurred on another part of the same structure in Potter County. This fault is considered to be capable, as defined in 10 CFR 100 Part A. The Wichita-O Zone includes the Amarillo Uplift surrounding Residual Events Zone that in Pantex Plant Site. Estimated magnitudes maximum earthquake for the Amarillo and the Residual Events Zone are R magnitudes of 6.3 and 5.3, respectively.

The maximum credible earthquake magnitude on the Richter scale occurring a distance of 16 kilometers (10 miles) of P Plant is considered to be an infrequent having an annual probability of occurre the order of 10^{-3} to 10^{-4} (Pantex 1996:3.5 damage due to an earthquake to facili Pantex Plant would be dependent o distance from the facilities to the center earthquake, the soil structure benea facilities, and the construction of each fa Damage to facilities may or may not ca release of materials that could result in h impacts. The potential health impacts accidental releases of contaminants asso with geological hazards and ability of s facilities to withstand seismic event discussed in section 4.14, Human Health.

Releases to the soil from continued opera would result from regulated waste discharges, deposition from the B Ground emissions, and construction acti As discussed in section 4.5.1, soil sampl the Burning Ground does not show contamination above regulatory action cle levels. Significant impacts to the sediment soils would not occur under normal cond because the Wastewater Treatment Facili the capacity to treat wastewater generated weapons related activities (section 4.6) a emissions have been calculated to be too s to result in a significant impact (section 4

Pit Storage Activities

Impacts to pit storage activities due to pot erosion, subsidence, and seismic hazards a same or less than those addressed for weapons-related activities. Storage activiti

not pose additional impacts to soil and sediment quality under normal conditions because the pits would not come in contact with the soil or sediment. Accident release scenarios are discussed in section 4.14, Human Health.

Environmental Restoration Activities

ER activities pertinent to geology and soils include activities such as soil and sediment sampling, characterization of vertical and horizontal extent of contamination in soils, remediation of soils, and possible removal of contaminated soils. Impacts to the soil as a result of ER activities are predicted to be minimal. Strategies to reduce the amount of waste generated during investigations as well as the amount of waste handled, treated, or disposed of during site cleanups have been implemented. Key points of these strategies include minimizing the amount of waste generated during the RFI by using sonic drilling, hydropunches, geophysical and soil gas survey techniques, and other types of surveys that generate data with minimal waste generation (DOE 1995e:3-7).

Corrective measures will give preference to techniques that do not generate waste or disturb the land's surface topography. Such measures include, for example, in situ bioremediation or capping. Some corrective measures may involve the removal of contaminated soils. In these cases, the waste will be disposed of as described in section 4.13, Waste Management, and excavated areas will be backfilled with clean soil to restore the natural topography. ER activities are expected to be completed by the year 2000. Impacts to soil and sediment at Pantex Plant are expected to be beneficial.

Waste Management Activities

Impacts to soils and sediments at Pantex Plant due to waste management activities are not expected to occur. Waste generated from waste management practices and which come in contact with the sediment and soil are typically nonhazardous. These wastes include treated wastewater from the Wastewater Treatment Facility and construction debris located onsite in a Class 3 landfill. Residuals from the Burning Ground are disposed of in accordance with specifications of the hazardous waste permit. Spills or releases of hazardous wastes and hazardous substances are managed per the Spill Prevention Control and Countermeasures Plan/ RCRA Contingency Plan (TWC 1991a). All of these facilities have the capacity to handle these wastes (sections 4.6, Water Resources, 4.7, Air Quality, and 4.13, Waste Management).

4.5.2.2 *Impacts of New Facility Construction and Upgrades*

Impacts to all new facility construction and upgrades due to potential erosion, subsidence, and seismic hazards would be the same as those addressed in section 4.5.2.1. Temporary soil disturbance for each of the new facilities is summarized in Table 4.5.2.2–1.

During the operations phase of these projects, impacts to the soil and sediment quality would be negligible. Moreover, existing and proposed treatment facilities will have the capacity to handle all discharges associated with the new facilities.

4.5.2.3 *Summary of Impacts*

There are no impacts to geology and soil due to the Proposed Action. Temporary disturbance of soil in Zones 11 and 12 would occur due to construction activities. Potential impacts to the Proposed Action due to erosion and subsidence (resulting in sinkholes or surface rupture) are negligible. The annual probability of the occurrence of a maximum credible earthquake of 6.3 Richter magnitude within a distance of 16 kilometers (10 miles) from Pantex Plant is on the order of 10^{-3} to 10^{-4} (Pantex, 1996:3.5). The potential for a seismic event of this magnitude to

result in a release is discussed in section 4.14, Human Health.

4.5.3 Impacts of No Action Alternative

The impacts to geology and soil due to the No Action Alternative are the same or less than those described for the Proposed Action.

4.5.4 Impacts of Pit Storage Relocation Alternative

The Pit Storage Relocation Alternative includes continued operation and maintenance activities at Pantex Plant and transportation and interim storage of pits from Pantex Plant to other DOE and/or Department of Defense facilities. Relocating the pits would not impact the geology and soils at Pantex Plant. There would be no impacts to the soil while pits are stored at Pantex Plant prior to relocation because the pits would not come in contact with the soil under normal conditions. Impacts due to erosion, subsidence, and seismic hazards are the same as those described for the Proposed Action.

4.5.5 Cumulative Impacts

The cumulative impacts presented here impacts of the continued operations at Plant combined with impacts associat activities described in the WM PEI PEIS, and S&D PEIS. Since the Pant EIS Proposed Action and the SSM P Action Alternative represent a contin operations, the impacts associated with mission or facility that could be implem Pantex Plant are discussed in the contex continuum. The impacts from the W program are combined with those of the Plant EIS Proposed Action. The impa the S&D PEIS are combined with thos SSM PEIS No Action Alternative. A discussion of this methodology is pres section 4.2.

4.5.5.1 *Impacts of Alternative the Waste Managem Programmatic Environmental Impa Statement*

Soil disturbance due to the location management facilities was not addres WM PEIS. However, temporary distu

TABLE 4.5.2.2–1.—*Area of Temporarily Disturbed Soil Due to the Construction of New Facilities*

NEW FACILITY TO BE CONSTRUCTED	LOCATION	AREA OF TEMPO DISTURBED SO
Hazardous Waste Treatment and Processing Facility	Adjacent to Zones 11 & 12	5,296 m^2 (57,00
Pit Reuse Facility	Zone 12	987 m^2 (10,62
Gas Analysis Lab	Adjacent to Zone 11	5,073 m^2 (54,60
Materials Compatibility Assurance Facility	Adjacent to Zone 11	4,030 m^2 (43,39
Nondestructive Evaluation Facility	Zone 12	7,468 m^2 (80,5
Metrology and Health Physics Calibration and Acceptance Facility	Zone 12	8,948 m^2 (96,3

[1]Area of temporarily disturbed soil is estimated to be twice the floor area of facilities listed above.
Source: PC 1995g:7-10

as much as 21.2 hectares (52.6 acres) could occur during the construction phase. Contamination of the soil and sediments are not expected to occur as a result of construction activities.

The WM PEIS determined that there were no programmatic issues that would affect the selection of alternatives for any waste type at Pantex Plant. Future site-wide or project-specific NEPA reviews would be expected to assess such issues as soil erosion, soil characteristics, etc.

4.5.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. Under the No Action Alternative, no downsizing or modification of facilities would occur, and there would be no construction. Therefore, impacts to soils are expected to remain the same as those from current operations. Under the downsizing alternative, all construction activities would be modifications to existing facilities. Consequently, no significant land disturbance would occur. Under the relocation alternative, decontamination and decommissioning of the facilities would not be expected to have impacts to the soil.

4.5.5.3 *Impacts of Alternatives in the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*

The S&D PEIS is considering Pantex Plant for long-term storage of inventories of nonsurplus weapons-usable plutonium and highly enriched uranium (HEU), storage of inventories of surplus weapons-usable plutonium and HEU pending disposition, and disposition of surplus weapons-usable plutonium. For storage, the strategy for long-term storage of weapons-usable plutonium and HEU, as well as the storage site(s), would be decided. The storage alternatives include upgrading the existing plutonium storage facilities, consolidation of plutonium from other sites, and collocation of plutonium and HEU storage. The collocation alternative is used for analysis purposes in this EIS as the bounding storage alternative.

Under the S&D PEIS Collocation Alternative, construction of new storage facilities would be required in order to store plutonium and HEU at Pantex Plant. No apparent direct or indirect effects on the geologic resources are anticipated, because neither facility construction and operational activities nor site infrastructure improvements would restrict access to potential geologic resources. Soil impacts during operation are expected to be minimal.

For the disposition alternatives in the S&D PEIS, the emphasis at this stage in the NEPA decision process is on choosing the strategy and technology mix rather than the actual site. The evolutionary Light Water Reactor is used for analysis purposes in this EIS as the bounding disposition alternative. Implementation of this disposition alternative would require the construction and operation of a pit disassembly and conversion facility, plutonium conversion

facility, MOX fuel fabrication facility, and one or more light water reactors. The bounding alternative also assumes that all of the facilities previously mentioned would be collocated at the same site (potentially Pantex Plant).

No apparent direct or indirect effects on the geologic resources are anticipated, because neither facility construction, operational activities, nor site infrastructure improvements would restrict access to potential geologic resources. The soil erosion potential from direct and indirect impacts associated with construction and operational activities is low for Pantex Plant.

4.5.6 Potential Mitigation Me

Since there are no impacts to geology a no mitigation measures are required. D choose to implement one or more following measures to mitigate the te disturbance to soils during cons activities. These measures include control measures such as applica commercial dust suppressants, wind fe particulates greater than 10 micro sediment traps, diversion of surface runoff from areas of construction, di fences, or covering the disturbed area rap.

environment. Pantex Plant's Environmental Protection Department conducts environmental monitoring on a routine basis. The results of environmental monitoring activities are summarized and presented in annual environmental reports that are available to the public.

The potential spread of the contamination in the groundwater from historical site-related activities is influenced by the physical and chemical characteristics of the soil and the underground materials, the presence and flow of groundwater, and the remediation efforts that are planned or underway. This section describes these factors and existing water contamination.

4.6.1.1 *Surface Water*

Hydrology

There are no streams or rivers at or in the vicinity of Pantex Plant; all site water needs are met by groundwater (DOE 1995k:4-292). Six playas are associated with the Pantex Plant Site. Playas 1 through 3 are located on Pantex Plant proper. Playas 4 and 5 are on the property DOE leases from Texas Tech University (TTU). Playa 1 contains water throughout the year. Playas 2 through 5 are dry most of the year. Pantex Lake (the sixth playa) is located approximately 4 kilometers (2.5 miles) northeast of the main site. Pantex Lake does not receive runoff from the plant and is dry most of the year. The only major stream in the area is the Canadian River, which is located approximately 40 kilometers (25 miles) north of Pantex Plant. Since surface runoff at the plant flows into local playa basins, the Canadian River is not affected by activities at Pantex Plant. Most of the surface drainage within the plant is directed to the playas via several major drainage ditches, as shown in Figure 4.6.1.1–1.

Playa 1 receives continuous discharges fr Pantex Plant Wastewater Treatment F (WWTF). Only in the ditch running fr WWTF to Playa 1 does flow occur thro the year, at approximately 950,000 (250,000 gallons) per day (Pantex 199 5.2.3). All effluents from plant operati treated and, along with some non industrial discharges, are directed into that drain into Playas 1, 2, and 4 (1996c:111). Playa 3 receives stormwater from the Burning Ground. Current Pante activities do not involve Playa 5 or Pante However, wastewater from Pantex Pla discharged to Pantex Lake from 1942 t 1987. Playa 5 has received wastewate numerous sources other than Pantex Pla past (Pantex 1989:223).

Playas are a significant part of the surfa subsurface hydrologic systems at Pante All playas at the site receive stormwater from the Pantex Plant vicinity. The playa also been identified as possible sou focused recharge to the groundwate system at Pantex Plant. Unlined ditche been used to convey wastewater and stor in the past. This practice continues however, the water quality and outfa subject to the conditions of surface discharge permits and permit limits. U ditches transmit treated waters or stor from discharge points at Pantex Plant to 1, 2, and 4. These unlined ditches ar away from the ditches are believed additional sources of groundwater re (Pantex 1996:4.5.1). Recharge to the aquifers is not fully understood. Investig of the ditches and playas, related to the pr for contamination, are being performed the Pantex Plant environmental restorati program. Current corrective measures preventing further migration of contam by identifying and removing contamina

along the ditches to Texas Risk Reduction Standards (RSS) (Stroller 1996:1-1).

Floodplains

Floodplains at Pantex Plant were delineated by the Tulsa Office of COE in accordance with Executive Order 11988 (EO 11988:804; 44 FR 1022:B.7-2). This assessment also fulfills the environmental review requirements under *Compliance with Floodplain/Wetlands Environmental Review Requirements* (10 CFR 1022). Although not formally stated there, the Notice of Intent to prepare this EIS (59 FR 26635) was the Notice of Floodplain/Wetlands Involvement. Locally intense rainfall can cause stormwater runoff and ponding in the playa basins (LLNL 1988:3-1). The COE delineated floodplain boundaries for Playas 1 through 4, Pantex Lake, and Pratt Lake (located north of Pantex Plant), using criteria for 100-year, 500-year, and Standard Project Flood boundaries. Detailed floodplain delineations at Pantex Plant are shown in Figure 4.6.1.1–2. Flood frequencies and their corresponding peak flood elevations as calculated by COE are provided in Table 4.6.1.1–1.

Except for Playa 3, the floodplains are within the drainage boundary for each playa. The 500-year and Standard Project Flood runoff into Playa 3 will overflow out of the drainage basin creating shallow (less than 30 centimeters [1 foot]) flooding of the drainage basins for Playas 1 and 2 (DOE 1995c:2). The elevations of the Burning Ground structures were not included in these floodplain studies, but have been included in Table 4.6.1.1–1 for informational purposes. The only structures that currently exist above land surface at the Burning Ground are the explosive burn trays (USCOE 1995:2-6, 2-7). These structures have a height of 0.6 meters (2 feet) above ground surface and an approximate surface elevation of 1,089 meters (3,572 feet) above mean sea level. The explosive burn trays are outside of the 100- and 500-year delineated floodplains for Playa 3, and are therefore, in compliance with 40 CFR 264.18 (Location Standards for Floodplains).

Surface Water Quality

Surface water monitoring is conducted at Playas 1 through 4 and at Pantex Lake. In addition, offsite surface water quality control samples (used as background samples) were collected from Bushland Playa, located 54 kilometers (34 miles) west of the plant, for comparative purposes (Pantex 1996c:111). Surface water quality sampling was conducted at the locations shown in Figure 4.6.1.1–1 for a full suite of analytical parameters including radionuclides, metals, HE, polychlorinated biphenyls (PCBs), pesticides, herbicides, volatile organics, semivolatile organics, and other miscellaneous constituents and field parameters. Table 4.6.1.1–2 gives the current and historic sources of flow for each monitoring location. Analytical water quality sampling results are presented in volume II, appendix C.

Pantex Plant conducts effluent monitoring at designated sampling locations in accordance with the requirements of the NPDES Permit (EPA 1996) and TNRCC Wastewater Discharge Permit (TNRCC 1996b). Flow from the WWTF is small but continuous. The NPDES Permit specifies a daily average discharge limitation for Outfall 001 of 2.5 million liters (0.65 million gallons) per day. Environmental surveillance monitoring is conducted at the other sampling locations when surface water is present (usually after rainfall). Surface water samples are analyzed for both radiological and non-radiological constituents.

Sampling locations, water quality parameters measured, and sampling frequency may change from one year to the next. Detailed information on surface water quality monitoring is summarized in annual environmental reports prepared for Pantex Plant. Results from 1994

FIGURE 4.6.1

surface water sampling confirm that Pantex Plant was in compliance with all regulations regarding discharge water quality (DOE 1995b:11-1, 11-35). There were no exceedances of the Quality Levels for Inland Waters as established by 30 TAC 319.29 (Pantex 1996c:150). With the exception of a high water level in Playa 1 in May and June 1995 due to rainfall events, all the requirements of the TNRCC Permit No. 02296 were met (Pantex 1996c:150). The high water level does not present a problem to the environment or human health.

Surface water quality samples from 1994 and 1995 that were tested for radionuclides were less than the DOE derived concentration guides for ingested water established by DOE for radiation protection of the public and the environment (DOE Order 5400.5). DOE is self-regulating with respect to standards and requirements for radiation. The *Atomic Energy Act of 1954*, as amended, authorizes DOE to protect public health and safety and the environment in conducting programs, such as Pantex Plant operations. The DOE derived concentration guide values given in DOE Order 5400.5 are reference values for radiological protection programs at operational DOE facilities. Even though no derived concentration guides exist for gross alpha/beta, results indicate that 1995 radionuclide levels in surface water were similar to historical levels, levels at the control location, and levels in water from the Ogallala aquifer. Thus Pantex Plant operations do not affect the radiological content of discharged waters (Pantex 1996c:111).

As at any 50-year old industrial facility, a variety of constituents are occasionally detected at very low concentrations. The semivolatile organic, 3,3'-dichlorobenzadine, and the HEs PETN, RDX, and TNT were detected in surface water quality samples from Playa 1 in 1993, but were not detected in surface water samples collected at this location in 1994. No PCBs, pesticides, or herbicides were detecto In Outfall 002, the HE HMX (0.047 m detected in September and the HE R detected in June and July 1995 (0.28 m 0.13 mg/L, respectively). Water qu from 1990 through 1994 are summa volume II, appendix C.

In addition to the routine surfa monitoring described above and pre volume II, appendix C, additional surfa surface soil, and subsurface soil samp collected as part of the Ditches and Pla System 1 *Resource Conservation and R Act* (RCRA) Facility Investigatio (USCOE 1994a:ES-4). Surface water were collected from Playa 1 (Flow Sy 1). The following five suspected conta were identified in the COE Prelimin Report: chromium, lead, phosphoro DDT, and heptachlor. Of these, only and phosphorous, were determined statistically significant. Elevated lea may be associated with the historical us of leaded gasoline in plant vehicles. Su currently being conducted to estab industrial background for lead. E phosphorous levels are assumed associated with onsite agricultural usage.

Surface Water Uses

Playas at TTU Research Farm are pe used for grazing livestock, but not o owned property. This is discussed in 4.4.1.1 (Pantex 1996:5.5). In additio grazing operations, some areas of Pa are cultivated. Water for irrigation is us on the TTU Research Farm, and when us potable water pumped from the Q aquifer. Water for irrigation of TTU pumped from five Pantex Plant wells an to TTU under an interagency ag between TTU and DOE (PC 1996v). T no irrigation of DOE property.

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Effluent permit limits vary per outfall. Specific NPDES permit requirements are tabulated in volume II, appendix C (Table C.1.2–2). The requirements and limitations specified in this NPDES permit formed the basis for amendments to TNRCC Permit 02296.

TNRCC Permit No. 02296. Historically, Pantex Plant discharged treated domestic and industrial wastewater into ditches and Playas 1 and 2 under the terms and conditions of TNRCC Wastewater No-Discharge Permit 02296, first issued on May 19, 1980 and renewed and modified on May 3, 1988. The term "No Discharge" referred to the playa lakes at Pantex Plant not being considered waters of the State of Texas by the State at the time of permit issuance. Recently TNRCC Permit 02296 was amended (effective June 14, 1996) and generally reflects the same effluent limitations and requirements as the EPA Region 6 NPDES Permit that became effective on June 1, 1996.

Pantex Plant has worked very closely with EPA Region VI and TNRCC to produce wastewater discharge permits (EPA NPDES Permit No. TX-0107107 and TNRCC Wastewater Discharge Permit No. 02296) that provide stringent wastewater discharge requirements that are protective of human health and the environment. The Pantex Plant wastewater discharge permit limits meet or exceed all current regulations that apply to surface water. Since the State of Texas applies regulations through the concentration limits specified in permits, the decision criteria for surface water compliance is based on the permit limits established in the NPDES Permit and Wastewater Discharge Permit for Pantex Plant. EPA and TNRCC determined which constituents would have reporting requirements and/or permit limits specified in the NPDES and Wastewater Discharge permits based on a review of the most recent surface water quality data available for the main outfalls and internal outfalls. The most recent analytical data at the time of regulatory review were f TNRCC calculated effluent limit were based on the Texas State Sur Quality Standards (Title 30 TAC 3 actual effluent limitations, cited in th are more stringent than those calc TNRCC and reported in its Fact Sheet 1995a). As stated in the NPDES Pe has accepted the statistical ca provided by Pantex Plant and has es metal limitations on a case-by-ca through best professional judgment u (a) of the *Clean Water Act* for best a technology economically available.

The Pantex Plant Environmental Pr Department conducts environmental oring to assure that all regulated surfa outfall discharges are in compliance w established permit limits. In addition constituents that are regulated in the perm Pantex Plant Environmental Pr Department also has conducted analyse following constituents that were not spe the permit: nitrite, strontium, vanadi methylphenol, 3,3-dichlorobenzidine, a benzoic acid, chloroform, ethyl methylene chloride, phenol, toluene, boron, and tin. By monitoring fo additional constituents, Pantex Pl providing additional assurance that any in chemical constituents and their concentrations are protective of human and the environment.

TNRCC Wastewater Discharge Perm 02296 (as amended) requires that wit year of the effective date of the permit (ju 1996), Pantex Plant must conduct a (which is currently underway) that det the feasibility of eliminating or mini discharges to playa lakes and open ditc improving the quality of discharge. Acc to the permit, the study should, at a mi include the following proposals:

- Upgrading existing treatment facilities or constructing new treatment facilities to ensure no groundwater quality effects from discharges to playa lakes and ditches;
- Constructing synthetically-lined impoundments to confine treated effluent and a closed collection system from all process areas to the treatment facilities;
- Establishing an irrigation disposal site and accompanying disposal practices plan to eliminate discharges to the playa lakes;
- Establishing a reuse and conservation program for all process wastewaters, thereby eliminating any industrial effluent discharge to the playa lakes and ditches; and
- Developing a schedule for completion of proposals or any other proposals deemed feasible by the permittee.

NPDES General Stormwater Discharge Permit TXR00G138. EPA issued a Stormwater General Permit Coverage Notice on February 15, 1995. Additionally, Pantex Plant has filed Notices of Intent for Stormwater Discharge Associated with Construction Activities for individual construction projects that disturb 2 hectares (5 acres) or more.

***Clean Water Act* Section 404 Dredge and Fill Permit.** This permit, issued by COE, was required for previous field activities conducted for hydrogeologic site characterization. Since these site characterization efforts have concluded, the permit was allowed to expire without renewal.

4.6.1.2 *Groundwater*

Assessment of the affected environment for groundwater resources consists of the following factors. Hydrogeologic properties are characterized to determine the presence and flow characteristics of aquifers, or water-bearing units, beneath Pantex Plant. The physical and chemical properties of soils and subsurface sediments, coupled with the occurrence and flow characteristics of the aquifers, are controlling factors in determining how potential contaminants discharged at the ground surface can migrate into subsurface materials, the presence or probable absence of contamination in groundwater, and the potential for contaminant movement in or between aquifers.

Characterization of the existing (baseline) water quality is necessary to determine the current extent of contamination and to determine how the actions proposed in this EIS may impact the current water quality conditions. The potential impacts to the existing water quality from the Proposed Action are discussed in section 4.6.2. It is important to note and to distinguish between the existing water quality conditions that have been affected by over 40 years of Pantex Plant operations and the associated waste generation versus the water quality of treated wastewater discharges that are currently entering the system.

Past discharges contained what is regarded under today's standards as unallowable amounts of contamination. Since 1980, wastestreams generated from the production activities have been reworked to greatly reduce the potential for contaminants to be discharged. As discussed in section 4.6.1.1, surface water discharge permits have been in effect since 1980, and all future discharges that occur at Pantex Plant will need to be in compliance with the plant's TNRCC and EPA permits. Current groundwater uses and groundwater rights and permits are discussed to provide a general background of groundwater availability and will be used for assessment of impacts in section 4.6.2.

Hydrology

Groundwater provides the primary water supply for the High Plains area, a major agricultural

region of the United States. The High Plains aquifer, commonly called the Ogallala aquifer, underlies the whole of the Texas Panhandle and the South Plains, as well as parts of New Mexico, Oklahoma, Colorado, Kansas, Nebraska, Wyoming, and South Dakota. The Ogallala aquifer is the principle aquifer and major source of water in the vicinity of Pantex Plant and the surrounding ROI. The locations of private and municipal supply wells in the vicinity of Pantex Plant are shown in Figure 4.6.1.2–1. A hydrogeologic feature that occurs locally at and in the vicinity of Pantex Plant are perched aquifers; these features form due to the presence of low-permeability materials that impede and may even prevent the downward migration of infiltrating water (Pantex 1996:4.1). Perched groundwater in Zone 12 is the uppermost water-bearing unit that has been affected by Pantex Plant activities.

Hydrogeologic site characterization activities to establish baseline conditions are underway as a component of the site's ongoing ER program. The Texas Bureau of Economic Geology (Texas A&M University) conducted extensive characterization studies at Pantex Plant from 1990 to 1995. Recent and ongoing hydrogeologic field investigations currently are being conducted by Battelle-Pantex and Argonne National Laboratory. These field investigations include the installation of several new wells and test borings, the collection of additional groundwater level measurements, aquifer testing, and groundwater quality sampling. The locations of existing Pantex Plant wells are shown in Figure 4.6.1.2–2. A north-south trending hydrogeologic cross-section is shown in Figure 4.6.1.2–3.

Pantex Plant is underlain by the following hydrogeologic units (from the ground surface downward), as shown in Figure 4.6.1.2–3:

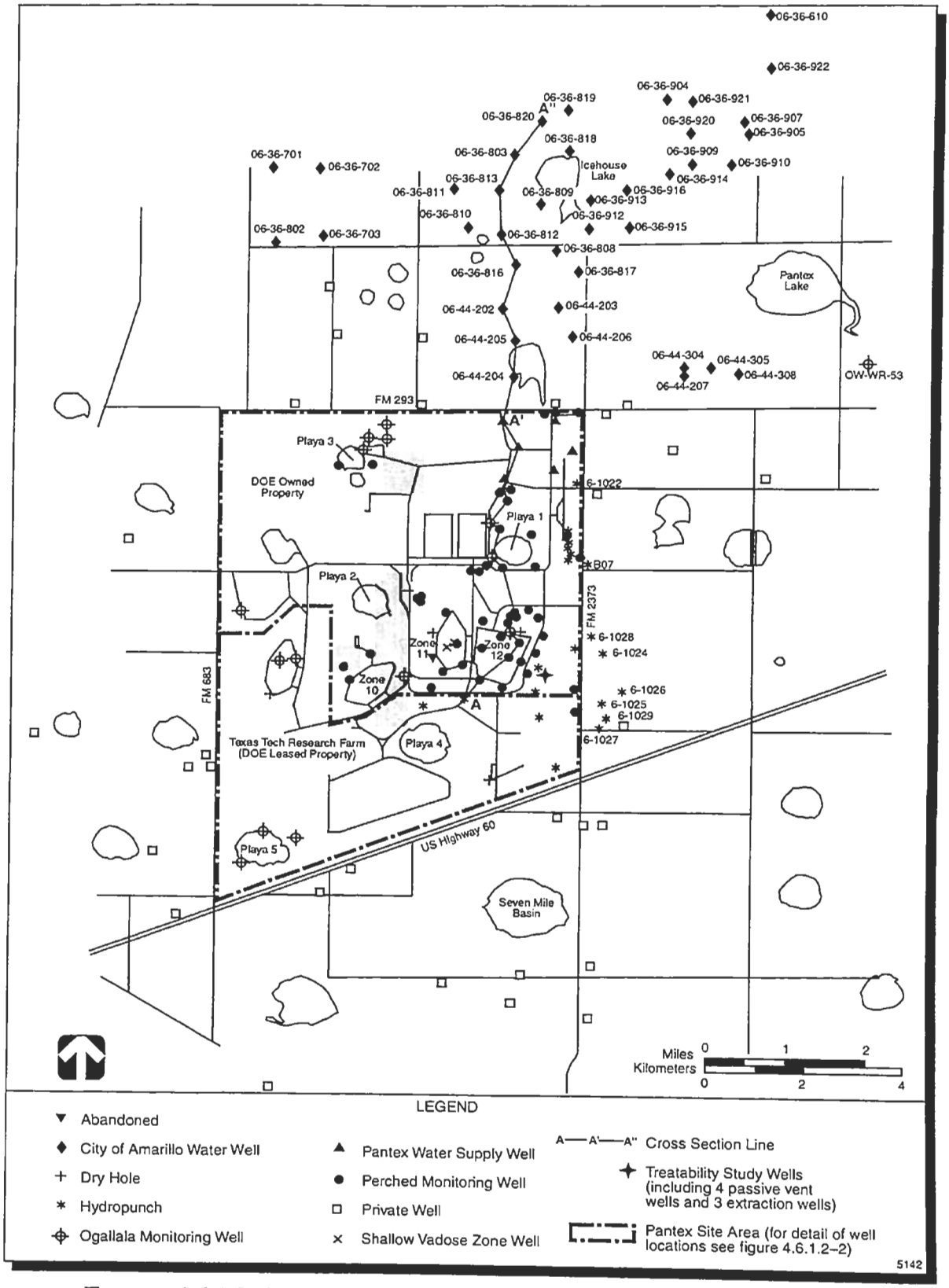
- Unsaturated sands and clays of the Blackwater Draw Formation and upper Ogallala Formation.
- Discontinuous perched aquif upper Ogallala Formation.
- The thick, extensive region aquifer in the lower Ogallala F
- The Dockum Group.

Unsaturated Zone

The unsaturated zone consists of su (generally consisting of Pullman so plains and Randall soils in th Blackwater Draw Formation soil sediments, sands, silts, clays, and gr the discontinuous upper Ogallala F Caprock caliche (cemented sediment interbedded with sands, silts, clays, a (Pantex 1996:4.2). Caliche layers, inc Caprock Caliche at the boundary be Blackwater Draw and the Ogallala For appear to vary locally in compos thickness (DOE 1994nn:3-21). saturated or partially saturated zones depths of 14 meters (45 feet) beneath and the major drainage ditch approximately 70 meters (230 feet) perched aquifer. The infiltration of water (e.g., rainfall, plant discharge within this unsaturated zone. It is poss in the past this infiltration might have re vertical migration of contaminan 1994n:5-2).

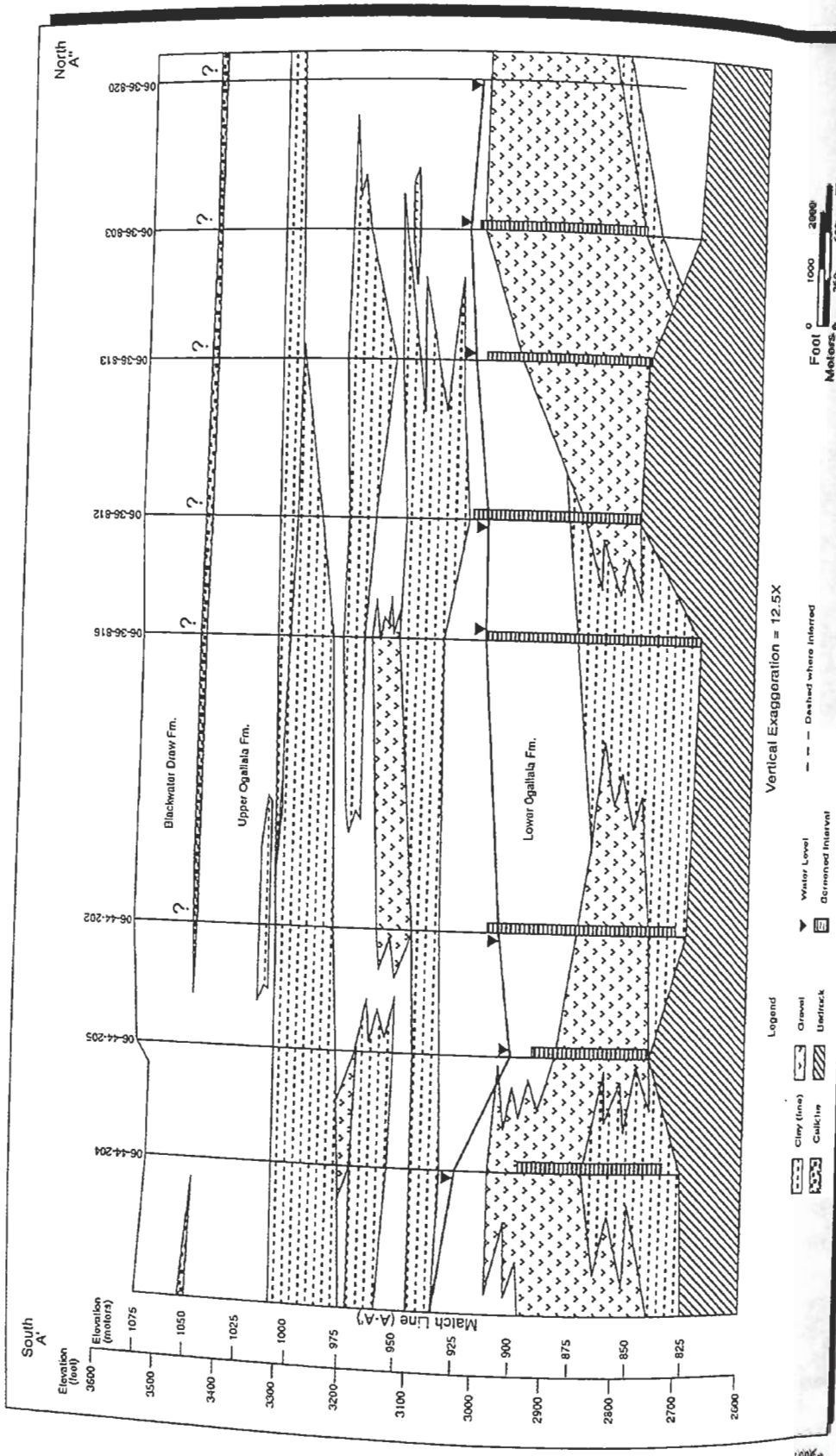
Perched Aquifer

The perched aquifers are the u saturated subsurface units capable of p water in the Pantex Plant area. An e site characterization was conducted in 1995 to characterize the location, s geometry, and depth of the perched a nature of recharge; and direct groundwater flow. An expedite characterization for the Pantex Plant groundwater was conducted to de working model of the perched aquifer.



SOURCE: Pantex 1996d

FIGURE 4.6.1.2–1.—*Locations of Pantex Plant Area Groundwater Wells.*



SOURCE: Pantex 1996c

objectives included characterizing the extent of the perched aquifer, nature of groundwater recharge, direction of groundwater flow, groundwater contamination, and identification of potential receptors.

The findings of the expedited site characterization are presented in the *Draft RCRA Facility Investigation Report for Groundwater in Zone 12 at the DOE Pantex Plant* (Argonne 1995a). Data collected during the expedited site characterization were used to predict contaminant movement and to evaluate cleanup options for perched groundwater; the results of this study are reported in *Two-dimensional Groundwater Flow Model and Design Tool for Evaluation of Remedial Options for Perched Groundwater at Pantex Plant* (Battelle 1996a). The primary area of concern in this modeling effort is the perched aquifer underlying Zones 11 and 12 and the area east and southeast of the plant boundary. Additional investigations have been conducted on private property south and southeast of Pantex Plant, under the Pantex Plant Groundwater Protection Project (MH 1996a).

The perched aquifer occurs as localized groundwater mounds that form beneath the playas from focused surface water recharge. Perched groundwater flow is unconfined (i.e., the water table forms the upper boundary of this aquifer). Perched groundwater accumulates in gravel and sand channel deposits at approximate depths of 64 to 88 meters (210 to 290 feet) below the ground surface. These water-bearing buried channel deposits are on top of a zone of fine-grained clays, clayey silts, and sands, as shown in Figure 4.6.1.2–3. The existence of the perched aquifer is dependent on the occurrence of the underlying fine-grained zone, which is of variable thickness, as shown in Figure 4.6.1.2–4. This fine-grained zone has a low vertical hydraulic conductivity that impedes the downward movement of infiltrating groundwater. Vertical hydraulic conductivity measurements for fine-grained sediments ranged from 4.62×10^{-6} to 6.92×10^{-9} centimeters per second (1.31×10^{-2} to 1.96×10^{-5} feet per day) (Texas A&M University 1995a:7).

The perched zone has an irregular surface, and generally occurs 90 meters (300 feet) below land surface (Battelle 1996a:4). Where the fine-grained zone is present, perched groundwater collects in overlying sand and gravel deposits that form subsurface channel features and have a greater permeability than the fine-grained zone deposits. As a result, the buried channel deposits form a conduit for groundwater flow, and groundwater movement follows the course of the buried channel deposits. Variations or heterogeneities in the specific types, grain size distributions, and configurations of subsurface sediments result in preferential subsurface flow.

The changes in the direction and gradient of groundwater flow indicate that the perched aquifer exhibits radial flow from Playa 1. The perched aquifer is thickest beneath Playa 1. The only Pantex Plant playa that contains water throughout the year, Playa 1 is considered to be a source of focused recharge to the perched aquifer. Groundwater in the perched aquifer is considered to flow radially away from Playa 1. As shown in Figure 4.6.1.2–5, the groundwater flow direction in the perched aquifer may be locally to the west, northwest, southwest, and southeast due to radial flow and lithologic changes within the perched aquifer.

The physical boundaries and groundwater flow conditions of the perched aquifer affect the extent and direction of suspected contaminant movement. The groundwater flow direction is primarily to the south and southeast under Zone 12, as shown in Figure 4.6.1.2–5. The perched aquifer is known to extend off the plant site to the east and southeast. Although data suggest that the perched aquifer may extend offsite to the north and to the west, hydraulic continuity is not completely understood due to lack of wells

drilled in those areas. Recharge varies laterally between playa, interplaya, and drainage ditch environments.

Although the effectiveness of the fine-grained zone to act as a retardant to vertical groundwater movement is not fully understood, the presence of the fine-grained zone under the perched aquifer probably serves to significantly slow the downward migration of contamination to the Ogallala aquifer while allowing the horizontal spread of potential contamination to be limited to buried channel deposits in the perched aquifer. It is important to note that the perched aquifer is stratigraphically higher (closer to the surface) and not directly hydraulically connected with the underlying Ogallala aquifer. The depth to groundwater ranges from 64 to 88 meters (210 to 290 feet) below land surface in the perched aquifer and from 100 to 140 meters (340 to 460 feet) in the underlying Ogallala aquifer (Figure 4.6.1.2–3).

The rate of groundwater movement, otherwise known as the groundwater velocity, can be calculated from estimates of the following physical hydrogeologic properties: conductivity, defined as the estimati relative ease of groundwater m hydraulic gradient, or slope of the gro level; and the effective porosity, or th of void space through which gro movement can occur. The hydraulic p have been measured from field and la tests. These properties are used to calc rates of groundwater withdrawal a potential spread of contamination. performance tests were used to groundwater velocities.

The results of these aquifer tests are variable and are dependent on the location, relative heterogeneities subsurface sediments from one loca another, duration of the test, variations in procedures, and the method of analysis variations in aquifer performance testing differences in groundwater velocity and Travel time estimates for grou movement in the perched aquifer are p in Table 4.6.1.2–1. Three estimates are

TABLE 4.6.1.2–1.—*Estimated Groundwater Velocities and Travel Times in the Perched*

HYDRAULIC PARAMETER	CONSERVATIVE ESTIMATE	REALISTIC ESTIMATE	UPDATED CALCULATIO
Hydraulic Conductivity meters/day (feet/day)	24.6 (80.7)	12.3 (40.4)	16.9 (55.6)[a]
Hydraulic Gradient	0.011	0.0071	0.005[b]
Effective Porosity	0.15	0.25	0.34[c]
Linear Velocity meter/day (feet/day)	1.8 (5.9)	0.34 (1.1)	0.06 (0.2) to 0.4
Travel Time (years)	2.1	11	9.5 to 62

[a]Hydraulic conductivity from Neuman analysis of PTX06-1017
[b]Average hydraulic gradient in Zone 12 and east area
[c]Specific yield value from Neuman analysis of PTX06-1017
Sources: Texas A&M University 1995:62; Argonne 1995a:4-19; PC 1996; Pantex 1995K:19, 27

Ogallala Aquifer

The Ogallala aquifer underlies the whole of the Texas Panhandle and the South Plains, as well as parts of New Mexico, Oklahoma, Colorado, Kansas, Nebraska, Wyoming, and South Dakota. It is the principal aquifer and the major source of water in the vicinity of Pantex Plant. Groundwater flow directions in the regional Ogallala aquifer in the vicinity of Pantex Plant trend from the southwest to northeast as shown in Figure 4.6.1.2–6. Groundwater movement is unconfined in the Ogallala aquifer. Depth to groundwater in the regional Ogallala aquifer ranges from 104 meters (340 feet) at the southern boundary of Pantex Plant to 140 meters (460 feet) at the northern boundary. The saturated thickness of the Ogallala Formation ranges from 15 meters (50 feet) to more than 120 meters (400 feet) and in some areas is capable of producing yields in excess of 4,000 liters (1,000 gallons) per minute (DOE 1991b:13). A summary of hydraulic parameters measured onsite is presented in volume II, appendix C.

Regional hydraulic conductivity in the Ogallala aquifer ranges from 0.9 to 79 meters (3 to 260 feet) per day. Estimates of annual recharge rates to the Ogallala aquifer vary from 0.02 to 4.1 centimeters (0.01 to 1.6 inches) per year, based on earlier studies that investigated slow regional infiltration of precipitation and recent studies that explored recharge of water through playa lakes and leakage from the Dockum Group aquifer into the Ogallala aquifer (Texas A&M University 1988:16, 25; TWD 1993:6). While these studies support the concept of Dockum recharge to the Ogallala in some areas of the Panhandle, the hydraulic characteristics of the Dockum Group aquifer have not been fully investigated in the vicinity of Pantex Plant. In 1990, the recoverable volume of water in storage and available for use in the Ogallala aquifer was estimated at approximately 5.15×10^{14} liters (1.36×10^{14} gallon High Plains aquifer system (TWD 199

Dockum Group

The Dockum Group underlies the aquifer and consists of shales, clayey si and sandstones. Beneath the Dockum are Permian salt beds and salt dis residues, as discussed in section 4.5, G and Soils. Aquifer properties of the D Group near Pantex Plant are highly vari generally have low permeability, low yields of 400 liters (105 gallons) per min poor water quality (high total dissolved relative to the overlying Ogallala aquife Pantex Plant, however, water quality Dockum Group aquifer is relatively possibly due to intermixing of waters fr overlying Ogallala aquifer (Pantex 19 Several wells near Pantex Plant lie in considered the Dockum aquifer and are domestic and livestock purposes. H since the overlying Ogallala aquifer primary source of groundwater for the pumping in the Ogallala is expected to upward groundwater movement fro Dockum Group. Furthermore, leakage fr Dockum Group upward into the Og aquifer has been reported as a potential of recharge to the Ogallala aquifer 1993:6).

Groundwater Quality

Assessment of the existing groundwater is necessary to establish a baseline, in order assess the potential for the Proposed Action impact groundwater resources. It is imp to note that this section only describes quality "snapshot" of the existing cond (baseline) of contaminants that were releas the past and have reached the water tab does not describe the quality of surface discharge that is currently being released ground surface (see section 4.6.1.1, and

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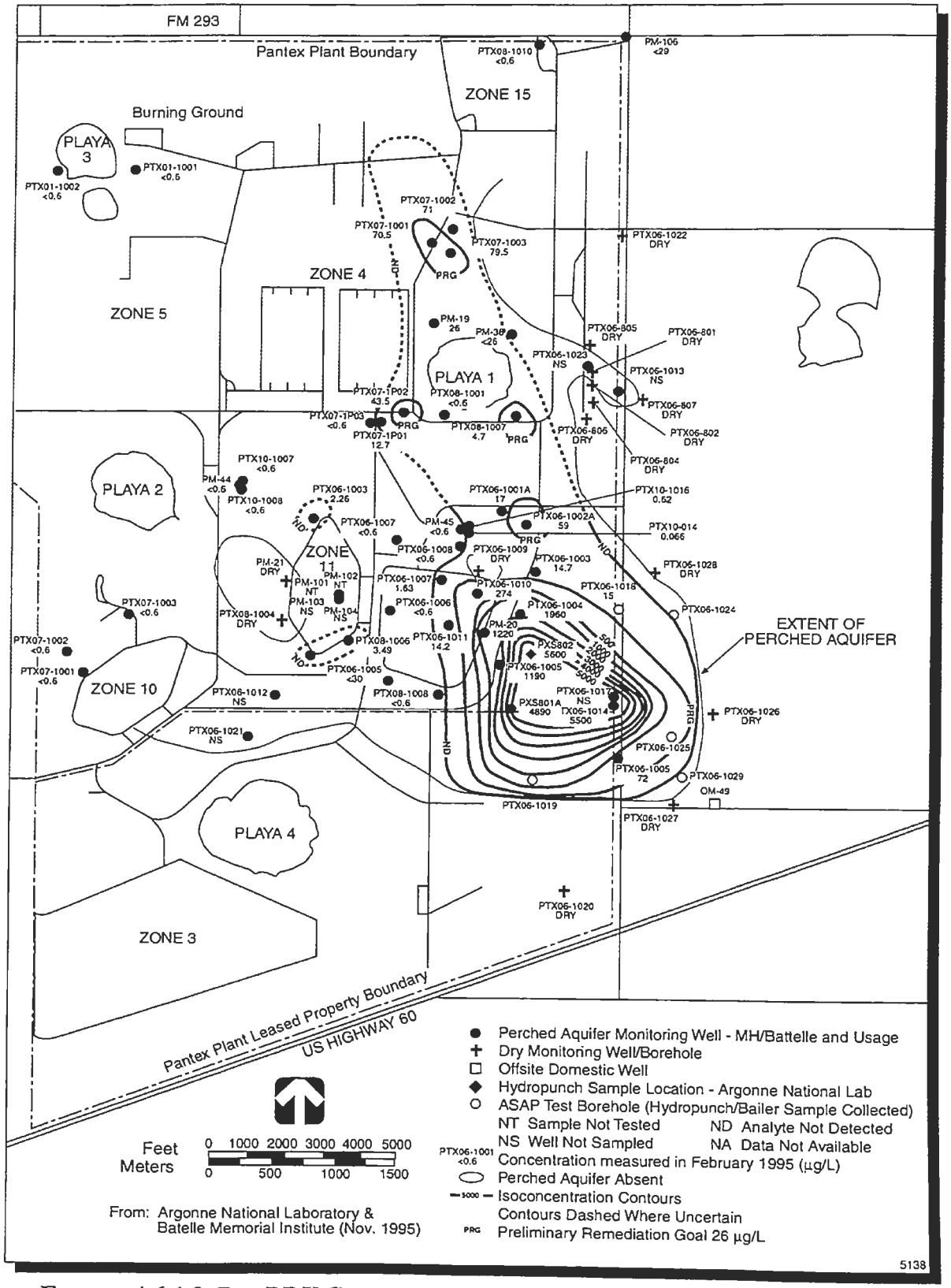


SOURCE: Argonne 1995a

FIGURE 4.6.1.2–7.—*RDX Concentrations in the Perched Aquifer, Pantex Plant.*

The absence of trinitrotoluene in the upper part of the perched aquifer may indicate a decline in historical usage and disposal of trinitrotoluene over time, and the subsequent release of trinitrotoluene from the unsaturated zone, since discharge of HE-contaminated water ceased in 1989 (DOE 1995f:5-20). Evidence of natural attenuation and degradation of HE compounds, such as trinitrotoluene, has been documented during treatability studies. In order to define the stratification of contaminants within the perched aquifer, due to different densities of the contaminants, it is necessary to sample at discrete intervals and depths.

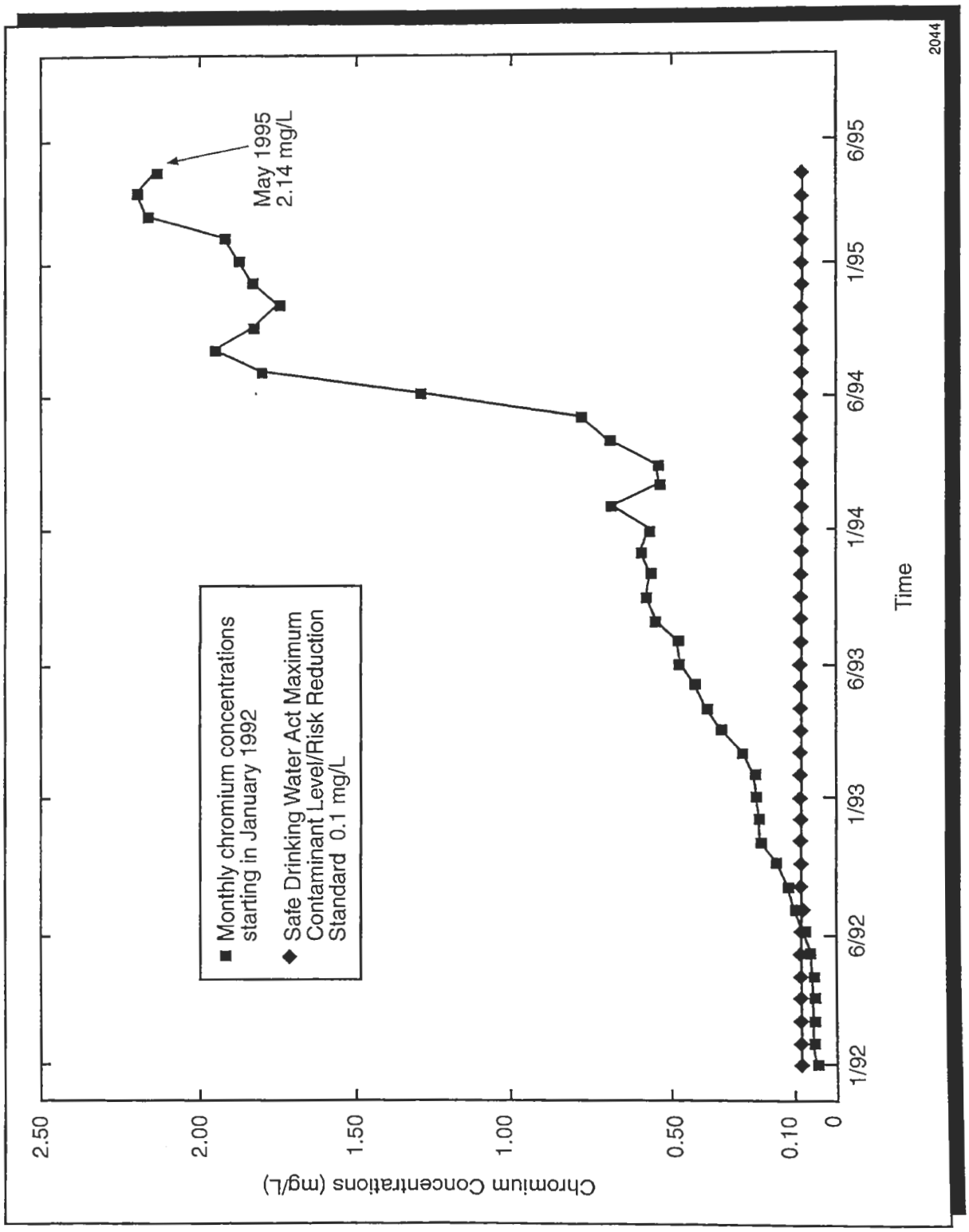
Volatile organic COCs include trichloroethylene, 1,2-dichloroethane, methylene chloride, tetrachloroethene, and benzene. Based on the number of exceedances and magnitude of contamination, trichloroethylene is the most significant volatile organic contaminant. However, much of the trichloroethylene contamination occurred at levels that often barely exceeded the RRS decision criteria of 5 micrograms per liter. Additional information is presented in volume II, appendix C.

Metal COCs include chromium, hexavalent chromium, copper, nickel, iron, lead, and manganese. Chromium and hexavalent chromium are the most widespread and have the highest concentrations of the metals detected in perched groundwater. In several perched aquifer wells, chromium concentrations exceeded the decision criteria standard of 100 micrograms per liter (TNRCC Primary Maximum Contaminant Levels for Drinking Water and Pantex Plant RRS). These exceedances ranged from barely over the standard to over 9,000 micrograms per liter in perched monitoring well PTX06–1010.

An example of how concentrations of chromium have changed over time is shown in a graphical plot of time versus chromium concentration for one well, OW–WR–20, in Figure 4.6.1.2–8. The areal extent of concentrations in the perched aquifer in Figure 4.6.1.2–9. Chromium conc for the perched aquifer are shown as (lines showing levels of equal conc One area of chromium contamina requires further delineation occurs eastern plant boundary, in the vicinity borehole PTX06-1025, where filte unfiltered perched aquifer sampl collected and analyzed for chromiu concentration of chromium measure filtered sample was less than the detect of 10 micrograms per liter, whe concentration of chromium measure unfiltered sample was 198 micrograms (Figure 4.6.1.2–9) (MH 1995c:18).

The historical sources of chromium were located in the vicinity of where the chromium concentrations occur. For chromium was processed in Zone electroplating facility (tool and die sho form of a chrome plating solution betwe and 1986. During this time, elec wastewater effluent would be discharg below-grade sump that would occa overflow. Other historical sou chromium at Pantex Plant include compounds used in the former coolin operations (from 1950 to 1964); resi chromic acid in old sewage treatme sludge beds, the construction debris waste products at the Burning Grou effluent disposal at Playa 1, and in and materials dumped in Landfills 1, 5, (Argonne 1995:3-29 to 3-49). It is high that these earlier releases contributed to concentrations of chromium that occu perched monitoring wells today.

Investigations regarding the concentrations, and removal of chromi Pantex Plant are ongoing. These investigations include determining elevated chromium levels could have



SOURCE: PC 1995i

FIGURE 4.6.1.2–8.—*Chromium Concentrations at OW–WR–20 from January 1992 through May 1995.*

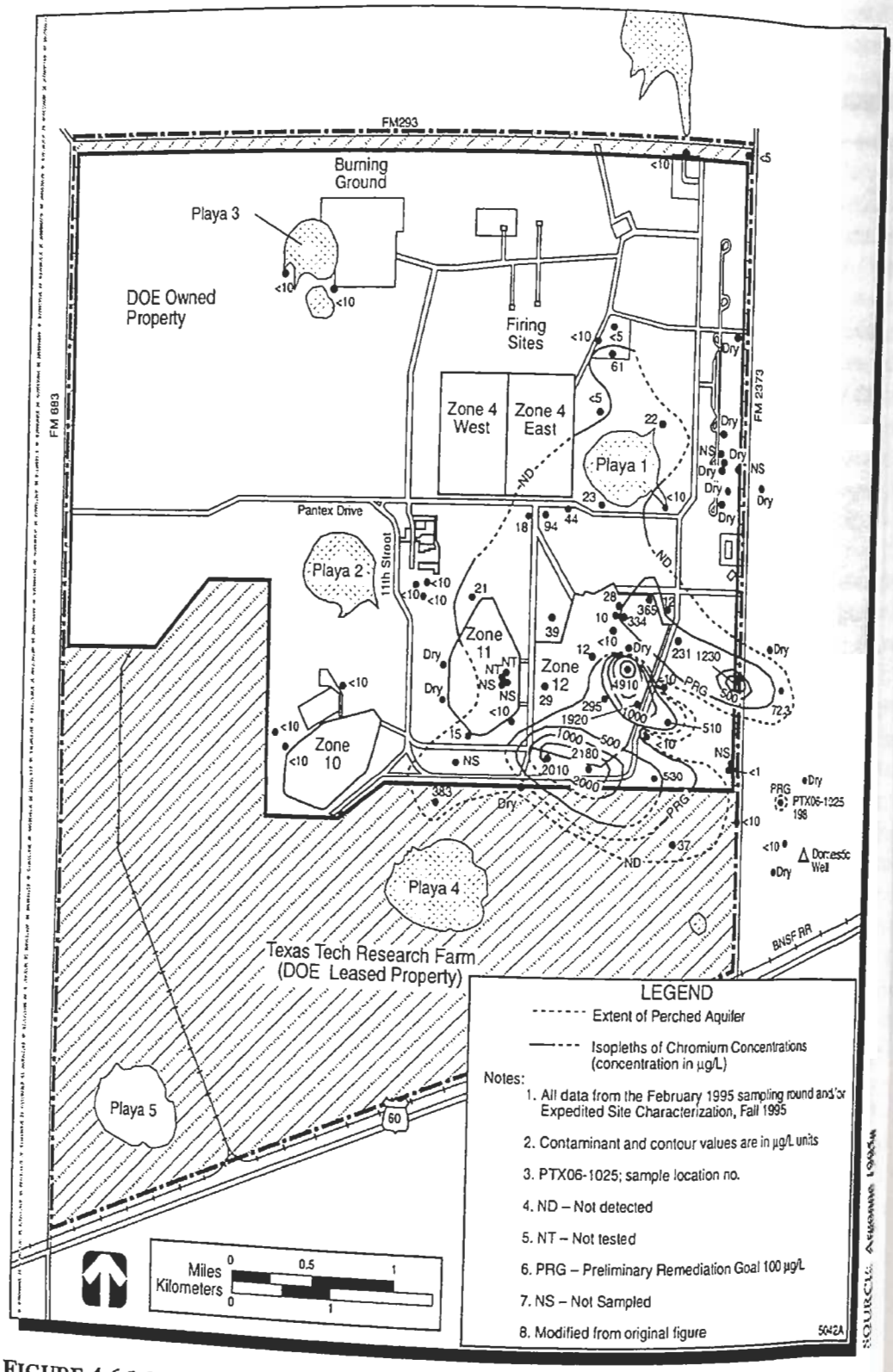


FIGURE 4.6.1.2–9.—*Chromium Concentrations in the Perched Aquifer, Pantex Plant.*

caused by the amount of chemicals used for conditioning cooling water during the tower's operational period (1950 to 1964), chromium anion exchange and column studies to determine whether ion exchange resins would be an effective treatment technology, and geochemical modeling to predict the fate and transport of chromium species in groundwater. Additional data for metals that exceed the decision criteria are provided in volume II, appendix C.

Radionuclides are also measured in groundwater quality samples; however, the levels (or activities) of radionuclides are less than the decision criteria specified in the DOE derived concentration guides for ingested water for radiation protection (DOE Order 5400.5). As a result, radionuclides are not considered to be suspected COCs in perched groundwater at Pantex Plant.

Groundwater quality in the perched aquifer has been affected by the activities that have occurred over the past 40 years at Pantex Plant. Since the perched aquifer is the shallowest water-bearing zone in the area, it is the first groundwater unit affected by migration of contaminants that were released from past industrial operations. These operations generated HE materials, organic solvents, and metals in liquid and solid wastes. The direction and rates of contaminant movement in the perched aquifer are controlled by the location of buried channel deposits and the underlying fine-grained zone, direction and rate of groundwater movement, and source areas of historical contamination. Contaminants originating in Zone 12 have reached the perched aquifer through historical vertical infiltration from ditches, landfills, and other past localized source areas in the interplaya area (DOE 1995f:5-16).

Available information on the historical sources of contamination and the waste disposal history has revealed that the inorganic wastes were discarded primarily in acid pits in the southern part of Zone 12. Explosive wastes were disposed of in the ditches in the eastern part of Zone 12 and at other locations cited in Table 4.6.1.2–2 (DOE 1994nn:3-33, 3-38). Argonne National Laboratory has noted that HE contaminant distributions suggest that a significant or dominant proportion of recharge to the perched aquifer in the Zone 12 area has occurred between the playas. This may be a result of vertical infiltration from unlined surface ditches used to carry liquid wastes onsite. HE was found at a depth of 14 meters (45 feet) in unsaturated zone samples collected from a ditch leading from Zone 12 to Playa 1. At this location RDX and HMX were found to a depth of 6 meters (20 feet), and 1,3,5-trinitrobenzene was found between 6 and 14 meters (20 and 45 feet). No trinitrotoluene was detected in the unsaturated zone. Because of its solubility and biodegradable characteristics, it is believed to have been leached or degraded since the practice of discharging effluent that may have contained HE was discontinued (DOE 1995f:5-20).

Downward migration of perched groundwater could potentially affect the groundwater quality of the underlying Ogallala aquifer. The low vertical permeability of the fine-grained zone could potentially be compromised by abandoned homestead wells that could provide contaminant pathways through the fine-grained zone to the Ogallala aquifer. Low levels of HE contamination have been detected by TNRCC at less than one part per billion of RDX in a domestic Ogallala well located on private property southeast of Pantex Plant. As a precautionary measure, DOE has identified and evaluated abandoned homestead wells in order to prevent potential pathways of contamination into the Ogallala aquifer. Efforts to mitigate further possible contamination have been completed. The well in question was properly

TABLE 4.6.1.2–2.—*Source Areas of Suspected Contaminants of Concern to Groundwater Resources at Pantex Plant*

CONTAMINANT	SOURCE	LOCATION
Chromium	Zone 12	12-5W, 12-68, 12-68 sump, 12-5 subsurface leaching system, 12-4 sulfuric acid pit, 12-44E subsurfa leaching bed.
	Zone 11	11-36 sump, 11-36 leach bed.
	Former cooling tower	Near 12-17 and 12-19.
	Zone 13	OSTP (discharge to Playa 1).
RDX	Zone 12	12-17, 12-19, 12-21, 12-24, 12-41, 12-59 subsurface leaching system.
	Zone 11	11-36 sump, 11-36 leach bed, 11-2 44.
Acids/Solvents	Zone 12	12-4B, 12-5, 12-5D, 12-9, 12-14, 12-41, 12-44, 12-59, 12-64.
	Zone 13	OSTP (discharge to Playa 1).
	Zone 11	11-36 leaching bed.
Construction Debris, Petroleum Waste	East Zone 12	Landfill #3.
	South Zone 12	Landfill #4.
	Southwest Zone 12	Landfill #5.
	South Zone 12	Landfill #6.
Diesel	Zone 12	12-5B, 12-17E, 12-84A.
Fuels	Fire Training burn pits	North of 16-18.
Gasoline	Zone 12	12-3, 12-35, 12-67.
	Zone 16	16-1.
HE	Zone 12	12-9, 12-10, 12-17, 12-19, 12-24, 12-59, 12-73.
	Zone 13	OSTP (discharge to Playa 1).
	Burning Ground	Burning Ground.
	Zone 11	11-36 sump.
	Zone 11	11-36 leaching bed, two evaporation (adjacent to 11-20).
Metals	Zone 12	12-5W, 12-5D, 12-9, 12-18, 12-21, 12-68, 12-81, 12-110.
	Former cooling tower	Near 12-17 and 12-19.
	East Zone 12	Landfill #3.
	Zone 13	OSTP (discharge to Playa 1).
PCBs	Zone 12	12-5E, 12-67.
Pesticides	Zone 12	12-35, 12-43, 12-51.
Solvents	Former cooling tower	Near 12-17 and 12-19.
	East Zone 12	Landfill #3.
	Burning Ground	Burning Ground.
	Fire Training burn pits	North of 16-18.
Volatile Organic Compounds	Zone 11	Two evaporation pits (adjacent to 11-2
Waste Oil	Burning Ground	Burning Ground.
	Zone 16	16-1.

Source: DOE 1994nn:2-16 through 2-32

plugged and sealed under the supervision of TNRCC and a replacement Ogallala well was drilled and completed in order to prevent further potential cross-contamination of the Ogallala aquifer.

Pantex Plant's Groundwater Protection Project was conducted to ensure the integrity of offsite groundwater quality (MH 1996a). The scope of this project included performing three distinct tasks to protect groundwater beneath Pantex Plant from cross contamination between the perched aquifer and the Ogallala aquifer. The activities associated with these tasks were completed in September 1996 at 23 different well locations. These tasks included upgrading existing monitoring wells, sealing offsite homestead wells, and installing new wells offsite.

Monitoring well upgrade activities included installation of barrier posts, installation of protective metal casings, construction or repair of concrete pads, painting exposed steel structures, and resurveying well locations. Well sealing and plugging was necessary for existing vintage Ogallala production wells that could potentially result in cross-contamination between the perched and Ogallala aquifers. Under this task, five wells at Pantex Plant and two private production wells on land adjacent to the plant were sealed. The third task involved installing three monitoring wells, two new perched wells and one new Ogallala well, on private property adjacent to and east of the plant. The Ogallala well has also been designated for use as a domestic production well.

Available routine groundwater quality analytical results from 1990 through 1994 are summarized in volume II, appendix C for groundwater samples collected from the regional Ogallala aquifer. Levels of copper in one Pantex Plant well, iron in four wells, and lead in three wells measured in the Ogallala aquifer have either met or been higher than Pantex Plant RRS and drinking water maximum contaminant levels on several occasions, as shown in volume II, appendix C. However, no exceedances of HE, organic compounds, or radionuclides were measured in Ogallala wells onsite. There was no evidence of contaminated groundwater from the overlying perched zone reaching the Ogallala aquifer in samples collected from Ogallala aquifer monitoring wells (Pantex 1996c:87). Elevated concentrations of copper, lead, iron, and zinc may be related to other factors, such as well construction and piping, rather than the spread of contaminants in groundwater.

Additional Investigations

The rate of potential contaminant transport under and beyond Pantex Plant boundaries is dependent upon the rate of infiltrating surface water recharge; the concentrations of contaminants; the solubility of these contaminants; vertical and horizontal groundwater movement; the mixture of contaminants present; soil and sediment characteristics; and physical, chemical, and biological processes, such as adsorption and biodegradation. Investigations to characterize the potential for contaminant migration are ongoing.

The University Consortium (University of Texas Austin, Texas A&M University, and TTU Water Resources Information Center) is conducting several investigations to support, supplement, and enhance the activities of the Pantex Plant ER Program. A perched aquifer tracer test at the Pantex Plant Zone 12 treatability site is being conducted to evaluate the efficiency of groundwater recirculation for remediation, to determine potential retardation effects on HEs from the injection of treated wastewater, and to predict long-term performance of the remediation system. Soil vapor extraction modeling and a tracer test in

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4.6.2 Impacts of Proposed Action

4.6.2.1 *Impacts of the Continued Operations*

Weapons-Related Activities

Surface Water. Operations at Pantex Plant have not substantially impacted delineated flood-prone areas in the past, and continued operations are not expected to cause impacts in the future. The proposed areas of activity are outside of 100-year, 500-year, and Standard Project Flood boundaries. Pantex Plant is in compliance with current wastewater and stormwater discharge permits. Wastewater discharge associated with operations on 2,000, 1,000, or 500 weapons per year is expected to continue. These discharges are not expected to impact surface water quality because, while the projected annual wastewater discharges represent a 36 percent increase over fiscal year (FY) 1994 usage for the 2,000 weapons level, the levels of contaminants in the wastewater are held by current regulations to levels that do not impact the environment. This increase is only 48 percent of the site's remaining wastewater treatment capacity. The 500 weapons level would represent an 8 percent decrease in wastewater production (Table 4.6.2.1–1).

Groundwater. Section 4.6.1.2 pr assessment of the existing hydrogeologic and water quality cond exist at Pantex Plant. The existing gro contamination that has been detecte perched aquifer is the result of over 4 past activities and waste generation a Plant. Over this time period, contami were previously released at the groun had to percolate through unsaturated sediments to the perched aquifer. Grou contamination of the perched aquifer b detected offsite to the east and south stated in section 4.6.1.2, if conta groundwater from the Zone 12 perched is used in the future for domestic or agri purposes, a potential exposure pathwa ingestion, bathing, or irrigation) coul (Argonne 1995a:5-37). Pantex P Groundwater Protection Project implemented to ensure the integrity of water quality by sealing homestead upgrading some monitoring wells, and b additional monitoring wells (MH 1996a

Assessment of the impacts of the cont operations to groundwater resources at the involves the evaluation of the potenti additional groundwater contamination b wastewater discharge activities, and

TABLE 4.6.2.1–1.—*Current and Projected Annual Water Usage and Capacities, Pantex Plant (million liters [million gallons])*[1]

	FY 1994 USAGE	FY 1994 CAPACITY	2,000 WEAPONS LEVEL	1,000 WEAPONS LEVEL	500 WEAPONS LEVEL
Wastewater	477 (126)	830 (219)	647 (171)	522 (138)	439 (116)
Water	836 (221)	1,890 (500)	1011 (267)	791 (209)	689 (182)

[1]Water consumption and capacity are shown in liters to be consistent with the units used in section 4.3, Plant Facilities and Infrastructure. (Liters can be converted to cubic meters by multiplying with 0.001.) Projected annual rates include a 10 percent margin.
FY – fiscal year

Sources: DOE 1995j:10; DOE 1994f:7

evaluation impacts from future groundwater use projections; these areas of concern are considered in this section. The potential for additional impacts to groundwater quality from wastewater discharge activities is minimal due to the contaminant removal efficiency of the industrial and sanitary wastewater treatment process currently being used. Although the projected annual wastewater discharges represent a 36 percent increase over FY 1994 usage, the quantity of wastewater discharge is less than the total wastewater discharge capacity. The quality of the wastewater discharge is such that it will not degrade the quality of the groundwater in either the perched or Ogallala aquifers, because the wastewater discharge is regulated through the EPA Region 6 NPDES Permit and TNRCC Wastewater Discharge Permit. Pantex Plant has worked very closely with EPA Region 6 and the TNRCC to produce wastewater discharge permits (EPA NPDES Permit No. TX-0107107 and TNRCC Wastewater Discharge Permit No. 02296) that provide stringent wastewater discharge requirements that are protective of human health and the environment (section 4.6.1.1).

The hydrology and recharge of the perched aquifer is very complex and the effects upon the vadose zone from continual discharge of water into the existing playas and drainage ditches does not necessarily result in contaminated groundwater being driven into the Ogallala aquifer. ER investigations, conducted at or before the time of publication, have indicated that the extent of offsite contamination detected in the perched groundwater has been limited to within one-half mile southeast of the main Pantex Plant site boundary. The ER Program is currently conducting corrective actions to protect human health and the environment.

Groundwater contamination has occurred in the perched aquifer as a result of past site-related activities. For the past seven years, the Pantex Plant ER Program has assessed inactive sites, conducted investigations to determine the nature and extent of contamination, and implemented remediation strategies to eliminate any present or future threat to human health and the environment. These activities to investigate historical sources of contamination and correct the extent of problems created by past practices will continue in the future through the ER program. Wastewater discharge would be released to the playas and natural drainage channels in accordance with the EPA NPDES and TNRCC Wastewater Discharge Permit requirements. There are no direct discharges to groundwater (DOE 1995k:4-327).

No additional impacts to groundwater quality conditions from routine continued operations are anticipated since all wastewater discharge must comply with TNRCC and EPA wastewater discharge permit limits. Although groundwater in the perched aquifer is contaminated as a result of past site-related activities, the ER program is currently conducting field activities to characterize the nature and extent of contamination. Groundwater monitoring for the perched and Ogallala aquifers will continue, and groundwater treatability options are currently being explored. The impacts of discharging treated wastewater, within permit limits, to the playas and ultimately to the groundwater system are negligible when compared to baseline conditions and in consideration of the ongoing ER activities at Pantex Plant.

Groundwater used for continued operations would be withdrawn from the onsite Pantex Plant production wells, completed in the Ogallala aquifer, at the projected withdrawal rates listed in Table 4.6.2.1–1. The 2,000 weapons level would represent a 20 percent increase over FY 1994 withdrawals. This increase represents 16 percent of the remaining water supply capacity at the plant.

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4.6.2.2 *Impacts of New Facility Construction and Upgrades*

Six new facilities have been proposed for Pantex Plant. The projected construction phase for these facilities spans from 1996–2001. All of these facilities would be located in Zones 11 and 12. Since no 100-year, 500-year, or Standard Project Flood boundaries have been delineated in Zones 11 and 12, there would be no impacts to floodplains. Surface water use is not an issue because all water required for construction or operation would be supplied from groundwater. The treated effluent from the process wastewater treatment would be discharged to the playas and monitored to comply with EPA NPDES Permit and TNRCC Wastewater Discharge Permit requirements. Environmental impacts to water resources from the proposed facility construction and upgrades for each of the six facilities are summarized in Table 4.6.2.2–1.

All water required for construction or operation would be supplied from groundwater withdrawn from Pantex Plant wells. Projected water usage is compared to current water usage on a site-wide and facility-specific basis. The upper bounding conditions (i.e., 2,000 weapons level) would result in a projected annual groundwater withdrawal of 1,011 million liters (267 million gallons), or an increase of 64 percent over FY 1995 industrial and domestic water use. Under the 2,000 weapons scenario, Pantex Plant groundwater withdrawals would only account for 0.8 percent of the total estimated annual groundwater withdrawals in Carson County.

Hazardous Waste Treatment Plant Facility

Domestic wastewater from the Wastewater Treatment Facility (HWTPF) would be collected in the Pantex Plant sanitary sewer system and treated in the WWTF prior to discharge into Playa 1. A treatment facility, such as the HWTPF, that is constructed and maintained properly would prevent further

TABLE 4.6.2.2–1.—*Current and Projected Annual Water Usage for Facility Upgrades, Pantex Plant (million liters [million gallons])*

USAGE	HWTPF	PIT REUSE	GAS ANALYSIS LABORATORY	MCAF	NDEF	METROLOGY HPCAF
WASTEWATER GENERATED						
Current	0.685 (0.181)	0 (0)	0.912 (0.241)	7.62 (2.013)	8.02 (2.1)	9.30 (2.45)
Projected	3.80 (1.00)	0.32 (0.084)	0.912 (0.241)	7.62 (2.013)	8.02 (2.1)	9.30 (2.45)
Change[1]	+3.12 (+0.819)	+0.32 (+0.084)	0	0	0	0
WATER USAGE						
Current	0.685 (0.181)	0 (0)	0.912 (0.241)	8.64 (2.28)	9.12 (2.41)	10.5 (2.78)
Projected	4.31 (1.14)	0.32 (0.084)	0.912 (0.241)	8.64 (2.28)	9.12 (2.41)	10.5 (2.78)
Change[1]	+3.63 (+0.959)	+0.32 (+0.084)	0	0	0	0

[1]Change designates the difference between current and projected usage. "+" denotes a projected increase in usage.
MCAF-Materials Compatibility Assurance Facility
NDEF-Nondestructive Evaluation Facility
HPCAF-Health Physics Calibration and Acceptance Facility

Sources: DOE 1995j:10; PC 1995g

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Action Alternative represent a continuum of operations, the impacts associated with any new mission or facility that could be implemented at Pantex Plant are discussed in the context of that continuum. The impacts from the WM PEIS program are combined with those of the Pantex Plant EIS Proposed Action. The impacts from the S&D PEIS are combined with those of the SSM PEIS No Action Alternative. A detailed discussion of this methodology is presented in section 4.2.

4.6.5.1 *Impacts of Alternatives in the Waste Management Programmatic Environmental Impact Statement*

If the facilities described in the WM PEIS were located at Pantex Plant, no groundwater quality impacts are expected, i.e., there would be no exceedances of water quality standards or permitted levels. Section 4.3.5.1 discusses water use and wastewater generation impacts.

4.6.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, impacts to water resources from operations would be expected to be less than current impacts. Water requirements would be met without increased aquifer drawdowns. Under the downsizing alternative, the groundwater withdrawals would reduc percent compared to those under the N Alternative. Under the relocation alte all water use for assembly and dis operations and HE fabrication would

4.6.5.3 *Impacts of Alternativ the Storage and Dispo of Weapons-Usable Fis Materials Programma Environmental Impact Statement*

The S&D PEIS is considering Pantex Pl long-term storage of inventories of non weapons-usable plutonium and highly e uranium (HEU), storage of inventori surplus weapons-usable plutonium a pending disposition, and disposition of s weapons-usable plutonium. For storag strategy for long-term storage of wea usable plutonium and HEU, as well a storage site(s), would be decided. The alternatives include upgrading the e plutonium storage facilities, consolida plutonium from other sites, and collocat plutonium and HEU storage. The colla alternative is used for analysis purposes EIS as the bounding storage alternative.

Under the S&D PEIS Collocation Alte construction of new storage facilities wo required in order to store plutonium and H Pantex Plant. Water requirement construction and operation would approximately 107 million liters (28 gallons) per year and 130 million liter million gallons) per year, respectively. Proposed Action, and if the Waste Manag program is located at Pantex Plant, a 96,200 liters (25,416 gallons) per year.

For the disposition alternatives in the PEIS, the emphasis at this stage in the decision process is on the strateg

technology mix rather than the actual site. The evolutionary Light Water Reactor is used for analysis purposes in this EIS as the bounding disposition alternative. Implementation of this disposition alternative would require the construction and operation of a pit disassembly and conversion facility, plutonium conversion facility, MOX fuel fabrication facility, and one or more light water reactors. The bounding alternative also assumes that all of the facilities previously mentioned would be collocated at the same site (potentially Pantex Plant).

Construction for the Disposition Alternative would require 110.2 million liters (29.1 million gallons) per year of wastewater discharge and 130.2 million liters (34.4 million gallons) per year of groundwater use.

Operation for the Disposition Alternative would require 484.7 million liters (128 million gallons) per year of wastewater discharge and 572.9 million liters (151.8 million gallons) per year of groundwater use.

4.6.6 Potential Mitigation Measures

The Proposed Action is not expected to have a significant impact on water resources at Pantex Plant. However, new best management practices and institutional controls, coupled with the ongoing ER activities, could further mitigate the occurrence of any impacts to water resources. ER activities will continue and are an integral part of each alternative. In addition, DOE could choose any of the new measures being considered to reduce effects from stormwater runoff during construction, including silt fences, dikes, and sediment traps to divert runoff away from disturbed areas. Soils and materials such as rip rap or mulch could be used for stabilization in order to prevent direct exposure to soils and runoff. Surface recharge from wetted areas of ditches in playas is naturally mitigated, to some extent, by high evaporation rates (TTU 1994).

Groundwater conservation measures that could be considered include decreasing TTU Research Farm irrigation demands through dry land farming, limiting groundwater production hours, installing dripless faucets, and process water reuse. If there were a Pantex Plant mission that required large quantities of treated wastewater, the City of Amarillo would consider developing reclaimed wastewater from the City of Amarillo Hollywood Road Wastewater Treatment Plant. The use of reclaimed wastewater could curtail the annual withdrawal rate of the Ogallala aquifer (TIE 1996).

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4.7 AIR QUALITY

4.7.1 Affected Environment

The following sections describe the affected environment at Pantex Plant and surrounding region for meteorology and climate, atmospheric dispersion, air quality, and atmospheric radiological environment.

4.7.1.1 *Meteorology and Climate*

Pantex Plant is located in the Texas Panhandle, approximately 27 kilometers (17 miles) northeast of Amarillo, at an elevation of approximately 1,085 meters (3,560 feet).

Regional Climate

The climate at Pantex Plant and the surrounding region is characteristically that of middle latitude steppe. It is typified by large variations in temperature and precipitation from year to year, with summers that are hot and dry and winters that are mild. A high percentage of sunshine and a rather low humidity prevail over the region. The region is subject to rapid and large temperature changes, especially during the winter when cold fronts from the northern Rocky Mountains and Plains move across the region at speeds up to 64 kilometers (40 miles) per hour. In the spring, moving low-pressure systems produce high winds, with March and April having the strongest. Severe local storms are infrequent, though a few thunderstorms, with damaging hail, lightning, and wind in very localized areas occur most years, usually in spring and summer. These storms are often accompanied by very heavy rain, which produces local flooding.

Local Climate

The nearest representative station with long-term climatological data (30 years) is 16.1 kilometers (10 miles) west of Pantex Plant at the Amarillo International Airport. Meteorological data have been recorded at the airport over a period of more than 60 years (1931 to present).

The annual average temperature in the area is 13.6 °C (56.4 °F); average daily temperatures vary from a minimum of -5.7 °C (21.8 °F) in January to maximum of 32.8 °C (91.1 °F) in July and August. The average annual precipitation is 49.7 centimeters (19.56 inches). Seventy-five percent of the total annual precipitation falls between April and September. The average annual snowfall is 42.9 centimeters (16.9 inches). The snow usually melts in a few days (Pantex 1996:6.2).

Pantex Plant is located in an area with a relatively high frequency of tornados. Fifty-three tornados were recorded in Carson County between 1950 and 1994 (Pantex 1996:6.3). The estimated probability of a tornado striking a point at Pantex Plant is 2.3×10^{-4} per year (DOE 1995q).

Average wind speeds at Amarillo are relatively high. For the period 1944 through 1993, the average speed was 22 kilometers (14 miles) per hour. Calms occur about 1 percent of the time. The wind blows predominantly from the south from May to September and from the southwest the remainder of the year (Pantex 1996:6.2). Figure 4.7.1.1–1 is a wind rose for the Amarillo International Airport (EPA 1995a).

4.7.1.2 *Atmospheric Dispersion*

Once pollutants are emitted into the atmosphere, the prevailing weather conditions determine their dispersion. Atmospheric stability controls the dispersion of pollutants in the vicinity of a source. This factor is especially important to the assessment of primary pollutant impacts. Stability is affected by thermal and mechanical turbulence of the atmosphere and wind velocity of the layer of air closest to the ground. When the atmosphere is unstable, usually during daytime, dispersion of airborne particulates increases. Data collected at the Amarillo

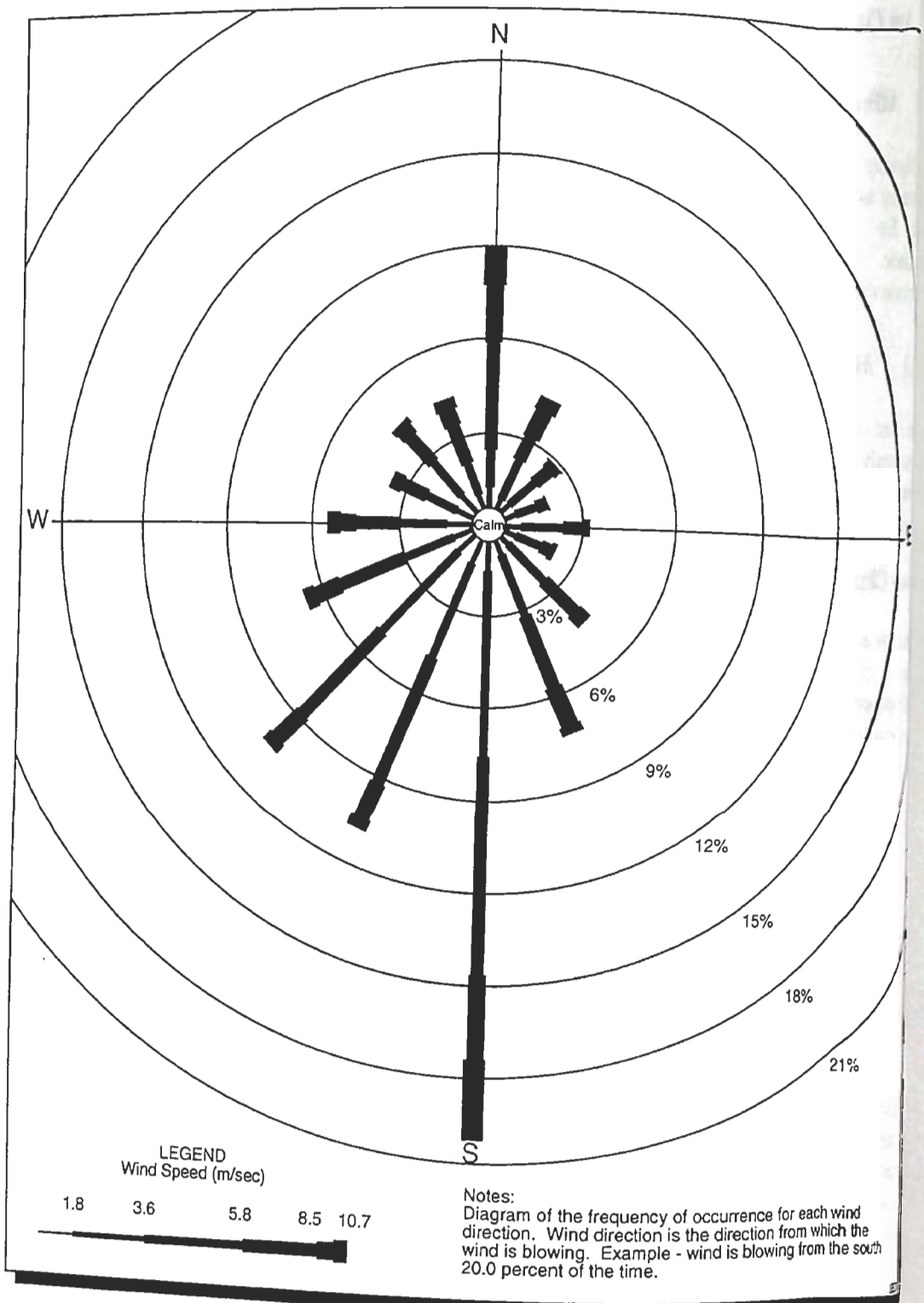


FIGURE 4.7.1.1–1.—*Distribution of Wind Speed and Direction at the Amarillo International Airport, Texas, 1988.*

National Weather Service station for 1988 indicated that unstable conditions occurred approximately 16 percent of the time, neutral conditions approximately 60 percent, and stable conditions approximately 24 percent, on an annual basis (DOE 1995q:B–17). Thus, relatively good vertical dispersion occurs about 76 percent of the time in the vicinity of Pantex Plant.

Another meteorological element that influences dispersion is the mixing height. The mixing height is the height above the ground through which relatively vigorous vertical mixing occurs. The mixed layer dilutes pollutants released in it. Annual average mixing heights over the Amarillo area range from about 328 meters (1,076 feet) in the morning to about 1,973 meters (6,473 feet) in the afternoon (Pantex 1996:6.4). Therefore, based on stability and mixing height considerations, atmospheric dispersion at Pantex Plant and vicinity is, in general, quite good.

4.7.1.3 *Ambient Air Quality*

Ambient air quality is determined by the emission of pollutants and their interaction with atmospheric conditions. Air quality is described in terms of concentrations of pollutants. If these concentrations in the ambient air are high enough to cause health concerns or effect visibility in visual resource areas then emissions are regulated to bring the concentrations down. Ambient air quality is assessed by the monitoring of pollutant levels in the air and modeling of emissions' interactions with atmospheric conditions. This subsection discusses the regulation and control of air pollutants, the air quality monitoring at Pantex Plant, and the modeling performed to evaluate potential impacts of the Proposed Action and the Alternatives.

Regulation of Air Quality

Concentrations. Air quality in a given location is described by the concentration of various pollutants in the atmosphere expressed in units of parts per million or in micrograms per cubic meter. The standards and limits set by regulations on air quality are listed in concentrations averaged over certain time limits (e.g., 30 minutes, 1 hour, 3 hours). The averaging times listed in the tables in this section correspond to the regulatory averaging times for the individual pollutants. Ambient air is defined as that portion of the atmosphere external to the buildings to which the general public has access. Ambient air quality standards specify upper limits of concentrations and durations of pollutants in the ambient air that are consistent with the goal of preventing harmful effects.

The impact of exposure to ambient contaminants is a function of the pollutant involved, the duration of the exposure, and the concentrations reached during the exposure. The significance of pollutant concentrations is determined by comparing the concentrations with appropriate Federal or State ambient air quality standards. These standards represent the allowable pollutant concentrations at which public health and welfare are protected and include a reasonable margin of safety.

Another determining factor in the significance of pollutant concentrations is whether the area is in attainment or nonattainment for that pollutant. An area is designated by the U.S. Environmental Protection Agency (EPA) as being in attainment for a pollutant if ambient concentrations of that pollutant are below the National Ambient Air Quality Standards (NAAQS) and nonattainment if exceedances of NAAQS occur. Areas where insufficient data are available to make an attainment status designation are listed as unclassified. Unclassified areas are treated as attainment areas for regulatory purposes.

The NAAQS were established by EPA. The State of Texas implements and enforces the NAAQS, plus TNRCC has placed regulations on additional pollutants. NAAQS have been established for ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (fine dust) of aerodynamic diameter less than 10 micrometers (PM_{10}), and lead (Pb). These NAAQS pollutants are sometimes referred as "criteria" pollutants. TNRCC has also set net ground level limitations for total suspended particulate matter, inorganic fluoride compounds calculated as hydrogen fluoride (HF), hydrogen sulfide, sulfuric acid, and beryllium. NAAQS and the Texas Air Quality Standards are presented in Table 4.7.1.3–1 (TNRCC 1993a).

The EPA has granted to TNRCC the authority to implement regulations to prevent the significant deterioration of air quality in areas that are designated as attainment or unclassifiable. The Prevention of Significant Deterioration (PSD) program is implemented in large part through the use of "increments" and area classifications that effectively define what "significant deterioration" is for individual pollutants. The *Clean Air Act's* area classification scheme for PSD establishes three classes of geographic areas (Class 1, 2, and 3) and applies increments of different stringency to each class. Air quality impacts, in combination with other PSD sources in the area, must not exceed the maximum allowable increments presented in Table 4.7.1.3–2 (TNRCC 1993a).

Visibility. Class 1 areas are those of special National concern where any appreciable deterioration in air quality is considered significant. Consequently, the most restrictive increments apply in Class 1 areas. Class 1 areas include all international and National parks, wilderness areas, and memorial parks that exceed certain sizes.

The *Clean Air Act* (CAA) (42 U.S.C. 7401) requires a visibility analysis for any new or modified major stationary sources, in an attainment or nonattainment area emissions would affect the visibility in area. The nearest PSD Class 1 areas Plant are the Salt Creek Wilderness, Mexico, approximately 274 kilome miles) to the southwest, and the Mountains Wilderness, in O approximately 290 kilometers (180 mil east-southeast (40 CFR 81.421 and Since these Class 1 areas are approxim kilometers (170 miles) from Pantex pollutant emissions from Pantex Plant would not have an adverse impact on quality in these areas and no additional would be required. No public recreatio are located within 16 kilometers (10 Pantex Plant.

Less restrictive increments apply designated as Class 2 or Class 3. Class are all PSD areas that are design attainment or unclassifiable with respec NAAQS and are not classified in CAA 1 areas. Individual states have the auth redesignate Class 2 areas to Class 3 allow for higher levels of development and emissions growth. The as yet no designated Class 3 areas.

PSD requirements apply to major sta sources. CAA specifies 26 categori stationary sources which are considered sources if they emit or have potential 90.7 metric tons (100 tons) per year or mo any pollutant subject to CAA regulatio CFR Section 52.21). Any other sta source which emits or has the potential 226.8 metric tons (250 tons) per year or mo any air pollutant subject to regulation CAA is considered a major source and is to PSD requirements.

Pantex Plant stationary sources do not within the 26 categories of stationary so Also, plant stationary sources emit less 226.8 metric tons (250 tons) per year of regulated pollutant (see Tables 4.7.1.3- 4.7.1.3–6). Pollutant emissions from

TABLE 4.7.1.3–1.—*National Ambient Air Quality Standards and Texas Limitations*

POLLUTANT	AVERAGING TIME	NATIONAL STANDARDS[1]		TEXAS STANDARDS
		PRIMARY CONCENTRATION	SECONDARY CONCENTRATION	
Ozone (O_3)	1-hour	0.12 ppm (235 μg/m^3)	Same as primary standard	Same as NAAQS
Carbon Monoxide (CO)	8-hour	9 ppm (10,000 μg/m^3)	—	Same as NAAQS
	1-hour	35 ppm (40,000 μg/m^3)	—	Same as NAAQS
Nitrogen Dioxide (NO_2)	Annual	0.053 ppm (100 μg/m^3)	Same as primary standard	Same as NAAQS
Sulfur Dioxide (SO_2)	Annual	0.03 ppm (80 μg/m^3)	—	Same as NAAQS
	24-hour	0.14 ppm (365 μg/m^3)	—	Same as NAAQS
	3-hour	—	0.5 ppm (1,300 μg/m^3)	Same as NAAQS
	30-minute[5]	—	—	0.4 ppm[2] (1,021 μg/m^3)
PM_{10}	Annual	50 μg/m^3	Same as primary standard	Same as NAAQS
	24-hour	150 μg/m^3		Same as NAAQS
Lead	Calendar Quarter	1.5 μg/m^3	Same as primary standard	Same as NAAQS
Total Suspended Particulates	3-hour[5]	—	—	200 μg/m^3
	1-hour[5]	—	—	400 μg/m^3
Hydrogen Fluoride (HF)	30-day[5]	—	—	1.0 ppb (0.82 μg/m^3)
	7-day[5]	—	—	2.0 ppb (1.63 μg/m^3)
	24-hour[5]	—	—	3.5 ppb (2.86 μg/m^3)
	12-hour[5]	—	—	4.5 ppb (3.68 μg/m^3)
	3-hour[5]	—	—	6 ppb (4.9 μg/m^3)
Hydrogen Sulfide	30-minute[5]	—	—	0.08 ppm[3] 0.12 ppm[4]
Sulfuric Acid	24-hour[5]	—	—	15 μg/m^3
	1-hour[5]	—	—	50 μg/m^3
Beryllium	24-hour[5]	—	—	0.01 μg/m^3

[1]National standards for ozone and PM_{10} are determined by statistical methods. Both ozone and PM_{10} NAAQS are based on exceedances; i.e., non-sampling days must be accounted for when calculating attainment determination. NAAQS is attained when expected number of days per calendar year, averaged over a three-year period, with a maximum hourly average concentration for ozone and 24-hour average concentration for PM_{10} above the standard, is equal to or less than one. Sulfur dioxide annual, nitrogen dioxide annual, and lead quarterly NAAQS are not to be exceeded. Carbon monoxide 1-hour and 8-hour, and sulfur dioxide 3-hour and 24-hour standards cannot be exceeded more than once per year.
[2]Conversion from ppm to μg/m^3 assuming temperatures of 90 °F, standard is 0.28 ppm for Galveston and Harris Counties and 0.32 ppm (no ground-level concentrations from all sources on property) for Jefferson and Orange Counties
[3]If it affects a residential area, business, or commercial property.
[4]If it affects only property used for other than residential, recreational, business, or commercial purposes.
[5]Texas net ground level limitations applicable at the property line. The maximum predicted concentration is compared with the appropriate standard for each averaging time. These are TNRCC's standards.
Sources: TNRCC 1993a; TNRCC 1994b; 40 CFR 50.4 through 50.12.

The ROI and Pantex Plant are located in the Amarillo-Lubbock Intrastate Air Quality Control Region (AQCR) 211. AQCR 211 is designated by EPA as "better than national standards" for SO_2, "unclassifiable/attainment" for CO and O_3, "cannot be classified or better than National standards" for NO_2, "unclassifiable" for PM_{10}, and "not designated" for lead (40 CFR 81.344).

Air Monitoring Results. TNRCC operates six air quality monitoring stations in the ROI, one at Amarillo and five at Pantex Plant. The Amarillo station only monitors PM_{10}. The monitoring report issued by the TNRCC for the year 1992 indicated that concentrations of this pollutant in Amarillo were within the NAAQS (Pantex 1996:6.5).

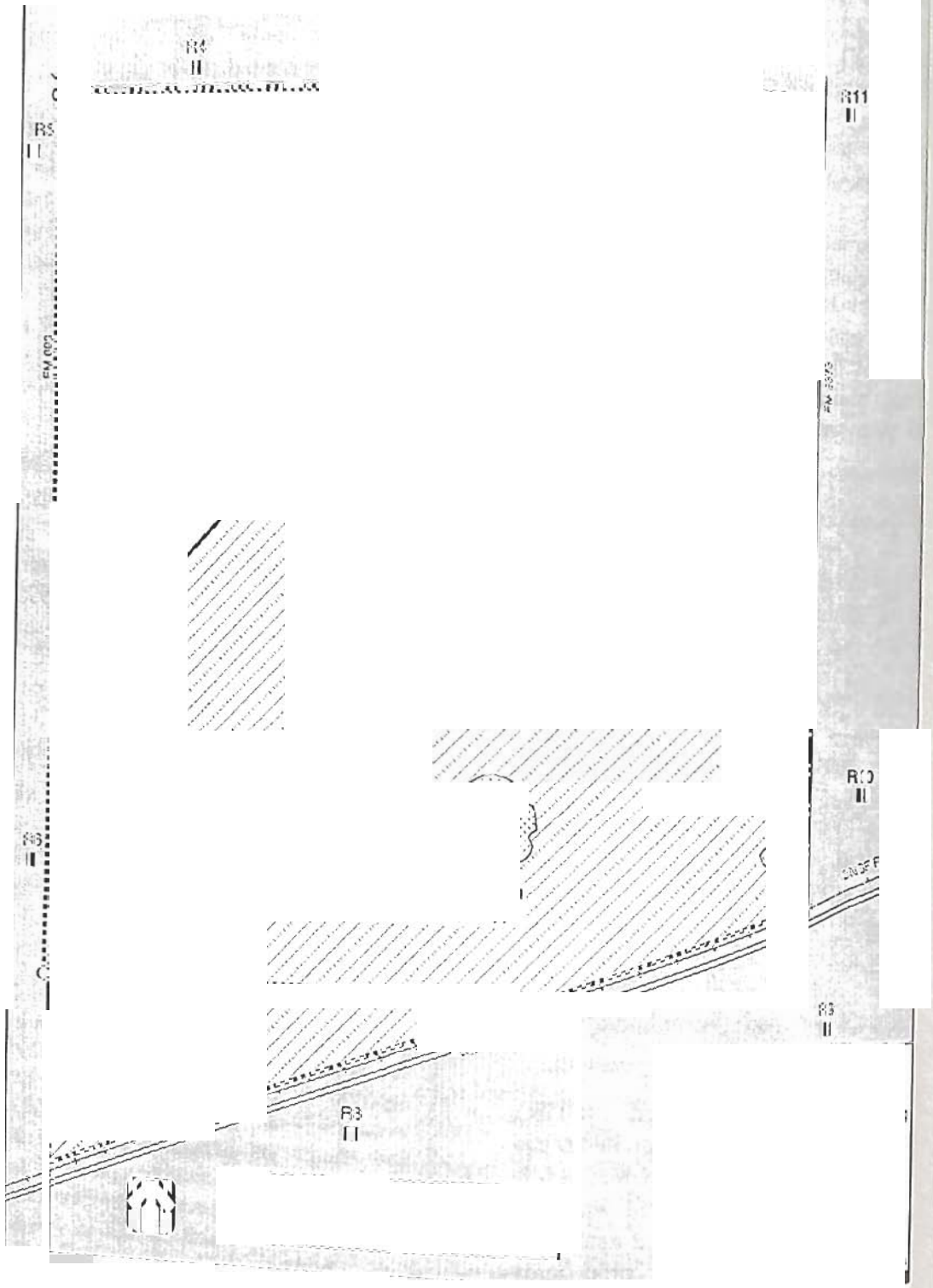
TNRCC, through a grant from DOE, established five air quality monitoring stations at Pantex Plant in September 1992. Locations of these stations are shown in Figure 4.7.1.3–1. In August 1995, one of these monitoring stations (Site No. 3) was repositioned to a new location (Site No. 6). The first annual report on this program covered the period January 1 to December 31, 1993 (TNRCC 1995d). Twenty-four hour sampling is conducted once every six days. The TNRCC measures inorganic pollutants as PM_{10} and HF. Organic pollutants are measured as VOCs in parts per billion by volume (ppbv). A few samples have been analyzed for metals, but this is not done on a regular basis. At two sites, wind speed, wind direction, temperature, and relative humidity are measured.

A Fourier Transform Infrared (FTIR) continuous monitor has also been installed at the Masterson Pump station located two miles north of Pantex Plant. The data collected with this sampler is considered developmental data since the TNRCC is still developing procedures (including quality assurance procedures) for this method. Initial screening of the data, however, does not indicate levels that might be harmful to public health and/or welfare. The first annual report on this program covered the period from January 1, 1993 to December 31, 1993 (Pantex 1996).

During 1993, only one 24-hour PM_{10} measurement exceeded the NAAQS while, in 1994, the standard was exceeded on one day in January and one day in June. From July 6, 1993, through December 31, 1994, TNRCC air sampling coincided with Pantex Plant burn days on 57 occasions. Of those 57 days, all had valid PM_{10} samples at one or more sites; however, the exceedance of the standard on the January day was a non-burn day and TNRCC stated that windblown dust particles are strongly suggested as a major contributor to that exceedance (TNRCC 1995c; Pantex 1996:6.5).

Two compounds, methylene chloride and 1,2-dibromoethane, exceeded the TNRCC Effects Screening Levels (ESLs) once each during 1993. Methylene chloride was measured at 213.7 ppbv on July 6, 1993 (TNRCC 1993c). The concentration was approximately seven times the ESL (30 ppbv) established by TNRCC. In 1994, the maximum concentration of methylene chloride was measured at 11.75 ppbv, which is lower than the ESL (TNRCC 1995c).

The TNRCC ESLs are "tools" the Toxicology and Risk Assessment Staff of TNRCC use to evaluate the impacts of air pollutant emissions. They are not ambient air standards. If predicted or measured airborne levels of a certain chemical do not exceed its screening level, it would not be expected to have any adverse health or welfare effects. If ambient levels of air contaminants exceed the screening levels, it does not necessarily indicate a problem. It is just a trigger for a more in-depth review. Therefore, TNRCC sets the ESL at levels where TNRCC would not expect adverse effects. These levels are sometimes below the limit of detection for a pollutant.


R4
II
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R10
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II

lowest heat output and highest emission of HF allowed by regulation.

Modeling Results. Four criteria air pollutants, 36 air pollutants that are listed in CAA, and 50 air pollutants that are listed by the TNRCC have been identified that are emitted from existing Pantex Plant operations (Pantex 1996:6.6). All 90 air pollutants were modeled. The Pantex Plant chemical air emissions inventory is summarized in Table 4.7.1.3–3. The maximum estimated fence line concentrations of these pollutants are presented in Tables 4.7.1.3–4 and 4.7.1.3–5. Table 4.7.1.3–4 presents the results for the criteria pollutants CO, NO_2, PM_{10}, and Pb. The NAAQS for each pollutant is also presented in Table 4.7.1.3–4. As shown in the table, none of the pollutant concentrations exceeded standards at the Pantex Plant boundary.

The results for the rest of the chemical air pollutants emitted by Pantex Plant are presented as two groups. The first group includes those chemical air pollutants emitted by Pantex Plant that are listed in CAA, as amended, plus those pollutants with estimated concentrations above the appropriate ESL. Only alcohols, modeled as a group, were estimated to exceed an ESL. The second group includes those chemical air pollutants emitted by Pantex Plant that are listed in State of Texas regulations (except for alcohols as mentioned above). Both groups were originally modeled for the current status of the plant (i.e., Affected Environment) and the potential future impacts related to the alternatives.

The maximum estimated fence line concentrations for both groups are presented in Table 4.7.1.3–5 in comparison with the appropriate TNRCC ESLs. The first group, including alcohols, was also modeled for the maximum estimated concentrations at eleven of the residences near the boundaries of the Pantex Plant Site. These results are presented in Table B.4.1–1 in appendix B. All of the air pollutants except alcohols were estimated to be bel[illegible] respective ESLs at the Pantex Plant bou[illegible]

The group of alcohols consisted of alcohols used by Pantex Plant for whi[illegible] were no individual emission rates. T[illegible] does not have an ESL for the family of al[illegible] but rather chose in their modeling of [illegible] Plant to use a conservative ESL equal to [illegible] m^3 as the ESL for the group of alcohol[illegible] group of alcohols exceeded the conserv[illegible] hour ESL at and near the Pantex Plant bou[illegible] The maximum estimated fence concentration for alcohols (195 $\mu g/m^3$ almost twice the conservative ESL explained earlier, the exceedance of a[illegible] does not necessarily indicate a problem just a trigger for a more in-depth review.

A subsequent review of the inventory [illegible] amounts of the individual alcohols prese[illegible] Plant showed that the ESL used in the mo[illegible] was excessively conservative (PC [illegible] Since the emission rates for the ind[illegible] alcohols in the group were not speciated [illegible] original emissions inventory, a [illegible] inventory was obtained to determine qu[illegible] of individual alcohols maintained on-hand [illegible] plant. An estimation of the maximum fen[illegible] concentration for each of the alcohols wa[illegible] calculated based on the ratio of the amo[illegible] each alcohol to the total inventory of the [illegible] of alcohols present at Pantex Plant (see [illegible] B.4.1–2 in appendix B). None of the ind[illegible] alcohols were found to exceed their resp[illegible] ESLs at or near the plant boundary.

HF is a pollutant regulated by TNRCC. [illegible] modeling results predicted a maximum [illegible] average concentration of 1.52 $\mu g/m^3$. [illegible] concentration is below the standard of [illegible] micrograms per cubic meter. [illegible] concentration resulted from a 45.4-kilo[illegible] (100-pound) burn of HE. For a 363-kilo[illegible] (800-pound) burn of HE, the 3-hour av[illegible] maximum concentration was also bel[illegible] standard (see Table 4.7.1.3–5).

TABLE 4.7.1.3–3.—*Estimated Pantex Plant Chemical Air Emissions Inventory*

POLLUTANT	CHEMICAL ABSTRACT SERVICE NUMBER	KILOGRAMS (POUNDS) PER YEAR	METRIC TONS (TONS) PER YEAR
CLEAN AIR ACT LISTED AIR POLLUTANTS			
1,1,2-trichloroethane	79005	3.78 (8.34)	0.00 (0.00)
1,3-butadiene	106990	51.76 (114)	0.05 (0.06)
2-nitropropane	79469	1.71 (3.76)	0.00 (0.00)
Benzene	71432	91.27 (199)	0.09 (0.10)
Carbon Disulfide	75150	27.03 (59.60)	0.03 (0.03)
Carbon Tetrachloride	56235	15.60 (34.4)	0.02 (0.02)
Chlorobenzene	108907	1.79 (3.94)	0.00 (0.00)
Chromium	7440473	1.51 (3.33)	0.00 (0.00)
Cresols	1319773	0.05 (0.11)	0.00 (0.00)
Cresylic Acid	1319773	0.05 (0.11)	0.00 (0.00)
Dibenzofurans	132649	0.07 (0.16)	0.00 (0.00)
Dimethylformamide	68122	0.95 (2.09)	0.00 (0.00)
Ester Glycol Ethers	NA	0.86 (1.89)	0.00 (0.00)
Ethyl Acetate	141786	5,625 (12,400)	5.54 (6.20)
Ethyl Benzene	100414	1.51 (3.33)	0.00 (0.00)
Ethylene Dichloride	107062	1.33 (2.93)	0.00 (0.00)
Formaldehyde	50000	54.89 (121)	0.06 (0.06)
HCl (Hydrogen chloride)	7647010	5,206.59 (11,478.37)	1.11 (1.22)
HCN (Hydrogen cyanide)[a b]	74908	0.00 (0.00)	0.00 (0.00)
HF (Hydrogen fluoride)	7664393	3,973.54 (8,760)	1.18 (1.30)
Lead	7439421	7.71 (17.0)	0.19 (0.20)
Mercury[b]	7439976	0.00 (0.00)	0.00 (0.00)
Methanol	67561	1,093.18 (2,410)	1.10 (1.21)
Methyl Cyanide[b]	NA	0.00 (0.00)	0.00 (0.00)
Methyl Ethyl Ketone	78933	7,076.16 (15,600)	7.07 (7.79)
Methyl Isobutyl Ketone	108101	0.62 (1.36)	0.00 (0.00)
Methylene Chloride	75092	187.79 (414)	0.18 (0.20)
Naphthalene	91203	0.41 (0.90)	0.00 (0.00)
Nickel[a]	7440020	0.16 (0.36)	0.00 (0.00)
Nitrobenzene	98953	0.05 (0.11)	0.00 (0.00)
Phenol	108952	2.22 (4.90)	0.00 (0.00)
Tetrachloroethylene	127184	6.44 (14.20)	0.01 (0.01)
Titanium[a]	7440326	0.03 (0.07)	0.00 (0.00)
Toluene	108883	2,227.18 (4,910)	0.47 (0.51)
Trichloroethylene	79016	19.50 (43.00)	0.02 (0.02)
Triethylamine	121448	0.00 (0.00)	0.00 (0.00)
Xylene	1330207	222.72 (491)	0.22 (0.25)

TABLE 4.7.1.3–3.—*Estimated Pantex Plant Chemical Air Emissions Inventory-Contin*

POLLUTANT	CHEMICAL ABSTRACT SERVICE NUMBER	KILOGRAMS (POUNDS) PER YEAR	METRIC TO (TONS) PER Y
TNRCC LISTED AIR POLLUTANTS			
1,1,1-chloroethane	75003	22.74 (50.14)	0.02 (0.0
1,3,5-trinitrobenzene	99354	0.00 (0.00)	0.00 (0.0
1-butanol	71363	0.09 (0.02)	0.00 (0.0
2,4,6-trinitrotoluene	118967	0.02 (0.04)	0.00 (0.0
2,4-dinitrotoluene	121142	0.05 (0.10)	0.00 (0.0
2,6-dinitrotoluene	606202	0.09 (0.19)	0.00 (0.0
2-nitronaphthalene	NA	0.02 (0.05)	0.00 (0.0
2-ethoxyethanol	110805	1.81 (3.98)	0.00 (0.0
Acetone	67641	3,519 (7,750)	3.36 (3.5
Acetylene	74862	84.44 (186)	0.08 (0.0
Alcohols	NA	1,185 (2,610)	1.18 (1.3
Aluminum	7429905	0.02 (0.043)	0.00 (0.0
Ammonia	7664417	18.16 (40.0)	0.02 (0.0
Barium	7440393	2.24 (4.94)	0.00 (0.0
Benzo(a)anthracene	56553	0.04 (0.08)	0.00 (0.0
Benzo(a)pyrene	50328	0.02 (0.05)	0.00 (0.0
Bismuth	1304821	0.01 (0.01)	0.00 (0.0
Butane	106978	85.35 (188)	0.09 (0.0
Butene	2516673	99.43 (219)	0.11 (0.1
Calcium	7440702	0.38 (0.85)	0.00 (0.0
Chlorinated Fluorocarbon	NA	53.12 (117)	0.05 (0.0
Copper	7440508	3.78 (8.32)	0.00 (0.0
Cyanogen	460195	0.00 (0.00)	0.00 (0.0
Cyclohexane	110827	312.35 (688)	0.31 (0.3
Cyclohexanone	108941	4.34 (9.56)	0.00 (0.0
Dioxane	123911	40.90 (90.1)	0.04 (0.0
Ethyl Ether	60297	4,903.2 (10,800)	4.90 (5.4
Ethylene	74851	213.8 (471)	0.21 (0.2
Formic Acid[b]	64186	0.00 (0.00)	0.00 (0.0
Iron	7439896	22.50 (49.57)	0.02 (0.0
Isobutane	75285	11.80 (26.0)	0.01 (0.0
Isobutanol	78831	1.11 (2.45)	0.00 (0.0
Ketene[b]	763514	0.00 (0.00)	0.00 (0.0
Ketone	NA	0.28 (0.61)	0.00 (0.0
Lithium	NA	0.00 (0.00)	0.00 (0.0
Magnesium	546930	0.77 (1.69)	0.00 (0.0
Methane	74828	1,889 (4,160)	1.89 (2.0
N-butyl Alcohol	71363	0.39 (0.86)	0.00 (0.0

TABLE 4.7.1.3–3.—*Estimated Pantex Plant Chemical Air Emissions Inventory-Continued*

POLLUTANT	CHEMICAL ABSTRACT SERVICE NUMBER	KILOGRAMS (POUNDS) PER YEAR	METRIC TONS (TONS) PER YEAR
Non-F Listed Solvents	NA	0.021 (0.46)	0.00 (0.00)
Ortho-dichlorobenzene	95501	0.29 (0.64)	0.00 (0.00)
Propane	74986	103 (227)	0.10 (0.11)
Propene	115071	158.9 (350)	0.16 (0.18)
Pyrene	129000	0.00 (0.00)	0.00 (0.00)
Pyridine	110861	1.85 (4.08)	0.00 (0.00)
Silicon	7440213	46.31 (100)	0.05 (0.05)
Silver	7440224	1.05 (2.32)	0.00 (0.00)
Tetrahydrofuran	109999	776.34 (1710)	0.78 (0.85)
Trichlorofluoromethane	75694	157.99 (348)	0.16 (0.17)
Trichlorotrifluoroethane	76131	11.39 (25.1)	0.01 (0.01)
Zinc	7440666	0.031 (0.68)	0.00 (0.00)

[a]Projected emissions that would result from future Burning Ground upgrade. Only included in modeling for 2,000, 1,000, and 500 projected activity levels.
[b]These chemicals are emitted but in amounts far below 0.01 kilograms or pounds per year.
NA - Not available.
Sources: CAA Nov 1990; Pantex 1996, 6.6; PC 1994; TNRCC 1996a

TABLE 4.7.1.3–4.—*Estimated Maximum Fence Line Concentration of Criteria Pollutants at Pantex Plant Site*

POLLUTANT	AVERAGING TIME	NAAQS $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION $\mu g/m^3$
CO - 45.4 kg (100 lb) HE	1-hour	4.00×10^4	9.24×10^2
	8-hour	1.00×10^4	1.61×10^2
CO - 363 kg (800 lb) HE	1-hour	4.00×10^4	9.24×10^2
	8- hour	1.00×10^4	1.61×10^2
Lead	1st Qtr	1.50	1.02×10^{-3}
	2nd Qtr	1.50	9.60×10^{-4}
	3rd Qtr	1.50	1.58×10^{-3}
	4th Qtr	1.50	9.50×10^{-3}
NO_2 - 45.4 kg (100 lb) HE	Annual	1.00×10^2	8.95×10^{-1}
NO_2 - 363 kg (800 lb) HE	Annual	1.00×10^2	5.79×10^{-1}
PM_{10} - 45.4 kg (100 lb) HE	Annual	5.00×10^1	8.73
	24-hour	1.50×10^2	8.85×10^1
PM_{10} - 363 kg (800 lb) HE	Annual	5.00×10^1	1.51
	24-hour	1.50×10^2	2.24×10^1

Note: Table shows the ISCST2 and ISCLT2 modeling results (maximum fence line concentrations).
Source: TNRCC 1993a

TABLE 4.7.1.3–5.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants at Pantex Plant Site*

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION $\mu g/m^3$
CLEAN AIR ACT LISTED AIR POLLUTANTS[b]			
1,1,2-trichloroethane	Annual 30-minute	5.50×10^{1} 5.50×10^{2}	8.07×10^{-2} 1.73×10^{1}
1,3-butadiene - 45.4 kg (100 lb) HE	Annual 30-minute	1.10×10^{1} 1.10×10^{2}	9.09×10^{-3} 3.76
1,3-butadiene - 363 kg (800 lb) HE	Annual 30-minute	1.10×10^{1} 1.10×10^{2}	9.09×10^{-3} 3.76
2-nitropropane	Annual 30-minute	5.00 5.00×10^{1}	3.56×10^{-2} 8.55
Alcohols[c]	Annual 30-minute	NA 1.00×10^{2}	7.01×10^{-1} 1.95×10^{2}
Benzene	Annual 30-minute	3.00 7.50×10^{1}	5.47×10^{-2} 1.94×10^{1}
Carbon Disulfide	Annual 30-minute	3.00 3.00×10^{1}	9.39×10^{-2} 2.26×10^{1}
Carbon Tetrachloride	Annual 30-minute	1.30×10^{1} 1.26×10^{2}	8.19×10^{-2} 1.97×10^{1}
Chlorobenzene	Annual 30-minute	4.60×10^{1} 4.60×10^{2}	8.13×10^{-2} 1.95×10^{1}
Chromium - 45.4 kg (100 lb) HE	Annual 30-minute	1.00×10^{-1} 1.00	1.91×10^{-3} 9.72×10^{-2}
Chromium - 363 kg (800 lb) HE	Annual 30-minute	1.00×10^{-1} 1.00	8.00×10^{-5} 7.62×10^{-3}
Cresols	Annual 30-minute	NA 5.00	1.72×10^{-3} 4.13×10^{-1}
Cresylic Acid	Annual 30-minute	NA 5.00	2.14×10^{-3} 5.13×10^{-1}
Dibenzofurans - 45.4 kg (100 lb) HE	Annual 30-minute	NA NA	2.00×10^{-5} 9.60×10^{-4}
Dibenzofurans - 363 kg (800 lb) HE	Annual 30-minute	NA NA	0.00[e] 8.00×10^{-5}
Dimethylformamide	Annual 30-minute	3.00×10^{1} 3.00×10^{2}	6.19×10^{-2} 2.80×10^{1}
Ester Glycol Ethers	Annual 30-minute	NA NA	1.50×10^{-1} 3.59×10^{1}
Ethyl Acetate	Annual 30-minute	1.44×10^{3} 1.44×10^{4}	6.93 1.99×10^{3}
Ethyl Benzene	Annual 30-minute	4.34×10^{2} 2.00×10^{3}	1.29×10^{-1} 3.11×10^{1}

TABLE 4.7.1.3–5.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants at Pantex Plant Site*-Continued

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION $\mu g/m^3$
Ethylene Dichloride	Annual 30-minute	4.00 1.60×10^2	3.99×10^{-2} 9.58
Formaldehyde - 45.4 kg (100 lb) HE	Annual 30-minute	1.50 1.50×10^1	4.03×10^{-3} 3.66×10^{-1}
Formaldehyde - 363 kg (800 lb) HE	Annual 30-minute	1.50 1.50×10^1	4.03×10^{-3} 3.66×10^{-1}
Hydrogen chloride - 45.4 kg (100 lb) HE	Annual 30-minute	1.00×10^{-1} 7.50×10^1	8.76×10^{-2} 5.98
Hydrogen chloride - 363 kg (800 lb) HE	Annual 30-minute	1.00×10^{-1} 7.50×10^1	3.54×10^{-2} 3.75
Hydrogen fluoride - 45.4 kg (100 lb) HE	3-hour 12-hour 24-hour	4.90 3.68 2.86	1.52 3.81×10^{-1} 2.70×10^{-1}
Hydrogen fluoride - 363 kg (800 lb) HE	3-hour 12-hour 24-hour	4.90 3.68 2.86	1.07×10^{-1} 2.67×10^{-2} 2.08×10^{-2}
Mercury	Annual 24-hour 30-minute	5.00×10^{-2} 2.50×10^{-1} 5.00×10^{-1}	0.00[e] 0.00[e] 0.00[e]
Methanol	Annual 30-minute	2.62×10^2 2.62×10^3	5.75×10^{-1} 2.45×10^2
Methyl Cyanide - 45.4 kg (100 lb) HE	Annual 30-minute	NA NA	0.00[e] 0.00[e]
Methyl Cyanide - 363 kg (800 lb) HE	Annual 30-minute	NA NA	0.00[e] 0.00[e]
Methyl Ethyl Ketone	Annual 30-minute	5.90×10^2 3.90×10^3	5.10 1.40×10^3
Methyl Isobutyl Ketone	Annual 30-minute	2.05×10^2 2.05×10^3	1.85×10^{-2} 4.45
Methylene Chloride	Annual 30-minute	2.60×10^1 2.60×10^2	7.37×10^{-1} 1.80×10^2
Naphthalene - 45.4 kg (100 lb) HE	Annual 30-minute	5.00×10^1 4.40×10^2	1.10×10^{-4} 5.48×10^{-3}
Naphthalene - 363 kg (800 lb) HE	Annual 30-minute	5.00×10^1 4.40×10^2	0.00[e] 4.30×10^{-4}
Nitrobenzene	Annual 30-minute	5.00 2.40×10^1	2.14×10^{-3} 5.13×10^{-1}
Phenol - 45.4 kg (100 lb) HE	Annual 30-minute	1.90×10^1 1.54×10^2	5.70×10^{-4} 2.92×10^{-2}
Phenol - 363 kg (800 lb) HE	Annual 30-minute	1.90×10^1 1.54×10^2	2.00×10^{-5} 2.29×10^{-3}

TABLE 4.7.1.3–5.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants at Pantex Plant Site*-Continued

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION $\mu g/m^3$
Acetylene - 45.4 kg (100 lb) HE	Annual 30-minute	2.66×10^3 2.66×10^4	3.33×10^{-3} 1.11
Acetylene - 363 kg (800 lb) HE	Annual 30-minute	2.66×10^3 2.66×10^4	3.33×10^{-3} 1.11
Aluminum - 45.4 kg (100 lb) HE	Annual 30-minute	5.00 5.00×10^1	1.28×10^{-3} 5.22×10^{-2}
Aluminum - 363 kg (800 lb) HE	Annual 30-minute	5.00 5.00×10^1	1.17×10^{-3} 4.94×10^{-2}
Ammonia	Annual 30-minute	1.70×10^1 1.70×10^2	2.89×10^{-2} 1.31×10^1
Barium	Annual 30-minute	5.00×10^{-1} 5.00	1.25×10^{-3} 2.93×10^{-3}
Benzo(a)anthracene - 45.4 kg (100 lb) HE	Annual 30-minute	NA 5.00×10^{-1}	1.00×10^{-5} 5.00×10^{-4}
Benzo(a)anthracene - 363 kg (800 lb) HE	Annual 30-minute	NA 5.00×10^{-1}	0.00[e] 4.00×10^{-5}
Benzo(a)pyrene - 45.4 kg (100 lb) HE	Annual 30-minute	3.00×10^{-3} 3.00×10^{-2}	1.00×10^{-5} 4.10×10^{-4}
Benzo(a)pyrene - 363 kg (800 lb) HE	Annual 30-minute	3.00×10^{-3} 3.00×10^{-2}	0.00[e] 2.00×10^{-5}
Bismuth	Annual 30-minute	5.00 5.00×10^2	3.00×10^{-5} 1.13×10^{-3}
Butane	Annual 30-minute	1.90×10^3 1.90×10^4	2.98×10^{-2} 1.12×10^1
Butene	Annual 30-minute	NA 1.60×10^2	2.81×10^{-1} 1.18×10^1
Calcium	Annual 30-minute	5.00 5.00×10^1	5.00×10^{-5} 1.90×10^{-3}
Chlorinated Fluorocarbon	Annual 30-minute	NA 1.80×10^4	2.90×10^{-1} 6.93×10^1
Copper	Annual 30-minute	1.00 1.00×10^1	3.08×10^{-3} 1.25×10^{-1}
Cyanogen - 45.4 kg (100 lb) HE	Annual 30-minute	2.10×10^1 2.10×10^2	1.00×10^{-5} 2.00×10^{-4}
Cyanogen - 363 kg (800 lb) HE	Annual 30-minute	2.10×10^1 2.10×10^2	0.00[e] 2.00×10^{-5}
Cyclohexane	Annual 30-minute	3.40×10^2 1.44×10^3	3.68×10^{-1} 9.41×10^1
Cyclohexanone	Annual 30-minute	1.00×10^2 4.81×10^2	6.09×10^{-2} 1.44

TABLE 4.7.1.3–5.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants at Pantex Plant Site*-Continued

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION $\mu g/m^3$
Dioxane	Annual 30-minute	9.00×10^{1} 9.00×10^{2}	7.88×10^{-1} 3.57×10^{1}
Ethyl Ether	Annual 30-minute	NA 9.27×10^{2}	3.33×10^{-1} 7.96×10^{1}
Ethylene - 45.4 kg (100 lb) HE	Annual 30-minute	NA 1.17×10^{3}	6.04×10^{-1} 2.53×10^{2}
Ethylene - 363 kg (800 lb) HE	Annual 30-minute	NA 1.17×10^{3}	6.04×10^{-1} 2.44×10^{2}
Formic Acid - 45.4 kg (100 lb) HE	Annual 30-minute	9.40 9.40×10^{1}	0.00[e] 8.00×10^{-5}
Formic Acid - 363 kg (800 lb) HE	Annual 30-minute	9.40 9.40×10^{1}	0.00[e] 2.00×10^{-5}
Iron - 45.4 kg (100 lb) HE	Annual 30-minute	NA 5.00×10^{1}	4.99×10^{-2} 1.82
Iron - 363 kg (800 lb) HE	Annual 30-minute	NA 5.00×10^{1}	2.44×10^{-2} 1.02
Isobutane	Annual 30-minute	1.90×10^{3} 4.85×10^{3}	4.01×10^{-2} 1.39×10^{1}
Isobutanol	Annual 30-minute	1.52×10^{2} 1.52×10^{3}	2.27×10^{-2} 5.46
Ketene - 45.4 kg (100 lb) HE	Annual 30-minute	9.00×10^{-1} 9.00	0.00[e] 0.00[e]
Ketene - 363 kg (800 lb) HE	Annual 30-minute	9.00×10^{-1} 9.00	0.00[e] 0.00[e]
Ketone	Annual 30-minute	NA 1.00×10^{2}	1.39×10^{-1} 3.34×10^{1}
Lithium	Annual 30-minute	NA 1.00×10^{1}	4.00×10^{-5} 1.84×10^{-3}
Magnesium	Annual 30-minute	NA 5.00×10^{1}	1.05×10^{-3} 4.41×10^{-2}
Methane - 45.4 kg (100 lb) HE	Annual 30-minute	NA 3.00×10^{4}	7.16×10^{-1} 2.64×10^{1}
Methane - 363 kg (800 lb) HE	Annual 30-minute	NA 3.00×10^{4}	7.16×10^{-1} 2.61×10^{1}
N-butyl Alcohol	Annual 30-minute	7.60×10^{1} 7.60×10^{2}	1.35×10^{-1} 3.25
Non-F Listed Solvents[f]	Annual 30-minute	NA 1.00×10^{1}	9.40×10^{-4} 2.26×10^{-1}
Ortho-dichlorobenzene	Annual 30-minute	NA 1.50×10^{3}	6.36×10^{-1} 1.53×10^{2}

TABLE 4.7.1.3–5.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants at Pantex Plant Site*-Continued

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION $\mu g/m^3$
Propane	Annual 30-minute	1.80×10^3 1.80×10^4	4.21×10^{-2} 1.32×10^1
Propene	Annual 30-minute	NA 3.00×10^4	3.71×10^{-1} 1.56×10^2
Pyrene - 45.4 kg (100 lb) HE	Annual 30-minute	5.00×10^{-2} 5.00×10^{-1}	5.00×10^{-4} 1.57×10^{-3}
Pyrene - 363 kg (800 lb) HE	Annual 30-minute	5.00×10^{-2} 5.00×10^{-1}	0.00[e] 9.00×10^{-5}
Pyridine	Annual 30-minute	1.50×10^1 6.90×10^1	3.78×10^{-1} 9.08
Silicon	Annual 30-minute	5.00 5.00×10^2	0.00[e] 2.90×10^{-4}
Silver	Annual 30-minute	1.00×10^{-2} 1.00×10^{-1}	1.45×10^{-3} 6.22×10^{-2}
Tetrahydrofuran	Annual 30-minute	5.90×10^2 5.90×10^3	7.55×10^{-1} 3.42×10^2
Trichlorofluoromethane	Annual 30-minute	5.62×10^3 2.80×10^4	4.21×10^{-1} 1.01×10^2
Trichlorotrifluoroethane	Annual 30-minute	NA 7.60×10^4	1.77 4.73×10^2
Zinc	Annual 30-minute	5.00 5.00×10^1	1.32×10^{-3} 5.58×10^{-2}

[a]EPA Model ISCST2 was used to calculate maximum fence line concentrations.
[b]Hours of operations were taken into account for emissions from open burning and engine emissions for CAA listed air pollutants.
[c]The group of alcohols, while not listed in CAA, were estimated to exceed the conservative ESL used by TNRCC. Therefore, alcohols were included for more complete presentation of results.
[d]Hours of operation were not taken into account and emissions were modeled for an entire year of meteorological data for TNRCC listed air pollutants.
[e]The ISCST2 air quality model returns a value of 0.00 for any concentration equal to or less than 1.00×10^{-5} $\mu g/m^3$ (i.e., less than one ten millionth of a part per billion or less than ten parts per quadrillion).
[f]Solvents that are not listed under 40 CFR 261.33 (Hazardous Waste from Non-Specific Sources).
NA - An ESL has not been established by TNRCC.
Sources: TNRCC 1996a; CAA as amended

The maximum pollutant concentrations which were predicted to occur at 11 residences that are located near the plant boundaries are all below respective NAAQS. Appendix B presents tables of these concentrations for each of the 11 residences.

In summary, the modeling results presented in this document are the highest concentrations predicted by the model. The modeling results suggest that existing short-term air quality may be slightly degraded on or near the boundary of Pantex Plant by alcohol emissions. However, subsequent review of specific alcohol concentrations indicates that this degradation would not occur and that the regional and long-term air quality is good.

Emissions. The amount of pollutants entering the atmosphere (from all sources) in a given time period is used by EPA to determine the overall emissions in an area. This definition facilitates the identification of the sources that can be defined as the major sources whose control can lead to a considerable reduction in the pollutant levels for the area. There are various other sources that contribute to overall pollutant emissions, including mobile sources, point (stationary) sources, and area emissions.

Mobile sources include conventional motor vehicles (including Safe Secure Tractor Trailers) and others such as boats, trains, planes, and off-road motor vehicles. Point sources include most industrial and energy-producing facilities that have stacks, vents, or flues from which emissions discharge. Area sources are groups of similar emission sources that do not individually contribute significant amounts of air pollutants, but that do contribute collectively.

CAA, as amended in August 1977 and November 1990, dictates that project emission sources must comply with ambient air quality standards and regulations that have been established by Federal, State, and county regulatory agencies. These standards and regulations focus on the maximum allowable ambient pollutant concentrations resulting from project emissions, both separately and combined with other surrounding sources, and the maximum allowable emissions from the project.

The primary emission sources of criteria pollutants at Pantex Plant are steam plant boilers, the explosives burning operation, diesel and gasoline engines and motor vehicles. Potential emission sources of chemical air pollutants include the HE synthesis facility, the explosive burning operation, miscellaneous laboratories, and other small operations. Table 4.7.1.3–6 presents a summary of the 1993 criteria pollutant emission inventory for stationary and mobile sources at Pantex Plant (Pantex 1996: 6.6.1). The mobile emissions were developed using factors from the EPA mobile sources factor model MOBILE 5a and estimates traffic volumes on Pantex Plant (EPA Pantex 1996: 9.5).

The 1990 CAA amendments established control standard for air toxics called Maximum Achievable Control Technology (MACT) which will have as its foundation the maximum level of control achieved in practice in industry. The MACT standard must be achieved by sources with the potential to 9.08 metric tons (10 tons) per year of any hazardous air pollutant (HAP), or more than 22.7 metric tons (25 tons) per year of a combination of HAPs. Since, as shown in Table 4.7.1.3–3, none of the emissions of individual HAPs at Pantex Plant exceed metric tons (10 tons) per year and the combined emissions of all the HAPs are less than metric tons (25 tons) per year, MACT standards are not applicable.

A summary of the criteria pollutant emissions for the nine counties in the ROI is shown in Table 4.7.1.3–7. These emissions include stationary and mobile source emissions and were obtained from the EPA National Emissions Data System. Pantex Plant emissions are also shown in the table for comparison to ROI emissions.

Pantex Plant emissions contribute a small portion of pollutants to the overall pollutant burden in the ROI. Because of the atmospheric dispersion and relatively low emissions over the region, the existing air quality in the ROI is generally very good.

4.7.1.4 *Atmospheric Radiological Environment*

The population of the Texas Panhandle is exposed to environmental radiation from both natural and manmade sources. This section

TABLE 4.7.1.3–6.—*Estimated Criteria and Non-Criteria Pollutant Emission Inventory for Stationary and Mobile Sources at Pantex Plant*

SOURCE	POLLUTANT					
	CO	NO_2	PM_{10}	SO_2	Pb	VOC[1]
STATIONARY SOURCES						
Building 10–2 kg/yr (lb/yr)	6.4 (14.0)	0.02 (0.04)	—	—	0.07 (0.15)	—
Zone 11 (8 Buildings) kg/yr (lb/yr)	101.7 (224.1)	504.0 (1,111.1)	11.7 (25.7)	—	—	—
Zone 12 (17 Buildings) kg/yr (lb/yr)	3,018.2 (6,654.1)	3,641.7 (8,028.5)	217.9 (480.3)	—	—	—
Firing Sites kg/yr (lb/yr)	90.5 (199.6)	3.9 (8.6)	1.1 (2.4)	—	—	—
Burning Trays kg/yr (lb/yr)	3,393.3 (7,480.8)	12,519.8 (27,600.9)	6,486.4 (14,300.0)	—	—	—
Buildings 16-7, 16-8, 16-10, 16-12, 16-13, 16-15 kg/yr (lb/yr)	7,955.6 (17,539.0)	28,918.0 (63,753.2)	1,028.7 (2,267.8)	—	7.6 (16.8)	—
Buildings 9-4, 9-5, 9-6 kg/yr (lb/yr)	7.9 (17.4)	39.5 (87.0)	1.0 (2.2)	—	—	—
Natural Gas Engines kg/yr (lb/yr)	570.6 (1,258.0)	4,421.6 (9,748.0)	—	—	—	—
Gasoline and Diesel Engines kg/yr (lb/yr)	2,671.3 (5,889.3)	8,485.4 (18,707.1)	605.8 (1,335.5)	—	—	—
Welding, Cutting, and Grinding kg/yr (lb/yr)	—	—	86.6 (191.0)	—	—	—
Subtotal kg/yr (lb/yr)	17,815.5 (39,276.3)	58,533.9 (129,044.44)	8,439.2 (18,604.9)	0.0 (0.0)	7.7 (17.0)	2,806.45 (6,187.06)
Subtotal metric tons/yr (tons/yr)	17.82 (19.64)	58.53 64.52	8.44 (9.30)	0.00 (0.00)	0.01 (0.01)	2.81 (3.09)
MOBILE SOURCES						
Mobile Sources metric tons/yr (tons/yr)	567.22 (625.25)	246.36 (271.57)	—	—	—	61.49 (67.79)
TOTALS						
Total metric tons/yr (tons/yr)	585.04 (644.89)	304.89 (336.09)	8.44 (9.30)	0.00 0.00	0.01 (0.01)	64.3 (70.88)

[1]Based on VOCs in Table 4.7.1.3–3
Source: Pantex 1996; PC 1994

release of tritium occurred in Cell 1 in Zone 12 during a routine disassembly operation. The accidental release of tritium in 1989 was conservatively estimated as 40,000 curies (Pantex 1996:16.1).

Existing Radiological Conditions

Monitoring and assessment activities are conducted to characterize existing radiological conditions at Pantex Plant and the surrounding environment (DOE 1995b:8-6 to 8-7). Results of these activities show that exposures resulting from airborne radionuclide emissions are well within applicable standards and are a small fraction of the dose from background sources. These results are discussed separately below for onsite and offsite environments.

Onsite Doses. An indication of onsite radiological conditions is obtained by comparing measured onsite concentrations with those from Pantex Plant nearby locations and a distant location. Results from onsite and nearby locations include contributions from background conditions and Pantex Plant emissions, while the distant location represents background conditions beyond the influence of Pantex Plant emissions. Pantex Plant has 10 offsite, 7 onsite, and 17 perimeter air sampling locations for the air monitoring program for airborne radioactive emissions only. Nine of the 10 offsite units are located within an approximately 8-kilometer (5-mile) radius of the plant. A control site, used to collect background air data is located 48 kilometers (30 miles) west of Pantex Plant at the Bushland Agricultural Research Station (Pantex 1996:16.1).

The data show that 1994 average airborne radioactivity and radiation exposure levels within and around Pantex Plant were only slightly different than those at the control station. The average annual dose (as measured by thermoluminescent dosimeters during 1994) was 97 millirem onsite, 95 at the nearby offsite locations and 93 at the control station (DOE 1995b).

Offsite Doses. The offsite population may receive a very small radiation dose as a result of radiological conditions directly attributable to Pantex Plant operations. The dose associated with baseline radiological emissions is assessed for a maximally exposed individual. The maximally exposed individual is a hypothetical person whose habits and proximity to Pantex Plant are such that the person would receive the highest dose projected to result from site-wide radiological emissions.

The dose calculated for the maximally exposed individual for 1994 was 5.8×10^{-5} millirem per year. The offsite radiation doses from onsite sources were calculated using the CAP88/PC model and 1994 meteorological data in accordance with 40 CFR 61, Subpart H (Pantex 1996). This value was obtained for tritium, the only radionuclide that was released in 1994. The maximally exposed individual dose was well below the National Emissions Standards for HAPs dose limit (10 millirem per year) and the dose received from background sources (95 millirem per year).

The collective dose to the surrounding population as a result of Pantex Plant emissions, assessed using the total population residing within a circular area with an 80-kilometer (50-mile) radius extending from the plant, was 1.37×10^{-4} person-rem in 1994. This population dose was distributed over a population of about 267,000. This population dose is very small when compared with the dose received by the same population from background sources (over 26,000 person-rem).

Results of fence line monitoring for oxidized tritium, elemental tritium, uranium-234, uranium-238, plutonium-239, plutonium-240, and gross alpha and beta were compared to the Derived Concentration Guidelines (DCG) for inhalation listed in DOE Order 5400.5 "Radiation Protection of the Publ ı To th a

TABLE 4.7.2.1–1.—*Estimated Maximum Fence Line Concentration of Criteria Pollutants for the 2,000, 1,000, and 500 Weapons Levels*

POLLUTANT	AVERAGING TIME	NAAQS $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION $\mu g/m^3$		
			2,000 LEVEL	1,000 LEVEL	500 LEVEL
CO - 45.4 kg (100 lb) HE	1-hour	4.00×10^4	9.24×10^2	9.24×10^2	9.23×10^2
	8-hour	1.00×10^4	1.61×10^2	1.61×10^2	1.61×10^2
CO - 363 kg (800 lb) HE	1-hour	4.00×10^4	9.24×10^2	9.24×10^2	9.23×10^2
	8-hour	1.00×10^4	1.61×10^2	1.61×10^2	1.61×10^2
CO - BGU	1-hour	4.00×10^4	2.90×10^3	2.90×10^3	2.90×10^3
	8-hour	1.00×10^4	6.02×10^2	6.02×10^2	6.02×10^2
Lead	1st Qtr	1.50	1.02×10^{-3}	5.10×10^{-4}	2.55×10^{-4}
	2nd Qtr	1.50	9.64×10^{-4}	4.82×10^{-4}	2.41×10^{-4}
	3rd Qtr	1.50	1.58×10^{-3}	7.90×10^{-4}	3.95×10^{-4}
	4th Qtr	1.50	9.50×10^{-3}	3.25×10^{-3}	1.62×10^{-3}
Lead - BGU	1st Qtr	1.50	2.28×10^{-2}	1.89×10^{-2}	1.87×10^{-2}
	2nd Qtr	1.50	6.62×10^{-2}	3.22×10^{-2}	3.20×10^{-2}
	3rd Qtr	1.50	9.36×10^{-2}	4.41×10^{-2}	4.38×10^{-2}
	4th Qtr	1.50	4.14×10^{-2}	2.08×10^{-2}	2.08×10^{-2}
NO_2 - 45.4 kg (100 lb) HE	Annual	1.00×10^2	2.15	2.15	2.15
NO_2 - 363 kg (800 lb) HE	Annual	1.00×10^2	6.39×10^{-1}	6.26×10^{-1}	6.19×10^{-1}
NO_2 - BGU	Annual	1.00×10^2	5.42×10^{-1}	5.28×10^{-1}	5.21×10^{-1}
PM_{10} - 45.4 kg (100 lb) HE	Annual	5.00×10^1	8.73	8.68	8.67
	24-hour	1.50×10^2	8.85×10^1	8.84×10^1	8.83×10^1
PM_{10} - 363 kg (800 lb) HE	Annual	5.00×10^1	1.51	7.64×10^{-1}	5.63×10^{-1}
	24-hour	1.50×10^2	2.24×10^1	9.97	9.84
SO_2 - BGU	Annual	8.00×10^1	0.00	0.00	0.00
	24-hour	3.65×10^2	2.00×10^{-5}	2.00×10^{-5}	2.00×10^{-5}
	3-hour	1.30×10^3	8.00×10^{-5}	8.00×10^{-5}	8.00×10^{-5}
	30-minute	1.02×10^3	1.60×10^{-4}	1.60×10^{-4}	1.60×10^{-4}

Note: Table shows the ISCST2 and ISCLT2 modeling results (maximum fence line concentrations).
BGU - Burning Ground Upgrade
Source: TNRCC 1993a

TABLE 4.7.2.1–2.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants for 1,000, and 500 Weapons Levels at Pantex Plant*

POLLUTANT	AVERAGING TIME	ESL µg/m³	MAXIMUM FENCE LINE CONCENTRA (µg/m³)		
			2,000 LEVEL	1,000 LEVEL	500 L
CLEAN AIR ACT LISTED AIR POLLUTANTS[b]					
1,1,2-trichloroethane	Annual	5.50×10^{1}	8.07×10^{-2}	3.97×10^{-2}	1.99
	30-minute	5.50×10^{2}	1.73×10^{1}	8.53	4
1,3-butadiene - 45.4 kg (100 lb) HE	Annual	1.10×10^{1}	9.09×10^{-3}	8.06×10^{-3}	7.55
	30-minute	1.10×10^{2}	3.76	3.73	3
1,3-butadiene - 363 kg (800 lb) HE	Annual	1.10×10^{1}	9.09×10^{-3}	8.06×10^{-3}	7.55
	30-minute	1.10×10^{2}	3.76	3.73	3
2-nitropropane	Annual	5.00	3.56×10^{-2}	1.78×10^{-2}	8.88
	30-minute	5.00×10^{1}	8.55	4.27	2
Alcohols[c]	Annual	NA	7.01×10^{-1}	6.37×10^{-1}	6.05
	30-minute	1.00×10^{2}	1.95×10^{2}	1.95×10^{2}	1.95
Benzene	Annual	3.00	5.47×10^{-2}	4.54×10^{-2}	4.48
	30-minute	7.50×10^{1}	1.94×10^{1}	1.83×10^{1}	1.82
Carbon Disulfide	Annual	3.00	9.39×10^{-2}	4.70×10^{-2}	2.35
	30-minute	3.00×10^{1}	2.26×10^{1}	1.13×10^{1}	5
Carbon Tetrachloride	Annual	1.30×10^{1}	8.19×10^{-2}	4.07×10^{-2}	2.03
	30-minute	1.26×10^{2}	1.97×10^{1}	9.77	4
Chlorobenzene	Annual	4.60×10^{1}	8.13×10^{-2}	4.07×10^{-2}	2.03
	30-minute	4.60×10^{2}	1.95×10^{1}	9.77	4
Chromium - 45.4 kg (100 lb) HE	Annual	1.00×10^{-1}	1.91×10^{-3}	1.91×10^{-3}	1.91
	30-minute	1.00	9.72×10^{-2}	9.72×10^{-2}	9.72
Chromium - 363 kg (800 lb) HE	Annual	1.00×10^{-1}	8.00×10^{-5}	8.00×10^{-5}	8.00
	30-minute	1.00	7.62×10^{-3}	7.62×10^{-3}	7.62
Chromium - BGU	Annual	1.00×10^{-1}	1.49×10^{-3}	1.49×10^{-3}	1.49
	30-minute	1.00	1.33×10^{-1}	1.33×10^{-1}	1.33
Cresols	Annual	NA	1.72×10^{-3}	8.60×10^{-4}	4.30
	30-minute	5.00	4.13×10^{-1}	2.07×10^{-1}	1.03
Cresylic Acid	Annual	NA	2.14×10^{-3}	1.07×10^{-3}	5.30
	30-minute	5.00	5.13×10^{-1}	2.56×10^{-1}	1.28
Dibenzofurans - 45.4 kg (100 lb) HE	Annual	NA	2.00×10^{-5}	2.00×10^{-5}	2.00
	30-minute	NA	9.60×10^{-4}	9.60×10^{-4}	9.60
Dibenzofurans - 363 kg (800 lb) HE	Annual	NA	0.00[e]	0.00[e]	0.00
	30-minute	NA	8.00×10^{-5}	8.00×10^{-5}	8.00
Dimethylformamide	Annual	3.00×10^{1}	6.19×10^{-2}	6.19×10^{-2}	6.19
	30-minute	3.00×10^{2}	2.80×10^{1}	2.80×10^{1}	2.80

TABLE 4.7.2.1–2.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants for the 1,000, and 500 Weapons Levels at Pantex Plant*-Continued

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION ($\mu g/m^3$)		
			2,000 LEVEL	1,000 LEVEL	500 LEVEL
Methyl Cyanide - 45.4 kg (100 lb) HE	Annual	NA	0.00[e]	0.00[e]	0.00[e]
	30-minute	NA	0.00[e]	0.00[e]	0.00[e]
Methyl Cyanide - 363 kg (800 lb) HE	Annual	NA	0.00[e]	0.00[e]	0.00[e]
	30-minute	NA	0.00[e]	0.00[e]	0.00[e]
Methyl Ethyl Ketone	Annual	5.90×10^{2}	5.10	4.89	4.71
	30-minute	3.90×10^{3}	1.40×10^{3}	1.40×10^{3}	1.40×10^{3}
Methyl Isobutyl Ketone	Annual	2.05×10^{2}	1.85×10^{-2}	9.16×10^{-3}	4.58×10^{-3}
	30-minute	2.05×10^{3}	4.45	2.20	1.10
Methylene Chloride	Annual	2.60×10^{1}	7.37×10^{-1}	6.69×10^{-1}	6.69×10^{-1}
	30-minute	2.60×10^{2}	1.80×10^{2}	1.80×10^{2}	1.80×10^{2}
Naphthalene - 45.4 kg (100 lb) HE	Annual	5.00×10^{1}	1.10×10^{-4}	1.10×10^{-4}	1.10×10^{-4}
	30-minute	4.40×10^{2}	5.48×10^{-3}	5.48×10^{-3}	5.48×10^{-3}
Naphthalene - 363 kg (800 lb) HE	Annual	5.00×10^{1}	0.00[e]	0.00[e]	0.00[e]
	30-minute	4.40×10^{2}	4.30×10^{-4}	4.30×10^{-4}	4.30×10^{-4}
Nickel - BGU	Annual	1.50×10^{-2}	2.40×10^{-4}	2.40×10^{-4}	2.40×10^{-4}
	30-minute	1.50×10^{-1}	2.16×10^{-2}	2.16×10^{-2}	2.16×10^{-2}
Nitrobenzene	Annual	5.00	2.14×10^{-3}	1.07×10^{-3}	5.35×10^{-4}
	30-minute	2.40×10^{1}	5.13×10^{-1}	2.56×10^{-1}	1.28×10^{-1}
Phenol - 45.4 kg (100 lb) HE	Annual	1.90×10^{1}	5.70×10^{-4}	5.70×10^{-4}	5.70×10^{-4}
	30-minute	1.54×10^{2}	2.92×10^{-2}	2.92×10^{-2}	2.92×10^{-2}
Phenol - 363 kg (800 lb) HE	Annual	1.90×10^{1}	2.00×10^{-5}	2.00×10^{-5}	2.00×10^{-5}
	30-minute	1.54×10^{2}	2.29×10^{-3}	2.29×10^{-3}	2.29×10^{-3}
Tetrachloroethylene	Annual	3.40×10^{1}	7.33×10^{-2}	3.67×10^{-2}	1.83×10^{-2}
	30-minute	3.40×10^{2}	1.76×10^{1}	8.81	4.41
Titanium - BGU	Annual	NA	6.50×10^{-4}	6.50×10^{-4}	6.50×10^{-4}
	30-minute	5.00×10^{2}	5.82×10^{-2}	5.82×10^{-2}	5.82×10^{-2}
Toluene	Annual	1.88×10^{2}	1.73	1.45	7.15×10^{-1}
	30-minute	1.88×10^{3}	5.58×10^{2}	5.41×10^{2}	2.66×10^{2}
Trichloroethylene	Annual	1.35×10^{2}	2.12×10^{-1}	1.06×10^{-1}	5.27×10^{-2}
	30-minute	1.35×10^{3}	5.11×10^{1}	2.55×10^{1}	1.26×10^{1}
Triethylamine	Annual	4.00	2.38×10^{-3}	2.38×10^{-3}	2.38×10^{-3}
	30-minute	4.00×10^{1}	1.08	1.08	1.08
Xylene	Annual	4.34×10^{2}	4.74×10^{-1}	2.34×10^{-1}	1.17×10^{-1}
	30-minute	3.70×10^{3}	1.45×10^{2}	7.26×10^{1}	3.62×10^{1}

TABLE 4.7.2.1–2.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants for the 2,000, 1,000, and 500 Weapons Levels at Pantex Plant*-Continued

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION ($\mu g/m^3$)		
			2,000 LEVEL	1,000 LEVEL	500 LEVEL
TNRCC LISTED AIR POLLUTANTS[d]					
1,1,1-chloroethane	Annual 30-minute	5.00×10^{1} 5.00×10^{2}	5.28×10^{-1} 1.27×10^{-2}	The maximum estimated fence line concentrations of these air pollutants for these operation levels would be lower than those concentrations estimated for the 2,000 weapons operation level.	
1,3,5-trinitrobenzene - 45.4 kg (100 lb) HE	Annual 30-minute	NA 2.00	0.00[e] 3.00×10^{-5}		
1,3,5-trinitrobenzene - 363 kg (800 lb) HE	Annual 30-minute	NA 2.00	0.00[e] 0.00[e]		
1-butanol	Annual 30-minute	7.60×10^{1} 7.60×10^{2}	1.99×10^{-2} 4.79		
2,4,6-trinitrotoluene - 45.4 kg (100 lb) HE	Annual 30-minute	NA 5.00	0.00[e] 3.30×10^{-4}		
2,4,6-trinitrotoluene - 363 kg (800 lb) HE	Annual 30-minute	NA 5.00	0.00[e] 2.00×10^{-5}		
2,4-dinitrotoluene - 45.4 kg (100 lb) HE	Annual 30-minute	1.50×10^{-1} 1.50×10^{1}	0.00[e] 5.00×10^{-5}		
2,4-dinitrotoluene - 363 kg (800 lb) HE	Annual 30-minute	1.50×10^{-1} 1.50×10^{1}	0.00[e] 3.00×10^{-5}		
2,6-dinitrotoluene - 45.4 kg (100lb) HE	Annual 30-minute	NA 1.50×10^{1}	0.00 5.00×10^{-4}		
2,6-dinitrotoluene - 363 kg (800 lb) HE	Annual 30-minute	NA 1.50×10^{1}	0.00[e] 4.00×10^{-5}		
2-ethoxyethanol	Annual 30-minute	NA 1.80×10^{2}	3.91×10^{-1} 9.42		
2-nitronaphthalene - 45.4 kg (100 lb) HE	Annual 30-minute	NA 5.00×10^{2}	1.00×10^{-5} 4.20×10^{-4}		
2-nitronaphthalene - 363 kg (800 lb) HE	Annual 30-minute	NA 5.00×10^{2}	0.00[e] 2.00×10^{-5}		
Acetone	Annual 30-minute	5.90×10^{2} 5.90×10^{3}	3.39 5.19×10^{2}		
Acetylene - 45.4 kg (100 lb) HE	Annual 30-minute	2.66×10^{3} 2.66×10^{4}	3.33×10^{-3} 1.11		
Acetylene - 363 kg (800 lb) HE	Annual 30-minute	2.66×10^{3} 2.66×10^{4}	3.33×10^{3} 1.11		
Aluminum - 45.4 kg (100 lb) HE	Annual 30-minute	5.00 5.00×10^{1}	1.28×10^{-3} 5.22×10^{-2}		
Aluminum - 363 kg (800 lb) HE	Annual 30-minute	5.00 5.00×10^{1}	1.17×10^{-3} 4.94×10^{-2}		
Ammonia	Annual 30-minute	1.70×10^{1} 1.70×10^{2}	2.89×10^{-2} 1.31×10^{1}		
Barium	Annual 30-minute	5.00×10^{-1} 5.00	1.25×10^{-3} 2.93×10^{-3}		

TABLE 4.7.2.1–2.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants for the 1,000, and 500 Weapons Levels at Pantex Plant*-Continued

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATI ($\mu g/m^3$)		
			2,000 LEVEL	1,000 LEVEL	500 LE
Benzo(a)anthracene - 45.4 kg (100 lb) HE	Annual 30-minute	NA 5.00×10^{-1}	1.00×10^{-5} 5.00×10^{-4}	The maximum estimated fence li concentrations of these air pollu these operation levels would be le those concentrations estimated fro 2,000 weapons operation level.	
Benzo(a)anthracene - 363 kg (800 lb) HE	Annual 30-minute	NA 5.00×10^{-1}	0.00[e] 4.00×10^{-5}		
Benzo(a)pyrene - 45.4 kg (100 lb) HE	Annual 30-minute	3.00×10^{-3} 3.00×10^{-2}	1.00×10^{-5} 4.10×10^{-4}		
Benzo(a)pyrene - 363 kg (800 lb) HE	Annual 30-minute	3.00×10^{-3} 3.00×10^{-2}	0.00[e] 2.00×10^{-5}		
Bismuth	Annual 30-minute	5.00 5.00×10^{2}	3.00×10^{-5} 1.13×10^{-3}		
Butane	Annual 30-minute	1.90×10^{3} 1.90×10^{4}	2.98×10^{-2} 1.12×10^{1}		
Butene	Annual 30-minute	NA 1.60×10^{2}	2.81×10^{-1} 1.18×10^{1}		
Calcium	Annual 30-minute	5.00 5.00×10^{1}	5.00×10^{-5} 1.90×10^{-3}		
Chlorinated Fluorocarbon	Annual 30-minute	NA 1.80×10^{4}	2.90×10^{-1} 6.93×10^{1}		
Copper	Annual 30-minute	1.00 1.00×10^{1}	3.08×10^{-3} 1.25×10^{-1}		
Cyanogen - 45.4 kg (100 lb) HE	Annual 30-minute	2.10×10^{1} 2.10×10^{2}	1.00×10^{5} 2.00×10^{-4}		
Cyanogen - 363 kg (800 lb) HE	Annual 30-minute	2.10×10^{1} 2.10×10^{2}	0.00[e] 2.00×10^{-5}		
Cyclohexane	Annual 30-minute	3.40×10^{2} 1.44×10^{3}	3.68×10^{-1} 9.41×10^{1}		
Cyclohexanone	Annual 30-minute	1.00×10^{2} 4.81×10^{2}	6.09×10^{-2} 1.44		
Dioxane	Annual 30-minute	9.00×10^{1} 9.00×10^{2}	7.88×10^{-1} 3.57×10^{1}		
Ethyl Ether	Annual 30-minute	NA 9.27×10^{2}	3.33×10^{-1} 7.96×10^{1}		
Ethylene - 45.4 kg (100 lb) HE	Annual 30-minute	NA 1.17×10^{3}	6.04×10^{-1} 2.53×10^{2}		
Ethylene - 363 kg (800 lb) HE	Annual 30-minute	NA 1.17×10^{3}	6.04×10^{-1} 2.44×10^{2}		
Formic Acid - 45.4 kg (100 lb) HE	Annual 30-minute	9.40 9.40×10^{1}	0.00[e] 8.00×10^{-5}		
Formic Acid - 363 kg (800 lb) HE	Annual 30-minute	9.40 9.40×10^{1}	0.00[e] 2.00×10^{-5}		
Iron - 45.4 kg (100 lb) HE	Annual 30-minute	NA 5.00×10^{1}	4.99×10^{-2} 1.82		

TABLE 4.7.2.1–2.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants for the 2,000, 1,000, and 500 Weapons Levels at Pantex Plant*-Continued

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRATION ($\mu g/m^3$)		
			2,000 LEVEL	1,000 LEVEL	500 LEVEL
Iron - 363 kg (800 lb) HE	Annual 30-minute	NA 5.00×10^{1}	2.44×10^{-2} 1.02	The maximum estimated fence line concentrations of these air pollutants for these operation levels would be lower than those estimated concentrations for the 2,000 weapons operation level.	
Isobutane	Annual 30-minute	1.90×10^{3} 4.84×10^{3}	4.01×10^{-2} 1.39×10^{1}		
Isobutanol	Annual 30-minute	1.52×10^{2} 1.52×10^{3}	2.27×10^{-2} 5.46		
Ketene - 45.4 kg (100 lb) HE	Annual 30-minute	9.00×10^{-1} 9.00	0.00[e] 0.00[e]		
Ketene - 363 kg (800 lb) HE	Annual 30-minute	9.00×10^{-1} 9.00	0.00[e] 0.00[e]		
Ketone	Annual 30-minute	NA 1.00×10^{2}	1.39×10^{-1} 3.34×10^{1}		
Lithium	Annual 30-minute	NA 1.00×10^{1}	4.00×10^{-5} 1.84×10^{-3}		
Magnesium	Annual 30-minute	NA 5.00×10^{1}	1.05×10^{-3} 4.41×10^{-2}		
Methane - 45.4 kg (100 lb) HE	Annual 30-minute	NA 3.00×10^{4}	7.16×10^{-1} 2.64×10^{1}		
Methane - 363 kg (800 lb)	Annual 30-minute	NA 3.00×10^{4}	7.16×10^{-1} 2.61×10^{1}		
N-butyl Alcohol	Annual 30-minute	7.60×10^{1} 7.60×10^{2}	1.35×10^{-1} 3.25		
Non-F Listed Solvents	Annual 30-minute	NA 1.00×10^{1}	9.40×10^{-4} 2.26×10^{-1}		
Ortho-dichlorobenzene	Annual 30-minute	NA 1.50×10^{3}	6.36×10^{-1} 1.53×10^{2}		
Propane	Annual 30-minute	1.80×10^{3} 1.80×10^{4}	4.21×10^{-2} 1.32×10^{1}		
Propene	Annual 30-minute	NA 3.00×10^{4}	3.71×10^{-1} 1.56×10^{2}		
Pyrene - 45.4 kg (100 lb) HE	Annual 30-minute	5.00×10^{-2} 5.00×10^{-1}	5.00×10^{-4} 1.57×10^{-3}		
Pyrene - 363 kg (800 lb) HE	Annual 30-minute	5.00×10^{-2} 5.00×10^{-1}	0.00[e] 9.00×10^{-5}		
Pyridine	Annual 30-minute	1.50×10^{1} 6.90×10^{1}	3.78×10^{-1} 9.08		
Silicon	Annual 30-minute	5.00 5.00×10^{2}	0.00[e] 2.90×10^{-4}		
Silver	Annual 30-minute	1.00×10^{-2} 1.00×10^{-1}	1.45×10^{-3} 6.22×10^{-2}		
Tetrahydrofuran	Annual 30-minute	5.90×10^{2} 5.90×10^{3}	7.55×10^{-1} 3.42×10^{2}		

TABLE 4.7.2.1–2.—*Estimated[a] Maximum Fence Line Concentration of Air Pollutants for 1,000, and 500 Weapons Levels at Pantex Plant*-Continued

POLLUTANT	AVERAGING TIME	ESL $\mu g/m^3$	MAXIMUM FENCE LINE CONCENTRAT ($\mu g/m^3$)		
			2,000 LEVEL	1,000 LEVEL	500 LE
Trichlorofluoromethane	Annual 30-minute	5.62×10^{3} 2.80×10^{4}	4.21×10^{-1} 1.01×10^{2}	The maximum estimated fence lin concentrations of these air pollut these operation levels would be lo those estimated concentrations for 2,000 weapons operation level.	
Trichlorotrifluoroethane	Annual 30-minute	NA 7.60×10^{4}	1.77 4.73×10^{2}		
Zinc	Annual 30-minute	5.00 5.00×10^{1}	1.32×10^{-3} 5.58×10^{-2}		

[a]EPA Model ISCST2 was used to calculate maximum fence line concentrations for all three operations levels.
[b]Hours of operations were taken into account for emissions from open burning and engine emissions for CAA listed air pollutants.
[c]The group of alcohols while not listed in CAA were estimated to exceed the conservative ESL used by TNRCC. Therefore, alcohols were here for more complete presentation of results.
[d]Hours of operation were not taken into account and emissions were modeled for an entire year of meteorological data for TNRCC listed pollutants.
[e]The ISCST2 air quality model returns a value of 0.00 for any concentration equal to or less than 1.00×10^{-5} $\mu g/m^3$ (i.e., less than one ten of a part per billion or less than ten parts per quadrillion).
[f]Solvents that are not listed under 40 CFR 261.33.
BGU - Burning Ground Upgrade
NA - An ESL has not been established by TNRCC.
Sources: TNRCC 1996a; CAA as amended

The maximum concentrations of criteria pollutants and CAA listed air pollutants estimated to occur at the 11 residences located near the Pantex Plant boundary are below their respective ambient air standards or their respective ESLs. Appendix B presents tables of these concentrations for each of the 11 residences.

Alcohols exceeded the ESL at the boundary and at residence 10. These alcohols were modeled as a group and compared with the conservative ESL used by TNRCC. However, subsequent review of the inventories of the types of alcohols and quantities on hand at the plant showed that the use of the conservative ESL for the group of alcohols was excessively conservative. When the total concentrations of the individual alcohols were prorated, none of the individual alcohols exceeded their respective ESLs at or near the fence line. Table B.4.1–2 in appendix B shows the prorated concentrations of these alcohols.

Since ambient concentrations of all c pollutants and HAPs do not violate any ambient standards or ESLs beyond the Pl Plant boundary, the air quality impacts continued operations under the Proposed A would be minor and would not be consi significant.

Criteria and VOC Pollutant Emissions

A summary of criteria and VOC poll emissions for the 2,000, 1,000 and 500 weap levels are presented in Tables 4.7.2 4.7.2.1–4, and 4.7.2.1–5, respec Emissions for the 2,000 weapons level wou about the same as those shown in T 4.7.1.3–6 with the addition of emiss projected for the Burning Ground upgrade general, emissions for 1,000 and 500 level less than those for the 2,000 weap However, emission reductions are not di proportional to weapons level reductions. T result occurs because some facility emiss would not be reduced when weapons level reduced (e.g., heating of buildings).

TABLE 4.7.2.1–3.—*Estimated Criteria and VOC Pollutant Emissions Inventory for Stationary and Mobile Sources at Pantex Plant for 2,000 Weapons Level*

SOURCE	POLLUTANT					
	CO	NO_2	PM_{10}	SO_2	Pb	VOC[1]
STATIONARY SOURCES						
Building 10–2 kg/yr (lb/yr)	6.4 (14.0)	0.02 (0.04)	—	—	0.07 (0.15)	—
Zone 11 (8 Buildings) kg/yr (lb/yr)	101.7 (224.1)	504.0 (1,111.1)	11.7 (25.7)	—	—	—
Zone 12 (17 Buildings) kg/yr (lb/yr)	3,018.2 (6,654.1)	3,641.7 (8,028.5)	217.9 (480.3)	—	—	—
Firing Sites kg/yr (lb/yr)	90.5 (199.6)	3.9 (8.6)	1.1 (2.4)	—	—	—
Burning Trays kg/yr (lb/yr)	867.2 (1,911.9)	31,851.4 (70,219)	6,486.4 (14,300.0)	—	—	—
Burning Ground Upgrade kg/yr (lb/yr)	5,005.8 (11,036.0)	1,081.2 (2,383.6)	—	0.10 (0.2)	177.5 (391.4)	—
Buildings 16-7, 16-8, 16-10, 16-12, 16-13, 16-15 kg/yr (lb/yr)	7,955.6 (17,539.0)	28,918.0 (63,753.2)	1,028.7 (2,267.8)	—	7.6 (16.8)	—
Buildings 9-4, 9-5, 9-6 kg/yr (lb/yr)	7.9 (17.4)	39.5 (87.0)	1.0 (2.2)	—	—	—
Natural Gas Engines kg/yr (lb/yr)	570.6 (1,258.0)	4,421.6 (9,748.0)	—	—	—	—
Gasoline and Diesel Engines kg/yr (lb/yr)	2,671.3 (5,889.3)	8,485.4 (18,707.1)	605.8 (1,335.5)	—	—	—
Welding, Cutting, and Grinding kg/yr (lb/yr)	—	—	86.6 (191.0)	—	—	—
Subtotal kg/yr (lb/yr)	20,295.2 (44,743.4)	78,946.7 (174,046.1)	8,439.2 (18,604.9)	0.1 (0.2)	185.2 (408.4)	2,806.45 (6,187.06)
Subtotal metric tons/yr (tons/yr)	20.30 (22.37)	78.95 (87.02)	8.44 (9.30)	0.00 (0.00)	0.19 (0.20)	2,81 (3.09)
MOBILE SOURCES						
Mobile Sources metric tons/yr (tons/yr)	567.22 (625.25)	246.36 (271.57)	—	—	—	61.49 (67.79)
TOTALS						
Total metric tons/yr (tons/yr)	589.51 (647.6)[2]	325.31 (358.6)[2]	8.44 (9.30)	0.00 0.00	0.19 (0.20)	64.3 (70.88)

[1]Based on VOCs in Table 4.7.1.3–3

[2]Totals are different from those of Table 4.7.1.3–7 because of differences in future operation at the 2,000 weapons per year level compared to the Affected Environment which was based on 1993 data.

Note: SO_2 is emitted only from BGU operation; therefore, this pollutant is considered only for 2,000, 1,000, and 500 weapons scenarios.

Sources: Pantex 1996; PC 1994

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TABLE 4.7.2.1–5.—*Estimated Criteria and VOC Pollutant Emissions Inventory for Stationary and Mobile Sources at Pantex Plant for 500 Weapons Level*

SOURCE	POLLUTANT					
	CO	NO_2	PM_{10}	SO_2	Pb	VOC[1]
STATIONARY SOURCES						
Building 10–2 kg/yr (lb/yr)	1.6 (3.5)	0.01 (0.01)	—	—	0.02 (0.04)	—
Zone 11 (8 Buildings) kg/yr (lb/yr)	101.0 (222.7)	503.9 (1,111.0)	10.7 (23.6)	—	—	—
Zone 12 (17 Buildings) kg/yr (lb/yr)	2,881.7 (6,353.0)	3,558.5 (7,845.1)	127.4 (280.9)	—	—	—
Firing Sites kg/yr (lb/yr)	22.6 (49.9)	1.0 (2.1)	0.3 (0.6)	—	—	—
Burning Trays kg/yr (lb/yr)	867.2 (1,911.9)	31,851.4 (70,219)	1,621.6 (3,575.0)	—	—	—
Burning Ground Upgrade kg/yr (lb/yr)	5,005.8 (11,036.0)	1,081.2 (2,383.6)	—	0.1 (0.2)	177.5 (391.4)	—
Buildings 16-7,16-6,16-10,16-12,16-13,16-15 kg/yr (lb/yr)	7,384.0 (16,279.0)	28,916.2 (63,744.3)	1,028.4 (2,267.2)	—	1.9 (4.2)	—
Buildings 9-4, 9-5, 9-6 kg/yr (lb/yr)	7.9 (17.4)	39.5 (87.0)	1.0 (2.2)	—	—	—
Natural Gas Engines kg/yr (lb/yr)	570.6 (1,258.0)	4,421.6 (9,748.0)	—	—	—	—
Gasoline and Diesel Engines kg/yr (lb/yr)	2,671.3 (5,889.3)	8,485.4 (18,707.1)	605.8 (1,335.5)	—	—	—
Welding, Cutting, and Grinding kg/yr (lb/yr)	—	—	86.6 (191.0)	—	—	—
Subtotal kg/yr (lb/yr)	19,013.2 (43,020.7)	78,858.7 (173,847.2)	3,481.8 (7,676.0)	0.1 (0.2)	179.4 (395.6)	1,997.43 (4,403.52)
Subtotal metric tons/yr (tons/yr)	19.01 (21.51)	78.86 (86.92)	3.48 (3.84)	0.00 (0.00)	0.18 (0.20)	2.00 (2.20)
MOBILE SOURCES						
Mobile Sources metric tons/yr (tons/yr)	326.77 (360.20)	73.27 (80.77)	—	—	—	38.34 (42.26)
TOTALS						
Total metric tons/yr (tons/yr)	345.78 (381.71)	152.13 (167.69)	3.48 (3.84)	0.00 (0.00)	0.18 (0.20)	40.34 (44.46)

[1]Based on VOCs in Table 4.7.1.3–3

Note: SO_2 is emitted only from BGU operation; therefore, this pollutant is considered only for 2,000, 1,000 and 500 weapons scenarios.

Source: Pantex 1996; PC 1994

Criteria pollutant emissions resulting from continued operations at Pantex Plant would contribute about 1 percent or less to the overall pollution burden in Carson and Potter Counties (see Table 4.7.1.3–7 for county emissions). Since this represents such a small impact on the two closest counties, emissions from Pantex Plant would be expected to have a negligible impact on the regional air quality.

Radiological Emissions

The radiological emissions that were discussed for the Affected Environment (section 4.7.1.4) were assumed for the 2,000 weapons level. The impacts from these emissions would also be the same as those discussed in the Affected Environment above. The impacts from these emissions are several orders of magnitude below the DCGs and National Emissions Standards for Hazardous Air Pollutants (NESHAP) dose limits. Therefore, the impacts would not be significant. The emissions levels associated with the 1,000 and 500 weapons levels would be less than those for the 2,000 weapons level. Therefore, the impacts for these levels are bounded by the impacts for the 2,000 weapons level and are also not significant.

Pit Storage Activities

Only indirect pollutant emissions would result from pit storage activities. Pollutant exhaust emissions from the Safe Secure Tractor Trailers hauling weapons or pits to Pantex Plant and from the vehicles used by personnel responsible for pit storage would be the principal sources. Onsite pit transfers are accomplished with electric forklifts which do not emit any pollutants.

Pollutant emissions from these indirect sources are a small fraction of the total emissions from Pantex Plant. Therefore, air quality impacts resulting from pit storage activities would be negligible.

Environmental Restoration Activities

In May 1994, Pantex Plant was placed National Priorities List by EPA. The motivations for cleanup of these sites protect the general environment and to the health and safety of persons in prox the site.

Environmental restoration (ER) activ Pantex Plant are expected to generate cubic meters (1,010 cubic yards) of haz solid waste between 1997 and 2000 (see 4.13), most of which will be in the fo contaminated soil. The majority of activities are expected to be completed by

Remedial actions at Pantex Plant could handling of contaminated soil. This ha could result in fugitive dust emissions th carry inorganic particles and or constituents that are contained in or are ad to the dust.

Soil handling can also lead to enhanced volatile organic emissions due to expos the contaminated soil to the atmosp Specific activities with emission pot include excavation, transport, dumping, sto and grading.

Pantex Plant procedures for minimizing fu dust emissions would keep the impacts minimum. Thus, air quality impacts from activities would be reduced to a minimum would, therefore, be negligible.

Waste Management Activities

The principal sources of pollutant emis related to waste management activities a follows:

- Burning Ground.
- Drum sampling.
- Bulk transport.

The emissions from these sources were included in the site-wide dispersion modeling. As indicated previously, the results of the site-wide modeling indicated that the continued operation of Pantex Plant would produce only negligible impacts to the regional and local air quality (see section 4.7.2.1).

4.7.2.2 *Impacts of New Facility Construction Upgrades*

Construction Impacts

During the construction phase of the new facility upgrades, exhaust emissions from construction equipment would consist of CO, VOCs, NO_2, SO_2, and particulate matter. The calculation of emission rates of exhaust pollutants from construction equipment was based on emission factors provided in the EPA document AP–42, *Compilation of Air Pollutant Emission Factors* (EPA 1995b, volume 2, Table II-7.1). For highway vehicles (worker commuting vehicles and delivery vehicles) emission factors were obtained from the EPA Mobile Source Emission Factor Model (MOBILE 5a) (EPA 1994).

Construction equipment composition that was assumed for the peak construction year, 1999, is shown in Table 4.7.2.2–1. (See section 3.1.1 for description of facility upgrade projects.) Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors, which include silt and moisture content of the soil, wind speed, and area disturbed. A common procedure to estimate fugitive emissions from an entire construction site is to use the EPA emission factor of 1.2 tons per acre per month of construction activity (EPA 1995b, volume 1, Section 13.2.3.3). This emission factor represents particles less than 30 microns in diameter. A multiplication factor of 0.5 was used to correct the emission rate to one for PM_{10} (EPA 1995b, volume 1, Page 13.2.2-3). Also, it was assumed that water would be applied to disturbed areas. This would reduce emission rates by about 50 percent (EPA 1985). It was estimated that construction of the facilities would disturb a total of 3.2 hectares (7.9 acres) over the construction period. It was assumed that the disturbance would occur in the first 2 years, 1998 and 1999, of the construction period.

TABLE 4.7.2.2–1.—*Assumed Equipment Used for Construction of New Facility Upgrades for 1999, the Peak Construction Year*

TYPE OF EQUIPMENT	NUMBER USED DAILY
Bulldozer	3
Grader	1
Front-End Loader	3
Backhoe	2
Roller	2
Crane	1
Portable Generator	3
Off-Highway Truck	3

The estimated annual pollutant emissions resulting from construction activities for the years 1998 through 2004 are presented in Table 4.7.2.2–2. Construction emissions during the peak year, 1999, increase the Pantex Plant annual emissions (see Table 4.7.1.3–7) by about 8 to 13 percent. The emission increases for the other construction years (1998, 2000, and 2001) are less. These temporary increases are too small to result in violations of the NAAQS beyond the Pantex Plant boundary. Therefore, air quality impacts resulting from construction of the new facility upgrades would be negligible.

Operations Impacts

Emissions resulting from the operation of the new or upgraded facilities have been mostly accounted for in the site-wide air quality analysis for continued operations under the

**TABLE 4.7.2.2–2.—*Estimated Annual Pollutant Emissions Related to Construction Acti New Facility Upgrades for the Period 1998 Through 2000 in metric tons (tons) per y*

YEAR	CO	NO_2	VOC	SO_2	PM_{10}
CONSTRUCTION EXHAUST					
1998	5.16 (5.69)	14.11 (15.55)	1.46 (1.61)	1.41 (1.55)	1.06 (1.17)
1999	8.33 (9.18)	22.77 (25.10)	2.34 (2.59)	2.27 (2.50)	1.71 (1.88)
2000	6.63 (7.31)	18.12 (19.97)	1.87 (2.06)	1.81 (1.99)	1.36 (1.50)
CONSTRUCTION WORKER AND DELIVERY VEHICLES					
1998	35.81 (39.47)	8.24 (9.09)	4.06 (4.51)	—	—
1999	58.01 (63.95)	13.84 (15.26)	6.65 (7.33)	—	—
2000	45.92 (50.62)	10.49 (11.56)	5.24 (5.78)	—	—
2001	8.51 (9.38)	2.16 (2.38)	0.98 (1.08)	—	—
FUGITIVE DUST FROM SOIL DISTURBANCE					
1998	—	—	—	—	1.096 (1.20)
1999	—	—	—	—	1.02 (1.12)
TOTAL					
1998	40.97 (45.16)	22.35 (24.64)	5.55 (6.12)	1.41 (1.55)	2.15 (2.37)
1999	66.34 (73.13)	36.61 (40.36)	8.99 (9.92)	2.27 (2.50)	2.73 (3.00)
2000	52.55 (57.93)	28.61 (31.53)	7.11 (7.84)	1.81 (1.99)	1.36 (1.50)
2001	9.73 (10.72)	5.47 (6.03)	1.32 (1.46)	0.33 (0.36)	0.24 (0.27)

Source: Calculated values

Proposed Action (section 4.7.2.1). Emissions from the Materials Compatibility and Assurance Facility, the Metrology and Health Physics Calibration and Acceptance Facility, the Nondestructive Evaluation Facility, and the Gas Analysis Laboratory currently occur at Pantex Plant. The only change in their emissions would be a change in their location.

The HWTPF and Pit Reuse Facility would be new facilities. The HWTPF and Pit Reuse Facility will use high efficiency particulate air (HEPA) filters to reduce particulate emissions. The HEPA filters have a collection efficiency of 99.97 percent. Activated charcoal canisters or equivalent equipment would be used to absorb organic gases at the HWTPF. These filter systems are capable of controlling both radioactive and nonradioactive pollutants. Since the emissions from this facility would be reduced to very low levels, air quality impacts would be negligible.

Overall, the emissions from these ne upgraded facilities would not produce am concentrations that would exceed the NA or the Texas ESLs. In addition, no increa radiological emissions are antici Therefore, the air quality impacts wo negligible.

4.7.2.3 *Summary of Impacts*

An analysis of pollutant emissions and am concentrations resulting from Proposed A activities found that air quality standa guidelines would not be violated beyo Pantex Plant boundary. Specifically, max ambient concentrations that would occur a 11 residences near the boundary were fo be below the NAAQS and Texas E Therefore, air quality impacts resulting fro Proposed Action would be negligible.

4.7.3 Impacts of No Action Alternative

Weapon-Related Activities

The major difference between this alternative and the Proposed Action is that weapons disassembly operations would cease when 12,000 pits have been placed in interim storage at Pantex Plant. However, the requirement to support the weapons stockpile with other operations, including weapons assembly, modification, and surveillance activities will continue. Three weapon levels—2,000, 1,000, and 500—are assumed for analysis. In addition, no upgrade projects would be initiated under the No Action Alternative. Therefore, there would be no emissions from construction under this alternative.

Since the activities related to the assembly of weapons produce chemical and radiological pollutant emissions similar to those produced by disassembly, the ambient concentrations resulting from the three levels of weapons for this alternative would be approximately the same as those described in the Proposed Action (section 4.7.2.1). No operational emissions or air quality impacts above those described in the affected environment would occur because new facility upgrades would not be implemented under this alternative. Therefore, it may be concluded that the air quality impacts resulting from continued operation under the No Action Alternative would be similar to the Proposed Action; i.e., impacts would not be significant.

Pit Storage Activity (12,000 Pits Only)

The emissions resulting from pit storage activity would be the same as those for the Proposed Action (section 4.7.2.1). Indirect emissions from Safe Secure Tractor Trailers hauling weapons or pits to Pantex Plant would be only a small fraction of the total Pantex Plant emission inventory. Also, once the storage limit of 12,000 pits has been reached, the emissions related to this activity would cease. Thus air quality impacts resulting from the storage of 12,000 pits would be negligible.

Environmental Restoration Activities

ER activities under the alternative would proceed in the same manner as under the Proposed Action (section 4.7.2.1). Emissions related to soil disturbance activities would be minimized through the application of water. Particulate emissions would not cause PM_{10} standards to be violated offsite. Air quality impacts would be negligible.

Waste Management Activities

Waste management activities under this alternative would be the same as under the Proposed Action. The emissions from these activities were included in the site-wide dispersion modeling for the Proposed Action. Air quality impacts for waste management activities under this alternative would also be negligible.

4.7.4 Impacts of Pit Storage Relocation Alternative

4.7.4.1 *Impacts of Relocating 20,000 Pits*

The Pit Storage Relocation Alternative includes all operations, upgrades, and modifications of the Proposed Action. Emissions resulting from activities related to the relocation of 20,000 pits would be added to those of the Proposed Action (see section 4.7.2.1). Indirect emissions from exhausts of the vehicles required to haul the pits to the alternative sites would be the only chemical or radiological emissions associated with the Pit Storage Relocation Alternative. These additional pollutant emissions would constitute a small fractional increase in the site-wide emission inventory of the Proposed Action. This small emission increase would not produce any detectable change in the ambient concentrations described in the Proposed

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usable plutonium and HEU, as well as the storage site(s), would be decided. The storage alternatives include upgrading the existing plutonium storage facilities, consolidation of plutonium from other sites, and collocation of plutonium and HEU storage. The collocation alternative is used for analysis purposes in this EIS as the bounding storage alternative.

Under the S&D PEIS Collocation Alternative, construction of new storage facilities would be required in order to store plutonium and HEU at Pantex Plant. Increased PM_{10} and total suspended particle concentrations may occur during the peak construction period, particularly during dry and windy conditions. Appropriate control measures would be followed to minimize pollutant concentrations during construction. Concentrations of all pollutants at the site boundary would remain within applicable Federal and State ambient air quality standards. During operation, concentrations of criteria and toxic or hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines (DOE 1996a:chapter 4).

For the disposition alternatives in the S&D PEIS, the emphasis at this stage in the NEPA decision process is on choosing the strategy and technology mix rather than the actual site. The evolutionary Light Water Reactor is used for analysis purposes in this EIS as the bounding Disposition Alternative. Implementation of this disposition alternative would require the construction and operation of a pit disassembly and conversion facility, plutonium conversion facility, MOX fuel fabrication facility, and one or more light water reactors. The bounding alternative also assumes that all of the facilities previously mentioned would be collocated at the same site (potentially Pantex Plant).

4.7.6 Potential Mitigation Measures

Although the air emissions do not involve significant impacts, DOE used Best Available Control Technology as defined in TNRCC regulation and will continue to do so, to identify operational areas where improvements can be made in the management practices. An example is the ongoing substitution of newer, more environmentally benign cleaning solvents.

DOE may chose one or more of the following measures to alleviate the temporary dust emissions from construction activities. These measures could include covering, watering, or applying nontoxic solid binders to exposed piles of gravel, sand, dirt; and suspending all excavation and grading operations when wind speeds are exceedingly high.

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4.8 ACOUSTICS (NOISE)

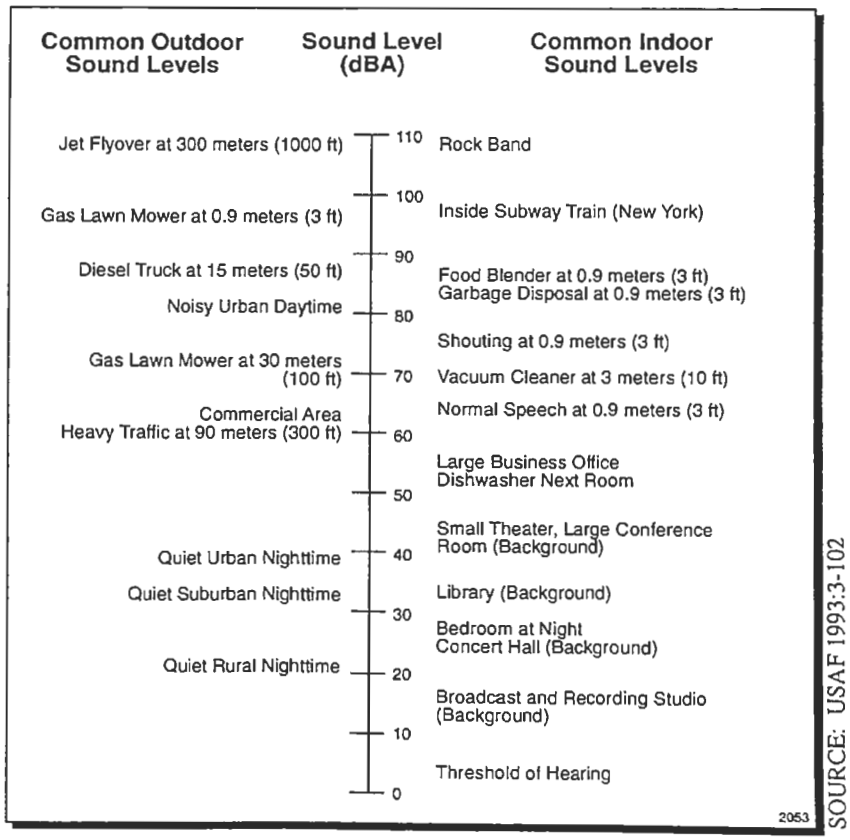
4.8.1 Affected Environment

This section addresses noise issues at Pantex Plant. The characteristics of sound include parameters such as amplitude, frequency, and duration. The decibel (dB), a logarithmic unit that accounts for large variations in amplitude, is the accepted standard unit measurement of sound. Different sounds have different frequency content.

When measuring sound to determine its effects on the human population, A-weighted sound levels (dBA) are typically used to account for the response of the human ear. A-weighted sound levels represent adjusted sound levels. The adjustments are made according to the frequency content of the sound. Examples of typical A-weighted sound levels are shown in Figure 4.8.1–1.

Another sound scale is the C-weighted scale (dBC). In contrast to the A-weighted scale, the C-weighted scale provides no adjustment to the noise signal over most of the audible frequency range. The C-weighted scale is generally used to measure impulsive noise such as airblasts from explosions, sonic booms, and gunfire.

Noise is usually defined as sound that is undesirable because it interferes with speech, communication, or hearing; is intense enough to damage hearing; or is otherwise annoying. Noise levels often change with time. To compare levels over different time periods, several descriptors were developed that take into account this time-varying nature. These descriptors are used to assess and correlate the various effects of noise on man, including land use compatibility, sleep and speech interference, annoyance, hearing loss, and startle effects.



SOURCE: USAF 1993:3-102

FIGURE 4.8.1–1.—*Comparative A-Weighted Sound Levels.*

The day-night average sound level (DNL) (also written as L_{dn} in equations) was developed to evaluate the total community noise environment. The DNL is the average A-weighted sound level during a 24-hour period with 10 dB added to nighttime levels (between 10:00 p.m. and 7:00 a.m.). This adjustment is added to account for the increased human sensitivity to nighttime noise events. The DNL was endorsed by the Environmental Protection Agency and is mandated by the U.S. Department of Housing and Urban Development, the Federal Aviation Administration, and the Department of Defense for land use assessments.

The DNL is sometimes supplemented with other metrics, primarily the equivalent sound level (L_{eq}). The L_{eq} is the equivalent, steady state level that would contain the same acoustical energy as the time-varying level during the same time interval.

Frequently, statistical values of noise levels are used to describe a time-varying noise measured in dBA. The noise variation is described in terms of the percentage of time a given noise level is exceeded. The L_{eq} values usually used are L_{10}, L_{50}, and L_{90}, the noise levels that are exceeded 10, 50, and 90 percent of the time, respectively. L_{10} gives an indication of the top end of the level range though it ca substantially less than the occasio (L_{max}). L_{90} corresponds to the ba noise level in the absence of near sources. L_{50} is the median noise level

Table 4.8.1–1 shows how differences i magnitudes are perceived. Differen long timespans, such as before and project requiring several years to comp more difficult to judge. Consequen changes that take place over a long p time, sound level shifts of 5 dBA or m be "barely perceptible."

Except for the prohibition of nuisance neither the State of Texas nor its governments have established s numerical environmental noise st applicable to Pantex Plant. H community annoyance surveys have pro basis for establishing guidelines for levels compatible with various land uses 4.8.1–2 shows land uses that are defined Federal Aviation Administration a Federal Interagency Committee on Urba as normally compatible with various exposures. This table is used to a compatible planning around airports a appropriate for evaluating exposures from noise sources. The guidelines a

TABLE 4.8.1–1.—*Subjective Response to Changes in Sound Level*[1]

CHANGE IN SOUND LEVEL	PERCEIVED CHANGE IN LOUDNESS
±1 dB	Requires close attention to notice
±3 dB	Barely perceptible
±5 dB	Quite noticeable[2]
±10 dB	Dramatic; sounds nearly twice or half as loud
±20 dB	Striking; fourfold change in loudness

[1]Comparative judgments of sounds presented within a short timespan
[2]OSHA considers a 5 dB increase to represent a doubling of acoustic energy effects on hearing.

Source: GSA 1995:3-58

4.8.1.1 *Ambient Noise Levels*

A survey of outdoor ambient sound levels at Pantex Plant, both onsite and offsite, was conducted September 8–16, 1994. During this time a total of 11 locations were selected as representative of onsite sound levels and the noise environment of offsite receptors. Figure 4.8.1.1–1 shows the measurement locations that are representative of those adjoining Pantex Plant and the location of points for which acoustic modeling was used to predict noise from blasts at firing sites. The figure also shows those onsite noise sources that have been identified as audible at offsite locations. These sources are the high explosive(s) (HE) firing sites and the target range used by Pantex Plant's Security and Courier sections. The summer-autumn sound survey was augmented with an autumn-winter survey conducted December 1–3, 1994. At this time, four locations (J, K, L, and M) were added, and measurements were made at these and one of the previously monitored locations, location F.

Traffic is the primary source of noise at the site boundary and at residence near roads. As shown in Table 4.8.1.1–1, L_{eq} levels ranged from 38 to 58 dBA. Onsite noise L_{eq} levels generally ranged from 40 to 60 dBA. However, measurements which were C-weighted indicated noise levels at a distance of 366 meters (1,200 feet) from the target ranges of 70 to 103 dBC (Pantex 1996:11.2.1, 11.2.3). A summary of the noise measurements is presented in Table 4.8.1.1–1.

4.8.1.2 *Occupational Noise*

Representative occupational noise levels are summarized in Table 4.8.1.2–1. The noise levels are representative of exposure-monitoring data obtained in the hearing conservation program. In addition to industrial noise exposure, the data include noise exposure of Security and DOE Courier section personnel while maintaining weapons proficiency.

4.8.1.3 *Noise from High Explosive Detonation*

Pantex Plant detonates explosive charges in open air. These charges generally vary in weight from 2 to 21 kilograms (5 to 47 pounds). During 1994, Pantex Plant detonated 60 charges of HE (Pantex 1996:11.2.2). The maximum HE charge exploded was 24.9 kilograms (55 pounds). In October 1995, during an emergency preparedness training exercise, a charge greater than 24.9 kilograms (55 pounds) of HE was detonated. Since the plant does not typically detonate charges larger than 25 kilograms (55 pounds) of HE equivalent, that size charge was modeled for various wind speeds. Should a larger charge be exploded in the future, the plant would perform appropriate NEPA review for that charge.

Airblast noise resulting from the detonation of HE is impulsive in nature and generally lasts less than a second in duration. Although the duration of individual blasts is short, the rapid onset of such sounds could be a source of discomfort to many persons. In addition, the vibration of buildings and other structures induced by the noise impulse could be a source of increased annoyance. This vibration and the rapid onset produce "startle" effects.

The noise produced by airblast results from the generation of shock waves. Figure 4.8.1.3–1 depicts a typical blast impulse, which consists of an abrupt compression (characterized by an extremely short rise time) followed by a gradual pressure reduction to below ambient pressure, and finally a recovery to ambient. The overpressure (and therefore the noise level) is a function of the source strength (charge weight), meteorological conditions, and distance to observer. For explosions aboveground, propagation of the airblast is influenced by wind and temperature gradients, which can create focusing effects.

Irrigation pumps, aircraft, truc

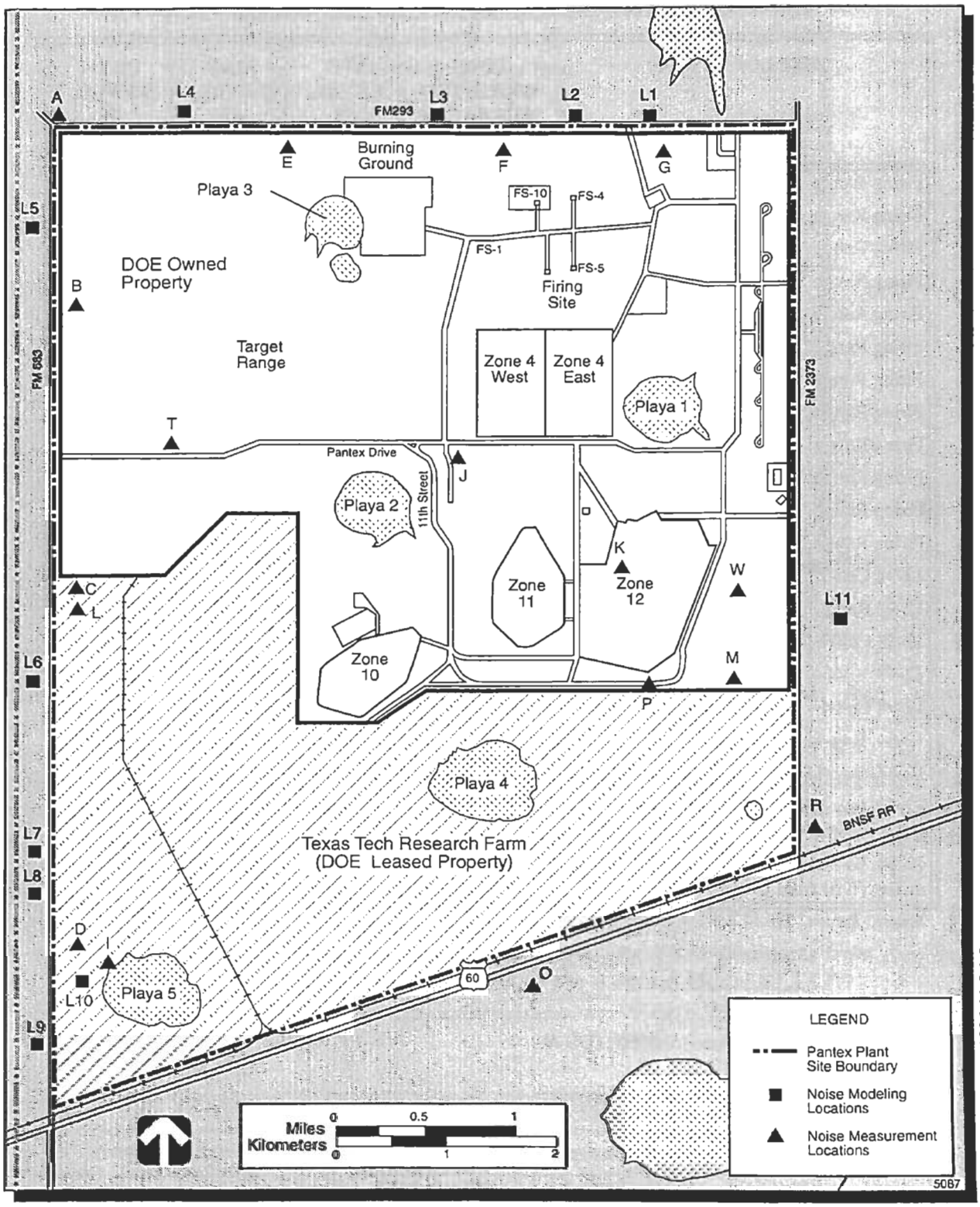
TABLE 4.8.1.1–1.—*Summary of Noise Measurements (dBA) at and in the Vicinity of Pantex Plant*-Continued

LOCATION	MONTH/ DAY	TIME	L_{max}	L_{min}	L_{eq}	L_{90}	L_{50}	L_{10}	TOTAL BAND HERTZ (Hz)	COMMENTS
F (cont.)	4/12	1356	76	38	51	42	45	51		Irrigation pumps, tractor plowing
	6/20	1410	79	29	56	38	45	53		3 autos, 1 truck, 1 aircraft
	6/21	1150	80	34	53	42	48	56		This and the following two
	6/21	1220	75	32	51	40	45	51		measurements were made during
	6/21	1250	81	31	53	39	45	50		blast noise measurements.
G	9/12	1112	50	35	41					Microphone height 12 inches
		1127	54	35	39					rather than normal 60 inches
	6/20	1314	82	28	55	41	48	54		
I	9/13	0745	77	45	60					23 Autos, 1 truck, 1 train
		0823	73	45	55					One plane, IBP[1] roar, 3 autos
		0845	68	42	52					One truck
	4/11	1610	75	38	61	47	56	66		Aircraft, autos, truck
	6/20	1215	78	34	55	45	50	57		180 autos and light trucks, 8 autos, motorcycle, aircraft
J	12/3	1035	65	29	45	33	35	41		One 30-minute measurement, includes visit by security
K	12/3	0650	72	44	52	46	48	55		Two 30-minute measurements
		0720	73	44	55	47	50	57		12 cars 1st run, 17 cars 2nd
	4/11	0855	68	43	51	46	49	53		Cranes and other construction sounds
	4/12	1450	60	39	40	42	44	47		Same except wind N, not W
L	12/2	0555	79	25	57	27	30	51		Two 30-minute measurements
		0625	83	28	65	35	52	68		Eight cars 1st run, 52 cars 2nd
	4/12	1205	67	27	44	29	37	46		Seven Autos, 4 aircraft
	6/20	0915	84	44	57	50	53	55	Birds and Insects	Three autos, 2 trains, 4 aircraft
M	12/2	1725	·59	34	40	33	37	44		Two 30-minute measurements
		1755	70	34	48	34	36	43		Aircraft, trains, migrating birds
	4/11	1812	69	32	50	40	47	53		Commuter traffic on FM 2373

TABLE 4.8.1.1–1.—*Summary of Noise Measurements (dBA) at and in the Vicinity of Pantex Plant*-Continued

LOCATION	MONTH/ DAY	TIME	L_{max}	L_{min}	L_{eq}	L_{90}	L_{50}	L_{10}	TOTAL BAND HERTZ (Hz)	COMMENTS
M (cont.)	6/20	1018	61	42	52	49	52	55	Birds and Insects	Five aircraft, cars and truck
O	4/11	1150	66	32	51	42	48	55		Eleven heavy trucks, 120 cars, 2 jets
	6/21	0614	64	44	54	51	54	57		Maximum per min.: 10 autos, 7 trucks
		0650	71	48	57	52	55	59		Maximum per min.: 15 autos, 7 trucks
		0720	72	42	53	57	51	56		Maximum per min.: 18 autos, 5 trucks
		0750	70	40	51	44	47	54		Maximum per min.: 9 autos, 0 trucks
P[2]	9/16	0905	49	45	46				63 Hz, 53 dB	Pure tone and harmonics audible
R	4/12	0638	75	41	62	53	61	64		19 cars and light trucks/min.
		0708	74	43	61	55	61	64		16.5 vehicles/min., 2 trucks, 2 trains
		0738	71	42	60	49	59	64		Continued commuter traffic
		0820	74	41	54	45	49	58		Lighter traffic, 3 trains
	6/20	1524	72	36	53	43	49	57		Maximum 5 vehicles per minute
		1554	80	39	57	46	53	59		Maximum 8 vehicles per minute
		1624	73	44	58	51	57	61		Maximum 24 vehicles per minute
T	9/16	0815	98							Distance from source to
		–	97							microphone approximately 1,200 feet
		–	94							
		–	102							The first 5 measurements
		0832	103							are peak C-weighted
		0834	70							
W[3]	9/15	1045	70	37	54				125 Hz 47 dB 250 Hz, 36 dB Minimum levels	Pure tone and harmonics are audible

[1]IBP - Iowa Beef Processors plant
[2]P - Persing Drive, on road adjacent to industrial area.
[3]W - Washington Street, on road [illegible] to industrial [illegible]



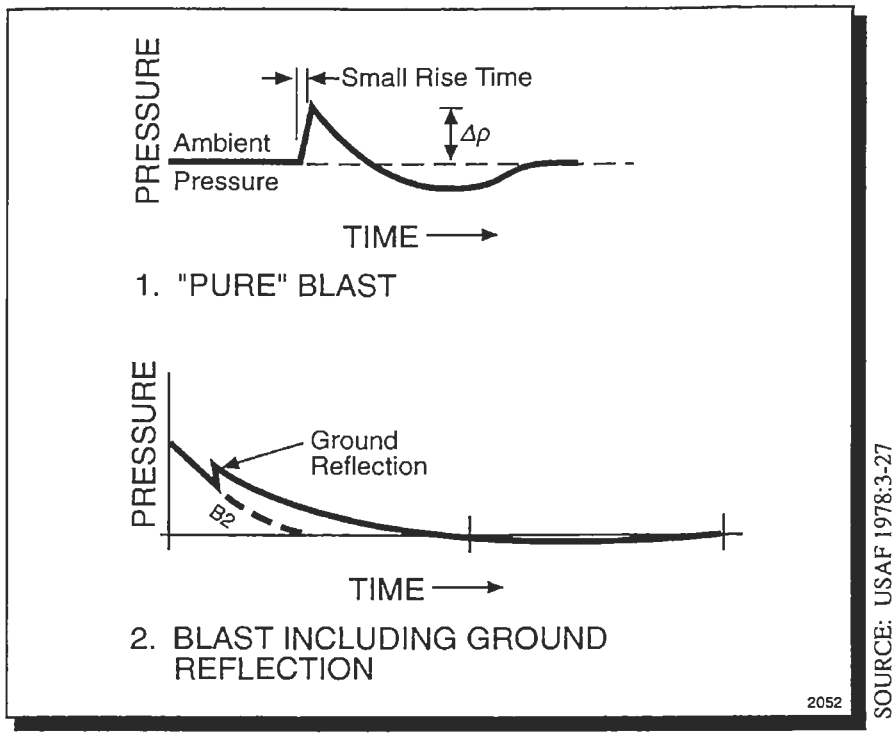
SOURCE: Pantex 1996:11.2.1.2.

FIGURE 4.8.1.1–1.—***Boundary Roads of Pantex Plant Site, Noise Modeling Locations, and Noise Measurement Locations.***

TABLE 4.8.1.2–1.—*Representative Employee Noise Exposure at Pantex Plant*

TEST LOCATION	TIME WEIGHTED AVERAGE, dB	AVG. LEVEL, dB	MAX LEVEL, dB	PEAK LEVEL, dB
Firing Range	80.7	75.4	116.8	Overload
Firing Range	83.1	89.2	120.1	Overload
Firing Range	84.1	90.0	119.8	Overload
Firing Range	81.7	75.2	117.2	Overload
Firing Range	91.8	100.6	129.0	Overload
Firing Range	94.8	103.7	133.0	Overload
Firing Range	95.7	103.9	130.2	Overload
Firing Range	80.7	75.4	116.8	Overload
Firing Range	84.1	90.1	119.8	Overload
Firing Range	83.1	89.2	120.1	Overload
Firing Range	84.1	90.0	119.8	Overload
Firing Range	81.7	75.2	117.2	Overload
12-98 Cell-2	56.0	58.4	108.6	138.2
12-98 Ramp	69.0	71.4	114.1	140.7
12-98 Cell-1	53.7	55.9	98.0	128.7
12-49	79.0	81.0	118.9	136.1
12-98 Cell-1	78.6	80.6	113.2	133.5
12-64, Bay-11	93.6	95.5	122.2	Overload
12-54, Bay-11	84.4	86.7	117.8	134.7
12-64, Bay 11/W28 Sleeve Removal —1.8 meters (6 ft) from Unit	85.8	87.5	120.3	Overload
12-64, Bay 11/W28 Sleeve removal —1.8 meters (6 ft) from Unit	67.3	86.9	100.2	124.5

Source: Pantex 1996:11.2.6-1



SOURCE: USAF 1978:3-27

FIGURE 4.8.1.3–1.—*Typical Blast Impulses.*

There is no record of measurements of noise levels or overpressures made in connection with Pantex Plant detonations. Therefore, an airblast prediction model called BLASTO was used to estimate the overpressures resulting from Pantex Plant HE detonations (Reed 1995:1-17). A neutral lapse rate was assumed. Overpressures (dB) and their downwind distances from the source are presented for three wind speeds in Table 4.8.1.3–1. As shown in the table, the maximum size of Pantex Plant HE detonations could be audible out to distances of 5 to 10 kilometers (3 to 6 miles), depending on atmospheric conditions.

TABLE 4.8.1.3–1.—*Summary of Overpressures and Their Distances from the Source at Pantex Plant Predicted by the Airblast Model BLASTO*

WEIGHT OF EXPLOSIVE CHARGE (kg)		WIND SPEED (km/hr)		
24.9 (55 lb)	11.3 (25 lb)	4.28 (6.9 mph)	7.15 (11.5 mph)	11.42 (18.4 mph)
OVERPRESSURE (dB)		DISTANCE FROM SOURCE (meters)		
140	137.7	1,100 (3,608 ft)	1,490 (4,888 ft)	2,200 (7,218 ft)
133	131.7	2,200 (7,218 ft)	2,900 (9,514 ft)	5,200 (17,060 ft)
128	125.7	4,400 (14,436 ft)	6,200 (20,341 ft)	>10,000 (>32,808 ft)

Source: Reed 1995:1-17

4.8.2 Impacts of Proposed Action

4.8.2.1 *Impacts of Continued Operations*

Operations are assumed to continue at any of the three potential annual activity levels for the approximately 10-year period examined in this EIS. The three activity levels are for operations on 2,000, 1,000, and 500 weapons per year.

Noise levels onsite and near the Pantex Plant boundary for operations on 2,000 weapons per year would be about the same as those which currently exist (see section 4.8.1.1). Noise sources would consist of vehicular traffic, industrial facilities, aircraft overflights, and railroad trains. Traffic is the primary source of noise at the site boundary and at residences near the Farm-to-Market (FM) roads adjacent to Pantex Plant boundary. Noise levels (L_{eq}) range from 40 to 60 dBA. Target range noise at 366 meters (1,200 feet) ranged from 70 to 103 dBC. Aircraft overflights can produce maximum noise levels of 90 dBA (Pantex 1996:11.2.1 and 11.2.6).

A reduction to operations on 1,000 and 500 weapons per year would produce some decrease in noise levels because of reduced traffic, resulting from fewer employees commuting to and from work. Noise from HE detonations would continue for all three levels of weapon operations. On the other hand, the frequency of explosive tests would decrease as the level of weapons decreased.

Except for airblast noise, noise levels at the Pantex Plant boundary for all three levels of weapon operations would be below the 65 dBA guideline level (see section 4.8.1). Thus noise impacts from the usual noise sources at Pantex Plant would be negligible. Airblast noise resulting from detonation of HE would continue for the 2,000 weapons level at about the same frequency that is currently used at Pantex Plant.

The reduction of weapons levels to th and 500 unit levels would likely result i HE detonations. Since current levels detonations have not generated significa impacts at any of the residences near the Plant boundary, continued operations therefore, not produce significant noise i at these sensitive receptors.

Pit Storage Activities

The principal noise source from pit s activities would be the tractor-trailers t haul the weapons or pits to Pantex Plan number of tractor-trailers would be a very fraction of the total traffic generated by P Plant (less then 0.2 percent). Overall noise increases resulting from pit storage act would not be detectable by the human ea Table 4.8.1–1). Therefore, noise impacts pit storage activities would be negligible.

Environmental Restoration Activities

Environmental restoration activities will re various types of construction equipme cleanup hazardous waste sites on Pantex P Types of equipment would include bulld backhoes, front-end loaders, drill rigs, dump trucks. Noise levels in the imme vicinity (15 meters [50 feet]) of the remedi site would range from 80 to 90 dBA.

These noise levels would be reduced to 45 dBA at 914 meters (3,000 feet) from remediation area. This is the approxi distance from a remediation site to the nea residence. These noise levels are about same as the ambient noise levels existing at residences near the Pantex Plant bound Thus, noise levels generated by restora activities on Pantex Plant would not noticeable at the sensitive receptors outside plant boundary. Noise impacts fr environmental restoration activities, therefo would be negligible.

Waste Management Activities

Sources of noise from waste management activities are trucks which haul waste offsite, a garbage truck, a document incinerator, and two compactors. About one truck per week is used to haul waste offsite. Onsite sources are at sufficient distance from the Pantex Plant boundary that noise originating from these sources would not be detectable at the boundary or at any of the sensitive receptors outside the boundary. Therefore, noise impacts from waste management activities would be negligible.

4.8.2.2 *Impacts of New Facility Construction and Upgrades*

Noise sources during the new facility construction and upgrade would include heavy-construction and increased traffic. Small increases in traffic would occur onsite and along offsite transportation routes used to bring construction material and workers to the site. Small increases in noise levels would occur at the residences located along FM Roads 2373 and 683. Noise levels would be below the 65 dBA level specified as acceptable in the Federal Interagency Committee or Urban Noise guidelines (see section 4.8.1). Due to the size of the site, noise emissions from construction and operation activities of the facilities would not be expected to cause annoyance to the public. Therefore, noise impacts associated with construction and operation of the new facilities would be negligible.

4.8.2.3 *Summary of Impacts*

Noise levels associated with the Proposed Action may be increased slightly during construction activities. Operational noise levels from operations on 2,000 weapons per year would be approximately the same as the noise levels which currently exist onsite and offsite. Airblast noise levels from HE detonations would also continue at current levels. The reduction to the 1,000 and 500 weapons per year levels would reduce noise levels a few decibels. Therefore, noise impacts associated with the Proposed Action would be negligible.

4.8.3 Impacts of No Action Alternative

Noise sources for the No Action Alternative would be similar to those of the Proposed Action. Three levels of activity, operations on 2,000, 1,000, and 500 weapons per year, are assumed for the No Action Alternative. The major difference between this alternative and the Proposed Action is that weapons disassembly operations would cease when 12,000 pits have been placed in storage at Pantex Plant. Construction of new facilities would not take place under the No Action Alternative. Therefore, construction noise levels would be less than those described for the Proposed Action (see section 4.8.2). HE detonations would continue at about the same level as would occur under the Proposed Action.

Noise impacts for this alternative would therefore be approximately the same as the Proposed Action; i.e., they would be negligible.

Pit Storage Activity

Impacts of pit storage activities under this alternative would be the same as the Proposed Action until the 12,000 pits are stored. After this storage level is achieved, transportation of pits to other facilities would occur. Overall, the noise levels resulting from these activities would be about the same as the Proposed Action. Noise impacts for pit storage activities under this alternative would, therefore, be negligible.

Environmental Restoration Activities

Noise sources and resulting noise levels associated with environmental restoration under this alternative would be the same as those

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4.8.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, noise impacts from operations are expected to be less than current impacts. Under the downsizing alternative, facilities would be consolidated. The noise impacts would be equivalent to the No Action Alternative. Under the relocation alternative, noise from assembly and disassembly operations and HE fabrication would cease.

4.8.5.3 *Impacts of Alternatives in the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*

The S&D PEIS is considering Pantex Plant for long-term storage of inventories of nonsurplus weapons-usable plutonium and highly enriched uranium (HEU), storage of inventories of surplus weapons-usable plutonium and HEU pending disposition, and disposition of surplus weapons-usable plutonium. For storage, the strategy for long-term storage of weapons-usable plutonium and HEU, as well as the storage site(s), would be decided. The storage alternatives include upgrading the existing plutonium storage facilities, consolidation of plutonium from other sites, and collocation of plutonium and HEU storage. The collocation alternative is used for analysis purposes in this EIS as the bounding storage alternative.

Under the S&D PEIS Collocation Alternative, construction of new storage facilities would be required in order to store plutonium and HEU at Pantex Plant. Nontraffic operational noise sources associated with the consolidation of plutonium and collocation of plutonium and highly enriched uranium alternatives include additional equipment and machines. These noise sources would be located at sufficient distance from offsite areas that the contribution to offsite noise levels would be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public.

For the disposition alternatives in the S&D PEIS, the emphasis at this stage in the NEPA decision process is on the strategy and technology mix rather than the actual site. The evolutionary Light Water Reactor is used for analysis purposes in this EIS as the bounding disposition alternative. Implementation of this disposition alternative would require the construction and operation of a pit disassembly and conversion facility, plutonium conversion facility, mixed oxide fuel fabrication facility, and a light water reactor. The bounding alternative also assumes that all of the facilities previously mentioned would be collocated at the same site (potentially Pantex Plant).

Nontraffic operational noise sources associated with the Disposition Alternative includes additional equipment and machines. These noise sources would be located at sufficient distance from offsite areas that the contribution to offsite noise levels would be small. Due to the size of the site, noise emissions from construction equipment and operations activities would not be expected to cause annoyance to the public (DOE 1996a:chapter 4). However, should Pantex Plant be selected as the site for such a facility, further NEPA review

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4.9 BIOTIC RESOURCES

4.9.1 Affected Environment

The biotic resources considered in this section consist of the following components: terrestrial resources, aquatic resources, wetland resources, and protected and sensitive species. Scientific names of threatened and endangered species are presented in Table 4.9.1–1 while those for nonthreatened and nonendangered species are presented in Table 4.9.1–2.

4.9.1.1 *Terrestrial Resources*

Vegetation

Pantex Plant Site is located within the Southern High Plains whose vegetation is characterized as shortgrass prairie (DOE 1993b). The shortgrass prairie is dominated by two grass species: blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*). Other typical, less abundant grass species include sideoats grama (*Bouteloua curtipendula*), western wheatgrass (*Agropyron smithii*), vine mesquite (*Panicum obtusum*), and silver bluestem (*Bothriochloa laguriodes*) (Pantex 1996:7.1). Much of the native shortgrass prairie has been converted and used for agricultural purposes, primarily crop cultivation and cattle grazing (Haukos 1994:85). The current state of the altered shortgrass prairie at Pantex Plant ranges from unvegetated, in the south-central region, to a variety of species elsewhere on the site.

The dominant vegetation on the uplands surrounding Playas 3, 5, and Pantex Lake is buffalograss, while the uplands surrounding Playa 1 support buffalograss, blue grama, and prickly pear (*Opuntia macrorhiza*). The area south of Playa 1 contains a small grove of crabapple (*Malus sylvestris*), Asiatic honeysuckle (*Lonicera tatarica*), and Russian olive (*Elaeagnus angustifolia*). Playa 2 uplands support buffalograss, blue grama, and silver bluestem; and Playa 4 uplands consist of buffalograss and blue grama. The Texas Tech University Farms headquarters area has grass lawns with planted mimosa tree (*Albizia julibrissin*), Siberian elm (*Ulmus pumilia*), and black locust (*Robinia pseudoacacia*). The previously cultivated southeastern portion of Pantex Plant is dominated primarily by silver bluestem and rare individuals of yankee weed (*Eupatorium compositifolium*). The west-central region of Pantex Plant has vegetative composition of predominantly kochia (*Kochia scoparia*) and pigweed (*Amaranthus sp.*), with lesser extents of buffalograss, planted Siberian elm, and cottonwood (*Populus deltoides*) (DOE 1993b:7-31, 7-44).

Pantex Plant has historically monitored radionuclide levels in both onsite and offsite vegetation. The 17 offsite and 5 onsite collecting locations are sampled for uranium and tritium isotope levels in primarily native and domestic grasses. The onsite stations and the offsite control station, at Bushland, Texas, are sampled monthly for comparison; the non-control offsite stations are sampled quarterly. No standards exist for uranium or tritium concentrations in vegetation; however, with few exceptions, concentrations at Pantex Plant in recent years have been comparable to the offsite vegetation monitored at Bushland (MH 1991:67, 75; Battelle 1992:4-38, 4-48; DOE 1994b:9-1, 9-2).

Radiological surveys of beef cattle raised on or near Pantex Plant Site have not been considered necessary based on the results of a study that showed routine operations do not pose a risk to the public from the consumption of these animals (LANL, 1982; 22-23; Pantex 1996:16.1). The study indicated that if beef consumption of 79 kg/yr is assumed, then the 50-yr dose commitment to an adult from ingestion of ground beef at 1.6×10^{-4} pCi/g weight would be 0.2 mrem to bone, 0.01 mrem to kidneys, and 0.01 mrem to liver. These values are 500 times below the radiation dose each year from natural background (LANL

TABLE 4.9.1–1.—*Federal and State Listed Threatened, Endangered, and Candidate Spe Occurring or Potentially Occurring at Pantex Plant*

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS CODE[1]	STATE STATU CODE[1]
SPECIES OBSERVED			
Birds			
Bald eagle	*Haliaeetus leucocephalus*	T	EE
Western burrowing owl	*Athene cunicularia hypugea*	SOC	NNL
Whooping crane	*Grus americana*	E	EE
Black tern	*Chlidonias niger*	SOC	NNL
Ferruginous hawk	*Buteo regalis*	SOC	NNL
Loggerhead shrike	*Lanius ludovicianus*	SOC	NNL
White-faced ibis	*Plegadis chihi*	SOC	T
Reptiles			
Texas horned lizard	*Phrynosoma cornutum*	SOC	T
Mammals			
Swift fox[2]	*Vulpes velox*	C	NL
SPECIES POTENTIALLY OCCURRING			
Birds			
American peregrine falcon	*Falco peregrinus anatum*	E	E
Interior least tern	*Sterna antillarum athalassos*	E	E
Mountain plover	*Charadrius montanus*	C	NL
Arctic peregrine falcon	*Falco peregrinus tundris*	E (S/A)	T
Migrant loggerhead shrike	*Lanius ludovicanus migrans*	SOC	NL
Baird's sparrow	*Ammodramus bairdii*	SOC	NL
Reptiles			
Smooth green snake	*Opheodrys vernalis*	NL	E
Texas garter snake	*Thamnophis sirtalis annectens*	SOC	NL
Mammals			
Cave myotis	*Myotis velifer*	SOC	NL
Longlegged myotis	*Myotis volans*	SOC	NL
Occult little brown myotis	*Myotis lucifugus occultus*	SOC	NL
Western small footed myotis	*Myotis ciliolabrum*	SOC	NL
Yuma myotis	*Myotis yumanensis*	SOC	NL
Plains spotted skunk	*Spilogale putorius interrupta*	SOC	NL

[1]Status codes: NL—Not listed; C—Federal candidate (probably appropriate to list); T—Threatened; E—Endangered; SOC—Species of concern (Species that may be of concern to the U.S. Fish and Wildlife Service (FWS) that do not receive *Endangered Species Act* recognition, but FWS encourages agencies to include in NEPA studies); S/A—protected under the similarity of appearances provision of the *Endangered Species Act* (16 U.S.C. 1531).
[2]Sighted in May 1996; tracks, scat, and probable dens located 1995.
Sources: TPW 1992; DOE 1993c; DOE 1994g; DOE 1996d; Pantex 1996:7.4

TABLE 4.9.1–2.—*Common and Scientific Names of Some of the Nonthreatened and Nonendangered Plants and Animals at Pantex Plant*

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
PLANTS		**PLANTS (CONTINUED)**	
blue grama	*Bouteloua gracilis*	snow-on-the-mountain	*Euphorbia marginata*
buffalograss	*Buchloe dactyloides*	vervain (prostrate)	*Verbena bracteata*
sideoats grama	*Bouteloua curtipendula*	hairy water clover	*Marsilea vestita*
western wheatgrass	*Agropyron smithii*	cocklebur	*Xanthium strumarium*
vine-mesquite	*Panicum obtusum*	Suckleya suckleyana	*Suckleya suckleyana*
silver bluestem	*Bothriochloa laguriodes*	goosefoot	*Chenopodium glaucum*
prickly pear (plains)	*Opuntia macrorhiza*	threeawn (purple)	*Aristida purpurea*
crabapple	*Malus sylvestris*	**INSECTS, PROTISTANS AND OTHER INVERTEBRATES**	
Asiatic honeysuckle	*Lonicera tatarica*	grasshoppers	*Orthoptera: Acrididae*
Russian olive	*Elaeagnus angustifolia*	beetles	*Coleoptera*
mimosa tree	*Albizia julibrissin*	true bugs	*Hemiptera*
Siberian elm	*Ulmus pumilia*	flies	*Diptera*
black locust	*Robinia pseudoacacia*	bees	*Hymenoptera*
yankee weed	*Eupatorium compositifolium*	wasps	*Hymenoptera: Vespidae*
kochia	*Kochia scoparia*	ants	*Hymeoptera: Formicidae*
pigweed	*Amaranthus sp.*	moths	*Lepidoptera*
cottonwood (eastern)	*Populus deltoides*	butterflies	*Lepidoptera: Papilionoidea*
cattail	*Typha angustifolia*	dragonflies	*Odonata: Anisoptera*
great bulrush	*Scirpus validus*	mayflies	*Ephemeroptera*
smartweed	*Polygonum pensylvanicum* *P. amphibium* *P. coccineum*	damselflies	*Odonata: Zygoptera*
		crayfish	*Crustacea*
		mollusks	*Mollusca*
pondweed	*Potamogeton nodosus*	leeches	*Annelida*
arrowhead	*Sagittaria montevidensis*	water mites	*Acarina*
spikerush	*Eleocharis macrostachya*	Chlorophyta	*Chlorophyta*
slim aster	*Aster subulatus*	Chrysophyta	*Chrysophyta*
western black willow	*Salix goodingii*	Cyanophyta	*Cyanophyta*
mallow	*Malvella leprosa*	Ciliophora	*Ciliophora*
ragweed	*Ambrosia grayii*	nematode worms	*Nematoda*
sunflower	*Helianthus annuus*	**REPTILES AND AMPHIBIANS**	
tumbleweed	*Salsola iberica*	Barred tiger salamander	*Ambystoma tigrinum mavoritum*
frog fruit	*Phyla cuneifolia*	Great Plains toad	*Bufo cognatus*
wheatgrass	*Agropyron sp.*	Woodhouse's toad	*Bufo woodhousei*

TABLE 4.9.1–2.—*Common and Scientific Names of Some of the Nonthreatened and Nonend Plants and Animals at Pantex Plant*-Continued

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC
REPTILES AND AMPHIBIANS (CONTINUED)		MAMMALS (CONTINUED)	
Plains Spadefoot toad	*Scaphiopus bombifrons*	coyote	*Canis latrans*
Great Plains skink	*Eumeces obsoletus*	bobcat	*Lynx rufus*
Checkered garter snake	*Thamnophis marcianus marcianus*	badger	*Taxidea taxus*
Western coachwhip snake	*Masticophis flagellum testaceus*	BIRDS	
bullsnake	*Pituophis melanoleucus sayi*	Western meadowlark	*Sturnella neglecta*
upland chorus frog	*Pseudacris triseriata feriarum*	horned lark	*Eremophila alpestri*
plains leopard frog	*Rana blairi*	mourning dove	*Zenaida macroura*
prairie rattlesnake	*Crotalus viridis viridis*	Bewick's wren	*Thryomanes bewick*
hognose snake (western)	*Heteredon nasicus*	house finch	*Carpodacus mexica*
northern earless lizard	*Holbrookia maculata maculata*	mockingbird (northern)	*Mimus polyglottos*
MAMMALS		nighthawk (common)	*Chordeiles minor*
deer mouse	*Peromyscus maniculatus*	greater roadrunner	*Geococcyx californi*
plains harvest mouse	*Reithrodontomys montanus*	killdeer	*Charadrius vocifer*
white-footed mouse	*Peromyscus leucopus*	Swainson's hawk	*Buteo swainsoni*
hispid cotton rat	*Sigmodon hispidus*	red-tailed hawk	*Buteo jamaicensis*
Southern Plains wood rat	*Neotoma micropus*	turkey vulture	*Cathartes aura*
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	FISH	
desert cottontail	*Sylvilagus auduboni*	fathead minnows	*Pimephales promelas*
black-tailed prairie dog	*Cynomys ludovicianus*	black bullhead	*Ictalurus melas*
striped skunk	*Mephitis mephitis*		

1982:23). The largest source of uranium in the cattle feed was from commercial mineral supplements typically fed to cattle in the area (Pantex 1996:16.1). An ecological analysis of potential risks to various animals from either direct or indirect ingestion of radiological residues in vegetation in the immediate vicinity of Pantex Plant obtained similar conclusions (PC 1995s).

Agriculture within the Pantex Plant Region of Influence is considered an important asset. A detailed discussion of the ecological and land use resources of the regional agricultural industry is provided in the Pantex *Environmental Information Document* (P 1996).

Wildlife

The uplands of Pantex Plant support a vari invertebrates, reptiles, amphibians, birds, mammals. With individuals of the follo taxa recorded at Pantex Plant, the insect cl well-represented: grasshoppers, beetles, bugs, flies, bees, wasps, ants, moths, butter and dragonflies (DOE 1994k:6). The frequently occurring species of reptiles

amphibians include the following: the Great Plains toad (*Bufo cognatus*), Woodhouse's toad (*Bufo woodhousei*), Plains spadefoot toad (*Scaphiopus bombifrons*), Great Plains skink (*Eumeces obsoletus*), Western coachwhip snake (*Masticophis flagellum testaceus*), bullsnake (*Pituophis melanoleucus sayi*), checkered garter snake (*Thamnophis marcianus marcianus*) and prairie rattlesnake (*Crotalus viridis viridis*) (DOE 1994e:8; DOE 1994k).

Some of the more common species of birds that have been observed at Pantex Plant include the Western meadowlark (*Sturnella neglecta*), horned lark (*Eremophila alpestris*), mourning dove (*Zenaida macroura*), Bewick's wren (*Thryomanes bewickii*), mockingbird (*Mimus polyglottos*), house finch (*Carpodacus mexicanus*), common nighthawk (*Chordeiles minor*), greater roadrunner (*Geococcyx californianus*), killdeer (*Charadrius vociferus*), Swainson's hawk (*Buteo swainsoni*), red-tailed hawk (*Buteo jamaicensis*), and turkey vulture (*Cathartes aura*) (DOE 1994g:2-6; DOE 1993c:A.1, A.2; DOE 1994k:7-10).

Representative mammals that occur at Pantex Plant are the deer mouse (*Peromyscus maniculatus*), plains harvest mouse (*Reithrodontomys montanus*), white-footed mouse (*Peromyscus leucopus*), hispid cotton rat (*Sigmodon hispidus*), Southern Plains wood rat (*Neotoma micropus*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), desert cottontail (*Sylvilagus audoboni*), black-tailed prairie dog (*Cynomys ludovicianus*), striped skunk (*Mephitis mephitis*), and coyote (*Canis latrans*) (DOE 1993c:10, B-1; DOE 1994k:11).

4.9.1.2 *Aquatic Resources*

Aquatic resources at Pantex Plant are not extensive and are comprised of the perennial Playa 1 and several concrete ponds located in the northeast area of Pantex Plant. Since Playas 1 through 4 and Pantex Lake are considered wetlands, they are described in more detail in section 4.9.1.3. Playa 1 is permanently inundated with water, receiving discharge from the Pantex Plant wastewater treatment plant. The aquatic regions of Playa 1 support over six genera of plants. The dominant vegetation is cattail *(Typha anqustifolia)*, great bulrush *(Scirpus validus)*, and three species of smartweed *(Polygonum sp.)* (DOE 1993b:4, B-7). During surveys in 1992, 26 families of macroinvertebrates were collected from Pantex Plant playas. The notable orders of organisms found include the following: beetles, true bugs, flies, and crustaceans (DOE 1993c:12). Vertebrate species recorded at Playa 1 include the Plains leopard frog (*Rana blairi*), the Woodhouse's toad, and the upland chorus frog (*Pseudoacris triseriata feriarum*) (DOE 1994e:7).

The concrete ponds, representing another aquatic habitat at Pantex Plant, are inhabited by six different species of amphibians, including: the barred tiger salamander (*Ambystoma tigrinum mavoritum*), the upland chorus frog, and the Great Plains toad. In May 1996, Pantex Plant personnel resampled the earthen stock tank near Pantex Lake. No specimens of *Notropis* minnows were found, but a number of fathead minnows (*Pimephales promelus*) and one black bullhead (*Ictalurus melas*) were collected (PC 1996d).

4.9.1.3 *Wetlands*

This assessment fulfills the environmental review requirement of *Compliance with Floodplain/Wetlands Environmental Review Requirements* (10 CFR 1022). There are six playas on DOE-owned or leased land at the Pantex Plant Site: Playas 1, 2, and 3 are on the main Pantex Plant; Playas 4 and 5 are on land leased from Texas Tech University; and Pantex Lake is on a separate parcel of DOE-owned property (Pantex 1996:7.2). Playas 1 through 4 and Pantex Lake have been delineated as jurisdictional wetlands using the U.S. Army

Corps of Engineers' *Wetland Delineation Manual* (Pantex 1996:7.2; MH 1995). These delineations are being used for ecosystem management at the Pantex Plant Site wetlands noted above. Wetlands are very important to wildlife, especially in an area having little undisturbed native grassland. They provide stopovers for migrating waterfowl and habitat for countless other species of birds, reptiles, amphibians, and mammals (TTU 1988:5; Bolen 1979:24).

4.9.1.4 *Playa Vegetation*

Playa vegetation on the Southern High Plains varies from one playa to another and throughout the changing conditions of the seasons. When water is prevalent within the basins, playa vegetation is usually composed of emergent and submergent aquatic species; however, as available water subsides, the species shift to semiaquatic annuals. With little moisture present, playa vegetation is commonly made up of characteristic upland species (Haukos 1994:93). Because of the diversity among individual playas, a specific vegetative characterization is presented for each playa at Pantex Plant. Most botanical information about Pantex Plant playas was gathered during a comprehensive floristic survey conducted during May, July, and September of 1993 and updated in June, July, and September 1995.

Playa 1

This playa is continuously inundated with water received from the Pantex Plant Wastewater Treatment Facility. As such, it supports 19 obligate aquatic plant species, the highest number of any playa at Pantex Plant (Pantex 1996:7.2). Like most wet playas, the dominant plants are emergent and submergent species. Cattail and bulrush are present at Playa 1 (DOE 1993b:4). Other notable obligate aquatic species present within the playa were pondweed (*Potamogeton nodosus*), arrowhead (*Sagittaria montevidensis*), spikerush (*Eleocharis macrostachya*), and smartweed (
1996:7.2). The following facultative aq
semiaquatic species are found at Pl
several species of smartweed (*Polygon*
slim aster (*Aster subulatus*), and wester
willow (*Salix goodingii*). The
surrounding Playa 1 are typical ove
High Plains grassland compos
buffalograss, blue grama, and prickl
(DOE 1993b:5; Haukos 1995:5).

Playa 1 has received some attention rel
the uptake of various chemicals. Pezzo
his Master's Thesis, analyzed nutrie
heavy metal cycling in vegetation (i.e.,
and smartweed), surface water, and soil
playa (TTU 1994a:26–30). However,
degree of variability was noted in nutri
heavy metal concentrations. Add
information on the Pantex Plant biomon
activities is provided in Chapter 16 (Ra
and Hazardous Chemical Environment)
Environmental Information Document (
1996).

Playa 2

The basin of this playa is dominated by s
species of smartweed, primarily *Poly*
pensylvanicum, *P. amphibium*, and
coccineum. Other significant species wit
basin included mallow (*Malvella le*
ragweed (*Ambrosia grayii*), and sunf
(*Helianthus annuus*). One small associat
cattails was also noted within the playa
edge of the playa basin contains tumble
and frog fruit, while, slightly above the
the major plant species are wheatgrass
snow-on-the-mountain (*Euphorbia marg*
The plant composition of the up
surrounding Playa 2 is very similar to t
Playa 1 (DOE 1993b:5).

Playa 3

This playa, adjacent to the Burning Grou
a basin floral composition of pri
spikerush with little vervain (*Ver*

bracteata) and hairy water clover (*Marsilea vestita*). The edge of the basin is dominated by spikerush and cocklebur (*Xanthium strumarium*), and the uplands surrounding Playa 3 have a species composition similar to Playas 1 and 2 (DOE 1993b:6).

Playa 4

The low areas of this playa contain abundant spikerush and ragweed, with some hairy water clover and buffalograss. One of the lowest areas in the basin supports cattails and several species of smartweed. Extensive stands of wheatgrass are present on the slopes leading from the basin to the uplands. The shortgrass prairie immediately adjacent to Playa 4 has a composition similar to other areas at Pantex Plant, but with a greater coverage of buffalograss (DOE 1993b:7).

Playa 5

When mostly dry, this playa exhibits large areas of bare clay. The plant species found within the playa include *Suckleya suckleyana*, goose foot (*Chenopodium glaucum*), and cocklebur. In a small, wet area of the playa, cattails and great bulrush were found to be locally prevalent, and their coverage expands when the playa contains more water from seasonal rains. The lower slopes, which transition into the surrounding grassland, contain buffalograss and wheatgrass. The High Plains grassland surrounding Playa 5 is similar in composition to the remainder of the site, except that three-awn has a more significant presence (DOE 1993b:8).

Pantex Lake

Major plants within the basin of Pantex Lake are spikerush, wheatgrass, and cocklebur. The area at the edge of the basin is dominated by wheatgrass, but there is a transition into High Plains grassland dominated by buffalograss and, to a lesser degree, three-awn and blue grama (DOE 1993b:11). In the past, Pantex Lake received discharge from site activities, but does not now.

4.9.1.5 *Playa Wildlife*

The Southern High Plains of Texas contain relatively little native undisturbed grassland. Land in the Texas Panhandle which is used for agricultural purposes does not support extensive wildlife populations. The remaining, undisturbed playas are "islands" of wildlife habitat, allowing the continued existence of many species (Smith 1994:119, 120; Dierauf 1994:246; Haukos 1994:85). Wildlife surveys conducted at Pantex Plant have characterized wildlife presence and use of the entire site, rather than focusing on each playa specifically. However, organisms and groups of organisms known to be specific to the playas are presented below.

Insects, Protistans, and Other Invertebrates

Insects identified from Pantex Plant playas include the following: mayflies (one family), dragonflies and damselflies (three families), beetles (six families), true bugs (six families), and flies (three families). There were also four families of crustaceans, two families of mollusks, leeches, and water mites (DOE 1993c:E.1). Unicellular organisms (protistans) from the phyla Chlorophyta, Chrysophyta, Cyanophyta, and Ciliophora, as well as two types of nematode worms, have also been collected from Pantex Plant playas (DOE 1994k:3, 4).

Reptiles and Amphibians

Members of the classes Amphibia and Reptilia that have been identified at Pantex Plant playas include: the plains leopard frog, Woodhouse's toad, the upland chorus frog, the prairie rattlesnake, the Great Plains skink, the hognose snake (*Heteredon nascius*), the northen earless lizard (*Holbrookia maculata maculata*), and the bullsnake (DOE 1994e:7).

4.9.1.6 *Protected and Sensitive Species*

Table 4.9.1–1 lists observed and potentially occurring protected and candidate species at the site. The bald eagle (*Haliaeetus leucocephalus*) is the only Federally protected species known to inhabit Pantex Plant for extended periods of time. Currently it is listed as threatened by the U.S. Fish and Wildlife Service (FWS) (Pantex 1996:7.4). It winters in the high plains of Texas, usually from October through February or March (a 4- to 5-month period), and forages near bodies of water (playas), feeding on fish, waterfowl, and small mammals. The bald eagle is sighted yearly at Pantex Plant and is considered a winter resident and a spring and fall migrant.

Additional listed species that may occur on or around Pantex Plant include the following: the American (*Falco peregrinus anatum*) and Arctic peregrine falcon (*Falco peregrinus tundris*), a spring and fall migrant; the interior least tern (*Sterna antillarum athalassos*), a possible spring and fall migrant; and the whooping crane (*Grus americana*), a spring and fall migrant. The whooping crane has been sighted at Pantex Plant in recent years.

No critical habitat for Federally threatened or endangered species exists on or around Pantex Plant (Pantex 1996:7.4). On May 9, 1996, Pantex officials submitted a biological assessment (BA) addressing section 7 (i.e., interagency consultation) *Endangered Species Act* requirements to FWS (Letter 1996). On May 27, 1996, the FWS stated that "We commend Pantex for developing a comprehensive and complete BA, and concur that the proposed action is not likely to adversely affect any Federally listed threatened or endangered species (Letter 1996a)."

The Texas horned lizard (*Phrynosoma cornutum*) is a Pantex Plant resident and has State-threatened status. The State also lists the white-faced ibis (*Plegadis chihi*), a spr fall migrant and summer resident at Plant, as threatened.

Species that are Federally propos candidates for listing as threatene endangered species do not receive protection under the *Endangered Speci* However, FWS encourages the consider impacts to these species in project pl since their status can be changed to thre or endangered in the foreseeable future. FWS has recently changed the classifica species under review for listing as threate endangered (61 FR 7596). Proposed sp include those plants and animals for w proposed rule to list as threatened or end has been published. Candidate species i those plants and animals for which the FW on file sufficient information on biol vulnerability and threat to support issuan proposed rule for listing as threaten endangered. Candidate species previ included Category 1 (species appropria listing as protected) and Category 2 (sp possibly appropriate for listing as prote Due to the recent rule change, candidate sp (now) include only those which are appro for listing as protected species (i.e., sp formerly (classified) as Category 1). Category 2 designation has been omitt Table 4.9.1–1. Species typically in Catego are now classified as species of concern, a that describes a broad realm of plants animals whose conservation status may be concern to the FWS, but do not have offi status. Some of the species previ identified as Federal candidate 2 in the D version of this EIS also have State status continue to be evaluated for potential impac

The swift fox (*Vulpes velox*) is the only Fede candidate species known to occur at the Pa Plant Site. An adult fox was observed south Playa 2 on Texas Tech land in May 1996 signs of scat and other signs of activity w observed at a number of sites on the facility 1995 (WTU 1995; WTU 1996). This mam

has been observed at the Pantex Plant Site since 1971 (CSU 1976). The mountain plover (*Charadrius montanus*) is a Federal candidate species that has not been reported in bird surveys at the Pantex Plant Site, but may potentially occur there based on its presence elsewhere in the state of Texas (DOE 1994g; DOE 1996d).

The ferruginous hawk (*Buteo regalis*), black tern (*Childonias niger*), and loggerhead shrike (*Lanius ludovicianus*) are species of concern that formerly were given Federal candidate status, but not State listed. These species lost candidate status as part of the reclassification of notice of review species (61 FR 7596). To date, two adult ferruginous hawks have been radio-tagged and one remained at Pantex Plant for approximately one month (Pantex 1996:7.4). At Pantex Plant Site, the ferruginous hawk frequents the playas and large prairie dog town near Playa 2. In August 1993, a pair of black terns was identified foraging at Playa 2.

There are no protected plant species known to occur at Pantex Plant or within Carson County (Pantex 1996:7.4). However, two rare cacti have been identified adjacent to Playa 1: *Coryphantha vivipara* and *Echinocereus viridiflorus* var. *viridiflorus*. An additional rare cactus, *Coryphantha missouriensis*, was confirmed in June 1995 at Playa 2. The Playa 1 *Echinocereus viridiflorus* population may be the largest one existing in the world (DOE 1993b:5). A floristic survey was conducted in the summer of 1995 to determine if any additional plant species of concern exist at the Pantex Plant Site. Although no Federal or State protected species were identified during this survey, 35 additional plant species were identified in 1995 for the first time at the Pantex Plant Site (Johnston 1995).

4.9.2 Impacts of Proposed Action

4.9.2.1 *Impacts of Continued Operations*

Weapons-Related Activities

Impacts to biotic resources at Pantex Plant as a result of the weapons-related activities are expected to be minimal. No additional disturbance is required whether operations are conducted at the 2,000, 1,000, or 500 weapons level; therefore, direct impacts to biotic resources are not anticipated. Existing operations generate noise due to human activity and operation of equipment and vehicles, which could have a temporary impact on some terrestrial, aquatic, and threatened and endangered species. Animal and plant surveys conducted for this EIS have not shown any decline in the number of species present. The Ecology chapter of the *Environmental Information Document* describes the measures underway to ensure that continuing operations do not adversely affect wetlands and biotic resources at this Federal facility (Pantex 1996). As stated earlier, a biological assessment was prepared to address section 7 *Endangered Species Act* requirements, and obtained FWS concurrence that the proposed action is not likely to adversely affect any Federally listed threatened or endangered species at the Pantex Plant (DOE 1996d; Letter 1996a).

The trace level of radionuclides in vegetation due to Pantex Plant activities and biouptake of heavy metals in playa vegetation has not been found to cause adverse impacts in plants and animals on or around this Federal facility (Pantex 1996:16.1; TTU 1994a:26-30). In fact, wetland resources would benefit from continued operations since Pantex Plant officials are taking steps to further increase the beneficial use of Pantex Plant playas by various species (Pantex 1996:7.5). In summary, continued operations would not create any significantly adverse impact to biotic resources, and existing

natural resource programs are attempting to manage the portions of the property for the benefit of native resident and migratory wildlife species.

Pit Storage Activities

Section 3.1.1 discusses increasing interim storage of pits at Pantex Plant from 12,000 to 20,000 as part of the Proposed Action. This storage would use existing facilities and would not pose adverse impacts to biotic resources.

Environmental Restoration Activities

The environmental restoration activities will have a long-term beneficial impact on plant and animal species at Pantex Plant as contamination from past activities is removed from soils and water at Pantex Plant Site. Some remediation activities (e.g., soil removal) may have a temporary impact on some species, through the loss of some vegetation and some of the less mobile animals such as reptiles and small mammals, but these impacts would not be considered significant.

Waste Management Activities

Waste management activities are not anticipated to have any significant adverse impacts to animal and plant species at Pantex Plant. The facility's compliance with the *Resource Conservation and Recovery Act* and implementing TNRCC regulations are intended to minimize, if not preclude, direct impacts to threatened or endangered species or wetlands.

4.9.2.2 *Impacts of New Facility Construction and Upgrades*

Under the Proposed Action, the following facilities would either be constructed or upgraded at Pantex Plant between 1996 and 2001: Hazardous Waste Treatment and Processing Facility; Pit Reuse Facility; Gas Analysis Laboratory; Materials Compatibility Assurance Facility; Nondestructive Evaluation Facility; and Metrology and Health P Calibration and Acceptance Facility. F construction would be in or adjacent to Ze and 12 (as shown Figure 3.1.1–1) and result in the loss of some vegetation and of the less mobile animals, such as reptil small mammals. However, since construction would occur in previ disturbed areas and the disturbance involve less than 1 percent of the DOE-o land at Pantex Plant Site, the potentia impacts to biotic resources is anticipated minimal.

Playas 1 through 4 have been declare jurisdictional wetlands under section 404 *Clean Water Act* by the U.S. Army Co Engineers. Although the proposed facilit not threaten these playas, the potential imp soil runoff to wetlands can be minimize applying the standard soil erosion sedimentation control measures during the disturbance phase of new projects.

The bald eagle, a Federally listed spe forages at the playas during winter. Since playas are more than 1 kilometer (0.6 m from the nearest construction site, no impa bald eagles are expected. Impacts to black white faced ibis, and swift fox would als negligible because these species are not resi at the proposed construction sites. Pri clearing operations, it may be necessary conduct preactivity surveys to identify nes migratory birds as well as the presence Federal and State protected and/or sensi species. This would allow measures to be t to protect these species and avoid clea operations during the breeding season migratory birds. The impacts of new fac construction and upgrades to biotic reso are not anticipated to be significant.

4.9.2.3 *Summary of Impacts*

The continued operations at Pantex Plant at of the weapons activity levels would minimal. Land disturbed by new fac

construction would be confined to Zones 11 and 12, which are already substantially altered. The impacts to biotic resources are, therefore, considered to be negligible. Environmental protection activities currently ongoing at the plant meet all regulatory requirements of FWS.

4.9.3 Impacts of No Action Alternative

Impacts to biotic resources at Pantex Plant as a result of the No Action Alternative are expected to be minimal. Since the weapons activity levels under the No Action Alternative would remain the same as described for the Proposed Action, the impacts on terrestrial, aquatic, and threatened and endangered species would remain negligible.

4.9.4 Impacts of Pit Storage Relocation Alternative

As discussed in section 3.1.3, the Pit Storage Relocation Alternative would involve the relocation of stored pits at Pantex Plant to one or more alternate sites. Two Pit Storage Relocation Alternative options are proposed; the first involves the storage of 20,000 pits at an alternative site, and the second involves the storage of 8,000 pits.

4.9.4.1 *Impacts of Relocating 20,000 Pits*

Under this Pit Storage Relocation Alternative option, up to 20,000 pits would be relocated from Pantex Plant to other DOE or Department of Defense sites. Impacts to biotic resources are not expected.

4.9.4.2 *Impacts of Relocating 8,000 Pits*

Under this Pit Storage Relocation Alternative option, up to 8,000 pits would be relocated from Pantex Plant to other DOE or Department of Defense sites. Impacts to biotic resources are not expected.

4.9.5 Cumulative Impacts

The cumulative impacts presented here include impacts of the continued operations at Pantex Plant combined with impacts associated with activities described in the WM PEIS, SSM PEIS, and S&D PEIS. Since the Pantex Plant EIS Proposed Action and the SSM PEIS No Action Alternative represent a continuum of operations, the impacts associated with any new mission or facility that could be implemented at Pantex Plant are discussed in the context of that continuum. The impacts from the WM PEIS program are combined with those of the Pantex Plant EIS Proposed Action. The impacts from the S&D PEIS are combined with those of the SSM PEIS No Action Alternative. A detailed discussion of this methodology is presented in section 4.2.

4.9.5.1 *Impacts of Alternatives in the Waste Management Programmatic Environmental Impact Statement*

The location of waste management facilities at Pantex Plant would increase the impacts to biotic resources. However, no specific sites have been identified in the WM PEIS. Therefore, no cumulative impacts can be identified at this stage.

4.9.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize

Existing Capability, and Relocate Capability. Under the No Action Alternative, no downsizing or modification of facilities would occur. Impacts to biological resources from operations would be expected to remain the same as current impacts. Under the downsizing alternative, all construction activities would be modifications to existing facilities. Consequently, no potential impacts to biota would occur. Under the relocation alternative, decontamination and decommissioning activities of the existing facilities would not impact biotic resources.

4.9.5.3 *Impacts of Alternatives in the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*

The S&D PEIS is considering Pantex Plant for long-term storage of inventories of nonsurplus weapons-usable plutonium and highly enriched uranium (HEU), storage of inventories of surplus weapons-usable plutonium and HEU pending disposition, and disposition of surplus weapons-usable plutonium. For storage, the strategy for long-term storage of weapons-usable plutonium and HEU, as well as the storage site(s), would be decided. The storage alternatives include upgrading the existing plutonium storage facilities, consolidation of plutonium from other sites, and collocation of plutonium and HEU storage. The collocation alternative is used for analysis purposes in this EIS as the bounding storage alternative.

Under the S&D PEIS Collocation Alternative, construction of new storage facilities would be required in order to store plutonium and HEU at Pantex Plant. The collocated storage alternative would disturb 94 hectares (232 acres) of t Construction would adversely affect animal populations. Vegetation wit proposed site would be lost during land-cl activities.

For the disposition alternatives in the PEIS, the emphasis at this stage in the decision process is on the strategy technology mix rather than the actual site. evolutionary Light Water Reactor is us analysis purposes in this EIS as the bo disposition alternative. Implementation d disposition alternative would requir construction and operation of a pit disass and conversion facility, plutonium conv facility, MOX fuel fabrication facility, or more light water reactors. The bo alternative also assumes that all of the fa previously mentioned would be colloca the same site (potentially Pantex Plant).

Construction and operation of the evolut Light Water Reactor would adversely some animal populations and would result disturbance of terrestrial resources on abo percent of the site. Land on which the fa would be built is presently used for agricul purposes. Two Federal candidate species be affected by construction activities. The eagle is the only consistently occurring Fed listed species at Pantex Plant that has potential to be affected by construction (D 1996a:4.0).

4.9.6 Potential Mitigation Measur

Since no significant impacts on biotic reso are identified from the Proposed Action, Action, or the Pit Storage Reloca Alternatives, no mitigation measures needed.

foundations, and features reflecting these periods (Pantex 1996:12.1). Brief histories of Pantex Plant covering the period 1942–1992 have been prepared by B.H. Carr (Carr 1992), N.A. Stricker and R.M. Poet (Legacy 1994 and 1994a). Pantex Plant began as Pantex Ordnance Plant in 1942, with its primary mission being the production of military ordnance. Since 1951, Pantex Plant has had Cold War and post-Cold War missions, including the fabrication of high explosives for nuclear weapons, nuclear weapons assembly and disassembly, and repair and modification of existing nuclear weapons (Pantex 1996:12.2).

Surveys/Inventories

Surveys of archaeological resources have been conducted at Pantex Plant since the first professional archaeological study conducted by West Texas State University during the spring of 1981 (MH 1981). This initial effort was a non-systematic survey of areas surrounding the playas on the main Pantex Plant Site and Pantex Lake (Pantex 1996:12.1). Other field investigations included the following: a 1992 Ditches and Playas *Resource Conservation and Recovery Act* Facility Investigation study by Mariah Associates; Phase II test excavations of 23 archaeological sites on Pantex Plant from 1993 through 1994 by Geo-Marine, Inc.; and a 1994 cultural resources survey of 1,700 hectares (4,200 acres) of previously unsurveyed land at Pantex Plant conducted by Geo-Marine, Inc. (Battelle 1993; USCOE 1994; USCOE 1994b). The 1994 study involved land owned by TTU and leased to DOE. In addition, 971 hectares (2,400 acres) of DOE land were systematically resurveyed in 1994 by Geo-Marine, Inc. (MH 1995b:1, 25).

During the 1981 survey, remains of 42 prehistoric Native American campsites and three pre-World War II farmsteads were identified. Except for one historic site (farmstead), all sites were found near Pantex Lake and Playas 1, 2, and 3 on the main plant site. None of the sites appear to be potentially eligible for inclusion in the National Regis Historic Places (NRHP), but the researche that 17 sites had "medium" to "E significance and recommended preservat additional investigation (MH 1981:65-66). 1992 survey of ditches and playas identif new sites and 39 isolated occurrences (I Three of the sites and 14 IOs were located a the perimeter of Playa 2, and 2 sites and 25 were located along the perimeter of Play The 1994 survey on TTU land identif Native American sites, 2 historic sites, a IOs. The 1994 resurvey of DOE land ide 4 new prehistoric Native American sites a IOs (MH 1995b:79).

A comprehensive survey of the World W historical resources at Pantex Plant conducted from 1992 to 1994, DOE authorized an inventory of buil constructed between 1942 and 1945 (Pa 1996:12.2; Legacy 1994 and 1994a). Ini survey work focused on World War II sta structures, such as buildings used for mag storage and bomb-loading lines, in the a zones of Pantex Plant. Through 1993 and 1 survey efforts expanded to other World W Era standing structures that had not b previously surveyed, and World War II b foundations and ruins inside histo boundaries of Pantex Ordnance Plant. T effort inventoried an additional 29 World W standing structures and documented foundations and ruins (Pantex 1996:1 Historical resources still exist in the general of Pantex Plant and include structures such guard tower foundations, the Dunnage Complex ruins, standing and in-use towers, and a control lab foundation.

Cold War operations at Pantex Plant date 1951 to 1991. Although historical rese surveys for this period of Pantex P operations have not yet been conducted, are currently being developed to begin such survey. Completion of this work, com with the surveys and evaluations archaeological and World War II resources,

lead to the implementation of a comprehensive CRMP scheduled for completion by late 1998. The CRM staff at Pantex Plant considers resources from the Cold War period to be among the most important historical resources at Pantex Plant (Pantex 1996:12.2).

As part of the comprehensive CRMP, an Impact Mitigation Plan will be developed for preservation of cultural resources on Pantex Plant Site. Many of these resources have remained relatively undisturbed because of the security maintained by Pantex Plant during the past 50 years. Until a CRMP can be completed in CY 1998, cultural resources will be managed and protected by DOE. A programmatic agreement for the continued interim management of NRHP-eligible archaeological and historical resources at Pantex Plant will be implemented by DOE in 1996. The PA will be produced in consultation with the State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation, and will contain procedures that DOE will follow to ensure that plant operations comply with Section 106 and Section 110 requirements.

Cultural Resources Eligible for National Register Listing

Eligibility criteria for listing cultural resources on the NRHP are contained in Code of Federal Regulations, Title 36, Part 60 (36 CFR 60.4). Cultural resource studies and eligibility determinations have been and are being coordinated with the Texas SHPO in accordance with Sections 106 and 110 of NHPA. Eligibility criteria are met if a cultural resource has integrity and exhibits any of the following characteristics:

- Association with events that have made a significant contribution to the broad patterns of our history.
- Association with the lives of persons significant in our past.
- Illustration of a type, period, or method of construction; for its aesthetic values or for its representation of the work of a master; or if it represents a significant and distinguishable entity whose components may lack individual distinction.
- It has yielded, or may be likely to yield, information important in prehistory or history.

Earlier survey work on prehistoric sites at Pantex Plant did not result in a consensus on prehistoric sites eligible for the NRHP (MH 1981; Mariah 1992). However, test excavations conducted from 1993 to 1994 on 23 prehistoric sites did result in a recommendation that 22 out of the 23 sites may be ineligible for listing. No determinations of NRHP eligibility for Native American archaeological sites at Pantex Plant have been made (USCOE 1994b; Pantex 1996:12.1).

To date, no historic sites at Pantex Plant have been recommended as potentially eligible for NRHP listing; however, numerous World War II historical resources at Pantex Plant are potentially eligible for listing under the criteria discussed above (USCOE 1994b:174; Mariah 1992:3; Pantex 1996:12.1, 12.2, 12.4).

4.10.1.2 *Native American Groups*

In 1994, 10 Native American tribes with possible traditional interests in the Pantex Plant area were notified by Pantex Plant regarding their potential interest in proposed activities to be addressed in the Pantex EIS; these included the following: the Comanche Tribe of Oklahoma; the Kiowa Tribe of Oklahoma; the Apache Tribe of Oklahoma; the Mescalero Apache Tribe; the Jicarilla Apache Tribe; the Cheyenne-Arapaho Tribe of Oklahoma; the Wichita and Affiliated Tribes; the Caddo Tribe of Oklahoma; the Delaware Tribe of Western Oklahoma; and the Fort Sill Apache Tribe. The Jicarilla and Mescalero Apache Tribes stated

that they did not have concerns in the Central Texas Panhandle.

The eight remaining tribes were provided detailed information on EIS/NEPA and NHPA activities. Appendix J contains this documentation. These tribes expressed an interest in acquiring further information on future activities at Pantex Plant. In response, the Pantex Plant Cultural Resource Management staff visited each of the eight tribal offices during June, 1994. Each tribe was given a Pantex Plant EIS/NEPA information packet, an opportunity to view an informational video on the Pantex Plant EIS process, and CRMP/ NHPA information packets. Only the Kiowa and Apache Tribes of Oklahoma have been in contact with the plant since these 1994 visits.

The U.S. Indian Claims Commission has found that the Kiowa Tribe of Oklahoma, the Comanche Tribe of Oklahoma, and the Apache Tribe of Oklahoma have legally recognized traditional interests in the Texas Panhandle. These 3 tribes have been contacted and encouraged to participate in the EIS, NEPA, CRMP, and NHPA processes at Pantex Plant (Pantex 1996:12.4).

Inventory of Traditional Sites

Native American sites, traditional cultural properties (TCPs), or mortuary remains have not been discovered at Pantex Plant. If these are located during future activities they will be managed in compliance with relevant cultural and historical resource management regulations and statutes. DOE recognizes that its management of Pantex Plant may have cultural implications for concerned Native American tribes. To address these concerns, the DOE asked the tribes during their consultations in 1994 if any of Pantex Plant's mission plans impacted their traditional interests. No TCP's within the plant boundaries were identified by the tribes. The tribes are encouraged to notify the plant regarding potential future concerns of a cultural nature. This process will allow the DOE to address concerns on a governme government basis. No Native Ame mortuary remains have been located at Pa Plant; however, if any such remains uncovered, they will be managed in compl with the *Native American Graves Prot and Repatriation Act* (25 U.S.C. 3001) (Pa 1996:12.4).

Treaty Considerations

To ensure that the rights and interests of Na Americans are protected, DOE is perform historic treaties search and a public oc program to involve Native Ame stakeholders in decision making related t use of plant land and the protection of cu resources (Pantex 1996:12.4).

4.10.1.3 *Paleontological Resourc*

The surficial geology of the Pantex Plan consists of silts, clays, and sands of Blackwater Draw Formation. In other are the High Plains, this formation contains Pleistocene vertebrate remains, including camel, horse, mammoth, and mastodon, occasional and important evidence of the by early humans. A recent archaeolo testing program at the plant recovered bones associated stratigraphically with artifacts along an active drainage that f south into Pantex Lake (USCOE 1994b: 154; DOE1995k:4-300).

4.10.2 Impacts of the Proposed Action

4.10.2.1 *Impacts of Continued Operations*

Weapons-Related Activities

Impacts to cultural and paleontolo resources at Pantex Plant as a result of weapons-related activities under the Prop

Action are expected to be negligible. No land disturbance is proposed for these activities. Impacts of construction of new facilities under the Proposed Action are discussed separately in section 4.10.2.2.

Pit Storage Activities

The storage of up to 20,000 pits would utilize existing facilities and would not pose adverse impacts to cultural resources.

Environmental Restoration Activities

Although no cultural resources have been identified in the contaminated areas identified for environmental restoration, a cultural resources monitor would be present to identify any subsurface cultural resources during the land disturbance phase. Land disturbance for environmental restoration activities is a small fraction (less than 1 percent) of the total DOE-owned land at Pantex Plant Site. Cultural resource impacts, if any, would not be significant.

Waste Management Activities

The waste management activities will not disturb any new lands; hence no cultural resource impacts are anticipated.

4.10.2.2 *Impacts of New Facility Construction and Upgrades*

The six new facilities constructed under the Proposed Action will be located in or adjacent to Zones 11 and 12 (as shown in Figure 3.1.1–1). Some soil disturbance would be associated with these construction and facility upgrade projects. Although no cultural resources have been identified on the surface, subsurface cultural resources may be discovered during construction, remodeling, or land altering activities. If that occurs, the work would be stopped until an evaluation can be conducted to determine the significance of the resource. Mitigation, documentation, and/or preservation measures would be conducted as necessary.

The Hazardous Waste Treatment and Processing Facility would be constructed in an area that has previously been surveyed for cultural resources. No sites were located in the area to be affected by the proposed construction of this facility.

Modifications and building upgrades are proposed to convert bays 2, 4, 6, and 8 at Building 12–104 into a Pit Reuse Facility. Building 12–104 is of recent construction, and its eligibility to the NRHP has not been determined. Further, no prehistoric or historic sites are known to exist in this area.

The activities proposed for the Gas Analysis Laboratory are currently being conducted in Building 12–21. This was originally the location of the third Cooling and Top-off Building at the Pantex Ordnance Plant. This structure was demolished and replaced with a new building in 1951. The building was included in Legacy's 1994 historic building survey. Based on that evaluation, Building 12–21 was not recommended by the Texas SHPO as potentially eligible to the NRHP (Legacy 1994:107, 109, 111, 125). No cultural resources are known to exist in the proposed construction area.

The proposed construction of the Materials Compatibility Assurance Facility is within an area that has been inventoried for historic structures (Legacy 1994:167-168). The foundations of Ramp 11–R–23 are located adjacent to and immediately south of the proposed Materials Compatibility Assurance Facility. The remains of another structure, Building 11–13, adjacent to the south end of Ramp 11–R–23, are not considered eligible to the NRHP, and would not require avoidance. The remains of Ramp 11–R–23 will need to be monitored for avoidance during construction, and/or mitigated prior to construction.

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4.10.5.1 *Impacts of Alternatives in the Waste Management Programmatic Environmental Impact Statement*

The actual location of waste management facilities would likely disturb additional DOE-owned land at Pantex Plant. However, no specific locations have been identified in the WM PEIS. Therefore, cumulative impacts to cultural resources cannot be identified at this stage. In general, given that specific projects would likely undergo their own NEPA review, it is unlikely that the eventual siting would impact cultural resources.

4.10.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. Under the No Action Alternative, no downsizing or modification of facilities would occur. Impacts to cultural resources from operations are expected to remain the same as current impacts. Under the downsizing alternative, all construction activities would be modifications to existing facilities. Consequently, no potential impacts to cultural resources would occur.

4.10.5.3 *Impacts of Alternatives in the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*

The S&D PEIS is considering Pantex Plant for long-term storage of inventories of nonsurplus weapons-usable plutonium and highly enriched uranium (HEU), storage of inventories of surplus weapons-usable plutonium and HEU pending disposition, and disposition of surplus weapons-usable plutonium. For storage, the strategy for long-term storage of weapons-usable plutonium and HEU, as well as the storage site(s), would be decided. The storage alternatives include upgrading the existing plutonium storage facilities, consolidation of plutonium from other sites, and collocation of plutonium and HEU storage. The collocation alternative is used for analysis purposes in this EIS as the bounding storage alternative.

Under the S&D PEIS Collocation Alternative, construction of new storage facilities would be required in order to store plutonium and HEU at Pantex Plant. No prehistoric or historic resources were identified in the project area. Impacts to prehistoric or historic resources are not anticipated.

For the disposition alternatives in the S&D PEIS, the emphasis at this stage in the NEPA decision process is on the strategy and technology mix rather than the actual site. The evolutionary Light Water Reactor is used for analysis purposes in this EIS as the bounding disposition alternative. Implementation of this disposition alternative would require the construction and operation of a pit disassembly and conversion facility, plutonium conversion facility, MOX fuel fabrication facility, and one or more light water reactors. The bounding alternative also assumes that all of the facilities

previously mentioned would be collocated at the same site (potentially Pantex Plant).

Some NRHP-eligible resources may be affected by the construction of the disposition facilities. Any resources would be identified during Section 106 of the NHPA compliance process. There would be no operational impacts to archaeological remains because no additional ground disturbance is involved. Construction and operation of these facilities may affect some Native American resources. Native American resources would be identified through project-specific consultation with potentially affected groups. Some paleontological resources may occur in the area to be affected by construction. These operations would not have an additional impact (DOE 1996a:4.0).

4.10.6 Potential Mitigation Measures

No long-term adverse impacts to cultural resources have been identified relative to the Proposed Action, No Action, or Pit Storage Relocation Alternative; hence, no mitigation measures are needed. A Programmatic Agreement (PA) for the continued interim management of the NRHP-eligible archaeological and historical resources at Pantex Plant is being developed f implementation in 1996. The PA will superseded by the CRMP, which is schedu for implementation in 1998 (Pantex 1996).

If subsurface remains are identified d project construction, mitigation measures wo be taken in consultation with the SHPO. Th may include: groundwork monitoring, stop work upon discovery, and mitigation avoidance of cultural resources to minimize potential for adverse effects.

If Native American traditional use resources identified, but cannot be avoided throu project design or location, than accepta mitigation measures to lessen the effect on resources would be determined in consulta with the appropriate Tribal organizations governments. Mitigation measures m include; reconfiguration of project plan desig appropriate relocation of human remains a associated funerary items in compliance w the *Native American Graves Protection a Repatriation Act* (25 U.S.C. 3001), reduc visual intrusion, or transplanting/harvesti traditional or secular plant resources minimize the potential of adverse effects.

4.11 SOCIOECONOMIC RESOURCES

4.11.1 Affected Environment

This section addresses the population, housing, labor force, income, and public finance characteristics in the Pantex Plant region.

Pantex Plant is located in Carson County in the central Panhandle of Texas, 27 kilometers (17 miles) northeast of Amarillo on U.S. Highway 60. The western boundary of the site nearly coincides with the border between Potter and Carson Counties. The Amarillo metropolitan area extends between Potter County and its neighbor to the south, Randall County. A few miles south of Pantex Plant is Armstrong County, which shares its western border with Randall County and its northern border with Carson County. More than 96 percent of the employees at Pantex Plant reside within the rectangle formed by these four counties, and this area is accordingly defined as the Region of Influence (ROI) for this socioeconomic analysis. The area is depicted in Figure 4.11.1–1.

4.11.1.1 *Regional Population*

According to the 1990 Census, there were 196,144 persons and 75,067 households in the ROI. More than 95 percent of the persons and households were found in the Amarillo metropolitan area. In 1990, almost four-fifths (79.7 percent) of the ROI's population was White, 13.1 percent was Hispanic, and 4.9 percent was Black. Virtually all of the non-White population in the ROI is concentrated in the Amarillo Metropolitan Statistical Area (MSA), as shown in Table 4.11.1.1–1. More detailed information on the racial/ethnic composition of Amarillo's population is presented in section 4.17, Environmental Justice.

Outside of the Amarillo urbanized area are several small towns scattered across the ROI. Canyon, with a 1990 population of 11,365, is located south of Amarillo in central Randall County. Panhandle, with a 1990 population of 2,353, is situated approximately 16 kilometers (10 miles) east of Pantex Plant in south-central Carson County. The community of White Deer, with 1,125 persons, is situated northeast of Pantex Plant and the town of Panhandle, in east-central Carson County.

In north-central Armstrong County, southeast of Pantex Plant, is the town of Claude, with a 1990 population count of 1,199. The remainder of the 1990 population in the ROI—22,487 persons, or 11.5 percent of the ROI's total population—lived in communities with populations under 1,000 and on farms and ranches found throughout the four-county area. Table 4.11.1.1–2 presents the racial/ethnic characteristics of the small town and rural populations in the ROI.

The estimated population in the four-county ROI on July 1, 1995 was 209,762, an increase of nearly 13,700 persons from the time of the 1990 Census enumeration in April 1990. Thus, the overall rate of population growth in the ROI during this period was 6.9 percent or 1.4 percent per year (Pantex 1996:8.1).

According to the Texas State Data Center, the projected population in the ROI in 2005 ranges between 214,353 and 246,464, depending on specific economic development scenarios (TSDC 1994). The low-end projection represents a 0.6 percent average annual rate of growth in the ROI during the 15 years following the 1990 census, while the high-end figure represents a 1.7 percent average annual rate of growth in the ROI during this period.

The Amarillo Metropolitan Statistical Area (MSA), which consists of Potter and Randall Counties, accounted for 96 percent of the ROI population in 1995. Table 4.11.1.1–3 presents the history of population growth in the ROI and in the MSA during the period 1960–1995. As shown in this table, the Amarillo MSA

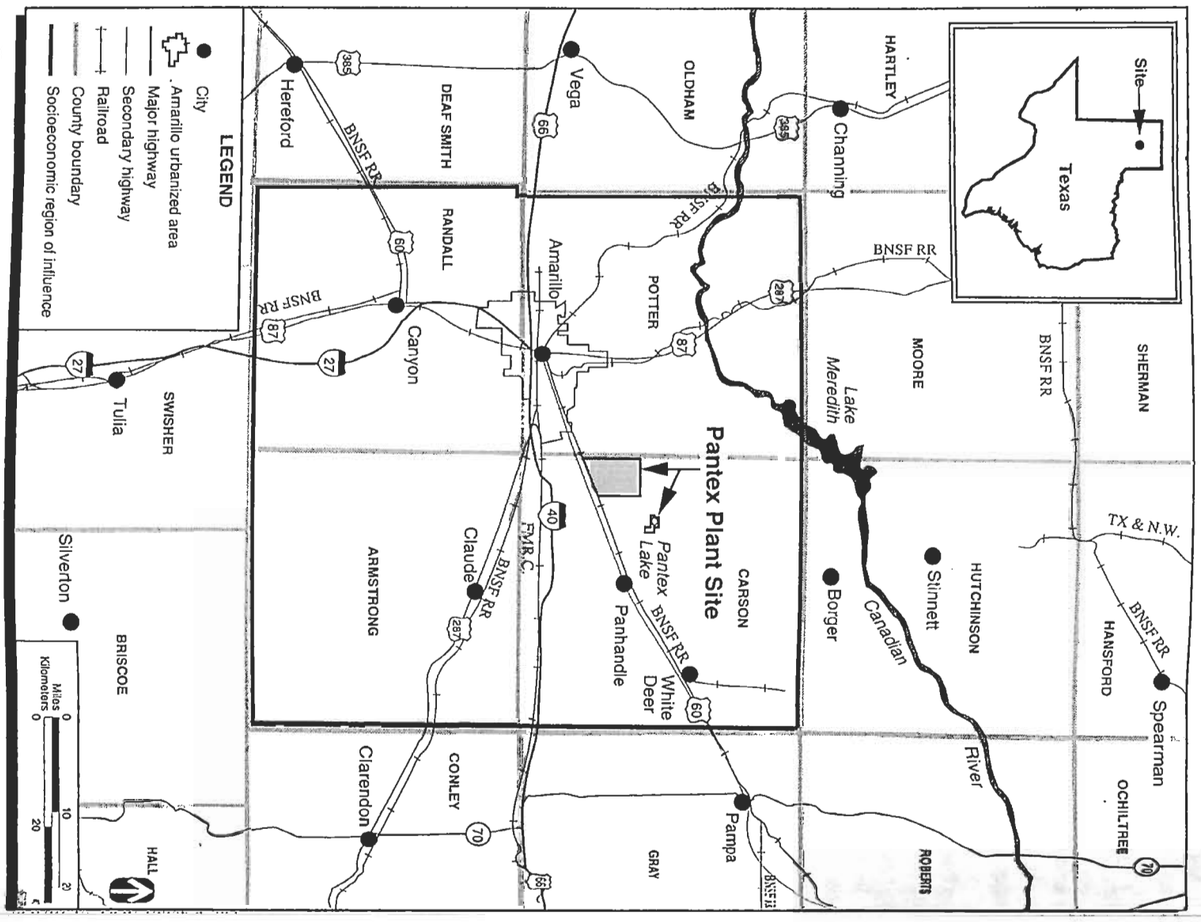

FIGURE 4.11.1.1–1.—*Pantex Plant, Texas, and Its Socioeconomic Region of Influence.*

TABLE 4.11.1.1–1.—*Population Distribution by Race and Ethnicity in the Pantex Plant Region of Influence, 1990*

CHARACTERISTIC	ARMSTRONG COUNTY	CARSON COUNTY	POTTER COUNTY	RANDALL COUNTY	TOTAL ROI	TOTAL ROI %	AMARILLO MSA[1]	AMARILLO MSA % OF TOTAL ROI
Persons by Race/Ethnicity								
Whites	1,951	6,158	66,877	81,364	156,350	79.7	148,241	94.8
Hispanics	55	354	19,246	6,144	25,799	13.1	25,390	98.4
Blacks	0	11	8,460	1,082	9,553	4.9	9,542	99.9
American Indians	9	41	709	414	1,173	0.6	1,123	95.7
Asian/Pacific Islanders	5	9	2,431	626	3,071	1.6	3,057	99.5
Others	1	3	151	43	198	0.1	194	98.0
Total 1990 Population	2,021	6,576	97,874	89,673	196,144	100.0	187,547	95.6
Total Number of Households	768	2,402	37,344	34,553	75,067		71,897	95.8

[1]MSA - Includes the Counties of Potter and Randall.
Sources: TX Cen 1992a:2, 5; Census 1992:2, 5

TABLE 4.11.1.1–2.—*Population by Race and Ethnicity in Communities of the Pantex Plant Region of Influence, 1990*

CHARACTERISTIC	CITY OF AMARILLO	CANYON	CLAUDE	PANHANDLE	WHITE DEER	TOWNS < 1,000 & RURAL AREAS	TOTAL ROI
Whites	121,229	9,785	1,147	2,151	1,047	20,991	156,350
Hispanics	23,231	1,048	40	183	63	1,234	25,799
Blacks	9,203	278	0	10	0	62	9,553
American Indians	961	38	6	5	13	150	1,173
Asian/Pacific Islanders	2,811	205	5	1	2	47	3,071
Others	180	11	1	3	0	3	198
Total Population	157,615	11,365	1,199	2,353	1,125	22,487	196,144

Sources: Census 1992:5; TX Cen 1992a:6

TABLE 4.11.1.1–3—*Population Growth by County in Pantex Region of Influence*

COUNTY	1960	1970	% CHANGE 1960-1970	1980	% CHANGE 1970-1980	1990	% CHANGE 1980-1990	1995	% CHANGE 19[illegible]-19[illegible]
Armstrong	1,966	1,895	-3.6	1,994	5.2	2,021	1.4	2,111	[illegible]
Carson	7,781	6,358	-18.3	6,672	4.9	6,576	-1.4	6,639	[illegible]
Potter	115,580	90,511	-21.7	98,637	9.0	97,874	-0.7	104,574	[illegible]
Randall	33,913	53,885	58.9	75,062	39.3	89,673	19.5	96,438	[illegible]
Total ROI	159,240	152,649	-4.1	182,365	19.4	196,144	7.6	209,762	[illegible]
Amarillo MSA	149,493	144,396	-3.4	173,699	20.3	187,547	8.0	201,012	[illegible]

Sources: City 1989; TX Cen 1961:6; TX Cen 1973:9; TX Cen 1982:14; TX Cen 1992a:1; TX Cen 1996; TX Cen 1996a

experienced a 3.4 percent decline in population between 1960 and 1970. This was largely attributable to the closing of the Amarillo Air Force Base in 1968. Amarillo MSA quickly recovered from this population loss by the mid 1970's. Between 1970 and 1980, it increased its population at an average annual rate of 2.0 percent. The growth rate slowed down to 0.8 percent per year in the 1980's but increased again to 1.4 percent per year during the 1990's (1990-1995).

4.11.1.2 *Regional Income and Poverty*

In 1989, the median household income in the ROI was $25,763, compared to the median of $27,016 for Texas as a whole. Per capita income in the ROI was $12,639 in 1989, compared to the State-wide per capita income of $12,904. A total of 30,253 persons in the ROI were below the poverty level based on their 1989 incomes, representing 15.4 percent of all persons in the ROI. Over 97 percent of these persons were residents of the Amarillo metropolitan area. Across Texas, 18.1 percent of all persons were below the poverty level based on their incomes in 1989. Table 4.11.1.2–1 summarizes the information on income and poverty levels in the ROI.

4.11.1.3 *Regional Housing*

Throughout the four-county area, a total of 84,506 housing units were counted in 1990. Slightly more than 11 percent, or 9,439 of the units were vacant, while just over 75,000 were occupied by an average of 2.56 persons per unit. Nearly 65 percent of the units were owner-occupied dwellings, while the remainder were occupied by renters. Less than 5 percent of the occupied units were overcrowded, with more than one person per room. Less than 1 percent of all housing units in the ROI lacked either complete plumbing or kitchen facilities. Table 4.11.1.3–1 presents the housing characteristics for the ROI as a whole and the four counties that comprise the ROI.

4.11.1.4 *Regional Labor Force*

In 1990, two-thirds of the ROI's population 16 years of age and older, or 97,713 persons, were in the civilian labor force. Of this total, 91,4[illegible] were employed, with 71,134 working at least [illegible] hours per week. Unemployed persons totaled 6,301, or 6.5 percent of the civilian labor force.

TABLE 4.11.1.2–1.—*Income and Poverty Statistics by County in the Pantex Plant Region of Influence*

CHARACTERISTIC	ARMSTRONG COUNTY	CARSON COUNTY	POTTER COUNTY	RANDALL COUNTY	TOTAL ROI	AMARILLO MSA
1989 Income						
Median Household Income	$23,081	$26,765	$20,472	$31,472	$25,763	$25,425
Per Capita Income	$11,212	$11,710	$10,230	$15,369	$12,639	$12,687
Number of Persons Below Poverty Level Income	232	583	21,619	7,819	30,253	29,438
Percent of Persons Below Poverty Level Income	11.5	8.9	22.1	8.7	15.4	15.7

Sources: TX Cen 1993:3, 148, 149; Census 1993:3, 37, 38; TX Cen 1992a:1, 2

TABLE 4.11.1.3–1.—*Housing Characteristics by County in the Pantex Plant Region of Influence*

CHARACTERISTIC	ARMSTRONG COUNTY	CARSON COUNTY	POTTER COUNTY	RANDALL COUNTY	TOTAL ROI
Total Housing Units	916	2,856	42,927	37,807	84,506
Occupied Housing Units	768	2,402	37,344	34,553	75,067
Persons in Occupied Units	1,966	6,474	95,961	88,130	192,531
Persons per Occupied Unit	2.56	2.70	2.57	2.55	2.56
Owner-occupied Units	620	1,950	22,490	23,642	48,702
Renter-occupied Units	148	452	14,854	10,911	26,365
Vacant Housing Units	148	454	5,583	3,254	9,439
Vacancy Rate (%)	16.2	15.9	13.0	8.6	11.2
Occupied Units with 1.01+ Persons per Room	23	72	2,654	809	3,558
Percent of Occupied Units with 1.01+ Persons per Room	3.0	3.0	7.1	2.3	4.7
Total Units Lacking Complete Plumbing Facilities	0	59	203	167	429
Total Units Lacking Complete Kitchen Facilities	4	82	536	220	842

Sources: TX Cen 1992:49, 50; TX Cen 1993b:66

TABLE 4.11.1.4–2.—*Class of Workers in the Pantex Plant Region of Influence*

SECTOR OF EMPLOYMENT PERSONS 16+ YEARS OLD	ARMSTRONG COUNTY	CARSON COUNTY	POTTER COUNTY	RANDALL COUNTY	TOTAL ROI
Private For-profit Wage and Salary Workers	429	1,625	30,343	30,073	62,470
Employees of Own Corporation	20	69	673	1,404	2,166
Private Not-for-profit Wage and Salary Workers	48	134	2,885	3,322	6,389
Local Government Workers	73	332	2,177	3,106	5,688
State Government Workers	58	141	1,696	3,027	4,922
Federal Government Workers	45	117	1,285	1,629	3,076
Self-employed Workers	184	412	3,299	4,478	8,373
In Agriculture	111	164	293	523	1,091
Unpaid Family Workers	5	14	210	265	494
Totals	842	2,775	41,895	45,900	91,412

Source: TX Cen 1993:147

TABLE 4.11.1.4–3.—*Employment by Industry and by County in Pantex Plant Region of Influence*

INDUSTRY	ARMSTRONG COUNTY	CARSON COUNTY	POTTER COUNTY	RANDALL COUNTY	TOTAL ROI
Agriculture	188	348	679	1,301	2,516
Forestry and Fisheries	0	0	7	31	38
Mining	0	129	368	485	982
Construction	78	330	3,026	2,719	6,153
Manufacturing	46	334	5,897	4,164	10,441
Transportation, Communications, and Other Public Utilities	48	162	3,242	3,951	7,403
Wholesale Trade	33	110	2,819	2,874	5,836
Retail Trade	100	383	8,722	8,561	17,766
Finance, Insurance, and Real Estate	47	109	1,838	3,654	5,648
Services	251	751	13,621	16,000	30,623
Public Administration	51	119	1,676	2,160	4,006
Totals	842	2,775	41,895	45,900	91,412

Source: TX Cen 1993:146

utilizes the broad Farming, Fishing, and Forestry occupational category to classify persons with these types of jobs. However, in the Texas Panhandle, this category includes only farm workers, since there are no fishing or forestry business operations in the area (PC 1995o). As shown in Table 4.11.1.4–4, at least 96 percent of the employed persons in the ROI lived in the Amarillo MSA, with the exception of those in farming jobs, of whom 79 percent resided in the Amarillo metropolitan area.

Of the persons in the ROI with work experience but who were unemployed in 1990, more than one-fourth, or 1,624, had held technical and administrative support positions. Nearly 1,200, or one out of five experienced unemployed persons, had been operators, fabricators, or laborers. Slightly more than 1,000, or 17 percent, had been precision production, craft, or repair persons, and nearly 600, or 10 percent of the experienced unemployed, had held managerial or professional positions (Table 4.11.1.4–5).

According to the Texas Emplo Commission, the labor force in 1994 i Amarillo MSA, consisting of Potter and R Counties, averaged 107,545 persons. O total, 103,116 were employed and 4,429 unemployed and seeking work. Thus average unemployment rate in 1994 fo Amarillo MSA stood at 4.1 percent (TEC1

4.11.1.5 *Regional Economy*

According to the Census Bureau's repo 1992 business patterns, there were more 5,300 business establishments in the county ROI. Services, retail, and whol businesses constituted 70 percent of establishments in the ROI, employed two-t of the employed persons covered in the su and accounted for a total annual payro excess of $800 million. Construction represented 7.8 percent of the businesses i ROI, but they employed less than 5 perce the covered workforce, with an annual pa

TABLE 4.11.1.4–4.—*Occupation of Employed Persons 16 Years and Over in the Pantex Plant Region of Influence*

OCCUPATIONAL GROUPS BY DESIGNATED AREA	ARMSTRONG COUNTY	CARSON COUNTY	POTTER COUNTY	RANDALL COUNTY	TOTAL ROI	% OF TOTAL ROI	AMARILLO MSA	% TOT RO
Managerial and Professional	137	519	7,604	13,312	21,572	23.6	20,916	97
Technical and Administrative Support	207	647	11,764	16,708	29,326	32.1	28,472	97
Service	141	423	7,895	5,427	13,886	15.2	13,322	95
Farming, Forestry and Fishing	171	304	684	1,084	2,243	2.4	1,768	78
Precision Production, Craft, and Repair	87	447	6,567	4,658	11,759	12.9	11,225	95
Operators, Fabricators, and Laborers	99	435	7,381	4,711	12,626	13.8	12,092	95
Total Employed Persons	842	2,775	41,895	45,900	91,412	100.0	87,795	96

Sources: TX Cen 1993:145; Census 1993:34

TABLE 4.11.1.4–5.—*Last Occupation of the Experienced Unemployed in the Pantex Plant Region of Influence*

OCCUPATIONAL GROUPS BY DESIGNATED AREA	ARMSTRONG COUNTY	CARSON COUNTY	POTTER COUNTY	RANDALL COUNTY	TOTAL ROI	% OF TOTAL
Managerial and Professional	0	5	229	350	584	9.7
Technical and Administrative Support	7	29	925	663	1,624	27.1
Service	7	17	817	417	1,258	21.0
Farming, Forestry, and Fishing	0	8	37	59	104	1.7
Precision Production, Craft, and Repair	4	17	647	361	1,029	17.2
Operators, Fabricators, and Laborers	6	22	861	306	1,195	19.9
Last Worked in 1984 or Earlier, or Unique Military Occupation	0	8	154	45	207	3.4
Total Experienced Unemployed Persons	24	106	3,670	2,201	6,001	100

Source: TX Cen 1993:147

of $77 million. Nearly 10 percent of area businesses were finance, insurance, and real estate firms, which employed slightly more than 5 percent of the workforce, with a total annual payroll of $86 million.

There were 200 manufacturing establishments in the ROI that comprised less than 4 percent of area businesses yet employed 10,590 people, or 15.5 percent of the covered workforce, with an annual payroll of $281 million. Activities at Pantex Plant were included in the manufacturing category. The 3,800 employees at Pantex Plant constituted 36 percent of the ROI's workforce employed in manufacturing. Table 4.11.1.5–1 provides more detail about businesses in the ROI.

According to the 1992 Census of Agriculture, farming and ranching contributed nearly $300 million to the economy of the ROI. Nearly 1,300 farms and ranches operated in the four-county area, with an average of 1,560 acres, covering more than 86 percent of the total land area in the four counties (TX Cen 1994:1; TX Cen 1993d:4). Nearly two-thirds of these operations reported cattle and calves in their inventory, with a total of 281,551 cattle and calves counted in the ROI in 1992. The value of the cattle and calves sold by area ranches in 1992 was in excess of $254 million (TX Cen 1994:14). Livestock raised within the four-county ROI includes dairy operations and beef cattle in feedlots and open range. Dairy operations and milk production consist of approximately 3,000 cows that produce up to 64,000 pounds of milk per day.

The number of beef cattle is difficult to obtain because of inherent characteristics of the industry. The beef cattle industry in the Texas panhandle has the following four distinct aspects:

- Cow-calf operations on open range.
- Grazing of cattle on wheat and native pasture.
- Feedlot operations.
- Slaughter and meat packaging operations.

TABLE 4.11.1.5–1.—*1992 County Business Patterns in the Pantex Plant Region of Influenc*

INDUSTRY	TOTAL # OF ESTABLISHMENTS	%	TOTAL # OF EMPLOYEES[1]	%	TOTAL ANNUAL PAYROLL[2] ($1000)
Agricultural Services, Forestry, Fishing	74	1.4	420	0.6	$7,656
Mining	102	1.9	610	0.9	$25,802
Construction	418	7.8	3,318	4.9	$77,053
Manufacturing	200	3.7	10,590	15.5	$281,266
Transportation, Public Utilities	241	4.5	4,422	6.5	$125,991
Wholesale Trade	451	8.4	6,091	8.9	$144,492
Retail Trade	1,410	26.3	16,651	24.4	$205,565
Finance, Insurance, Real Estate	498	9.3	3,674	5.4	$86,014
Services	1,896	35.4	22,475	32.9	$454,345
Unclassified	69	1.3	33	0.0	$1,021
Totals	5,359	100.0	68,284	100.0	$1,409,204

[1]Figures exclude self-employed persons, most government employees, railroad workers, agricultural production workers, domestic service workers, and employees of organizations totally exempt from FICA coverage. Total excludes 223 workers in Armstrong County who were not subdivided by industrial sector due to confidentiality considerations.
[2]Total payroll amount excludes $5.636 million in Armstrong County, which was not reported by industrial sector due to confidentiality considerations.
Source: TX Cen 1994a:Table 2

Each of these aspects is affected by precipitation levels and local and future agricultural meat prices for beef.

One step in beef cattle operations is slaughter and processing. The destination of beef cattle depends on market levels and transportation costs. Large meat processing operations often slaughter and ship carcasses to meat-cutting and meat-packaging operations, possibly in other states. Thus, the possibility that packaged beef is returned to the area of origin is very remote. It is likely that more than 95 percent of the beef cattle processed in large meat operations is distributed and consumed out of state. Conversely, more than 95 percent of the beef cattle processed by small-meat processors is distributed and consumed locally.

The number of cow-calf pairs and beef cows been compiled by the Texas Agricult Statistics Service for all Texas counties. A the January 1, 1994 inventory, Armstr County had 63,000 cow-calf pairs and 5,(beef cows. Corresponding numbers for Car County were 73,000 and 9,000. Potter 51,000 and 6,000, and Randall had 170,000; 9,000 (Pantex 1996:10.2).

Crops grown in the ROI during 1992 were s for a total of $43.8 million (TX Cen 1994:1). the four counties, Carson County is important agricultural county in the State Texas. In 1993, Carson County was eig among all Texas counties for production wheat and grain sorghum, and was 28th production of corn (Pantex 1996:10.1).

Since 1950, shortly before the nuclear weapons activities at Pantex Plant began, the value of crops grown and sold in the ROI has increased by 151 percent, relative to the 142 percent increase in the Producer Price Index for Crude Foodstuffs and Feedstuffs during this period. Cattle and calf sales in the ROI have increased by 2,007 percent since 1950, relative to a 153-percent increase in the Producer Price Index for Slaughter Livestock during this period. Details of the growth of the agriculture industry in the ROI are presented in Table 4.11.1.5–2.

Corn and sorghum grown for grain or seed and wheat grown for grain are the major cash crops of the four-county ROI. The number of bushels of each of the crops harvested in 1992 is depicted in Table 4.11.1.5–3. Corn production is significantly less than sorgham or wheat because extensive irrigation is needed for corn maturation. About half of the crops grown in the local area are strictly dryland because of the high cost of pumping water from the Ogallala aquifer (Pantex 1996:10.2).

In addition to agriculture, the economic activity in the ROI has historically depended on mining (oil and gas). Growth in manufacturing, distribution, food processing, and medical services has provided further diversification to the economy. In the 1960's, Amarillo Air Force Base, with a direct employment of approximately 4,000 military and civilian employees, was a dominant force in the Amarillo economy. With the closing of the Base in 1968, approximately 9,000 persons left the Amarillo area within a two-year period. The City of Amarillo, however, took immediate

TABLE 4.11.1.5–2.—*Characteristics of Farms in the Pantex Plant Region of Influence*

CHARACTERISTIC	1950	1959	1969	1978	1987	1992
Number of Farms	1,864	1,607	1,619	1,313	1,353	1,296
Acres in Farms (1,000's)	2,534.9	2,746.7	2,229.8	2,218.6	2,124.2	2,021.9
Average Acreage per Farm	1,359.0	1,709.0	1,377.0	1,690.0	1,570.0	1,560.1
Market Value All Crops Sold ($1,000's)[1]	$17,431.0	$14,456.9	$15,127.0	$26,078.0	$32,317.0	$43,801.0
Average Crops Sold Market Value per Farm	$9,351.3	$8,996.0	$9,343.0	$19,861	$23,885	$33,797.0
Number of Farms Reporting Cattle/ Calves	1,475	1,115	1,163	915	868	804
Number of Cattle/Calves	125,693	100,390	329,867	290,213	293,850	281,551
Value of Cattle/Calves Sold ($1,000's)[2]	$12,057.2	$16,798.2	$79,521.9	$185,019.0	$233,268.0	$254,033.0
Total Value of Crops Plus Cattle ($1,000's)	$29,488.2	$31,255.1	$94,648.9	$211,097.0	$265,585.0	$297,834.0

[1]The total market value of all crops sold in 1992 was 151 percent over the total for 1950, not adjusted for inflation (see note 3 below).
[2]The total market value for all cattle and calves sold in 1992 was 2,007 percent over the total for 1950, not adjusted for inflation (see note 4 below).
[3]From 1950 through 1992, the Producer Price Index for Crude Foodstuffs and Feedstuffs increased by 142 percent, relative to the 151-percent increase in sales in the ROI during this time period.
[4]From 1950 through 1992, the Producer Price Index for Slaughter Livestock increased by 153 percent, relative to the 2,007-percent increase in cattle sales in the ROI during this time period.
Sources: DOL nd.; TX Cen 1952, 1967, 1972, 1981, 1989, 1994

TABLE 4.11.1.6–2.—*Expenditures of Governing Bodies Within the Pantex Plant Region of Influence*

AREA OF EXPENDITURE	ARMSTRONG COUNTY	CARSON COUNTY	POTTER COUNTY	RANDALL COUNTY	CITY OF AMARILLO
Administrative/General Government	$132,547	$1,045,330	$919,664	$1,624,050	$4,132,407
Public Service, Agricultural, Health, Welfare	$54,896	$303,141	$500,046	$123,029	$6,992,525
Road and Bridge, Building Maintenance	$226,576	$1,246,913	$1,600,207	$1,126,876	$7,144,174
Tax and Recording Offices	$97,401	$228,084	$2,155,502	$832,557	$822,357
Judicial, Prosecution, Corrections, Law Enforcement	$188,546	$775,958	$11,127,778	$6,989,887	$23,456,147
Other	$0	$12,513	$1,036,781	$126,596	$16,914,296
Capital Outlay	$21,088	$220,329	$1,017,782	$619,279	$1,372,378
Debt Service	$25,929	$0	$1,320,746	$525,849	$1,145,380
Total	$746,983	$3,832,268	$19,678,506	$11,968,123	$61,979,664

Sources: County 1994d; County 1994a; County 1994b; County 1994c; City 1994

TABLE 4.11.1.6–3.—*Long-Term Outstanding Debts at End of 1994 Budget Year*

LOCAL GOVERNMENT	OUTSTANDING DEBT
Armstrong County	$66,093
Carson County	0
Potter County	$18,974,528
Randall County	$1,904,980
City of Amarillo	$55,793,763

Sources: County 1994d; County 1994a; County 1994b; County 1994c; City 1994

4.11.2 Impacts of Proposed Action

4.11.2.1 *Impacts of Continued Operations*

Analysis of socioeconomic effects utilizes total output, employment, and earnings multipliers for the Pantex Plant ROI from the U.S. Bureau of Economic Analysis Regional Input-Output Modeling System. The current employment of 3,800 direct (onsite) workers is considered to be sufficient for the continuation of operations at the 2,000 weapons activity level per year. The results from the Input-Output Modeling System indicate that, as a result of this level of operations, a total of 6,257 secondary jobs would be created throughout the ROI from regional spending by direct workers as well as from procurement of equipment, materials, and supplies by Pantex Plant. Most of the secondary jobs in the local economy are in the retail trade and service sectors, resulting from the first-round spending by direct workers and secondary impacts induced from business activity dispersed throughout the ROI economy.

Aggregated annual earnings (salary and wages paid to employees) for direct employees total $222 million in 1994 dollars (PC 1995v). An additional $176 million (in 1994 dollars) of earnings is generated annually through secondary employment in the ROI. Thus, total annual earnings in the ROI as a result of this level of continued Pantex Plant operations is estimated at approximately $398 million. Total personal income (income received by persons from all sources including wages, interest, dividends, and other transfer payments) generated by Pantex Plant operations at the 2,000 weapons activity level adds approximately $564 million (in 1994 dollars) to the ROI economy each year.

If Pantex Plant operations are reduced to the 1,000 weapons activity level per year, direct employment would decrease to approximately 3,000 workers. This would result in a decrease of secondary jobs in the ROI to 4,925. The combined (direct and secondary) decrease of 2,132 workers from the 2,000 weapons activity level could increase the unemployment rate in the ROI from 4.1 percent to approximately 6.0 percent. Aggregated annual earnings would total $175 million for direct employees (in 1994 dollars) and $138 million for secondary workers in the ROI. The total annual earnings and personal income in the ROI would be reduced to approximately $314 million and $445 million, respectively, as a result of reduction in activity level to 1,000 weapons operations per year. This would amount to approximately 79 percent of the earnings and personal income generated by the 2,000 weapons activity level.

If Pantex Plant operations are reduced to the 500 weapons activity level per year, employment would decrease to about 2,400 direct workers, and secondary jobs throughout the ROI would decrease to about 3,950. The combined reduction of 3,715 direct and secondary jobs from the 2,000 weapons activity level would increase the unemployment rate in the ROI from 4.1 percent to approximately 6.2 percent. This could trigger some out-migration of workers from the ROI. Aggregated annual earnings would total $140 million (in 1994 dollars) for direct employees and $111 million for secondary workers in the ROI. The total annual earnings and personal income in the ROI would be reduced to $251 million and $356 million, respectively, as a result of reducing Pantex Plant operations to the 500 weapons activity level. This would amount to approximately 63 percent of the earnings and personal income generated by the 2,000 weapons activity level.

Dr. Perryman's analysis reported in Amarillo Economic Development Corporation release dated August 3, 1993 and an undated press release by Perryman Consultants "Analysis Shows Pantex Plant Adds a Billion in Revenues and Thousands of Jobs to Amarillo Economy," have provided different projections for changes in Pantex related jobs. Dr. Perryman, in one place, mentions that Pantex Plant employs

to 276. Additional earnings in the ROI during the peak year of construction are estimated at $3.20 million and additional personal income at $4.55 million. After the construction is completed, 40 workers would be needed to operate the new facility. These workers would be transferred from existing facilities at the plant and would not generate additional socioeconomic impacts.

Nondestructive Evaluation Facility

During the peak year of construction, the Nondestructive Evaluation Facility would generate about 224 construction jobs. An additional 370 secondary jobs would be created in the ROI as a result of the facility construction, bringing the total jobs to 594 in the peak construction year. Additional earnings in the ROI during the peak construction year are estimated at $18.83 million and additional personal income at $26.71 million. After construction is completed, 42 workers would be needed to operate this facility. These workers would be transferred from the existing facilities at the plant and would not generate additional socioeconomic impacts.

Metrology Health Physics Calibration and Acceptance Facility

During the peak year of its construction, the Metrology and Health Physics Calibration and Acceptance Facility would generate an estimated 60 construction jobs. An additional 99 secondary jobs would be created in the ROI as a result of the facility construction, bringing the total jobs to 159 in the peak construction year. Additional earnings in the ROI during the peak year of construction are estimated at $5.04 million and additional personal income at $7.15 million. After construction is completed, 48 workers would be needed to operate the new facility. These workers would be transferred from existing facilities at the plant and would not generate additional socioeconomic impacts.

4.11.2.3 *Summary of Impacts*

At the 2,000 weapons per year level, a tota 10,057 jobs would be generated in the ROI a result of the activities at Pantex Plant Site. W weapons level reduced to 1,000 or 500 weap per year, the employment at Pantex Plant wo be reduced by 2,132 workers or 3,714 work respectively. Corresponding decreases earnings and personal income would also oc as described in section 4.11.2.1. Construct and associated secondary jobs generated by new projects in the peak construction year estimated at 1,227 workers. This amounts to increase of approximately 12 percent over plant's permanent workforce.

However, this increase would provide c short-term benefits to the local econo Because almost all construction workers ca locally hired, the benefits would gener accrue to the ROI population. Earnings in ROI would temporarily increase to $437 mil from $398 million generated by the contin operations at the 2,000 weapons activity le Personal income would correspondi increase from $564 million to $620 mill After the construction phase, the socioecono impacts would remain as described for continued operations.

For the 1,000 and 500 weapons levels, increase in employment, earnings, and pers income associated with new projects woul the same as described for the 2,000 weap level scenario.

4.11.3 Impacts of the No Action Alternative

Under the No Action Alternative, disassembly of weapons would cease when pit storage at Pantex Plant reaches 12,000 However, for purposes of analysis, it is assu that the weapons levels would remain at 2, 1,000, and 500 as described under the Propo Action. The activities associated with

disassembly would cease but would be substituted by an increase in activities associated with the assembly, modification, and surveillance of weapons to meet the stockpile requirements. With such a substitution, the workforce requirements at the plant and the expenditures that the plant would incur in Pantex Plant ROI would remain at the levels described under the Proposed Action. Therefore, socioeconomic impacts of the No Action Alternative would be similar to those described for the Proposed Action, with the exception that the impacts generated by the new projects planned under the Proposed Action would not occur.

4.11.4 Impacts of Pit Storage Relocation Alternative

4.11.4.1 *Impacts of Relocating 20,000 Pits*

Under this scenario, the activities at Pantex Plant would be similar to those described under the Proposed Action with 2,000 weapons per year activity level because the plant would continue to dismantle weapons until disassembly of 20,000 weapons is accomplished. The activities related to interim pit storage in Zone 4 of Pantex Plant would remain until pits are shipped to other site(s). As a result, the socioeconomic impacts of this Pit Relocation Alternative would be similar to those identified for the Proposed Action with 2,000 weapons per year activity level.

4.11.4.2 *Impacts of Relocating 8,000 Pits*

Even if only 8,000 pits are relocated to the other site(s), the assumption remains that Pantex Plant would continue to store 12,000 pits and weapons disassembly would continue until 20,000 weapons are disassembled. Socioeconomic impacts of this alternative scenario would, therefore, be similar to those identified for the Proposed Action with 2,000 weapons activity level per year.

4.11.5 Cumulative Impacts

The cumulative impacts presented here include impacts of the continued operations at Pantex Plant combined with impacts associated with activities described in the WM PEIS, SSM PEIS, and S&D PEIS. Since the Pantex Plant EIS Proposed Action and the SSM PEIS No Action Alternative represent a continuum of operations, the impacts associated with any new mission or facility that could be implemented at Pantex Plant are discussed in the context of that continuum. The impacts from the WM PEIS program are combined with those of the Pantex Plant EIS Proposed Action. The impacts from the S&D PEIS are combined with those of the SSM PEIS No Action Alternative. A detailed discussion of this methodology is presented in section 4.2. In addition, the cumulative impacts include impacts from the closure of the U.S. Department of Interior Helium Plant.

4.11.5.1 *Impacts of Alternatives in the Waste Management Programmatic Environmental Impact Statement*

The location of waste management facilities at Pantex Plant could increase employment at Pantex Plant by an additional 654 workers as projected in the WM PEIS. It should, however, be noted that the WM PEIS is projecting employment for both treatment and disposal facilities. The Proposed Action in this EIS already includes the construction and operation of a hazardous waste treatment and processing facility. The remaining disposal facility, if developed at Pantex Plant, would not generate the entire workforce as projected in the WM PEIS, and the cumulative impacts would more likely be lower than described above.

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4.12 INTRASITE TRANSPORTATION

4.12.1 Affected Environment

This section describes the intrasite transportation and handling of hazardous materials at Pantex Plant. Within Pantex Plant Site, approximately 30,000 transfers of nuclear and explosive materials take place each year, many of which are transported between zones, particularly Zones 4, 11, and 12, and between buildings in these zones. These materials include nuclear explosives, nuclear components, tritium, radioisotopic thermoelectric generators (RTGs), depleted uranium, high explosive(s) (HE) components and materials, chemicals, and other hazardous materials. The materials involved in these latter transfers do not involve an external radiation hazard as do weapons, pits, or to a lesser extent canned subassemblies (CSAs).

In addition, low-level waste, low-level mixed waste, and other hazardous wastes are transported onsite for storage, treatment, and disposal. Interzonal transfers between Zones 4, 11, and 12 are carried out on paved roads. Transportation between buildings in Zones 11 and 12 is frequently carried out via enclosed ramps. Typical vehicles and equipment used for transportation on roads include hardened trailers, Safe Secure Tractor Trailers (SSTs), flatbed trailers, vans, trucks, and tow motors. Transfer of materials via ramps is carried out by forklifts and pallet jacks.

The following subsections further describe the intrasite hazardous materials transportation activities at Pantex Plant. Worker doses resulting from transportation activities are also provided in these subsections to determine human health risks analyzed in section 4.14, Human Health.

4.12.1.1 *Onsite Transfers of Radioactive Material*

Onsite transfer of radioactive material is governed by DOE orders and Pantex-specific standards. The Transportation and Staging Department is responsible for transfers of nuclear explosives and nuclear explosive components between zones. The inventory control section of the Production Stores Department is responsible for transfers of nuclear explosives and nuclear explosive components between bays and cells within buildings in Zone 12. The Waste Operations Department is responsible for transportation of radioactive wastes onsite.

Nuclear Explosives

Within zones, nuclear explosives are transported on paved roads and covered walkways (ramps) using an electric forklift. During onsite transfers, nuclear explosives are retained in weapons-specific handling gear (H-gear) containers. Nuclear explosives within H-gear containers produce weapons system-specific external radiation hazards. Certain types of nuclear explosives are transported as a complete unit and are attached to their H-gear; this type of nuclear explosive has a bounding dose rate of 8 millirem per hour at 1 meter. Nuclear warheads, however, are contained within system-specific H-gear packages; this type of nuclear explosive has a bounding dose rate of 50 millirem per hour at the surface of the package. H-gear containers are towed between locations or lifted by the forklift and driven to locations. The speed limit for nuclear explosive transfers within ramps is 8 kilometers (5 miles) per hour.

Nuclear explosives are transported between zones within either hardened trailers or SSTs. SSTs are similar in appearance to commercial tractor trailers but are equipped with unique safety and safeguards features that prevent unauthorized cargo removal and minimize the

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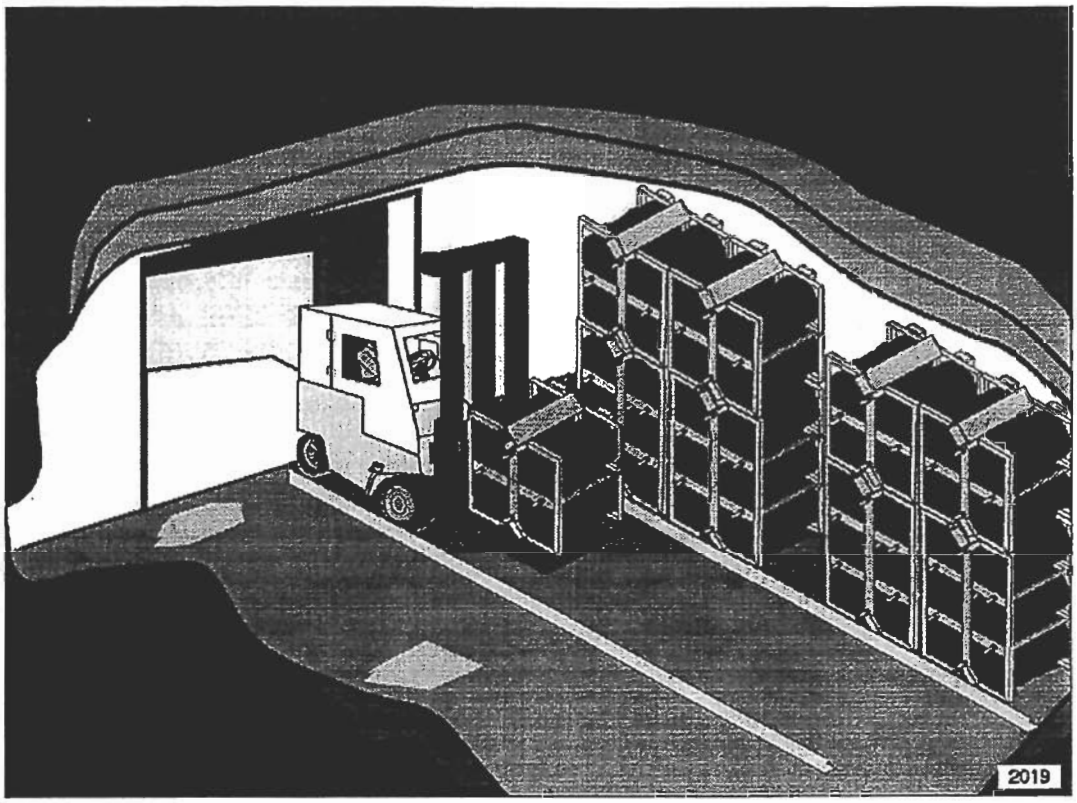


FIGURE 4.12.1.1–1.—*Stage Right Magazine.*

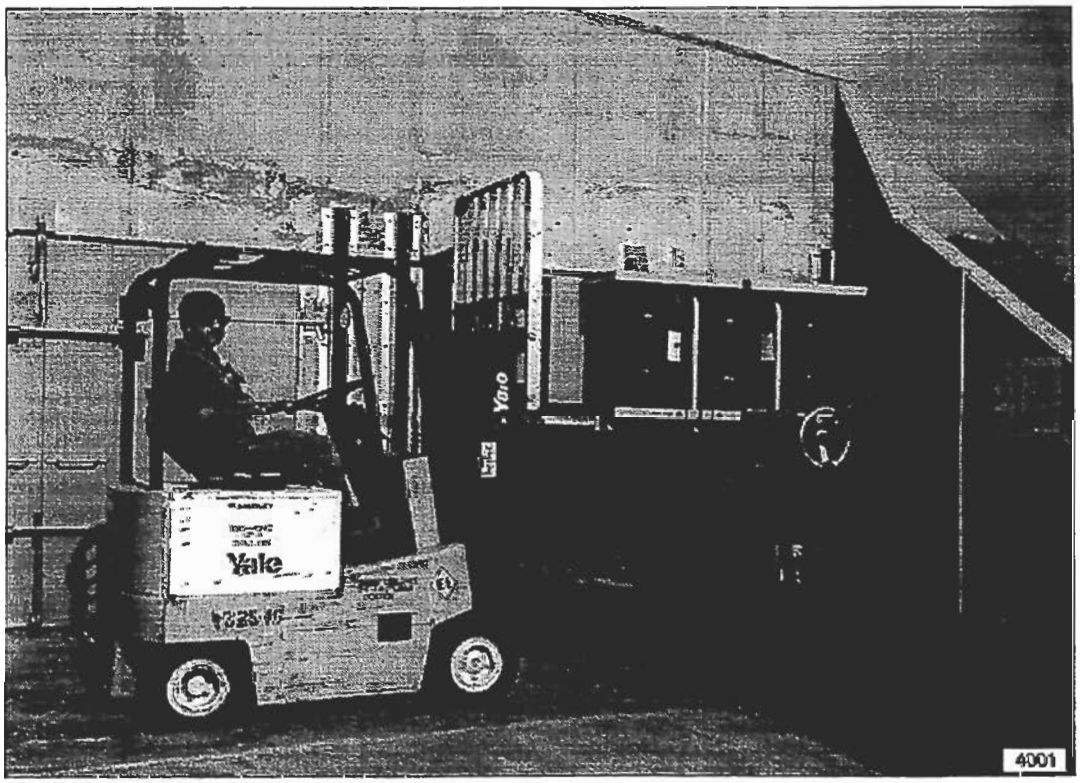


FIGURE 4.12.1.1–2.—*Placement of Stage Right Pallet on Pallet Turner.*

highly enriched uranium, are either packaged in sealed steel containers, fastened onto metal frames, or staged in plywood boxes. A packaged CSA produces a weapons system-specific external radiation hazard. A packaged CSA has a bounding dose rate of 0.2 millirem per hour at 1 meter. These components are loaded onto SNM tie-down pallets and transferred by electric forklift to an approved storage facility to await transfer to either the Y–12 Plant (at Oak Ridge Reservation) for final disassembly or Zone 4 for temporary staging. CSA transfers related to component testing, weapon assembly, or weapon modifications within Zone 12 are accomplished using either SNM tie-down pallets or special pallets and electric forklifts.

CSAs ready for transfer to Zone 4 are moved by electric forklift to a loading dock within Zone 12, where they are loaded into a hardened trailer or SST, tied down within the trailer, and driven to a storage magazine within Zone 4 West. Upon arrival at the magazine, CSAs are placed on a pallet and driven into the magazine using an electric forklift. CSAs are placed on the floor using the forklift, a manual hand truck, or a small hydraulic truck. CSAs are retrieved from a storage magazine in the same manner.

Radioisotopic Thermoelectric Generators

At the point of removal from a weapon, RTGs are placed in an approved container. The containers are then transported to an approved storage facility to await transfer to Los Alamos National Laboratory. RTGs within containers do not present a radiological hazard. RTG transfers related to component testing, weapon assembly, or weapon modifications within Zone 12 are accomplished with electric forklifts or carts using SNM tie-down pallets or wire baskets.

Tritium Reservoirs

At the point of removal from a weapon, tritium reservoirs are placed in either Kennedy Kits, metal suitcases, or H1616 containers. T reservoirs within the container do not pres radiological hazard. The container transported to the Tritium Staging Facility await transfer to the Savannah River Site. S reservoirs are processed through a sep facility prior to delivery to the Tritium Sta Facility. Reservoir transfers occur in a basket secured to either a forklift or the bed an electric cart. Tritium reservoir trans related to component testing, weapon assem limited-life component replacements, weapon modifications within Zone 12 accomplished in a similar manner.

Low-Level and Mixed Radioactive Wastes

Both low-level and mixed radioactive wa are transported from the generation point to central collection area in Building 12–42. U approval for shipment to Building 12–42, waste is loaded onto a flatbed or stakebed tr secured with tie-downs, and relocated to storage facility truck dock. At the truck d the waste package is checked for damage proper paperwork and added to the fac inventory. From Building 12–42, radioa wastes are transferred to an onsite sto facility using a flatbed or stakebed truck. T storage facilities include Building 11- Building 11–7N Pad, Zone 4 East Magazine and 56, and 25 Conex Boxes.

Transportation Management

Movements of nuclear explosives and nu components are coordinated with and tra by the SNM control center via a se telephone system. A custodian is assigned oversee transfer operations. For Zone transfers, a walker-spotter walks in front directs all traffic, including foot traffic, to until the vehicle safely passes. Signs corridor mirrors help alert drivers to approaching hazards during transfers. amount of combustible material allowed ramps used for nuclear material transfer strictly limited. The speed limit for vehi

inventory pallet. This pallet is moved inside the magazine by either the shielded Stage Right forklift or an automated guided vehicle. As the pallet is moved, the bar code reader and video camera verify the presence of each pit container within the magazine and the integrity of both the container and the tamper-indicating device. Only the driver using the shielded forklift is required to be in the magazine during the inventory. The use of an automated guided vehicle is currently being implemented. No personnel are required in the magazine with the automated guided vehicle. No pit movement is required for the inventory. All other inventories of magazines not in Stage Right configuration (weapons, weapons components, etc.) are inventoried by hand.

Random pit evaluations are required to meet component reliability requirements. Less than 30 pits (approximately) are selected each year for these evaluation activities. The pallets containing the pits chosen for evaluation are removed from the magazine either manually or using Stage Right techniques and equipment. These pits are transferred to Zone 12 for evaluation activities.

The shielded cab on the Stage Right forklift protects the driver from ionizing radiation while inside storage magazines. Stage Right forklifts are equipped with a special boom that prevents penetration of plutonium containers during handling operations. This boom is equipp with a limit switch that stops the forklift if t boom accidentally touches a pit contai Stage Right forklifts are operated within gu rails that prevent movement of the fork outside a clearly defined path. Zone 4 perso involved in pit movements are required to w lead aprons.

4.12.1.3 *Radiological Exposures from Onsite Radioactive Material Shipments and Zone 4 West Nuclear Material Staging Activitie*

Radiological exposures incurred by worker the Transportation and Staging Departm during the performance of both transporta and staging activities for the years 1993 thro 1995 are provided in Table 4.12.1.3–1. On transfers of SNM within buildings and betw bays and cells are performed by the produc technicians or Production Stores perso Exposures related to these activities considered as part of production operations, transportation. The doses incurred by wor in the Waste Operations Department are provided in Table 4.12.1.3–1. These doses incurred in the performance of all activ involving radioactive waste, not transportation.

TABLE 4.12.1.3–1.—*Dosimetry Records for Transportation Staging and Waste Operations Department*

YEAR	CUMULATIVE DOSE (PERSON-REM)		NUMBER OF PERSONS MONITORED		MAXIMUM INDIVIDUAL DOSE (MREM)	
	Transportation and Staging Department	Waste Operations Department	Transportation and Staging Department	Waste Operations Department	Transportation and Staging Department	Waste Operations Departmen
1993	3.338	0.00	45	48	284	0.00
1994	2.150	1×10^{-2}	49	62	200	0.10
1995	3.642	2×10^{-2}	46	56	320	21.00

Source: PC 1995k:1

Zone 4 West for interim storage. All container transfers would be performed using Stage Right techniques and equipment. Current schedules indicate an average repackage rate of approximately 1,000 pits per year starting in 1997. No public exposure to radiation is expected from onsite, incident-free transport of pits.

CSAs from both dismantlement and stockpile management activities would continue to be transported and handled within the Pantex Plant boundary. No public exposure to radiation is expected from onsite, incident-free movements of CSAs.

RTGs from both dismantlement and stockpile management activities would continue to be transported and handled within the Pantex Plant boundary. The twin pack currently used for onsite transport and handling of RTGs is being phased out in favor of a newer mode of the currently approved DOT–6M, Type B package for all onsite transfers. Onsite transfers of RTGs do not have the potential for significant environmental impacts because an RTG within a transfer container does not present an external radiological hazard and RTGs are constructed in such a way that an accidental release of plutonium is not reasonably foreseeable in the onsite transportation environment. RTGs are able to withstand an exposure of 1,000 °C (1,832 °F) for 1 hour or an impact of 571 kilometers (355 miles) per hour on a steel surface with no plutonium release (GE 1975).

Tritium reservoirs from both dismantlement and stockpile management activities would continue to be transported and handled within Pantex Plant boundary. No worker or public exposure to radiation occurs from onsite incident-free movements of tritium reservoirs.

Onsite transfers of depleted uranium (DU) would continue, but transfers of DU do not result in significant environmental impacts. DU does not present an external radiological hazard in the transportation environment. The radiological hazard of uranium depends upon degree of enrichment. With increas enrichment, there is a corresponding increase the radiological hazard from the uranium (DO 1988).

DOE is using the safety analysis process defined in DOE Order 5480.23 to identify a control threats to the safety of onsite shipme of radioactive material. Safety issues related onsite transportation activities are curre evaluated in the Onsite Transportation Saf Risk Assessment (Pantex 1994). Howev DOE is planning to issue a complete Saf Analysis Report for onsite transporta activities.

The bounding onsite transportation accid (low probability/high consequence), in term offsite consequences, would be an accid involving the detonation of HE contained wi weapons during transit. An HE detona within a weapon would lead to the dispersa plutonium and other radioactive material the environment. (Weapons are designed that in the event of an accidental HE detonat there would be no significant nuclear reactio An accidental HE detonation is only possibl those weapon systems containing conventi HE. The insensitive HE contained in s weapon systems does not have the potenti accidentally detonate. It has been determ that the following scenarios may lead to accidental HE detonation within an in-tr weapon: a long-lasting fire supplied with by a crashed aircraft; or a mechanical impa a weapon from a tornado, a wind-gener missile, a direct hit by a crashing aircraft, bullet striking the HE.

Because of speed limits and protective hard gear, no onsite vehicle accident can creat impact conditions necessary for an detonation within a nuclear explosive. addition, no onsite nuclear expl movements are allowed in severe weather may threaten the safety of the transport tornado, severe wind). Nuclear explosive

are sensitive to bullet impacts (those containing conventional HE) are protected by a bullet resistant covering when not inside a hardened trailer or SST.

The likelihood of an aircraft crashing into a critical area at Pantex Plant is extremely remote. The probability of this event occurring is evaluated in section 4.15, Aircraft Accidents. The likelihood of an aircraft crashing into a critical area at Pantex Plant and affecting (by fire or direct hit) an intransit weapon is considered not reasonably foreseeable (frequency of occurrence is less than 10^{-6} per year) and at least several orders of magnitude less likely than an aircraft impact to a Pantex Plant facility (because of the limited target area of the trailer compared with facilities and the limited time that weapons are contained in a trailer).

In terms of risk (the product of probability and consequence), the potential environmental impacts from an airplane crash into a Zone 4 weapons magazine, as discussed in section 4.14 (Human Health), are much more significant than those associated with a crash into a hardened trailer. However, if this event were to occur, it would have the potential to cause environmental impacts. It is estimated that an HE detonation of numerous nuclear weapons within a hardened trailer would lead to a cumulative population dose of 4,820 person-rem with a corresponding public health risk of less than 2×10^{-7} excess cancer fatalities per year.

Other potential onsite transportation accidents are much more likely to occur but have less potential for environmental impacts. A characteristic high probability/low consequence accident involving radioactive material is a forklift puncture causing a release of plutonium from a pit container in the onsite transportation environment. This event is discussed in section 4.14, Human Health.

Zone 4 West Staging Activities

Under the Proposed Action, as many as 20,000 pits could be stored in Zone 4. Approximately 60 storage magazines would be required to store that number of pits. This total includes 18 Modified Richmond magazines and 42 Steel Arch Construction magazines. Pit magazine activities would include inspections, inventory, surveillance pit removals, and repackaging pit removals. All of these activities would be performed using the Stage Right equipment and techniques.

In addition to the surveillance pit removals, DOE plans to sample a number of sealed storage containers from Zone 4 magazines. The purpose of this evaluation is to verify the integrity of the storage containers. It is expected that 20 to 22 containers would be removed from the magazines annually and taken to Zone 12 for evaluation. The containers selected for evaluation will be removed from a storage magazine and transported to Zone 12 using Stage Right equipment and techniques.

Other magazine activities that may occur within the timeframe evaluated in this EIS include the restacking of pits in a limited number of magazines to comply with design laboratory pit temperature limits and pit movements and instrumentation placements in a limited number of magazines to facilitate third-party verifications. In addition, to allow for operational flexibility, DOE may choose to store a small number of pits in a non-Stage Right configuration. All storage magazine operations will be performed in a manner that minimizes worker radiological exposure.

Radiological Impacts From Onsite Transfers of Radioactive Material and Zone 4 West Staging Activities

Because future stockpile management requirements cannot be accurately predicted, this EIS examines impacts associated with operations on 2,000, 1,000, and 500 weapons per year (and associated interzone transfers) in

Onsite movements of nuclear explosives, non-pit nuclear explosive components (excluding pits), and other hazardous material would be identical to those occurring under the Proposed Action including the repackaging of pits. Movements of pits would differ from the Proposed Action in that pits stored in Zone 4 would be shipped offsite. Impacts related to the offsite shipments of pits, including loading of pits into offsite shipment vehicles at Pantex Plant, are described below.

The loading and securing of pit containers within an SST will result in additional radiological exposures to onsite transportation workers. The over-the-road shipment of pits requires that the pit containers be restrained within the SST. Because of the complexity of the tiedown within a trailer, 10 to 15 minutes are required per container to perform the placement and tie-down operation. Transportation workers must be in proximity of the pit container during the placement and tie-down operation. Additionally, since an offsite pit shipment will contain more than one pit container, transportation workers will be in the proximity of numerous pit containers while operating within a trailer.

Because of the unavailability of historical dosimetry information specifically related to pit loading and unloading activities, conservative dose estimates have been made for this operation. Using estimates for time spent and position within a trailer during placement and tie-down operations and a dose rate of 1.5 millirem per hour at 1 meter from a pit package, the loading of pits into SSTs will result in an additional exposure of less than 27 person-rem per year (for 2,000 pits per year) or less than 270 person rem for 20,000 pits. Furthermore, the transfer of pits from magazines to SSTs would result in an additional 13 person-rem for the relocation of 20,000 pits. Further details of the assumptions used in these estimates are available in section F.7.

Onsite material movements for the 2,0 weapons level and the loading of 20,000 p into SSTs is estimated to result in a 10-y cumulative dose of 344 person-rem (2 person-rem plus 13 person-rem for pit trans loading activities plus 61 person-rem for nor operations) to transportation and stag workers. Using a dose-to-risk conversion fa of 4 x 10^{-4} excess cancer fatalities per pers rem and, assuming that the same 50 peo remain involved in material handling and loading operations, there would be an additio 0.14 excess cancer fatalities in this group du this exposure.

4.12.4.2 *Impacts of Relocating 8,0 Pits*

Under this option, DOE would relocate 8,000 pits to other site(s). Pantex Plant wo continue to store up to 12,000 pits onsite. other activities would remain as described u the Proposed Action including the repacka of pits.

Onsite material movements for the 2, weapons level and the loading of 8,000 pits SSTs is estimated to result in a 10- cumulative dose of 174 person-rem person-rem for pit transfer and loading activ plus 61 person-rem for normal operation transportation and staging workers. Usi dose-to-risk conversion factor of 4 x 10^{-4} ex cancer fatalities per person-rem and assu that the same 50 people remain involve material handling and pit loading operat there would be an additional 0.07 excess ca fatalities in this group due to this exposure.

4.12.5 Cumulative Impacts

The cumulative impacts presented here in impacts of the continued operations at P Plant combined with impacts associated activities described in the WM PEIS, PEIS, and S&D PEIS. Since the Pantex

EIS Proposed Action and the SSM PEIS No Action Alternative represent a continuum of operations, the impacts associated with any new mission or facility that could be implemented at Pantex Plant are discussed in the context of that continuum. The impacts from the WM PEIS program are combined with those of the Pantex Plant EIS Proposed Action. The impacts from the S&D PEIS are combined with those of the SSM PEIS No Action Alternative. A detailed discussion of this methodology is presented in section 4.2.

Cumulative impacts of radiological exposure of workers and the public in the Pantex Plant vicinity are described in section 4.14, Human Health.

4.12.5.1 *Impacts of Alternatives in the Waste Management Programmatic Environmental Impact Statement*

Intrasite transportation is not addressed in detail in the WM PEIS, but is included in parts of the intersite transportation analysis. Future project-specific NEPA reviews would be expected to assess this issue, if one or more waste disposal facilities are to be constructed at Pantex Plant as a result of the WM PEIS.

4.12.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, impacts from intrasite transportation activities are expected to be less than current impacts. Under the downsizing alternative, the facilities would be consolidated. This could further reduce the amount of intrasite transportation impacts. Under the relocation alternative, intrasite transportation associated with assembly and disassembly operations and HE fabrication would cease.

4.12.5.3 *Impacts of Alternatives in the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*

As discussed in sections 1.4 and 1.7.3 of this volume, the final S&D PEIS will include an alternative under which plutonium pits from Rocky Flats Environmental Technology Site (RFETS) could be transferred to Pantex Plant for storage in Zone 4 as early as 1997. Impacts related to intrasite transportation and additional pit handling will be described in appendix Q of the S&D PEIS. Adding RFETS pits to pits from Pantex Plant dismantlement operations would not exceed the storage limit of 20,000 pits analyzed under the Proposed Action. Furthermore, RFETS pits have the same characteristics, as analyzed in the S&D PEIS, as pits currently or previously stored at Pantex Plant.

Placing RFETS pits in Zone 4 storage would, however, require repackaging RFETS pits from FL-type containers into AL-R8 containers in Zone 12 prior to placement into Stage Right configuration. Additionally, once repackaged, the pits would be transferred from Zone 12 to Zone 4. The total exposure to workers from both the transfer of pit containers and the repackaging of pits arriving from RFETS would result in less than 10^{-2} additional latent cancer fatalities for involved workers, as reported in appendix Q of the S&D PEIS. No exposure to the public is expected from these operations.

4.12.6 Potential Mitigation Measures

Onsite shipments of radioactive material have been performed for many years at Pantex Plant without a significant accident involving radioactive material. Radiological exposures incurred from future onsite transportation activities would continue to be controlled and minimized by Pantex Plant procedures, administrative controls, and an active As As Reasonably Achievable program promotes work practices that minimize w exposures. The Pantex Plant *Radiol Control Manual*, and ultimately, the F regulations for occupational ra protection dictate the magnitude of radiol exposure to workers and safe radiologica practices (Pantex 1995d; 10 CFR 835).

TABLE 4.13.1.1–1.—*Permits Issued to Pantex Plant*

PERMIT	PERMIT NUMBER	ISSUING AGENCY	EFFECTIVE DATE	EXPIRATION DATE
Written Grant of Authority[1]		TNRCC	Reissued 5/29/91	None
Building 16–13 Steam Plant	C-18379	TNRCC	7/21/88	7/21/03
Burning Ground	Written Grant of Authority	TNRCC	Reissued 5/29/91	None
Building 11–36	21233	TNRCC	3/11/93	3/11/98
Building 12–19	21233	TNRCC	3/11/93	3/11/98
High Explosives Synthesis Building (11–55)	21233	TNRCC	3/11/93	3/11/98
Solid Waste Registration No.[2]	30459	EPA/ TNRCC	10/30/80	None
Hazardous Waste Permit[2 4]	HW-50284/ TX-4890110527	EPA/ TNRCC	4/25/91	4/25/01
Modification 1	Class 1 modification	TNRCC	1/26/93	4/25/01
Modification 2	Class 1 modification	TNRCC	7/28/93	4/25/01
Modification 3	Class 3 modification	EPA/ TNRCC	2/16/96	4/25/01
Wastewater No Discharge[3]	02296	TNRCC	5/19/80	5/03/93
Wastewater Discharge[3 5]	02296	TNRCC	6/14/96	6/14/01
NPDES Permit[3]	TX-0107107	EPA	6/1/96	5/31/01
NPDES General Permit for Stormwater Discharge Associated with Non-Construction Industrial Activity[3]	TXR00G138	EPA	2/15/95	10/1/97
NPDES General Permit for Stormwater Discharge Associated with Construction Activity	TX10L777	EPA	9/13/94	
Clean Water Act Section 404 Dredge and Fill Permit	Nationwide Permit for Survey Activities	Corps of Engineers	6/16/94	6/16/96

[1]Air.
[2]Solid Waste.
[3]Water.
[4]RCRA Part B Permit.
[5]New permit pending approval.
NPDES - National Pollutant Discharge Elimination System.
Sources: DOE 1996f:15; TNRCC 1996; TNRCC 1996b; EPA 1996

TABLE 4.13.1.1–2.—*Solid Waste Management Facilities, 1996*

FACILITY	FUNCTION	WASTE TYPES	WASTE FORMS	LISTED CAPACITY[1]
4–46, 4–50, 4–56, 4–72, 4–74	S	LLMW, HW, LLW	Liquid/Solid	1,029,920 liters (272,100 gal)
20 LLW Conex Boxes	S	LLW	Solid	1,438 m^3 (50,760 ft^3)
13 HW Conex Boxes	S	LLMW, HW	Solid	934 m^3 (32,988 ft^3)
11–7N, A, B	S	LLMW, HW, LLW, NHW	Liquid/Solid	527,099 liters (139,260 gal)
11–9N	S	LLMW, HW, LLW, NHW	Liquid/Solid	378,500 liters (100,000 gal)
12–42	A	LLW	Liquid/Solid	Variable
Burning Ground	T	LLMW, HW	Solid	181,818 kg (400,000 lb) total
9 Trays				680 kg (1,500 lb) per burn
3 Pads				153 m^3 (5,400 ft^3) per burn
3 Pans				680 kg (1,500 lb) per burn
11–50	F	Wastewater and HE particulates	Liquid	57,000 liters (15,000 gal) per month
12–43	T	HW	Liquid	15,000 liters (4,000 gal) per month
16–16RHWSF	S	LLMW, HW, LLW, NHW	Liquid/Solid	1,040,000 liters (275,000 gallons)
Construction Debris Landfill	D	NHW	Solid	Not Applicable
HWTPF	T	LLMW, LLW, HW, NHW	Liquid/Solid	500 m^3 (654 yd^3) per year—Proposed
11–9, 11–15A	T	LLMW, HW	Liquid/Solid	757 liters (200 gal) per treatment
12–19E	R	NHW	Liquid	Not Applicable
11–36	TS	HW	Liquid/Solid	1,000 kg (2,200 lb)/Study
11–29	R	HW	Liquid	Not Applicable

[1]Due to conversion rounding, listed capacities may differ from permitted capacities.
A - Accumulations, D - Disposal, F - Filtration, R - Recycle, RHWSF - RCRA Hazardous Waste Staging Facility, S - Storage, T - Treatment, TS - Treatability Study.
Sources: DOE 1994c:Table 7-1; Pantex 1996:14.0; PC 1995d:1; TNRCC 1996; PC 1996d; MH 1995d

Compliance Plan Annual Update document, construction of the HWTPF is no longer considered a regulatory requirement. DOE's purpose and need for enhanced efficiency and safety of its current mixed waste, low-level radioactive waste and hazardous waste operations remain and are discussed in greater detail in appendix H. Without the HWTPF, waste treatment and processing capabilities are greatly reduced.

In terms of overall operational waste management, the RCRA Part B Permit is the most significant regulatory instrument. The State of Texas and EPA jointly issued Pantex Plant a Hazardous Waste Permit in April 1991 to address the processing and storage of hazardous waste. The permit was modified in January 1993 to allow treatment in tanks and containers in Building 11–9 and 11–15A. In July 1994, the permit was modified to increase

permitted storage capacity for hazardous waste in Buildings 11–9N, 11–7A, and 11–7B by 780,700 liters (206,260 gallons) (TNRCC 1995a:9; PC 1995).

Pantex Plant requested a Class 3 modification to the Hazardous Waste Permit issued in April 1991 by TNRCC and EPA. The initial request for modification, made in November 1991 and revised in October 1992, asked for the addition of 17 RCRA units at the Burning Ground, which were excluded from the April 1991 permit but continued to operate under RCRA Interim Status, and 10 additional storage units. On February 16, 1996, the Class 3 permit modification was approved by TNRCC. As a result, permitted storage increased (5 Conexes and 3 magazines), 5 Burning Ground units (3 flash pits, 2 cages) were closed, and 15 Burning Ground units received permit status (DOE 1994b:2-6, 2-7; TNRCC 1996).

Air emissions from the ongoing Burning Ground activities are subject to general air quality conditions established in the Hazardous Waste Permit. The permit states that this facility shall be operated in accordance with and subject to the applicable provisions of the *Texas Solid Waste Disposal Act* and the *Texas Clean Air Act* as amended, Chapter 382 of the Texas Health and Safety Code, and all applicable rules, regulations, and orders of the TNRCC. The resulting ash shall be managed so as to not cause or contribute to a condition of "air pollution" as defined in subchapter 382.003 of the Texas Health and Safety Code (TNRCC 1996:20-22).

In 1984, RCRA was amended by the Hazardous and Solid Waste Amendments, which imposed waste minimization requirements on hazardous waste generators and treatment, storage, and disposal facilities. To comply with the waste minimization requirements, Pantex Plant established a Pollution Prevention and Waste Minimization program. Volume II, appendix G, Pollution Prevention and Waste Minimization, provides detailed information regarding pollution prevention and waste minimizatio Pantex Plant. This program has been tinguished with the White House Closing Circle Award and the Vice President's Ham Award in 1996 (MH 1996b).

Pantex Plant is also active in the Clean T 2000 pollution prevention program. organizations involved in this program co to reduce chemical releases and hazar waste generation by 50 percent by the 2000, using the 1987 Toxic Release Inve Report as a baseline. Current and pla studies examining alternative treat methods to open burning-open detonatic high explosives are discussed in volum appendix G.

Waste Management Practices

The major categories of wastes generat Pantex Plant are described below. discussion covers waste character activities, locations, quantities, and g waste management practices. Activit Pantex Plant generate wastes that categorized as low-level radioactive (LLW), low-level mixed waste (LL hazardous waste (HW), and nonhaz nonradioactive waste (NHW). NHW ha categories—Class 1, 2, and 3 (see 4.13.1.1–3). Other wastes include sanita industrial wastewater, storm polychlorinated biphenyls (PCBs), as and medical wastes.

Transuranic (TRU) and mixed TRU was not normally generated, and no hig radioactive wastes are currently gener Pantex Plant. Three drums of TRU was generated in 1993 as a result of an i during weapon dismantlement. The TRI is stored at Pantex Plant in an appro monitored facility awaiting approval of to an offsite management facility 1996:14.5). Pantex Plant uses trained pe and approved program procedures to waste from the point of generation

TABLE 4.13.1.1–3.—*Nonhazardous (Nonradioactive) Waste Classification*

WASTE CLASS	REGULATION	CRITERIA	EXAMPLES	ONSITE S/T/D	ONSITE S/T/D
Class 1	30 TAC 335.505	Is not hazardous waste. Contains constituents in excess of levels specified in 30 TAC 335.506.	Empty containers, rags, wipes, protective clothing, wastewater, and soils.	S/T/D[1]	T/D
Class 2	30 TAC 335.506	Is not hazardous waste. Contains constituents in excess of levels specified in 30 TAC 335.506. Is not a Class 3 waste.	Paper, plastics, plant wastewater, and soils refuse.	S/T/D[1 2]	T/D
Class 3	30 TAC 335.507	Is not hazardous waste. Is inert, essentially insoluble, and poses no threat to human health and/or the environment.	Rock, brick, glass, dirt, and certain plastics and rubber.	D[2]	None

S/T/D - Storage/Treatment/Disposal
[1]Onsite treatment and disposal is limited to wastewater treatment and disposal.
[2]Onsite disposal is in a Construction Debris Landfill located in Zone 10.
Source: Pantex 1996:14.5

storage, treatment, and disposal (TNRCC 1996).

4.13.1.2 *Waste Categories and Operations*

Table 4.13.1.2–1 shows the annual waste generation from 1992 through 1995 for LLW, LLMW, HW, and NHW. Table 4.13.1.2–2 shows ER program projected annual waste generation from 1997 to 2000 for LLW, LLMW, HW, and NHW. Table 4.13.1.2–3 shows projected waste generation from 1997 to 2007. As of September 1995, waste in storage included 474 m^3 (616 yd^3) of LLW, 147 m^3 (191 yd^3) of LLMW, 153 m^3 (199 yd^3) of HW, and 311 m^3 (404 yd^3) of NHW. Each of these waste types is discussed below. Additionally, Chapter 14 of the Pantex Plant Environmental Information Document provides detailed waste stream and waste management facility information.

Low-Level Radioactive Waste

LLW contains radioactivity not classified as high-level waste, TRU waste, spent nuclear fuel, or special by-product material as defined by DOE Order 5820.2A (DOE Order 5820.2A:Attachment 2, page 3). Pantex Plant's LLW wastestreams include materials contaminated during weapons assembly, disassembly, maintenance, or quality assurance testing. Other wastestreams include protective clothing, filters, wipes, plastic, foam, rubber, desiccant, and debris (PC 1995f).

LLW is stored onsite and shipped to the Nevada Test Site (NTS) for disposition. Pantex Plant must accumulate and store LLW in a manner that does not create a nuisance or endanger the public health or environment. Pantex Plant's LLW operating storage capacity is of at least 2,380 containers (Pantex 1996:14.8). To ensure that LLW does not pose a danger to the public or the environment, Pantex Plant manages LLW in accordance with the NTS Defense Waste

TABLE 4.13.1.2–1.—*Industrial Operation-Related Waste Volumes (in cubic meters [cubic yards]) 1992–1995*[1]

WASTE TYPE	1992	1993	1994	1995
LLW[3]	266 (346)	287 (373)	232 (302)	187 (241)
LLMW	51 (67)	38 (50)	25 (33)	29 (38)
HW	589 (770)	370 (484)	193 (252)	460 (598)
NHW[2]	7,078 (9,201)	11,610 (15, 093)	5,507 (7,159)	5,136 (6,677)
Total	7,984 (10,384)	12,305 (16,002)	5,957 (7,746)	5,810 (7,554)

[1]Conversion of different waste types from weight to volume were made using 0.72 kg per liter (6 pounds waste per gallon).
[2]NHW includes industrial Class 1 (includes Toxic Substances Control Act (15 U.S.C. 2601) wastes), Class 2, and Class 3 wastes.
[3]Volumes include non-production waste.
Source: DOE 1996f:18

TABLE 4.13.1.2–2.—*Environmental Restoration Waste Projections, 1997–2000*[1]

WASTE TYPE	FY 1997	FY 1998	FY 1999	FY[2] 2000
SOLID WASTE, m^3 (yd^3)				
LLW	237 (310)	0 (0)	0 (0)	0 (0)
LLMW	0 (0)	0 (0)	0 (0)	0 (0)
HW	765 (1,000)	7.6 (10)	0 (0)	0 (0)
NHW	8,659 (11,325)	772 (1,010)	0 (0)	0 (0)
LIQUID WASTE, L (gal)				
LLW	0 (0)	0 (0)	0 (0)	0 (0)
LLMW	0 (0)	0 (0)	0 (0)	0 (0)
HW	749 (198)	3,039 (803)	16,156 (4,268)	749 (198)
NHW	116,049 (30,757)	354,261 (96,492)	72,536 (19,162)	72,536 (19,162)
Total[3 4]	9,778 (12,711)	1,137 (1,478)	89 (116)	73 (95)

[1]Table includes a 10 percent margin to provide conservative estimates.
[2]Nonhazardous liquid waste and hazardous liquid waste would continue to be produced at this level beyond FY 2000.
[3]Assumed 1,000 liters equals one cubic meter.
[4]Totals (solid waste and liquid waste) are reported in m^3 (yd^3).
Source: Pantex 1996:14.5

TABLE 4.13.1.2–3.—*Annual Total Industry Related Waste Projections Excluding Environmental Restoration Waste at Pantex Plant, 1997–2007 (in cubic meters [cubic yards])*[1 2]

WASTE TYPE	WEAPONS LEVEL PER YEAR		
	2,000 WEAPONS/YEAR (3,800 EMPLOYEES)	1,000 WEAPONS/YEAR (3,000 EMPLOYEES)	500 WEAPONS/YEAR (2,400 EMPLOYEES)
LLW	249 (326)	131.5 (172)	71.6 (93.7)
LLMW	183.2 (239.6)	118.3 (154.7)	81.0 (105.9)
HW	191.6 (250.5)	107.9 (141)	63.8 (83.5)
NHW (Class1)	741.6 (970)	524.6 (686.2)	388.2 (507.8)
NHW (Class 2)	574 (751)	453 (593)	363 (475)
Total	1,939.4 (2239.1)	1,335.3 (1,746.9)	967.6 (1,265.9)

[1]Table excludes PCB, asbestos, and medical. Environmental restoration and wastewater discharge to playas and the wastewater treatment facility are covered in Table 4.13.1.2–2 and Table 4.3.2.1–1. NHW (Class 3) is not reported since the waste is inert, essentially insoluble, and poses no threat to human health or the environment (Pantex 1996:14.5). Transuranic wastes are not normally generated. No high-level radioactive wastes are currently generated at Pantex Plant.
[2]Table includes a 10 percent margin to provide conservative estimates.
Source: Pantex 1996:14.5

Acceptance Criteria Certification and Transfer Requirement Program (NVO–325). Under NVO–325, Pantex Plant is required to characterize wastes using process knowledge or sampling and analysis based on NTS-established analysis requirements and standardized reporting. In addition, each shipment of waste must be certified. Certification is the process of determining, verifying, and attesting in writing to compliance with the Waste Acceptance Criteria. Pantex Plant ensures compliance by conducting internal quality assurance and quality control audits. Furthermore, NTS conducts an annual program review and approval inspection of the plant's practices and quality controls (DOE 1992a:8, 17-20, 96-106).

Pantex Plant materials managed under NVO–325 for shipment to NTS for disposal include: demilitarized and sanitized weapon debris, desiccant, support materials, and packaging materials. Radioactively contaminated classified weapon components that cannot be demilitarized and sanitized are sent to the NTS classified repository. Pantex Plant is presently approved to ship nine LLW streams to NTS for disposal. Five more wastestreams have been through the NTS review process and have approval pending, waiting for sampling and verification. Pantex Plant has also identified 14 other potential streams for inclusion at a later date, and more may be added later. These wastes are currently stored onsite (Pantex 1996:14.5).

Low-Level Mixed Waste

LLMW contains both radioactive and hazardous constituents as defined by the *Atomic Energy Act* (42 U.S.C. 2011) and RCRA (DOE Order 5820.2A:Attachment 2, page 3). Pantex Plant's primary LLMW wastestreams are composed of debris from demilitarization and sanitization of weapons components contaminated during weapons assembly, disassembly, maintenance, and quality assurance testing. Other LLMW wastestreams include HE-contaminated support material, organic liquids, aqueous liquids, organic solids, inorganic solids, lab packs,

liquid mercury, batteries, and compressed gas (PC 1995f).

Pantex Plant stores all of its LLMW onsite. LLMW is managed in accordance with the Agreed Order and Site Treatment Plan–Compliance Plan (Pantex 1996f), 30 TAC 335, the RCRA Part B Permit, and 40 CFR 260–280. The Permit's Waste Analysis Plan requires Pantex Plant to characterize wastes using process knowledge and test methods. The Waste Analysis Plan contains the methodologies and analyses used to properly characterize the LLMW (TNRCC 1996).

Pantex Plant treats LLMW and HW in three areas: the Burning Ground, Building 11–9, and Building 11-15A (Figure 4.13.1.2–1). The Burning Ground, an open air thermal treatment facility, operating under RCRA Permit Status, is located in the northern part of Pantex Plant. The Burning Ground is designed to handle waste HE and explosive-contaminated wastes from HE research and production activities. HE is treated in 15 thermal treatment units (nine trays, three pads, and three pans) (TNRCC 1996). Building 11–9, located in Zone 11, is permitted to allow treatment and processing of HW and LLMW in tanks and containers (TNRCC 1996).

While not part of the current operations, Pantex Plant plans to use the Hazardous Waste Treatment and Processing Facility (HWTPF) for LLMW, LLW, and HW treatment and processing. DOE is in the process of examining DOE developed technologies for enhancing HWTPF LLMW treatment and processing capabilities (Battelle 1995). Pantex Plant is also pursuing commercial LLMW treatment and disposal. A detailed discussion of the HWTPF can be found in appendix H. A detailed discussion of waste stream treatability groups can be found in the FFCA Agreed Order and the approved Site Treatment Plan-Compliance Plan.

Hazardous Waste

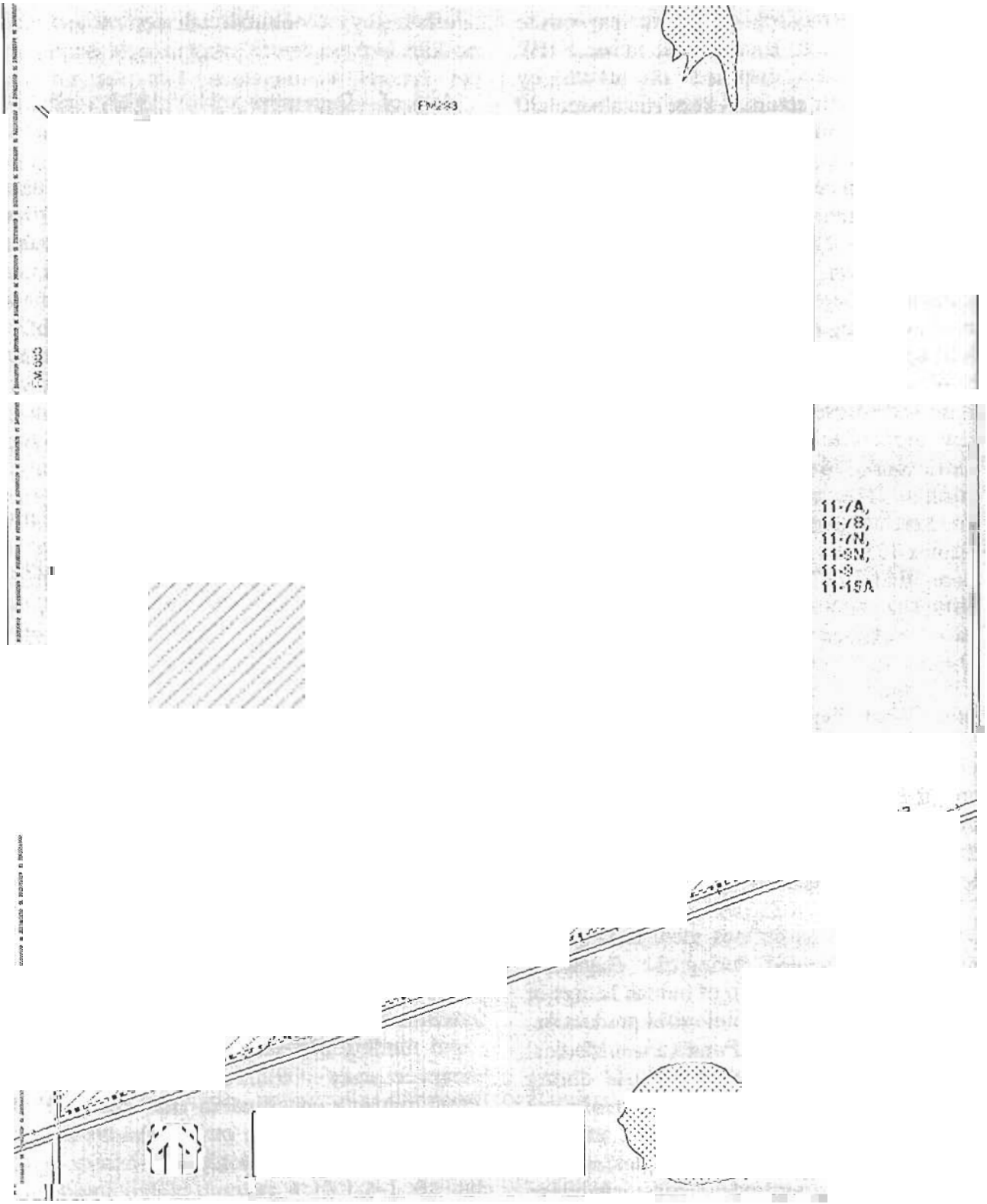
Under 40 CFR 261, HW is defined as a so waste that meets any of these four conditions: listed as a HW; exhibits a characteristic of HW; is a mixture of a HW and a nonhazard solid waste; or is derived from treatm storage, or disposal of a HW. The term "so in this context does not specify physical fo (i.e., HW may be solid, liquid, or gas) (40 CF 261.3). The regulations exempt or excl certain materials from its definition hazardous wastes, and these exclusions a exemptions are not considered in t discussion. Pantex Plant generates HW dur weapons assembly, disassembly, maintenan and quality assurance testing; HE research production; ER; and facility operatio Wastestreams include HE, solvents, protec clothing, filters, wipes, oils, soils, paint wa desiccant, tools, wastewater, and debris 1995f).

Pantex Plant stores HW onsite and trea onsite and offsite. HW is disposed of off Pantex Plant uses commercial facilities offsite treatment and disposal. HW is man in compliance with RCRA regulations from point of generation to storage and dis (Pantex 1996:14.5).

Nonhazardous Nonradioactive Waste

NHW is defined as a municipal solid was industrial solid waste that is not a liste characteristic hazardous waste as defined CFR 261 and 30 TAC 335. Pantex generates industrial solid NHW during we assembly, disassembly, maintenance, q assurance testing; HE research and produ ER; and facility operations. Wastest include nonhazardous solvents, prot clothing, filters, wipes, nonhazardous oils, nonhazardous paint waste, desiccant, wastewater, and debris (PC 1995f).

Pantex Plant accumulates and stores onsite, and the treatment of NHW occu


FM293
FM 663
11-7A,
11-7B,
11-7N,
11-9N,
11-9
11-15A

waste management units (SWMUs) as described in section 4.5, Geology and Soils. The permit also includes extensive investigation requirements and management criteria for SWMUs (TNRCC 1996:Attachments E–G).

While 144 SWMUs were identified as sites of potential concern and the early waste calculations were very high, subsequent investigations have determined that many of the sites are less contaminated and have smaller cleanup volumes (DOE 1995e:4-28). Table 4.13.1.2–2 provides the best available information on waste projections from ER activities. The ER program generates waste through investigation and remediation activities. Pantex Plant ER wastes are expected to include LLW, HW and NHW. The ER wastestreams include contaminated soils, HE-contaminated materials, protective clothing, wipes, tools, wastewater, and debris (PC 1995f). Starting in 1999, the ER wastes are expected to be primarily liquid wastes resulting from monitoring systems and restoration management of contaminated water from the perched aquifer (Pantex 1996:14.5, 15.5).

4.13.1.3 *Solid Waste Management Facilities*

Table 4.13.1.1–2 identifies the facilities where waste management activities are currently carried out. Wastes are collected from various generator sites in Zone 12 South at Pantex Plant and staged at Building 12–42 for sorting and segregating before they are transferred to various waste management facilities. Other generator sites throughout Pantex Plant move waste directly to the 11–7N storage pad or Building 11–9N (Pantex 1996:14.6, 14.7). Given below is a brief summary of the current and proposed management facilities for Pantex Plant waste. See Figure 4.13.1.2–1 for the location of these facilities.

Four facilities (11–7N Pad, 11–7A, 11–7B, and 11–9N) are used for storing waste in Zone 11. The 11–7N Pad is an above-grade permitted storage pad with two sheds. This facility is used to store LLMW, HW, LLW, and other wastes and materials. Units 11–7A and B are permitted storage pads adjacent to the 11–7N Pad and are used for storage of wastes on a single, above-grade concrete pad. Building 11–9 is used for the storage of HW, LLMW, LLW, and other wastes and materials. The north portion of this building is also used to repackage and stage waste for shipment (Pantex 1996:14.8).

In Zone 4, four HW magazines, one LLW magazine, thirteen HW Conex boxes, and 20 LLW Conex boxes are available for storage of wastes. The four HW magazines are used for storage of liquid and solid LLMW and HW. Containers of LLW are periodically moved from storage areas and transported to NTS for disposal. The Conex boxes are large steel containers with a capacity of about 72 cubic meters (94 cubic yards). The 13 HW Conex boxes have a permitted storage capacity of 4,467 drums and a total operating capacity of 946 containers. Twenty Conex boxes are used for storage of LLW until it is shipped offsite (Pantex 1996:14.8).

During 1996, three burn pits and two burn cages under went RCRA closure (TNRCC 1996). Closure plans for all RCRA permitted facilities are part of the existing permit; however, approved work plans are not in place. The plant has successfully completed several other RCRA closures and partial closures in recent years (TNRCC 1995a).

For wastewater treatment capabilities, also see sections 4.3, Plant Facilities and Infrastructure, and 4.6, Water Resources. Pantex Plant thermally treats HE and HE-contaminated wastes. Buildings 11–9 & 11–15A provide onsite LLMW treatment capabilities. Additionally, Pantex Plant is capable of treating and processing (such as compaction and repackaging) hazardous waste, including LLMW in tanks and containers.

4.13.2.3 *Summary of Impacts*

As shown in Table 4.13.1.2–3, the volume of all waste types generated at Pantex Plant excluding ER wastes would decrease with the decrease in operations on weapons levels.

If the site continues to ship HW offsite on a monthly basis, no additional storage capacity would be required. Annual HW projections in Table 4.13.1.2–3 are equal to or below HW generated annually in 1992–1995 (DOE 1996f:18). The number of HW shipments is expected to be at or below historic levels. If HW is treated at the HWTPF, the number of shipments would begin to increase in the year 2002 because treatment is expected to increase waste volume.

The Pantex Plant permitted operating storage capacity is 7,044 containers of LLMW (TNRCC 1996). In July 1996, 482 containers of LLMW were stored (PC 1996f). If no offsite disposal is provided, for annual operations on 2,000 weapons, 879 containers containing 183.2 cubic meters (239.6 cubic yards) of LLMW would be placed into storage starting in 1997. As a result, additional waste storage capacity would be required in 2004, regardless of whether the waste is treated or not. Similarly, for annual operations on 1,000 and 500 weapons, 568 and 389 containers containing 118.3 cubic meters (154.7 cubic yards) and 81 cubic meters (105.9 cubic yards) of LLMW, respectively, would be placed in storage starting in 1997. As a result, additional waste storage capacity would not be needed for the 1,000 weapons level and the 500 weapons level. For operations on 2,000, 1,000, and 500 weapons, Pantex Plant would be annually required to provide storage for 1,275, 824, and 564 containers, respectively, for the treatment of LLMW. For operations on 2,000 and 1,000 weapons, Pantex Plant would need to provide additional waste storage for 6,405 and 1,895 containers, respectively, by 2007. . For operations on 500 weapons, no additional waste storage facilities would be required by 2007.

In 1994, a shipment of LLMW totalling cubic meters (43 cubic yards) was disposed commercial facility in Utah. A second shipm in June 1996 totalled 70 cubic meters (91 c yards) of LLMW. The June 1996 shipm reduced the LLMW inventory by 31.6 perc A third shipment in September 1996 furt reduced LLMW inventories by a total of percent. Additional future offsite disp would further reduce waste operation imp including waste inventories (PC 1996e, 1995n).

To obtain additional storage for LLMW, Pa Plant has two options. The first is to convert expand an existing building. The second is build a new facility. Both require per changes, but the first option is more desira The first option was previously complete Pantex Plant in July 1994 when Buildi 11–9N, 11–7A, and 11–7B were added. additional storage is not approved, shutdow possible with impacts to all Pantex P operations and employees.

If the site continues to ship LLW routi throughout the year, no additional sto capacity would be required. From 1992-1 the plant shipped 990.9 cubic meters (1,2 cubic yards) of LLW in 4,760 drums 1995n). The plant has a storage capacity least 2,380 containers (495.82 cubic m [648.53 cubic yards]). For operations on 2, 1,000, and 500 weapons, 1,195, 631, and drums, respectively, would be gener annually. With an average of 1,587 d shipped annually, the shipment cap exceeds the generation projections for weapons levels. If the shipments cease an estimated storage capacity of 2,380 contain exceeded, storage facilities would be adde appropriate, to avoid impacting Pantex principal operations.

Treatment and processing of LLMW, LL HW at the HWTPF is scheduled to begin i year 2001. Depending on the treatmen

processing techniques, the volume of waste could either increase or decrease, which would affect the number of offsite shipments. However, minimal impacts are expected since historical capacities are greater than the expected generation rates.

Minimal impacts to NHW management are expected. The amount of NHW projected would be below historic numbers generated during 1992–1995 (DOE 1996f:18). The Amarillo landfill has more than 25 years of capacity (Pantex 1996:9.4, 14.5). Onsite disposal of NHW Class 2 and NHW Class 3 wastes is currently allowed. Minimal impacts from ER wastes are expected as they represent less than 3.8 percent of waste generated from industrial operations after 1999.

Any additional storage, treatment, and disposal facilities required beyond existing and currently planned activities will be covered in future NEPA documentation.

4.13.3 Impacts of No Action Alternative

Under the No Action Alternative, the operations on 2,000, 1,000, and 500 weapons per year are the same as those evaluated under the Proposed Action except that disassembly of weapons would cease once pit storage reached the authorized level of 12,000.

Under the three levels of activity, LLMW, LLW, HW, and NHW operations would continue as described in the Proposed Action with minimal impacts. However, without the HWTPF, waste treatment and processing capabilities are greatly reduced. If Building 11–9, 11–7 Pad, or offsite capacities do not compensate for the lack of a HWTPF, the plant would pursue possible options to avoid adverse regulatory and operational impacts. One option is to expand Building 11–9 or 11–7 Pad, and a second is to continue to reduce waste generation through reduced workloads or a combination of the options. Additional information regarding the HWTPF is available in volume II, appendix H.

4.13.4 Impact of Pit Storage Relocation Alternative

This section discusses the impacts of the Pit Relocation Alternative on waste management operations and regulatory status at Pantex Plant that would result during the 10-year period. The operations at Pantex Plant would be the same as those discussed under the Proposed Action, section 4.13.2.1.

4.13.4.1 *Impacts of Relocating 20,000 Pits*

Pit storage activities generate minimal waste (less than 1 cubic meter [1.3 cubic yards] per year of LLW, LLMW, HW, and NHW); therefore, relocation of pit storage to another site would not affect waste management at Pantex Plant. Impacts to the relocation alternative sites are addressed in chapter 5.

4.13.4.2 *Impacts of Relocating 8,000 Pits*

Pit storage activities generate minimal waste (less than 1 cubic meter [1.3 cubic yards] per year of LLW, LLMW, HW, and NHW); therefore, relocation of pit storage to another site would not affect waste management at Pantex Plant. Impacts to the relocation alternative sites are addressed in chapter 5.

4.13.5 Cumulative Impacts

The cumulative impacts presented here include impacts of the continued operations at Pantex Plant combined with impacts associated with activities described in the WM PEIS, SSM PEIS, and S&D PEIS. Since the Pantex Plant EIS Proposed Action and the SSM PEIS No

Action Alternative represent a continuum of operations, the impacts associated with any new mission or facility that could be implemented at Pantex Plant are discussed in the context of that continuum. The impacts from the WM PEIS program are combined with those of the Pantex Plant EIS Proposed Action. The impacts from the S&D PEIS are combined with those of the SSM PEIS No Action Alternative. A detailed discussion of this methodology is presented in section 4.2.

The final S&D PEIS will include an alternative that is a refinement of these storage alternatives. As discussed in sections 1.4 and 1.7.3 of this volume, the final S&D PEIS will include an alternative under which pits from Rocky Flats Environmental Technology Site (RFETS) could be transferred to Pantex Plant for storage in Zone 4 as early as 1997. The impacts of this alternative are fully accounted for in this EIS because the pits from RFETS could not cause the total number of pits stored in Zone 4 to exceed the storage limit of 20,000 pits analyzed under the Proposed Action. Furthermore, RFETS pits that could come to Pantex Plant would have the same characteristics, as analyzed in the S&D PEIS, as pits currently or previously stored at Pantex Plant.

4.13.5.1 *Impacts of Alternatives in the Waste Management Programmatic Environmental Impact Statement*

The WM PEIS examines the environmental impacts of alternative configurations for the management of radioactive and hazardous wastes at DOE sites throughout the U.S. Pantex Plant routinely manages three of the five waste types (LLMW, LLW, and HW) addressed in the WM PEIS. For the purpose of analyses, the WM PEIS considered a baseline inventory and a projected inventory after 20 years. Pantex LLMW represented only 0.3 percent of the entire DOE complex projected LLMW. Similarly, the analyses considered Pantex Plant LLW and HW projected waste inventory at 0.2 percent and 14 percent of the DOE Complex, respectively.

In most alternatives, LLMW and LLW wastes would be shipped offsite for treatment and disposal. Under all alternatives, HW would be shipped offsite for treatment and disposal.

Little or no cumulative waste management operational impacts from WM PEIS alternatives are expected. Current Pantex Plant waste management operational impacts are bounded by the Pantex Plant EIS. Additional and bounding impacts from HW operations are presented in the WM PEIS. Impacts of alternatives, including those noted above, are covered in the WM PEIS.

The WM PEIS provides environmental information to be used in deciding where to locate waste management activities on a national basis. Subsequent site- or project-level NEPA review would be conducted prior to implementing these decisions.

4.13.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, waste management impacts from operations are expected to be less than current impacts. Generated wastes would be adequately managed with existing waste management facilities. Under the downsizing alternative,

Pantex Plant has adequate waste management facilities to treat, store, and dispose of its wastes—although waste treatment, storage, and disposal alternatives are contingent upon programmatic decisions of the WM PEIS. Under the relocation alternative, the amount of decontamination and decommissioning activities and wastes would eventually increase.

4.13.5.3 *Impacts of Alternatives in the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*

The S&D PEIS is considering Pantex Plant for long-term storage of inventories of nonsurplus weapons-usable plutonium and highly enriched uranium (HEU), storage of inventories of surplus weapons-usable plutonium and HEU pending disposition, and disposition of surplus weapons-usable plutonium. For storage, the strategy for long-term storage of weapons-usable plutonium and HEU, as well as the storage site(s), would be decided. The storage alternatives include upgrading the existing plutonium storage facilities, consolidation of plutonium from other sites, and collocation of plutonium and HEU storage. The collocation alternative is used for analysis purposes in this EIS as the bounding storage alternative.

Under the S&D PEIS Collocation Alternative, construction of new storage facilities would be required in order to store plutonium and HEU at Pantex Plant. Construction and operation would have an impact on existing Pantex Plant waste management activities by increasing the generation of TRU, LLW, LLMW, HW, and NHW. Not including the Proposed Action or the Waste Management program, approximately 10 cubic meters (13 cubic yards) of TRU waste and 4 cubic meters (5 cubic yards) of mixed TRU waste would be processed and packaged to meet the offsite waste acceptance criteria. Approximately 1,300 cubic meters (1,700 cubic yards) of LLW contaminated with plutonium and uranium would require disposal. The 0.2 cubic meters (55 gallons) of liquid LLMW and 66 cubic meters (86 cubic yards) of solid LLMW would be treated and disposed of through the use of existing and planned facilities according to the *Pantex Site Treatment Plan* (Pantex 1996f). The 2 cubic meters (528 gallons) of liquid and 2 cubic meters (3 cubic yards) of solid HW would have a negligible impact on waste management activities at Pantex Plant. The 129,500 cubic meters (34,200,000 gallons) of liquid NHW may require construction of sanitary, utility, and process wastewater treatment systems. The 1,840 cubic meters (3,400 cubic yards) of solid NHW would require disposal at the offsite landfill.

For the disposition alternatives in the S&D PEIS, the emphasis at this stage in the NEPA decision process is on the strategy and technology mix rather than the actual site. The evolutionary Light Water Reactor is used for analysis purposes in this EIS as the bounding disposition alternative. Implementation of this disposition alternative would require the construction and operation of a pit disassembly and conversion facility, plutonium conversion facility, mixed oxide fuel fabrication facility, and one or more light water reactors. The bounding alternative also assumes that all of the facilities previously mentioned would be collocated at the same site (potentially Pantex Plant).

For disposition (not including the Proposed Action or the Waste Management program), approximately 52 metric tons (57 short tons) of spent fuel, 4 cubic meters (1,056 gallons) of liquid, and 651 cubic meters (846 cubic yards) of solid TRU, and approximately 204 cubic meters (265 cubic yards) of solid mixed TRU would be generated. Approximately 18,964 cubic meters (5.017 million gallons) of liquid and 2,498 cubic meters (3,247 cubic yards) of

4.14 HUMAN HEALTH

4.14.1 Affected Environment

This section addresses the sources of radioactivity and toxic chemicals at Pantex Plant and their effects on human health and the environment. The section also addresses the plant's vulnerability to accidents associated with these sources. Appendix D, Human Health Analysis, in volume II contains additional information.

The potential release of radioactivity and toxic chemicals to the environment from a DOE facility is an important issue for onsite workers and the public. Since the human environment contains many sources of radioactivity and toxic chemicals, it is essential to understand the sources of these substances and how effectively they are controlled.

Beyond radiation, chemical, and explosive hazards, workers involved with facility operations are exposed to common industrial workplace hazards (e.g., mechanical or electrical hazards). Adequate worker safety from these common industrial workplace hazards is furnished through compliance with the *Occupational Safety and Health Act of 1990* (5 U.S.C. 5108); and 29 CFR 1910, "Occupational Safety and Health Standards." As discussed in section 4.14.1.4, incidence rates at Pantex Plant are below national averages for general and manufacturing industries.

Exposure from inhalation is the overwhelmingly risk-significant pathway for public exposure. It bounds the risk in the assessment of chemical and radiological airborne hazards from normal operations. For accident scenarios involving the release of tritium, skin absorption of tritium oxide is accounted for since it represents about 50 percent of the dose of inhalation (DOE 1991). Inhalation remains the dominant pathway for all other releases.

In the case of a radioactive materials release, radiation doses to individuals result from immediate exposure to the passing radioactive material plume and from long-term exposure to radioactive material deposited in the environment during the plume passage. The dominant exposure pathway for cloud passage for plutonium accidents is inhalation. Plutonium does not readily absorb through the skin, and any ingestion of plutonium from the passing plume is minimal when compared with inhalation.

The long-term accumulation of doses to individuals affected by a radioactive material release could occur from (1) direct doses from groundshine and resuspension inhalation (inhalation dose from inhaling resuspended particles from the ground), (2) ingestion of food crops and milk produced from contaminated ground, and (3) ingestion of contaminated water. Independent of mitigative actions, both the magnitude of long-term doses and the relative importance between pathways is dependent on both the chemical and radiological behavior of the material released to the environment. The chemical nature of plutonium oxide decreases the importance of the ingestion pathways relative to inhalation. Plutonium oxide does not readily absorb into the body when ingested (PNL 1988). As such, the main health risk from plutonium oxide occurs when very small particles are inhaled and become lodged in the lungs.

Historical pathway analysis and dose reconstruction have clearly shown that inhalation is the dominant pathway for plutonium risk. The 1983 Pantex EIS (DOE 1983a) found that after a dispersal accident, over 95 percent of the total plutonium exposure is from inhalation, assuming no remediation or cleanup. With cleanup, over 99 percent of the estimated total plutonium exposure is from inhalation. The Rocky Flats dose reconstruction project analyzed the health impact of historical plutonium emissions from the Rocky Flats Plant and concluded that the only significant pathway,

again without remediation or cleanup, for plutonium exposure is inhalation (ChemRisk 1994). Thus, the dominant risk pathway for plutonium dispersal accidents at Pantex Plant is the inhalation pathway.

The Federal government is required under the Federal Radiological Emergency Response Plan (61 FR 20944) to respond to a radiological emergency and provide resources to assist in the evaluation and mitigation of potential long-term exposure pathways to humans. Specifically, the agencies listed below will provide resources to perform specific functions following an accidental release. The Environmental Protection Agency (EPA) will assume responsibility from DOE for long-term monitoring and remediation following an accident. EPA will assist in the preparation of area restoration plans and will recommend cleanup criteria.

The Department of Agriculture (USDA) will inspect meat and meat products, poultry and poultry products, and egg products to assure that they are safe for human consumption. In addition, USDA, in conjunction with the Department of Health and Human Services (HHS), will assist in monitoring the production, processing, storage, and distribution of food through the wholesale level to eliminate contaminated product and in reducing the contamination in the product to a safe level. HHS will assist with the assessment, preservation, and protection of human health, and will assist State and local government officials in making evacuation and relocation decisions.

Figure 4.14.1–1 depicts the offsite population within an 80-kilometer (50-mile) radius of Pantex Plant, known as the Region of Influence (ROI) (UN 1995). The highest population density occurs southwest of Pantex Plant. Wind speeds and directions in the Pantex Plant vicinity are presented in Figure 4.7.1.1–1. The wind blows predominately from the south from May to September and from the southwest for the remainder of the year.

4.14.1.1 *Radiation Environment*

Table 4.14.1.1–1 summarizes the major sources of radiation exposure in the vicinity of Pantex Plant (NCRP 1987). Releases from Pantex Plant operations constitute a very small fraction of the total exposure to the public in the vicinity of the plant. Cancer statistics for the State of Texas indicate that annually, a person in the Pantex Plant vicinity has a 1.7×10^{-3} probability of contracting a fatal cancer. From examining nominal fatal cancer risk factors for the public and Table 4.14.1.1–1 data, it can be seen that fatal cancers attributable to environmental radioactivity released from Pantex Plant constitute an extremely small fraction (less than 0.01 percent) of the average yearly fatal cancer probability in the vicinity of Pantex Plant (DOE 1994l:4-20).

The majority of Pantex Plant workers receive no detectable radiation exposures (i.e., zero dose) during normal operations as a result of their work and are considered non-involved workers. Of those workers that received non-zero doses (involved workers total 329) over the last 5 years, the average annual dose was 111 millirem with a maximum individual dose of 0.905 rem (Pantex 1996a). These exposures were in addition to exposures received from background sources described in Table 4.14.1.1–1. DOE Order 5480.11 and 10 CFR 835 specify a limit of 5 rem per year for occupational workers. In addition, as of 1996, the Pantex Plant administrative control level is 500 millirem per year for most workers and 900 millirem per year for production (weapons operations) workers.

The plant plans to continue to reduce the control level for production workers to the 500 millirem per year level. Using fatal cancer risk factors for workers, the average annual probability of a Pantex Plant worker contracting a fatal cancer due to occupational radiation exposure is

TABLE 4.14.1.1–1.—*Major Sources of Radiation Exposure in the Vicinity of Pantex Plant*

SOURCE OF EXPOSURE	AVERAGE DOSE TO AN INDIVIDUAL (mrem/yr)[1]	TOTAL EXPOSURE (PERCENT)
NATURAL BACKGROUND RADIATION		
Cosmic and external terrestrial radiation	95	
Internal terrestrial	39	
Radon in home	200	
Total natural	334	83.9
MEDICAL RADIATION		
Diagnostic x-rays	39	
Nuclear medicine	14	
Total medical	53	13.3
OTHER SOURCES		
Fallout from past weapons testing	<1	
Consumer and industrial products	10	
Air travel	1	
Nuclear facilities (other than Pantex and transportation of radioactive materials)	<1	
Pantex - environmental radioactivity	<<1 (4.98×10^{-7})	
Total other	11	2.8
Total - all sources	398	100

< - less than
<< - much less than
[1] Effective Dose Equivalent
Sources: NCRP 1987:15, 53; DOE 1995b:7-5

4.4×10^{-5}. For those Pantex Plant workers that receive radiation doses, this 4.4×10^{-5} value is essentially in addition to the average annual fatal cancer risk of 1.7×10^{-3} for the regional population.

The largest contributors to worker radiological doses at Pantex Plant are external exposures (i.e., those received from radiation-emitting sources). The largest potential for external doses occurs from weapon operations and pit repackaging. Worker population dose, from an external exposure viewpoint, has been significantly reduced at Pantex Plant due to improvements in work practices and changes in work scope. In 1980, Pantex Plant operations resulted in a cumulative worker dose of 148 person-rem over 719 personnel. In 1994, Pantex Plant operations resulted in a cumulative worker dose of 29 person-rem over 329 personnel (Pantex 1996a).

Internal exposures, received when radioactive materials are deposited through inhalation, ingestion, or absorption, are only minor contributors to worker doses. During normal operations, engineering controls (e.g., confinement and ventilation) are the primary methods of controlling airborne concentrations of radionuclides and minimizing internal exposure. Administrative controls (e.g., exposure limits and procedural requirements)

and personnel protective equipment (e.g., respirators) are used as supplemental methods to control internal radiation exposure. The largest single source of internal exposures was from the contamination of Building 12–44 Cell 1 with tritium in 1989; the result was a total worker dose of approximately 1.5 person-rem, with a maximum individual dose of 1.3 rem.

The Pantex *Radiological Control Manual* (Pantex 1996d) establishes site-specific guidelines and procedures to minimize or eliminate radiological exposure and risk to workers while performing work involving radioactive materials and radiation–generating devices. The Pantex Plant manual is based on the requirements contained in the DOE *Radiological Control Manual* (DOE 1992); 10 CFR 835, *Occupational Radiation Protection*; and DOE Order 5480.11, *Radiation Protection for Occupational Workers*.

The "As Low As Reasonably Achievable" (ALARA) program at Pantex Plant is another control to help limit the number of personnel occupational exposures and public/ environmental exposures to radioactive material. This program applies to all plant facilities, equipment, processes, and operations involving a potential or actual exposure of personnel to ionizing radiation, and is based on the regulations discussed above.

4.14.1.2 *Chemical Environment*

Hazardous chemicals are used in the performance of certain Pantex Plant operations. A full listing of hazardous chemicals used at Pantex Plant is provided in the *Pantex Plant Safety Information Document* (Pantex 1996a). Pantex Plant operations that require the use of hazardous chemicals are performed in full compliance with Occupational Safety and Health Administration (OSHA) regulations and American Conference of Government Industrial Hygienists guidelines.

Under normal operations, various chemicals are released to the air that have the potential to impact the public. Table 4.14.1.2–1 lists the hazardous air pollutants released to the air and their calculated maximum potential concentrations at the plant fence line (see section 4.7, Air Quality). The concentrations were calculated with the EPA-approved ISCST2 and ISCLT2 codes (see volume II, appendix B) using existing Pantex Plant sources (PC 1994). Emission inventories used here also apply for the 2,000 weapons activity level. Effects screening levels (ESLs) from TNRCC are also listed in the table and used for comparison.

A useful measure of potential human health effects resulting from exposure to non-carcinogenic chemicals is the hazard index. In its most general form, a hazard index is a ratio of the actual exposure of a human receptor to an established exposure limit. If this ratio is appreciably less than unity, no adverse human health effects are expected. If the hazard index is close to unity, some adverse human health effects may occur; and if the hazard index is substantially greater than unity, severe health effects can results. Table 4.14.1.2–2 presents the individual hazard quotients, which summed together make up the hazard index. The hazard index for chemicals released from Pantex Plant is 0.0909. That is an order of magnitude less than 1.0, and no adverse health effects are expected.

Within the plant boundary, calculated concentrations are somewhat higher. They are, however, below exposure limits established by OSHA and considered safe from adverse noncancer effects. Table 4.14.1.2–3 shows a comparison between maximum onsite concentrations and allowable exposure limits.

Some toxic chemicals are also carcinogenic. Table 4.14.1.2–4 gives the available chemical risk factors for those pollutants that are carcinogens (except for lead, which does not have an available risk factor). When combined

TABLE 4.14.1.2–1.—*Maximum Estimated[a] Fence Line Concentration of Air Pollutants Resulting from Existing Pantex Plant Sources*

POLLUTANT	AVERAGING TIME	ESL ($\mu g/m^3$)	MAXIMUM FENCE LINE CONCENTRATION ($\mu g/m^3$)	MAX. POTENTIAL CONCENTRATION AS A % OF ESL
CLEAN AIR ACT LISTED AIR POLLUTANTS[b]				
1,1,2-trichloroethane	Annual 30-minute	5.50×10^{1} 5.50×10^{2}	8.07×10^{-2} 1.73×10^{1}	0.2 3.1
1,3-butadiene	Annual 30-minute	1.10×10^{1} 1.10×10^{2}	9.09×10^{-3} 3.76	0.1 3.4
2-nitropropane	Annual 30-minute	5.00 5.00×10^{1}	3.56×10^{-2} 8.55	0.7 17
Alcohols[c]	Annual 30-minute	NA 1.00×10^{2}	7.01×10^{-1} 1.95×10^{2}	— 195
Benzene	Annual 30-minute	3.00 7.5×10^{1}	5.47×10^{-2} 1.94×10^{1}	1.8 26
Carbon Disulfide	Annual 30-minute	3.00 3.00×10^{1}	9.39×10^{-2} 2.26×10^{1}	3.1 75
Carbon Tetrachloride	Annual 30-minute	1.30×10^{1} 1.26×10^{2}	8.19×10^{-2} 1.97×10^{1}	0.6 16
Chlorobenzene	Annual 30-minute	4.60×10^{1} 4.60×10^{2}	8.13×10^{-2} 1.95×10^{1}	0.2 4.2
Chromium	Annual 30-minute	1.00×10^{-1} 1.00	1.91×10^{-3} 9.72×10^{-2}	1.9 9.7
Cresols	Annual 30-minute	NA 5.00	1.72×10^{-3} 4.13×10^{-1}	— 8.3
Cresylic Acid	Annual 30-minute	NA 5.0	2.14×10^{-3} 5.13×10^{-1}	— 10
Dibenzofurans	Annual 30-minute	NA NA	2.00×10^{-5} 9.60×10^{-4}	— —
Dimethylformamide	Annual 30-minute	3.00×10^{1} 3.00×10^{2}	6.19×10^{-2} 2.80×10^{1}	0.2 9.3
Ester Glycol Ethers	Annual 30-minute	NA NA	1.50×10^{-1} 3.59×10^{1}	— —
Ethyl Acetate	Annual 30-minute	1.44×10^{3} 1.44×10^{4}	6.93 1.99×10^{3}	0.5 14
Ethyl Benzene	Annual 30-minute	4.34×10^{2} 2.00×10^{3}	1.29×10^{-1} 3.11×10^{1}	0.0 1.6
Ethylene Dichloride	Annual 30-minute	4.00 1.60×10^{2}	3.99×10^{-2} 9.58	1.0 6.0
Formaldehyde	Annual 30-minute	1.50 1.50×10^{1}	4.30×10^{-3} 3.66×10^{-1}	0.3 2.4
Hydrogen Chloride	Annual 30-minute	1.00×10^{-1} 7.50×10^{1}	8.76×10^{-2} 5.98	88 8.0
Hydrogen Fluoride	3-hour 12-hour 24-hour	4.90 3.68 2.86	1.52 3.81×10^{-1} 2.70×10^{-1}	31 10 9.4

TABLE 4.14.1.2–1.—*Maximum Estimated[a] Fence Line Concentration of Air Pollutants Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	AVERAGING TIME	ESL ($\mu g/m^3$)	MAXIMUM FENCE LINE CONCENTRATION ($\mu g/m^3$)	MAX. POTENTIAL CONCENTRATION AS A % OF ESL
Lead	Quarter	1.50	9.50×10^{-3}	0.6
Mercury	Annual 30-minute	5.00×10^{-2} 5.00×10^{-1}	0.00[e] 0.00[e]	0.0 0.0
Methanol	Annual 30-minute	2.62×10^{2} 2.62×10^{3}	5.75×10^{-1} 2.45×10^{2}	0.2 9.4
Methyl Cyanide	Annual 30-minute	NA NA	0.00[e] 0.00[e]	— —
Methyl Ethyl Ketone	Annual 30-minute	5.90×10^{2} 3.92×10^{3}	5.10 1.40×10^{3}	0.9 36
Methyl Isobutyl Ketone	Annual 30-minute	2.05×10^{2} 2.05×10^{3}	1.85×10^{-2} 4.45	0.0 0.2
Methylene Chloride	Annual 30-minute	2.60×10^{1} 2.60×10^{2}	7.37×10^{-1} 1.80×10^{2}	2.8 69
Naphthalene	Annual 30-minute	5.00×10^{1} 4.40×10^{2}	1.10×10^{-4} 5.48×10^{-3}	0.0 0.0
Nitrobenzene	Annual 30-minute	5.00 2.40×10^{1}	2.14×10^{-3} 5.13×10^{-1}	0.4 2.1
Phenol	Annual 30-minute	1.90×10^{1} 1.54×10^{2}	5.70×10^{-4} 2.92×10^{-2}	0.0 0.0
Tetrachloroethylene	Annual 30-minute	3.40×10^{1} 3.40×10^{2}	7.33×10^{-2} 1.76×10^{1}	0.2 5.2
Toluene	Annual 30-minute	1.88×10^{2} 1.88×10^{3}	1.73 5.68×10^{2}	0.9 30
Trichloroethylene	Annual 30-minute	1.35×10^{2} 1.35×10^{3}	2.12×10^{-1} 5.11×10^{1}	0.2 3.8
Triethylamine	Annual 30-minute	4.00 4.00×10^{1}	2.38×10^{-3} 1.08	0.1 2.7
Xylene	Annual 30-minute	4.34×10^{2} 3.70×10^{3}	4.74×10^{-1} 1.45×10^{2}	0.1 3.9
TNRCC LISTED AIR POLLUTANTS[d]				
1,1,1-chloroethane	Annual 30-minute	5.00×10^{1} 5.00×10^{2}	5.28×10^{-1} 1.27×10^{2}	1.1 2.5
1,3,5-trinitrobenzene	Annual 30-minute	NA 2.00	0.00[e] 3.00×10^{-5}	— 0.0
1-butanol	Annual 30-minute	7.60×10^{1} 7.60×10^{2}	1.99×10^{-2} 4.79	0.0 0.6
2,4,6-trinitrotoluene	Annual 30-minute	NA 5.00	0.00[e] 3.30×10^{-4}	— 0.0
2,4-dinitrotoluene	Annual 30-minute	1.50×10^{-1} 1.50×10^{1}	0.00[e] 5.00×10^{-5}	0.0 0.0

TABLE 4.14.1.2–1.—*Maximum Estimated[a] Fence Line Concentration of Air Pollutants Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	AVERAGING TIME	ESL ($\mu g/m^3$)	MAXIMUM FENCE LINE CONCENTRATION ($\mu g/m^3$)	MAX. POTENTIAL CONCENTRATION AS A % OF ESL
2,6-dinitrotoluene	Annual 30-minute	NA 1.50×10^{1}	0.00[e] 5.00×10^{-4}	— 0.0
2-ethoxyethonol	Annual 30-minute	NA 1.80×10^{2}	3.91×10^{-1} 9.42	— 5.2
2-nitronaphthalene	Annual 30-minute	NA 5.00×10^{2}	1.00×10^{-5} 4.20×10^{-4}	— 0.0
Acetone	Annual 30-minute	5.90×10^{2} 5.90×10^{3}	3.39 5.19×10^{2}	0.6 8.8
Acetylene	Annual 30-minute	2.66×10^{3} 2.66×10^{4}	3.33×10^{-3} 1.11	0.0 0.0
Aluminum	Annual 30-minute	5.00 5.00×10^{1}	1.28×10^{-3} 5.22×10^{-2}	0.0 0.1
Ammonia	Annual 30-minute	1.70×10^{1} 1.70×10^{2}	2.89×10^{-2} 1.31×10^{1}	0.2 7.7
Barium	Annual 30-minute	5.00×10^{-1} 5.00	1.25×10^{-3} 2.93×10^{-3}	0.3 0.1
Benzo(a)anthracene	Annual 30-minute	NA 5.00×10^{-1}	1.00×10^{-5} 5.00×10^{-4}	— 0.1
Benzo(a)pyrene	Annual 30-minute	3.00×10^{-3} 3.00×10^{-2}	1.00×10^{-5} 4.10×10^{-4}	0.3 1.4
Bismuth	Annual 30-minute	5.00 5.00×10^{2}	3.00×10^{-5} 1.13×10^{-3}	0.0 0.0
Butane	Annual 30-minute	1.90×10^{3} 1.90×10^{4}	2.98×10^{-2} 1.12×10^{1}	0.0 0.1
Butene	Annual 30-minute	NA 1.60×10^{2}	2.81×10^{-1} 1.18×10^{1}	— 7.4
Calcium	Annual 30-minute	5.00 5.00×10^{1}	5.00×10^{-5} 1.90×10^{-3}	0.0 0.0
Chlorinated Fluorocarbon	Annual 30-minute	NA 1.80×10^{4}	2.90×10^{-1} 6.93×10^{1}	— 0.4
Copper	Annual 30-minute	1.00 1.00×10^{1}	3.08×10^{-3} 1.25×10^{-1}	0.3 1.3
Cyanogen	Annual 30-minute	2.10×10^{1} 2.10×10^{2}	1.00×10^{-5} 2.00×10^{-4}	0.0 0.0
Cyclohexane	Annual 30-minute	3.40×10^{2} 1.44×10^{3}	3.68×10^{-1} 9.41×10^{1}	0.1 6.5
Cyclohexanone	Annual 30-minute	1.00×10^{2} 4.81×10^{2}	6.09×10^{-2} 1.44	0.1 0.3
Dioxane	Annual 30-minute	9.00×10^{1} 9.00×10^{2}	7.88×10^{-1} 3.57×10^{1}	0.9 4.0
Ethyl Ether	Annual 30-minute	NA 9.27×10^{2}	3.33×10^{-1} 7.96×10^{1}	— 8.6

TABLE 4.14.1.2–1.—*Maximum Estimated[a] Fence Line Concentration of Air Pollutants Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	AVERAGING TIME	ESL ($\mu g/m^3$)	MAXIMUM FENCE LINE CONCENTRATION ($\mu g/m^3$)	MAX. POTENTIAL CONCENTRATION AS A % OF ESL
Ethylene	Annual 30-minute	NA 1.17×10^3	6.04×10^{-1} 2.53×10^2	— 22
Formic Acid	Annual 30-minute	9.40 9.40×10^1	0.00[e] 8.00×10^{-5}	0.0 0.0
Iron	Annual 30-minute	NA 5.00×10^1	4.99×10^{-2} 1.82	— 3.6
Isobutane	Annual 30-minute	1.90×10^3 4.85×10^3	4.01×10^{-2} 1.39×10^1	0.0 0.3
Isobutanol	Annual 30-minute	1.52×10^2 1.52×10^3	2.27×10^{-2} 5.46	0.0 0.4
Ketene	Annual 30-minute	9.00×10^{-1} 9.00	0.00[e] 0.00[e]	0.0 0.0
Ketone	Annual 30-minute	NA 1.00×10^2	1.39×10^{-1} 3.34×10^1	— 33
Lithium	Annual 30-minute	NA 1.00×10^1	4.00×10^{-5} 1.84×10^{-3}	— 0.0
Magnesium	Annual 30-minute	NA 5.00×10^1	1.05×10^{-3} 4.41×10^{-2}	— 0.1
Methane	Annual 30-minute	NA 3.00×10^4	7.16×10^{-1} 2.64×10^1	— 0.1
N-butyl Alcohol	Annual 30-minute	7.60×10^1 7.60×10^2	1.35×10^{-1} 3.25	0.2 0.4
Non-F Listed Solvents[f]	Annual 30-minute	NA 1.00×10^1	9.40×10^{-4} 2.26×10^{-1}	— 2.3
Ortho-dichlorobenzene	Annual 30-minute	NA 1.50×10^3	6.36×10^{-1} 1.53×10^2	— 10
Propane	Annual 30-minute	1.80×10^3 1.80×10^4	4.21×10^{-2} 1.32×10^1	0.0 0.1
Propene	Annual 30-minute	NA 3.00×10^4	3.71×10^{-1} 1.56×10^2	— 0.5
Pyrene	Annual 30-minute	5.00×10^{-2} 5.00×10^{-1}	5.00×10^{-4} 1.57×10^{-3}	1.0 0.3
Pyridine	Annual 30-minute	1.50×10^1 6.90×10^1	3.78×10^{-1} 9.08	2.5 13
Silicon	Annual 30-minute	5.00 5.00×10^2	0.00[e] 2.90×10^{-4}	0.0 0.0
Silver	Annual 30-minute	1.00×10^{-2} 1.00×10^{-1}	1.45×10^{-3} 6.22×10^{-2}	15 62
Tetrahydrofuran	Annual 30-minute	5.90×10^2 5.90×10^3	7.55×10^{-1} 3.42×10^2	0.1 5.8
Trichlorofluoromethane	Annual 30-minute	5.62×10^3 2.80×10^4	4.21×10^{-1} 1.01×10^2	0.0 0.4

TABLE 4.14.1.2–1.—*Maximum Estimated[a] Fence Line Concentration of Air Pollutants Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	AVERAGING TIME	ESL ($\mu g/m^3$)	MAXIMUM FENCE LINE CONCENTRATION ($\mu g/m^3$)	MAX. POTENTIAL CONCENTRATION AS A % OF ESL
Trichlorotrifluoroethane	Annual 30-minute	NA 7.60×10^4	1.77 4.73×10^2	— 0.6
Zinc	Annual 30-minute	5.00 5.00×10^1	1.32×10^{-3} 5.58×10^{-2}	0.0 0.1

NA= An ESL has not been established by the TNRCC.
[a]EPA Model ISCST2 was used to calculate results.
[b]Hours of operations were taken into account for emissions from open burning and engine emissions.
[c]The group of alcohols, while not listed in CAA, were estimated to exceed the conservative ESL used by the TNRCC. Therefore, alcohols were included here for more complete presentation of results.
[d]Hours of operation were not taken into account and emissions were modeled for an entire year of meteorological data.
[e]The ISCST2 air quality model returns a value of 0.00 for any concentration equal to or less than 1.00×10^{-5} $\mu g/m^3$ (i.e., less than one ten millionth of a part per billion or less than ten parts per quadrillion).
[f]Solvents that are not listed in 40 CFR 261.33 (Hazardous Waste from Non-Specific Sources).
Source: TNRCC 1996a (for averaging Time and ESL).

TABLE 4.14.1.2–2.—*Hazard Quotient for Concentrations Resulting from Existing Pantex Plant Sources*

POLLUTANT	MAX. FENCE LINE CONCENTRATION ($\mu g/m^3$)	REFERENCE CONCENTRATION (mg/m^3)	HAZARD QUOTIENT ANNUAL AVERAGE (%)
1,1-chloroethane	5.28×10^{-1}	10.0000	0.0
1,1,2-trichloroethane	8.07×10^{-2}	1.1020	0.0
1,3,5-trinitrobenzene	0.00[b]	No Standard	NA
1,3-butadiene	9.09×10^{-3}	53.9000	0.0
1-butanol	1.99×10^{-2}	0.3500	0.0
2,4,6-trinitrotoluene	0.00[b]	No Standard	NA
2,4-dinitrotoluene	0.00[b]	0.0069	0.0
2,6-dinitrotoluene	0.00[b]	No Standard	NA
2-ethoxyethanol	3.91×10^{-1}	0.2000	0.2
2-nitronapthalene	1.00×10^{-5}	No Standard	NA
2-nitropropane	3.56×10^{-2}	0.0200	0.2
Acetone	3.39	0.3500	1.0
Acetylene	3.33×10^{-3}	65.2200	0.0
Alcohols[a]	7.01×10^{-1}	24.1500	0.0
Aluminum	1.28×10^{-3}	0.3680	0.0
Ammonia	2.89×10^{-2}	0.1000	0.0
Barium	1.25×10^{-3}	0.0005	0.3
Benzo(a)anthracene	1.00×10^{-5}	No Standard	NA
Benzo(a)pyrene	1.00×10^{-5}	0.0044	0.0

TABLE 4.14.1.2–2.—*Hazard Quotient for Concentrations Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	MAX. FENCE LINE CONCENTRATION ($\mu g/m^3$)	REFERENCE CONCENTRATION (mg/m^3)	HAZARD QUOTIENT ANNUAL AVERAGE (%)
Benzene	5.47×10^{-2}	0.0796	0.1
Bismuth	3.00×10^{-5}	No Standard	NA
Butane	2.98×10^{-2}	46.5500	0.0
Butene	2.81×10^{-1}	No Standard	NA
Calcium	5.00×10^{-5}	No Standard	NA
Carbon Disulfide	9.39×10^{-2}	0.7000	0.0
Carbon Tetrachloride	8.19×10^{-2}	0.0025	3.3
Chlorinated Fluorocarbon	2.90×10^{-1}	50.0000	0.0
Chlorobenzene	8.13×10^{-2}	0.0200	0.4
Chromium	1.91×10^{-3}	0.0175	0.0
Copper	3.08×10^{-3}	0.0245	0.0
Cresols (All Isomers)	1.72×10^{-3}	0.5390	0.0
Cresylic Acid	2.14×10^{-3}	0.5390	0.0
Cyanogen	1.00×10^{-5}	0.1400	0.0
Cyclohexane	3.68×10^{-1}	25.7250	0.0
C-lohexanoe —	6 09 x 10^{-2}	17 5000	0.0
	5		
	2		
	1		
	1		
	1		
	1		
	1		
	2		
	3		
	2		
	1		
	2		
	2		

TABLE 4.14.1.2–2.—*Hazard Quotient for Concentrations Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	MAX. FENCE LINE CONCENTRATION ($\mu g/m^3$)	REFERENCE CONCENTRATION (mg/m^3)	HAZARD QUOTIENT ANNUAL AVERAGE (%)
Lithium	4.00×10^{-5}	No Standard	NA
Magnesium	1.05×10^{-3}	0.3680	0.0
Mercury	0.00	0.0003	0.0
Methane	7.16×10^{-1}	No Standard	NA
Methyl Alcohol (Methanol)	5.75×10^{-1}	1.7500	0.0
Methyl Cyanide	0.00	0.0500	0.0
Methyl Ethyl Ketone	5.10	1.0000	0.5
Methyl Isobutyl Ketone	1.85×10^{-2}	0.0800	0.0
Methylene Chloride	7.37×10^{-1}	3.0000	0.0
N-butyl Alcohol	1.35×10^{-1}	0.3500	0.0
Naphthalene	1.10×10^{-4}	0.0140	0.0
Nitrobenzene	2.14×10^{-3}	0.0020	0.1
Non-F Listed Solvents[c]	9.40×10^{-4}	Non Specific	0.0
Ortho-dichlorobenzene	6.36×10^{-1}	10.0690	0.0
Phenol	5.70×10^{-4}	2.1000	0.0
Propane	4.21×10^{-2}	44.1000	0.0
Propene	3.71×10^{-1}	No Standard	NA
Pyrene	5.00×10^{-4}	0.1050	0.0
Pyridine	3.78×10^{-1}	No Standard	NA
Silicon	0.00	0.1225	0.0
Silver	1.45×10^{-3}	0.0175	0.0
Tetrachloroethylene	7.33×10^{-2}	0.0350	0.2
Tetrahydrofuran	7.55×10^{-1}	14.4550	0.0
Toluene	1.73	0.4000	0.4
Trichloroethylene	2.12×10^{-1}	13.3770	0.0
Trichlorofluoromethane	4.21×10^{-1}	No Standard	NA
Trichlorotrifluoroethane	1.77	30.0000	0.0
Triethylamine	2.38×10^{-3}	0.0070	0.0
Xylene	4.74×10^{-1}	7.0000	0.0
Zinc	1.32×10^{-3}	0.0110	0.0
		Hazard Index	**9.09%**

NA - not applicable
[a]Group of alcohols without individual emission rates.
[b]Hours of operations were taken into account for emissions from open burning and engine emissions.
[c]Solvents that are not listed in 40 CFR 261.33 (Hazardous Waste from Non-Specific Sources).
Sources: EPA 1996a; EPA 1994a; DOE 1995k; DOE 1996b; Calculated values.

TABLE 4.14.1.2–3.—*Maximum Potential Onsite Ambient Concentration of Pollutants Resulting from Existing Pantex Plant Sources*

POLLUTANT	CONVERSION FACTOR	AVERAGING TIME	EXPOSURE LIMITS time weighted average (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (mg/m^3)
1,1,2-trichloroethane	1ppm = 5.55 mg/m^3	30-minute		3.12×10^{-3}	1.73×10^{-2}
		Annual	10 ppm [N,O]	4.86×10^{-5}	2.70×10^{-4}
1,3-butadiene	1ppm = 2.25 mg/m^3	30-minute		1.32×10^{-2}	2.96×10^{-2}
		Annual	1000 ppm[O]; 10 ppm [ACGIH]	4.36×10^{-4}	9.80×10^{-4}
2-nitropropane	1ppm = 3.70 mg/m^3	30-minute		2.31×10^{-3}	8.55×10^{-3}
		Annual	25 ppm [O]	3.51×10^{-5}	1.30×10^{-4}
Alcohol (Isopropyl)	1ppm = 2.50 mg/m^3	30-minute	500 ppm (ST) [N,O]	1.15	2.87
		Annual	400 ppm (ST) [N,O]	4.70×10^{-2}	1.17×10^{-1}
Benzene	1ppm = 3.25 mg/m^3	30-minute	5 ppm (ST) [O]; 1 ppm (ST) [N]	1.04×10^{-2}	3.38×10^{-2}
		Annual	1 ppm [O]; 0.1 ppm [N]	3.48×10^{-4}	1.13×10^{-3}
Carbon Disulfide	1ppm = 3.16 mg/m^3	30-minute	10 ppm (ST) [N]	7.15×10^{-3}	2.26×10^{-2}
		Annual	20 ppm [O]; 1 ppm [N]	1.11×10^{-4}	3.51×10^{-4}
Carbon Tetrachloride	1ppm = 6.39 mg/m^3	30-minute	2 ppm (ST) [N]	3.08×10^{-3}	1.97×10^{-2}
		Annual	10 ppm [O]	4.79×10^{-5}	3.06×10^{-4}
Chlorobenzene	1ppm = 4.68 mg/m^3	30-minute		4.17×10^{-3}	1.95×10^{-2}
		Annual	75 ppm [O]	6.50×10^{-5}	3.04×10^{-4}
Chromium	NA	30-minute			4.44×10^{-4}
		Annual	0.5 mg/m^3 [N,O]		8.44×10^{-6}

TABLE 4.14.1.2–3.—*Maximum Potential Onsite Ambient Concentration of Pollutants Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	CONVERSION FACTOR	AVERAGING TIME	EXPOSURE LIMITS time weighted average (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (mg/m^3)
Dimethylformamide	1ppm = 3.04 mg/m^3	30-minute		8.49×10^{-1}	2.58
		Annual	10 ppm [N,O]	7.55×10^{-3}	2.30×10^{-2}
Ester Glycol Ethers	NA	30-minute			3.59×10^{-2}
		Annual			5.59×10^{-4}
Ethyl Acetate	1ppm=3.36 mg/m^3	30-minute		5.27	1.77×10^{1}
		Annual	400 ppm [N,O]	3.35×10^{-1}	1.12
Ethyl Benzene	1ppm = 4.41 mg/m^3	30-minute	125 ppm (ST) [N]	7.05×10^{-3}	3.11×10^{-2}
		Annual	100 ppm [O]	1.10×10^{-4}	4.84×10^{-4}
Ethylene Dichloride	1ppm = 4.11 mg/m^3	30-minute	2 ppm (ST) [N]	2.33×10^{-3}	9.58×10^{-3}
		Annual	50 ppm O; 1 ppm [N]	3.63×10^{-5}	1.49×10^{-4}
Formaldehyde	1ppm = 1.25 mg/m^3	30-minute	2 ppm (ST) [O]	6.18×10^{-4}	7.72×10^{-4}
		Annual	0.75 ppm [O]; 0.016 ppm [N]	2.14×10^{-5}	2.67×10^{-5}
Hydrogen Chloride	1ppm = 1.52 mg/m^3	30-minute		3.93×10^{-2}	5.98×10^{-2}
		Annual	5 ppm (C) [N,O]	4.01×10^{-4}	6.10×10^{-4}
Hydrogen Fluoride	1ppm = 0.83 mg/m^3	3 hours		7.83×10^{-3}	6.50×10^{-3}
		12 hours		1.95×10^{-3}	1.62×10^{-3}
		24 hours			1.27×10^{-3}
Lead	NA	Calendar Quarter	0.100 mg/m^3 [N]		3.46×10^{-4}
			0.050 mg/m^3 [O]		0.00
Mercury	1ppm = 8.34 mg/m^3	30-minute	Hg Vapor 0.05 mg/m^3 [O]	0.00	0.00
		Annual	0.01 mg/m^3 (C) [O]	0.00	0.00

TABLE 4.14.1.2–3.—*Maximum Potential Onsite Ambient Concentration of Pollutants Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	CONVERSION FACTOR	AVERAGING TIME	EXPOSURE LIMITS time weighted average (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (mg/m^3)
Methane, Dichloro (Methylene Chloride)	1ppm = 3.53 mg/m^3	30-minute	1000 ppm (C) [O]	4.54×10^{-1}	1.60
		Annual	500 ppm [O]	2.89×10^{-2}	1.02×10^{-1}
Methanol (Methyl Alcohol)	1ppm = 1.33 mg/m^3	30-minute	250 ppm (ST) [N]	1.70×10^{1}	2.26×10^{1}
		Annual	200 ppm [N,O]	1.51×10^{-1}	2.01×10^{-1}
Methyl Cyanide	NA	30-minute			0.00
		Annual			0.00
Methyl Ethyl Ketone (2-Butanone)	1ppm = 3.00 mg/m^3	30-minute	300 ppm (ST) [N]	4.23	1.27×10^{1}
		Annual	200 ppm [N,O]	2.65×10^{-1}	7.95×10^{-1}
Methyl Isobutyl Ketone (Hexone)	1ppm = 4.17 mg/m^3	30-minute	75 ppm (ST) [N]	1.07×10^{-3}	4.45×10^{-3}
		Annual	100 ppm [O]; 50 ppm [N]	1.66×10^{-5}	6.91×10^{-5}
Naphthalene	1ppm = 5.33 mg/m^3	30-minute	15 ppm (ST) [N]	4.69×10^{-6}	2.50×10^{-5}
		Annual	10 ppm [N, O]	9.01×10^{-8}	4.80×10^{-7}
Nitrobenzene	1ppm = 5.12 mg/m^3	30-minute		1.00×10^{-4}	5.13×10^{-4}
		Annual	1 ppm [N, O]	1.52×10^{-6}	7.80×10^{-6}
Phenol	1ppm = 3.91 mg/m^3	30-minute	15.6 ppm (C) [N]	3.40×10^{-5}	1.33×10^{-4}
		Annual	5 ppm [N, O]	6.50×10^{-7}	2.54×10^{-6}
		[illegible]	200 ppm (C) [O]	2.55×10^{-3}	1.76×10^{-2}

TABLE 4.14.1.2–3.—*Maximum Potential Onsite Ambient Concentration of Pollutants Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	CONVERSION FACTOR	AVERAGING TIME	EXPOSURE LIMITS time weighted average (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (mg/m^3)
Calcium	N/A	30-minute			4.80×10^{-4}
		Annual			1.30×10^{-5}
Chlorinated Fluorocarbon	N/A	30-minute			6.99×10^{-2}
		Annual			1.09×10^{-3}
Copper (Dust)	N/A	30-minute			1.91×10^{-3}
		Annual	1 mg/m^3 [N,O]		5.20×10^{-5}
Cyanogen	N/A	30-minute			9.30×10^{-7}
		Annual	10 ppm [ACGIH]		0.00
Cyclohexane	1 ppm = 3.50 mg/m^3	30-minute		2.39×10^{-1}	8.38×10^{-1}
		Annual	300 ppm [N,O]	1.52×10^{-2}	5.33×10^{-2}
Cyclohexanone	1 ppm = 4.08 mg/m^3	30-minute		1.43×10^{-2}	5.85×10^{-2}
		Annual	25 ppm [N,O]	1.57×10^{-4}	6.40×10^{-4}
Dioxane	1 ppm = 3.36 mg/m^3	30-minute		9.78×10^{-1}	3.29
		Annual	1 ppm[N]; 25 ppm[O]	8.70×10^{-3}	2.92×10^{-2}
Ethyl Ether	1 ppm = 3.28 mg/m^3	30-minute	500 ppm (ST) [O]	2.43×10^{-2}	7.96×10^{-2}
		Annual	400 ppm[O]	3.78×10^{-4}	1.24×10^{-3}
Ethylene	N/A	30-minute			4.37×10^{-1}
		Annual			1.41×10^{-2}
Formic Acid	1 ppm = 1.91 mg/m^3	30-minute		1.41×10^{-7}	2.70×10^{-7}
		Annual	5 ppm [N,O]	0.00	0.00
Iron (oxide dust & fumes)	N/A	30-minute			3.04×10^{-3}
		Annual	5 mg/m^3 [N]; 10 mg/m^3 [O]		1.20×10^{-4}
Isobutane	N/A	30-minute			2.56×10^{-1}
		Annual			2.96×10^{-3}

TABLE 4.14.1.2–3.—*Maximum Potential Onsite Ambient Concentration of Pollutants Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	CONVERSION FACTOR	AVERAGING TIME	EXPOSURE LIMITS time weighted average (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (mg/m^3)
Isobutanol	1 ppm = 3.08 mg/m^3	30-minute		1.78×10^{-3}	5.47×10^{-3}
		Annual	50 ppm N,O	2.40×10^{-4}	7.40×10^{-4}
Ketene	1 ppm = 1.75 mg/m^3	30-minute	1.5 ppm (ST) N,O	0.00	0.00
		Annual	0.5 ppm N,O	0.00	0.00
Ketone	N/A	30-minute			3.35×10^{-2}
		Annual			5.20×10^{-4}
Lithium (Hydride)	N/A	30-minute			2.30×10^{-6}
		Annual	0.25 mg/m^3 N,O		9.00×10^{-8}
Magnesium (Oxide)	N/A	30-minute			5.70×10^{-5}
		Annual	10 mg/m^3 O		2.00×10^{-6}
Methane	N/A	30-minute			1.41
		Annual			2.72×10^{-2}
N-butyl Alcohol	1 ppm = 3.08 mg/m^3	30-minute		1.06×10^{-3}	3.25×10^{-3}
		Annual	50 ppm N,O	1.66×10^{-5}	5.10×10^{-5}
Non-F Listed Solvents	N/A	30-minute			2.30×10^{-4}
		Annual			3.50×10^{-6}
		30-minute		2.50×10^{-2}	1.53×10^{-1}

TABLE 4.14.1.2–3.—*Maximum Potential Onsite Ambient Concentration of Pollutants Resulting from Existing Pantex Plant Sources*-Continued

POLLUTANT	CONVERSION FACTOR	AVERAGING TIME	EXPOSURE LIMITS time weighted average (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (ppm)	PANTEX PLANT MAXIMUM POTENTIAL CONCENTRATION (mg/m^3)
Pyrene	N/A	30-minute			5.20×10^{-6}
		Annual			1.50×10^{-7}
Pyridine	1 ppm = 3.29 mg/m^3	30-minute		2.76×10^{-3}	9.09×10^{-3}
		Annual	5 ppm [N,O]	4.26×10^{-5}	1.40×10^{-4}
Silicone	N/A	30-minute			3.90×10^{-6}
		Annual	10 mg/m^3 [ACGIH]		3.00×10^{-8}
Silver (Dust)	N/A	30-minute			7.90×10^{-5}
		Annual			2.90×10^{-6}
Tetrahydrofuran	1 ppm = 3.00 mg/m^3	30-minute	250 ppm (ST) [N,O]	1.05×10^{1}	3.15×10^{1}
		Annual	200 ppm [N,O]	9.34×10^{-2}	2.80×10^{-1}
Trichlorofluoromethane	N/A	30-minute			1.01×10^{-1}
		Annual	1000 ppm [ACGIH]		1.58×10^{-3}
Trichlorotrifluoroethane	1 ppm = 7.79 mg/m^3	30-minute	1250 ppm (ST) [N,O]	6.08×10^{-2}	4.74×10^{-1}
		Annual	1000 ppm [N,O]	8.38×10^{-4}	6.53×10^{-3}
Zinc (Oxide fumes)	N/A	30-minute	10 mg/m^3 (ST) [N,O]		2.90×10^{-4}
		Annual	5 mg/m^3 [N,O]		8.00×10^{-6}

ACGIH - American Conference of Governmental Industrial Hygienists
C - Ceiling: Concentration should not be exceeded at any time during workplace exposure.
N - National Institute of Occupational Safety and Health
NA - No conversion factor
O - Occupational Safety and Health Administration
ST - STEL: 15-minute time weighted average exposure which should not be exceeded at any time during the workday, even if the 8-hour weighted average is within the threshold limit.
Sources: NIOSH 1994, ACGIH 1994; Calculated values.

TABLE 4.14.1.2–4.—*Chemical Risk Factors (Air Pathway)*[1]

CHEMICAL	RISK FACTOR[2] $(mg/kg\text{-}day)^{-1}$	WEIGHT-OF-EVIDENCE CLASSIFICATION	TYPE OF CANCER
INHALATION ROUTE			
1,1,2-trichloroethane	5.6×10^{-2}	C	Hepatocellular carcinoma
Benzene	2.9×10^{-2}	A	Leukemia
Carbon Tetrachloride	5.2×10^{-2}	B2	Hepatocellular carcinoma
Chlorobenzene		D	
Chromium	42	A	Lung
Dibenzofuran		D	
Ethyl Benzene		D	
Ethylene Dichloride	9.1×10^{-2}	B2	Hemangiosarcomas
Formaldehyde	4.6×10^{-2}	B1	Squamous cell carcinoma
Lead	(Not available)	B2	
Mercury		D	
Methane, Dichloro(Methylene Chloride)	1.6×10^{-3}	B2	Hepatocellular carcinoma
Methyl Ethyl Ketone(2-Butanone)		D	
Naphthalene		D	
Nitrobenzene		D	
Phenol		D	
Toluene		D	
Xylene (all isomers)		D	

A – Human carcinogen
B1 – Probable human carcinogen, based on limited human data
B2 – Probable human carcinogen, based primarily on animal data
C – Possible human carcinogen
D – Not classifiable
[1]U.S. Environmental Protection Agency. Integrated Risk Information System. March 1995.
[2]The risk factor is also referred to as a slope factor.
Source: EPA 1995

with chemical concentrations and human exposures (e.g. the amount of time an individual is in contact with the chemical), it is possible to calculate a latent cancer probability. It was assumed that exposure to the public was entirely from inhalation, since airborne transport is the only viable pathway to the public. Using the calculated concentrations in Table 4.14.1.2–1, toxic chemical emissions would result in a probability of 1.2×10^{-5} that a hypothetical individual living at the plant boundary would contract a latent cancer.

contamination to the bay of occurrence. Building 12–64 is an exception because it does not have the interlock. The impact of this exception is accounted for in the evaluation of potential accident scenarios. Upon detection of tritium (beta radiation), an exhaust will ventilate the tritium to the atmosphere. The design features of buildings provide other barriers that prevent the dispersal of plutonium during accidents. The building features also reduce the probability of damage to the facility from natural phenomena and external events (e.g., earthquakes and tornadoes).

Structural analysis performed on buildings representative of Pantex Plant construction types shows that heavily reinforced structures are not vulnerable to damage from large scale tornadoes. Fire was identified as a possible release scenario. However, a fire limited to the interior of the facility by the fire suppression system or the fire fighters would only cause internal releases in the room of the fire. Where applicable, the high efficiency particulate air filters could prevent release to the exterior atmosphere.

Besides the systems and structures noted above, numerous other features serve to enhance facility safety. These features include:

- Rad-safe systems (radiation detection and alarm systems) and continuous air monitors to protect personnel from radiological exposure.
- Fire protection systems.
- Grounding and lightning protection systems.
- Electrical power stability, including an uninterruptible power supply and emergency lighting.
- An emergency communication system to notify personnel and provide quick response to accidents, adverse weather, or natural disaster.

The defense-in-depth philosophy summarized above emphasizes physical barriers. In addition to these physical barriers, Pantex Plant also employs numerous administrative controls that minimize the likelihood of operator errors.

Pantex Plant has numerous integrated programs that work together to establish and maintain "barriers" to protect the public, the workers, and the environment. Programs of this type include the SAR (Safety Analysis Report) Program that defines the safety envelope for each facility, establishes the required and allowable facility configurations, and formally authorizes facility operations. Similarly, the HAR (Hazards Assessment Report) Program serves to evaluate and authorize individual operations which are conducted within the aforementioned facilities.

Once facility configurations and operational procedures are established by the SARs and HARs, programs such as Configuration Management, Conduct of Operations, Maintenance Management, USQ (Unreviewed Safety Question) Program, and the Change Control Board serve to continually ensure that facilities are maintained and operations are conducted as authorized. In the event that any facility or operation is found to be out of compliance with the authorized safety basis, immediate steps are taken to correct the deficiency. A determination is made whether or not to continue operations. Facilities or procedures may be modified to allow continued operations while the deficiency is being corrected. Additional programs, which work together to establish and maintain safety at Pantex Plant, include the following:

- Nuclear Safety Management
- Operational Readiness Reviews
- Radiation Safety
- Nuclear Explosives Safety

Information on these programs is presented in the Program Information Document and the Safety Information Document.

4.14.1.5 *Compliance with Occupational Safety and Health Requirements*

The health and safety of all workers associated with Pantex Plant operations is a primary consideration in the decision resulting from this EIS. A comprehensive nuclear and occupational safety and health initiative was announced by the Secretary on May 5, 1993, entailing closer consultation with OSHA regarding regulation of worker safety and health at DOE contractor-operated facilities. Regulation of worker health and safety at DOE contractor-operated facilities will gradually shift from DOE to OSHA.

The *Occupational Safety and Health Act of 1970* (Public Law 91-596) establishes Federal requirements for assuring occupational safety and health protection for employees. DOE and OSHA have agreed to a temporary pilot project to facilitate the shift of worker protection to OSHA. Under this temporary pilot project, OSHA will regulate and oversee worker health and safety at the Argonne National Laboratory in DuPage, Illinois. During the pilot, OSHA will evaluate the current safety and health program at Argonne and respond to employee complaints.

Information obtained during the Argonne pilot project is expected to help the two agencies determine the resource needs of OSHA if it is to ultimately assume responsibility for worker safety and health at DOE facilities. While OSHA regulates and enforces worker health and safety at industrial and some government workplaces, current law exempts most DOE facilities from external regulation and enforcement. DOE internal regulations do, however, require all facilities to meet current OSHA standards.

DOE facilities also comply with the *Emergency Planning and Community Right-to-Know Act* (42 U.S.C. 11001), which requires facilities to report the release of extremely hazardous substances and other specified chemicals; provide material safety data sheets or lists thereof; and provide estimates of the amounts of hazardous chemicals onsite. The reporting and emergency preparedness requirements are designed to protect both individuals and communities.

Workplace Safety and Accidents

Operations at Pantex Plant expose workers to occupational hazards during the normal conduct of their work activities. Occupational safety and health training that includes specialized job safety and health training appropriate to the work performed is provided for all employees at Pantex Plant. This training also includes informing employees of their rights and responsibilities under the *Occupational Safety and Health Act of 1970*; Executive Order 12196, which established OSHA Federal Agency Standards; 29 CFR 1960—The OSHA Federal Agency Standards—which describes the safety and health programs that Federal agencies must establish and implement under Executive Order 12196; and DOE Order 440.1—Federal Employee Occupational Safety and Health Program. DOE provides implementation guidance in DOE Order 440.1, including the requirements and guidelines for the DOE Federal Employee Industrial Hygiene Program. DOE policy is to:

- Provide places and conditions of employment that are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm.
- Assure that employees and employee representatives have the opportunity to participate in the Federal Employee Occupational Safety and Health Program.
- Establish programs in safety and health training for all levels of Federal employees.

- Consider the 29 CFR 1960 (OSHA Standards for Federal Agencies) requirements to be the minimum standards for DOE employees.

DOE contractor operations at Pantex Plant expose workers to hazardous constituents. DOE orders require that site operations have programs for protection of workers. DOE Orders 5480.11, Radiation Protection for Occupational Workers, and 440.1, Federal Employee Occupational Safety and Health Appraisal Program, establish procedures for protection of workers against radiological and hazardous materials, respectively. DOE Order 232.1, Occurrence Reporting and Processing of Operations Information, provides for reporting and guides appropriate corrective action(s) and follow-up should an exposure occur.

DOE Order 451.1, National Environmental Policy Act Compliance Program; DOE Order 5482.1B, Environment Safety and Health Appraisal Program for Department of Energy Operations; and DOE Order 5480.23, Nuclear Safety Analysis Reports provide the basis for review of all planned and existing construction and operation to determine the potential for accidents and the assessment of the associated human health and environmental consequences, should an accident occur. The results of these reviews are used as the basis for determining the need for controls or other mitigative actions to eliminate or greatly reduce the potential for and consequences of an accident. These reviews are required before authorization of construction or start of operation. These reviews also involve the identification of hazards and an analysis of normal, abnormal, and accident conditions. This analysis includes consideration of natural and man-made external events, including fires, floods, tornadoes, earthquakes, other severe weather events, human errors, and explosions.

In accordance with DOE Order 151.1, Emergency Management System, emergency response planning and training are provided to mitigate the consequences of potential accidents. Additionally, should an accident occur, the incident would be reported in accordance with DOE Orders 232.1, Occurrence Reporting and Processing of Operations Information. The reports would also include appropriate corrective action(s) and followup.

4.14.2 Impacts of Proposed Action

Under the Proposed Action, the following activities would occur at Pantex Plant:

- Assembly, disassembly, repair, retrofit, and evaluation of nuclear weapons in support of the national security policy.
- Development, fabrication, and testing of chemical high explosive(s) (HE) and HE components.
- Nuclear material staging as defined in section 3.1. Normal operational impacts associated with Zone 4 staging, and associated material movement are discussed in section 4.12, Intrasite Transportation.
- Construction and operation of new facilities. These are discussed in section 3.1.

This section describes the human health impacts from these activities.

4.14.2.1 *Impacts of Continued Operations*

The continuation of weapons-related operations at Pantex Plant would result in the continuation of radiological exposures to plant workers. Table 4.14.2.1–1 presents the expected radiological impact from future weapons operations based on historical exposures.

The combined involved worker dose from 10 years of operation at the 2,000 weapons activity level is estimated at 330 person-rem based on historical doses. Assuming that only 330 radiation workers (based on 1994 operations) are involved in weapon operations over a period

TABLE 4.14.2.1–1.—*Radiological Exposures to Workers from Normal Weapons Operations*

WEAPONS LEVEL	CUMULATIVE DOSE (10 YEARS OF OPERATIONS) (PERSON-REM)	EXPECTED EXCESS CANCER FATALITIES (10 YEARS OF OPERATIONS)
2,000	330	0.13
1,000	165	0.07
500	82	0.03

of 10 years (i.e., these people receive the entire plant dose), they would receive an average of 0.1 rem per person per year. The maximum dose an individual involved worker is allowed to receive annually is administratively limited to 900 mrem during normal operations. These involved workers include support personnel (e.g., auditors, inspectors) that participate in weapon operations.

Using a normal operations dose-to-risk conversion factor of 4×10^{-4} excess cancer fatalities per person-rem, there would be an additional 0.13 excess cancer fatalities experienced by this group in their lifetime. The probability of fatal cancer from all causes in the general population is estimated at 20 percent (NAP 1990:174), which implies that, on average, 66 of 330 people would develop a fatal cancer from all causes in their lifetime. As the weapon activity level decreases, so would the number of workers. The total person-rem and excess cancer fatalities would also decrease.

Non-involved personnel are not allowed in the vicinity of weapon operations and do not receive doses from weapons operations. The average dose to an individual member of the public or a non-involved worker results primarily from the small amounts of tritium offgassing from Cell 1, the small amounts from the Burning Ground, and the very small amounts that may escape during removal of tritium reservoirs. The total amount of tritium emissions are at the limit of detection. As a result, it is not possible to calculate doses and consequences to the non-involved workers and the public with high confidence levels. To the extent practicable, the dose to the public has been estimated to be less than 1.20×10^{-4} person-rem per year, resulting in 6.00×10^{-8} excess cancer fatalities. Practically speaking, the maximum dose to an individual non-involved worker or member of the public would be effectively zero.

The pit repackaging process is expected to begin operation in late 1996 or early 1997. It is planned that up to 20,000 pits will eventually be repackaged into AT–400A containers. This process will require the transfer of pits between Zone 4 and Zone 12. Impacts related to these transfers are described in section 4.12.

The pit repackaging will occur within existing facilities within Zone 12. Operations occurring as part of the pit repackaging process include:

1) Pit Leak Check—to verify the integrity of the pit encapsulation, pits will be leak checked prior to repackagement.
2) Pit Cleaning—pits with surface contamination that may initiate corrosion of the pit clad during storage will be cleaned prior to repackagement.
3) Placement of pits within inner containment vessel, inner containment vessel welding, inert gas introduction into inner containment vessel—pits will be placed within the inner containment vessel of

the AT–400A container. These vessels will be welded shut and filled with an inert gas mixture. The inner containment vessel will be leak checked to ensure the integrity of both the pit and the inner containment vessel.

4) Placement of inner containment vessel into outer containment vessel—once the integrity of the inner containment vessel is verified, the vessel will be placed in the AT–400A outer containment vessel. Further description of the AT–400A outer containment vessel is provided in volume II, appendix F.

All operations involving pits will be performed in a manner that minimizes radiological exposures to facility workers. However, the pit repackaging process will result in additional exposures at Pantex Plant. Because pit repackaging has not been done with this type container, there is no historical dosimetry information available. Therefore, conservative dose estimates have been made for this operation. For 2,000-pit repackage operations per year, it is estimated that an additional worker exposure of less than 30 person-rem will be incurred. Similarly, an additional worker exposure of less than 300 person-rem for the repackaging of 20,000 pits will be incurred. Using a normal operations dose-to-risk conversion factor of 4×10^{-4} excess cancer fatalities per rem, less than 0.12 excess cancer fatalities would be incurred in the workforce from this operation.

The dose estimates provided for the pit repackaging process are based on initial scoping studies performed prior to operation of the process. DOE expects that the actual worker doses will be less than the presented estimates. Additionally, as the pit repackaging effort proceeds, DOE will utilize the experience gained from initial operations to further reduce worker exposures.

Impacts of Potential Facility Accidents

For the purpose of this discussion an accident is defined as an unexpected or undesirable event that leads to a release of hazardous material within a facility or into the environment. Events that could result in an accidental release of hazardous material fall into three broad categories: external events, internal events, and natural phenomena events. External events (e.g., aircraft crashes and resulting explosions or fires) originate outside a facility. Internal events (e.g., equipment failures or human errors) originate within a facility. Natural phenomena events include weather-related occurrences (e.g., tornadoes and severe winds) and earthquakes. All of these events could lead to a release of hazardous material from a facility.

Identification of Risk Significant Accident Scenarios

Assessing the threat to public and worker health from potential accidents at Pantex Plant involved a screening process. The first step of this process was to identify a broad spectrum of potential accident scenarios that could occur during continued operations.

Facilities and operations at Pantex Plant have been analyzed to identify all hazards and potential accidents associated with the facilities and process systems, components, equipment, or structures and to establish design and operational means to mitigate these hazards to prevent potential accidents. The results of these analyses are contained in safety analysis reports and other safety basis documents including:

- *Basis for Interim Operations for the Pantex Plant*—Amarillo, Texas, Pantex Plant, June 1995 (Pantex 1995j).
- *Basis for Interim Operations for the Non-Nuclear Facilities*—Amarillo, Texas, Pantex Plant, September 1995 (Pantex 1995).

TABLE 4.14.2.1–2.—*Summary of Consequences to the Public from Risk Significant Accidents at Pantex Plant: Configuration 1*

SCENARIO	DESCRIPTION	FREQUENCY OF SCENARIO	POPULATION DOSE[1] (excess fatal cancer)	ANNUAL SOCIETAL RISK[2] (excess fatal cancers per year)
1	Explosive driven plutonium dispersal from internal event	Extremely Unlikely	1,200 Person-Rem (5.9×10^{-1} excess fatal cancers) Worker Fatalities	6.3×10^{-6}
2	Accidental high explosives detonation from internal event	Anticipated	No Public Impact, Worker Fatalities	NA
3	Explosive driven plutonium dispersal from external event/ natural phenomena	Not Reasonably Foreseeable	16,000 Person-Rem (8.0 excess fatal cancers), Worker Fatalities	7.2×10^{-6}
4	Accidental high explosives detonation from external event/ natural phenomena	Unlikely	Worker Fatalities, No Public Impact	NA
5	Tritium reservoir failure from internal event	Anticipated	0.080 Person-Rem (4.0×10^{-5} excess fatal cancers)	9.5×10^{-7}
6	Pit breach from internal event	Unlikely	0.00037 Person-Rem (1.9×10^{-7} excess fatal cancers)	1.5×10^{-9}
7	Multiple tritium reservoir failure from external event/natural phenomena	Not Reasonably Foreseeable	110 Person-Rem (0.055 excess fatal cancers)	2.2×10^{-8}
8	Fire driven plutonium release from external event/natural phenomena	Not Reasonably Foreseeable	1,100 Person-Rem (0.55 excess fatal cancers)	2.9×10^{-7}
9	Tritium or plutonium release caused by seismic event or aircraft accident	Unlikely	0.40 Person-Rem (2.0×10^{-4} excess fatal cancers)	6.8×10^{-8}
10	Chlorine release due to failure of system piping and valves or cylinder from natural phenomena	Unlikely	No adverse public impacts	NA
11	Chlorine release due to failure of system piping and valves or cylinder from internal event	Unlikely	No adverse public impacts	NA

[1]Appendix D presents details of the dose and excess fatal cancer consequence assessment methodology. No prompt fatalities in members of the general public from these scenarios are anticipated.
[2]Obtained by multiplying the scenario frequency by the excess cancer fatalities due to that scenario.

an unlikely event occurring within a human lifetime range from approximately 50 percent to less than 1 percent. Most unlikely events would not be expected to occur over a time span equal to the 200-year history of the U.S.

- *Extremely unlikely* events have a frequency between 10^{-4} per year and 10^{-6} per year. Extremely unlikely events are so rare that the chances of one occurring within a human lifetime range from less than 1 in 100 to less than 1 in 10,000. Extremely unlikely events would not be expected to occur over a timespan equal to the history of human civilization.
- *Not reasonably foreseeable* events have a frequency below 10^{-6} per year. The chances of such an event occurring within a human lifetime (100 years) are fewer than 1 in 10,000 (10^{-6} x 100 = 1 in 10,000). Examples of not reasonably foreseeable events are catastrophic natural phenomena. One such example is the impact of a meteorite in the U.S. severe enough to cause thousands of fatalities.

For all scenarios, the frequency and consequence assessments are performed on a site-wide, rather than a facility-specific basis.

For the accidents identified as risk significant, detailed consequence assessments were performed. The consequence assessment focused on exposures to involved and non-involved workers and the public. Radiological consequences to the public were evaluated using site-specific meteorological data, local demographic data, and either the Melcor Accident Consequence Computer Code System (MACCS) or the Explosive Release Atmospheric Dispersion (ERAD) computer code system. MACCS was principally used to model health impacts from scenarios that did not involve explosions, while the ERAD computer code system was used primarily to model the health impacts from releases initiated by explosions (see volume II, appendix D for additional information on MACCS and ERAD). Human health impacts were evaluated in terms of cumulative radiological exposure from an accident and the societal risks (subsequent number of expected excess LCFs). This process is summarized in Figure 4.14.2.1–1.

Expected Change in Societal Risks from Potential Pantex Accidents

During preparation of the Draft EIS, Pantex Plant personnel discovered that particular assembly/disassembly cells had larger gaps between the edges of personnel and/or equipment doors and their frames than had been analyzed in prior studies. The cumulative gaps around the personnel and equipment doors of individual cells varied, but the worst case resulted in a total gap area greater than the 42 square inches that had been analyzed in previous Safety Analysis Reports. Since the gap area affects the amount of radioactive material that can be forced out of a cell by the air pressure of an explosive accident, plant personnel immediately reported the variance and initiated an Unreviewed Safety Question.

To resolve the issue, the plant immediately implemented measures to reduce the amount of high explosives and plutonium allowed in the cell and then modified the doors to close the total gap area of each cell to less than 42 square inches. Additional modifications have been designed to further close the gap area of each cell to less than 5 square inches. These modifications have been approved and funded for implementation in Fiscal Year 1997. The Final EIS includes health risk analysis of cell accidents that portray a bounding gap area (42 square inches) and the future gap area (5 square inches).

In the interim period until modifications are completed, Pantex Plant is operating the cells under a Justification for Continued Operation (JCO) (MH 1996d). This JCO establishes administrative controls to minimize the consequences of a potential accident until the

How are Radiation Risks from Pantex Plant Operations Evaluated in the EIS? The discussion of risk in this EIS provides two relative comparisons:

- Between the risks from Pantex Plant operations and the risks from other causes.
- Between the alternatives under consideration in this EIS.

Baseline Cancer Incidence:

- Cancer incidence is defined as the probability of contracting a fatal cancer among individuals or groups of individuals. Approximately 20 percent of all deaths in the U.S. are from cancer (NAP 1990). Consequently an individual has, on average, a lifetime fatal cancer probability of approximately 0.2 (20 percent) from all causes. This probability varies from group to group and from individual to individual. Thus, this EIS uses the 20 percent figure solely to provide a relative comparison between baseline cancer incidence and the increase in fatal cancer probability from exposures related to Pantex Plant operations.
- Cancer incidence can also be described in terms of individual or societal risk. For the purpose of making comparisons between different contributors to risk, the risk associated with a specified event is defined as the "Consequence" of the event per unit of time. For example, there are approximately 25,090 deaths from cancer per year in the State of Texas. The total societal risk from cancer can therefore be defined as 25,090 deaths per year. Because the State of Texas contains approximately 17 million residents, the average individual risk is defined as:

$$\frac{25{,}090 \text{ fatal cancers/year}}{16{,}986{,}510 \text{ residents}} = 1.5 \times 10^{-3} \frac{\text{LCF for an individual}}{\text{year}}$$

Similarly, a person in the vicinity of Pantex Plant has an annual fatal cancer risk of 1.7×10^{-3} excess cancer fatalities/year. With 267,107 residents in the Pantex Plant Region of Influence, the societal risk from cancer can be calculated as:

$$\left[\frac{1.7 \times 10^{-3} \text{ fatal cancers}}{\text{year individual}}\right][267{,}107 \text{ residents}] = 454 \text{ fatal cancers per year}$$

The annual fatal cancer risk varies from group to group and from individual to individual. Thus, these calculations are used in the EIS solely to provide a relative comparison between baseline cancer risk and any increase in cancer risk from Pantex Plant operations.

Risk Factors for Radiological Exposures

- Exposure to ionizing radiation increases a person's likelihood of experiencing a latent cancer fatality. It is referred to as "latent" because the cancer may take many years to develop and for death to occur.
- Radiation exposure can cause other health effects, including non-fatal cancers and genetic effects. This EIS uses the risk of excess cancer fatality as the basis for comparison of impacts among alternatives. The International Commission on Radiological Protection conservatively estimates the total detriment (fatal cancers, non-fatal cancers, and genetic effects) by multiplying the estimates of excess cancer fatalities by 1.46.

FIGURE 4.14.2.1–1.—*Evaluation of Risk.*

How are Cancer Risks Estimated for Exposures Received from Pantex Plant Normal Operations?

- The risk from exposures received from Pantex Plant operations is calculated as frequency x consequence.

  For exposures received during normal operations, frequency = 1.0.

  For a 10-year worker population exposure of 330 person-rem:

$$\text{Risk} = (1) \times (330 \text{ person-rem}) \times \left(4 \times 10^{-4} \ \frac{\text{excess cancer fatalities}}{\text{rem}}\right) = 0.13 \text{ cancer fatalities}$$

  The value 0.13 cancer fatalities is the average number of excess cancer deaths that would result if a total dose of 330 person-rem were applied to many different groups of 330 people. The most likely outcome is zero excess cancer fatalities.

FIGURE 4.14.2.1–1.—*Evaluation of Risk*-Continued.

end objective of reducing the door gap area to 5 square inches is reached.

Currently, nuclear explosive cells (gravel gerties) have a bounding overall leak area of 42 square inches. Pantex Plant will reduce these leak areas such that the total leak area will be less than 5 square inches. For the purpose of analysis, Scenario 1, Configuration 1 assumes a 42-square inch leak area for the gravel gerties. The societal and individual risks from this configuration are presented in Table 4.14.2.1–2 and in the text in the following section.

Scenario 1, Configuration 2 is representative of the plant configuration when a leak area of less than 5 square inches is achieved. Table 4.14.2.1–3 presents the changing risks for Scenario 1 and for the overall societal risk. Individual exposure and risks for both the 5-square inch and 42-square inch configuration are discussed in the following section.

The societal risk in the Pantex Plant ROI from potential plant accidents is also dependent on the storage configuration of the Zone 4 West magazines. Two configurations are analyzed that describe the changes in storage configuration expected in the future. The changes in storage configuration expected in the next 10 years involves the increase in pit storage and corresponding decrease in weapon storage within Zone 4 West. Configuration 1 involves the storage of 12,000 pits within Zone 4 West in 36 total magazines. The remaining 24 magazines are in use for weapons storage. The societal and individual risks from this configuration are presented both in Table 4.14.2.1–2 (Scenarios 3 and 8) and in the following section. This configuration presents the highest risk for Pantex Plant operations.

Configuration 2 is representative of the plant configuration as fewer weapons and more pits are stored within Zone 4 West. Configuration 2 includes 60 magazines for pit storage and no weapons storage within Zone 4 West. The overall societal risks from potential accidents decrease as the storage configuration evolves. Table 4.14.2.1–3 presents the changing risks for those scenarios affected (Scenarios 3 and 8) by the storage configuration evolution as well as the change in overall societal risks.

Discussion of Risk Significant Accident Scenarios

The description of Scenario 1 includes explicit calculations for deriving the value discussed. These calculations are included to provide an example of how the values in the rest of the scenarios were derived. Unless otherwise noted, accident frequencies are based on the 2,000 weapons operational level.

Scenario 1: Explosive Driven Plutonium Dispersal from an Internal Event. Nuclear weapons may be made with either conventional or insensitive HE, depending upon weapon design. Scenario 1 represents the accidental detonation of conventional HE in the presence of plutonium due to an internally initiated event. HE is present with radioactive materials in facilities where nuclear explosives work occurs. Initiators for this scenario include accidental actuation of an electro-explosive device during disassembly and handling accidents. Insensitive HE is a negligible risk contributor because it is not susceptible to ignition under the conditions existing during assembly or disassembly operations. Insensitive HE is, thus, not a credible explosive source for this scenario.

Scenario 1 is comprised of three individual cases in which an accidental HE detonation is postulated to be initiated by an internal event. These cases differ in where the accidental detonation occurs; i.e., in a nuclear weapons assembly and disassembly cell, a bay, or a special purpose building. An HE detonation during assembly or disassembly would lead to the dispersal of radioactive material. Weapons are designed so that, in the event of an accidental detonation, there will be no significant nuclear reactions. Positive measures are engineered into nuclear explosives to preclude a nuclear yield from an accidental HE detonation.

For operation on 2,000 weapons annually, the frequency of Scenario 1 is 1.1×10^{-5} per year. It is, thus, *extremely unlikely* (frequency of occurrence is less than 10^{-4} per year but greater or equal to 10^{-6} per year). The derivation of this frequency involves summing of probabilities of different initiating events in different facilities (see appendix D, section D.4.1). Explosive driven plutonium dispersal from an internal event can result from operations conducted in bays, cells, or special purpose facilities. The probability per operation that an operational error could cause an explosive driven plutonium release was estimated for each facility using data from available safety analyses (see references mentioned in section 4.14.2.1 as well

TABLE 4.14.2.1–3.—*Societal Risk Evolution*

SCENARIO	CONFIGURATION 1	CONFIGURATION 2
Scenario 1 (Explosive Dispersal)	6.3×10^{-6} excess fatal cancers per year	3.5×10^{-6} excess fatal cancers per year
Scenario 3 (Explosive Dispersal)	7.2×10^{-6} excess fatal cancers per year	4.9×10^{-7} excess fatal cancers per year
Scenario 8 (Fire Dispersal)	2.9×10^{-7} excess fatal cancers per year	6.6×10^{-7} excess fatal cancers per year
Overall Risk	1.5×10^{-5} excess fatal cancers per year	5.7×10^{-6} excess fatal cancers per year

Configuration 1: Cell leak area = 42 square inches, Zone 4 storage configuration of 36 magazines with pits, 24 magazines with weapons.
Configuration 2: Cell leak area = 5 square inches, Zone 4 storage configuration of 60 magazines with pits.

as those cited in individual scenario descriptions). The frequency per year was then quantified by multiplying the probability per operation by the annual number of operations in each facility and summing the results.

Should this scenario occur, the public dose impact is estimated to be 1,200 person-rem for a cell leak area of 42 square inches and 660 person-rem for a cell leak area of 5 square inches. The consequence of Scenario 1 would be 5.9×10^{-1} excess fatal cancers in the population within 80 kilometers (50 miles) of Pantex Plant for a cell leak area of 42 square inches and 3.3×10^{-1} excess fatal cancers for a cell leak area of 5 square inches.

The derivation of this consequence involves calculating a weighted average of the consequence from the event occurring in bays, cells, and special purpose facilities. The consequences are calculated separately for the Scenario 1 accident occurring in a cell, bay, or special purpose facility. A weighted average is then obtained by multiplying the consequence related to each facility by the frequency of the event occurring in that facility and then summing the results. This result, which represents the overall risk, is divided by the frequency of Scenario 1 to obtain the frequency weighted consequence for the scenario. This process is illustrated in Figure 4.14.2.1–2.

λ_S = Frequency that Scenario 1 occurs in a Special Purpose Facility

C_S = Consequence if Scenario 1 occurs in a Special Purpose Facility

λ_B = Frequency that Scenario 1 occurs in a Bay

C_B = Consequence if Scenario 1 occurs in a Bay

λ_C = Frequency that Scenario 1 occurs in a Cell

C_C = Consequence if Scenario 1 occurs in a Cell

Frequency of Scenario 1 = $\lambda_S + \lambda_B + \lambda_C$

Risk from Scenario 1 = $\lambda_S C_S + \lambda_B C_B + \lambda_C C_C$

Consequence if Scenario 1 occurs = $\dfrac{\lambda_S C_S + \lambda_B C_B + \lambda_C C_C}{\lambda_S + \lambda_B + \lambda_C}$

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FIGURE 4.14.2.1–2.—*Consequence Calculation for Scenario 1.*

The bounding public dose impact to an individual is represented by a hypothetical person is located at the site boundary closest to the radiological release. The wind is assumed to blow the radiological release directly towards this individual. The bounding dose impact to a non-involved worker is represented by a hypothetical person located 100 meters (328 feet) downwind of release point. The exposures to the MEOI and to the non-involved worker for each of the cases is presented in Table 4.14.2.1–4.

The MEOI exposure is dominated by the case in which the accidental explosion occurs in a cell using a cell leak area of 42 square inches (i.e., for Configuration 1). The MEOI exposure is dominated by the case in which the accidental explosion occurs in either a bay or a special purpose facility using a cell leak area of 5 square inches (i.e., for Configuration 2). The doses for all accident scenarios are given as committed effective dose equivalents, which mean a 50-year committed dose, not an acute exposure.

The exposure to the maximally exposed non-involved worker is dominated by the case in which the accidental explosion occurs in a cell. The non-involved worker would be expected to receive an exposure of 2300 rem using a cell leak area of 42 square inches and exposure of 600 rem using a cell leak area of 5 square inches. This exposure to the non-involved worker is greater for the cell case because the plume of plutonium exits the cell at ground level and over a longer period of time through the very small gaps under the cell doors. Alternatively, the plume for the bay case or special purpose building case would exit very quickly through the roof. In addition, the cell case plume is less energetic, which would result in higher nearby concentrations. Public risk issues are discussed in detail later in this section as well as in Figure 4.14.1.1–1.

Note that the dose to the MEOI presented here is the bounding consequence for this accident scenario. As illustrated in Table 4.14.2.1–4, this scenario covers the consequences from three facilities, cell, bay, and special purpose buildings. Each facility has a slightly different consequence. Likewise, within each facility, operations on differing weapon systems occur. Each of these different weapon systems would have a different consequence at the site boundary. For example, in the Bay Safety Analysis Report (DOE 1996i), a dose range of 3 to 30 rem is estimated. This difference is dependent on the HE/Pu ratios from different weapon systems. However, the dose estimates in this document are point estimates that bound all weapons related operations at Pantex Plant.

The MEOI dose is a consequence measure, not a risk estimate. The reason for this is because the MEOI is an entirely hypothetical receptor. A reasonable estimate of the frequency that such a receptor is exposed to the scenario requires

TABLE 4.14.2.1–4.—*Representative Doses (REM CEDE) to Maximally Exposed Offsite Individuals and Non-Involved Workers for Individual Cases in Scenario 1*

SCENARIO 1 CASES	MEOI DOSE	NON-INVOLVED WORKER DOSE
Cell Case	49(11)[1]	2,300 (600)[1]
Bay Case	34	34
Special Purpose Building Case	34	34

[1]For 5-square inch cell leak area
Source: Calculations using MACCS model and ERAD model

multiplying the scenario frequency by the probability that a receptor is actually located at the nearest point on the site boundary when the accident occurs, and further multiplying by the probability that the wind is blowing toward the receptor. Although available data are too limited to permit quantifying the probability that a receptor is actually located at the nearest point on the site boundary, the probability that the wind is blowing towards that point is approximately 0.05 for Scenario 1.

No prompt fatalities would be expected among members of the public. However, workers within the cell at the time of an accidental explosion would not be expected to survive. With 267,107 people in the ROI, the average risk to a person in the ROI is on the order of 2.4 x 10^{-11} excess fatal cancers per year with a cell leak area of 42 square inches and 1.3 x 10^{-11} excess fatal cancers per year with a cell leak area of 5 square inches. The increased annual risk to a person is calculated by multiplying the frequency of the accident by the public consequences which have been averaged over the population in the ROI (i.e., 1.1 x 10^{-5} per year x 5.9 x 10^{-1} excess fatal cancers spread over 267,107 people). Cancer statistics indicate that the fatal cancer risk from all causes to a person in the vicinity of Pantex Plant is 1.7 x 10^{-3} fatal cancers per year.

The societal risk (annual expected number of excess cancer fatalities) is 6.3 x 10^{-6} excess fatal cancers per year (see Table 4.14.2.1–3) for a cell leak area of 42 square inches and 3.5 x 10^{-6} excess fatal cancers per year for a cell leak area of 5 square inches. This number is calculated by multiplying the excess fatal cancers resulting from the accident by the frequency of the accident (i.e., 5.9 x 10^{-1} excess fatal cancers x 1.1 x 10^{-5} per year).

Scenario 2: Accidental High Explosives Detonation from an Internal Event. This scenario represents the accidental detonation of HE, but without radioactive material present, due to an internally initiated event. This includes accidents associated with HE development, manufacturing, testing, evaluation, and treatment. Initiators that contribute to this scenario include handling accidents and mechanical failures resulting in HE detonation during HE machining (Pantex 1993).

The likelihood of this event is *anticipated* (frequency of occurrence greater than or equal to 10^{-2} per year). A fatal accident of this type has occurred once at Pantex Plant (in 1977) in over 40 years of operation. The specific circumstances that led to the prior occurrence no longer exist. The manually operated HE machining process was replaced by a robotic process.

This scenario poses a risk to worker safety. There is a possibility of a fatal injury resulting directly from the HE explosion, not from radionuclide exposure. Members of the public and non-involved workers are not at risk from this scenario.

Scenario 2 has a higher frequency than Scenario 1 because HE development, manufacturing, testing, evaluation, and treatment routinely expose bare HE to external stresses (e.g., stresses associated with HE machining) greater than the stresses associated with routine assembly/disassembly operations. If these stresses exceed allowable limits, an inadvertent HE detonation is possible. Although accidental HE detonations of the type included in Scenario 2 have occurred at Pantex Plant, none of the accidents included in Scenario 1 have been experienced.

Scenario 3: Explosive Driven Plutonium Dispersal from an External Event or Natural Phenomena. This scenario represents the accidental detonation of HE, in the presence of plutonium and tritium, due to an aircraft crash. HE is present with radioactive materials within nuclear explosives and in facilities where nuclear explosives work occurs. Initiators that contribute to this scenario include an aircraft impact initiated HE detonation in a Zone 12

facility containing nuclear material and an aircraft impact initiated HE detonation in a Zone 4 nuclear weapon storage magazine (DOE 1992f).

This scenario is dominated by an aircraft impact into a Zone 4 weapons magazine resulting in the HE detonation of numerous weapons with a small contribution from aircraft impacts into nuclear explosive bays. The overall likelihood of this scenario occurring is *not reasonably foreseeable* (frequency of occurrence is less than 10^{-6} per year). The public dose impact from this event is estimated to be 16,000 person-rem. No prompt fatalities would be expected in members of the public. The MEOI would be expected to receive an exposure of 60 rem. This corresponds to an incremental increase in lifetime fatal cancer probability of 3×10^{-2}. The 100-meter (328-foot) non-involved worker is not expected to survive the aircraft crash and explosion. If the individual did survive, the maximum expected dose would be 40 rem corresponding to an increase in lifetime fatal cancer probability of 1.6×10^{-2}. The non-involved worker is closer to the postulated release than the MEOI, yet receives a lower dose. This is due to the initial buoyancy of the released material as a result of the explosively driven dispersal event.

Considering the likelihood and consequence of this scenario, on the average, a member of the public will have an increased risk of developing a fatal cancer from this potential accident of 2.7×10^{-11} excess fatal cancers per year. The annual fatal cancer risk to a person in the vicinity of Pantex Plant from all causes is 1.7×10^{-3} fatal cancers per year.

Scenario 4: Accidental High Explosives Detonation from an External Event or Natural Phenomena. This scenario represents the accidental detonation of HE, with no radioactive material present, due to a seismic event or an aircraft crash. The scenario could occur in staging facilities and facilities involved with HE development, production, and disposal. The main initiator of this scenario is the seismic collapse of an HE development or manufacturing facility (Pantex 1993). These facilities tend to have lower structural strength than nuclear facilities.

The overall likelihood of this scenario occurring is *unlikely* (frequency of occurrence is less than 10^{-2} per year but greater than or equal to 10^{-4} per year). The blast resulting from the explosion could fatally injure a worker in the vicinity. Members of the public and non-involved workers are not at risk from this scenario.

Scenario 5: Tritium Reservoir Failure from an Internal Event. This scenario represents the release of tritium due to a reservoir failure during normal operations. Initiators for this scenario include an inadvertent squib valve actuation during weapon operations.

This type of event has occurred at Pantex Plant, and the frequency of this event is strongly dependent on the number of weapon operations being performed. For the 2,000 weapons activity level, this scenario is *anticipated* (frequency greater than or equal to 10^{-2} per year). For the 500 weapons activity level, this event is *unlikely* (frequency of occurrence is less than 10^{-2} per year but greater than or equal to 10^{-4} per year) (Pantex 1996a, DOE 1995g). This scenario is dominated by handling accidents during weapon operations. The public dose impact from this event is estimated at 8.0×10^{-2} person-rem. The MEOI would be expected to receive an exposure of 1.1×10^{-2} rem. This corresponds to an increase in lifetime fatal cancer probability of 5.5×10^{-6}.

Based upon the tritium exposure in 12–44 Cell 1, cited in section 4.14.1.1, a maximum worker exposure of between 1 and 2 rem is expected. This corresponds to an increase in fatal cancer probability of 8×10^{-4} or less, if the accident occurs. The non-involved worker (i.e., 100 meters [328 feet] downwind) would be expected to receive an exposure of 3×10^{-1} rem. This corresponds to an increase in lifetime fatal

a pit breach, resulting in a plutonium release, initiated by a seismic event or aircraft accident. The main initiator for this scenario is an aircraft impact initiated fire in a Zone 4 pit storage magazine (DOE 1994w; DOE 1992f).

This scenario is dominated by a heavy aircraft impact into a Zone 4 pit storage magazine resulting in a fire driven dispersal from numerous pit containers. The overall likelihood of this scenario occurring is *extremely unlikely* (frequency of occurrence is less than 10^{-4} per year but greater or equal to 10^{-6} per year) with 20,000 pits in Zone 4 storage. It is not reasonably foreseeable with 12,000 pits in Zone 4 West. The public dose impact from this event is estimated to be 1,100 person-rem. No prompt fatalities would be expected in members of the public. The MEOI would be expected to receive an exposure of 34 rem. This corresponds to an incremental increase in lifetime fatal cancer probability of 1.7×10^{-2}.

Workers in the vicinity of the crash and explosion would not be expected to survive. The non-involved worker would be expected to receive an exposure of 3,000 rem. This corresponds to an increase in lifetime fatal cancer probability of 1.0. This is a 50-year committed dose equivalent, which means that the radiological exposure is not acute, but occurs over a 50-year time period. Consequently, no actute radiological fatalities are expected (LLNL 1995).

Considering the likelihood and consequence of this scenario, a member of the public would, on the average, have an increase in the risk of developing a fatal cancer from this potential accident of 2×10^{-12} excess fatal cancers per year (with 20,000 pits in Zone 4 West). The fatal cancer risk, from all causes, to a person in the vicinity of Pantex Plant is 1.7×10^{-3} fatal cancers per year.

Scenario 9: Plutonium Dispersal from an External Event or Natural Phenomena. This scenario represents a tritium or plutonium release, without an explosion, caused by a seismic event or aircraft crash. Initiators include an aircraft impact initiated fire in a Zone 12 nuclear explosive facility and a seismic collapse of a special purpose facility (Pantex 1993a).

This scenario is dominated by seismic events resulting in structural failure of special purpose buildings containing nuclear explosives. Many stockpile support activities (e.g., testing and maintenance) are performed in older facilities without the structural strength of the storage magazines. Thus, these facilities are more vulnerable to external events and natural phenomena. The overall likelihood of this scenario occurring is *unlikely* (frequency of occurrence is less than 10^{-2} per year but greater than or equal to 10^{-4} per year). The public dose impact from this event is estimated to be 0.40 person-rem. The MEOI would be expected to receive an exposure of 2.0 rem. This corresponds to an increase in lifetime fatal cancer probability of 1.0×10^{-3}.

A worker in the vicinity of the fire or facility collapse would not be expected to survive. The non-involved worker would be expected to receive an exposure of 3.7 rem. This corresponds to an increase in lifetime fatal cancer probability of 1.5×10^{-3}.

Considering the likelihood and consequence of this scenario, a member of the public would, on the average, have an increase in the risk of developing a fatal cancer from this potential accident of 2.5×10^{-13} excess fatal cancers per year. The fatal cancer risk to a person in the vicinity of Pantex Plant from all causes is 1.7×10^{-3} fatal cancers per year.

Scenarios 10 and 11: Chlorine Releases. All potential accidental chemical releases were evaluated using the risk screening methodology. Chlorine was the risk dominant chemical accident. Chlorine is the only chemical with the potential for significant adverse offsite consequences.

ERPG DEFINITIONS

ERPG–1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

ERPG–2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

ERPG–3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

Table 4.14.2.1–3 identifies chlorine as the hazardous chemical dominating the risk from nonradiological releases (predicated upon the screening methodology described in appendix D). Since chlorine is not carcinogenic, the consequences of exposure to chlorine (primarily acute effects) differ from the consequences of exposure to radionuclides (potential latent cancers). This difference precludes a direct comparison between the risk and consequences associated with hazardous chemical releases and radionuclide releases.

A useful measure of potential human health effects resulting from exposure to non-carcinogenic chemicals is the hazard index. In its most general form, a hazard index is a ratio of the actual exposure of a human receptor to an established exposure limit. If this ratio is appreciably less than unity, no adverse human health effects are expected. If the hazard index is close to unity, some adverse human health effects may occur; and if the hazard index is substantially greater than unity, severe health effects can result.

Numerous exposure limits are available to form a hazard index. Since exposure to an accidental chlorine release is an unlikely, short-duration event, chronic exposure limits are inapplicable. Instead, Emergency Response Planning Guidelines (ERPG) values will serve to develop hazard indices for chlorine exposure.

Scenarios 10 and 11 both involve chlorine releases. The impact of these scenarios represents a residual risk at Pantex Plant and is independent of the alternatives. The rooms in which chlorine gas is used are equipped with a chlorine sensor alarm system that consists of an alarm siren and flashing light located outside the building. The sensor system is set to activate this alarm at a chlorine concentration of 1.0 part per million in the air. The rooms are also ventilated with a floor-level exhaust fan and contain an elevated fresh air inlet.

Scenario 10 is a chlorine release due to failure of system piping and valves or cylinder caused by a seismic event. Scenario 11 is a similar accident initiated by an internal event, such as operator error. Chlorine is used in two facilities, 15–29 and 13–47. A release of chlorine to the environment due to an earthquake is an unlikely event.

Should an earthquake occur with sufficient magnitude to damage one of the facilities that uses chlorine, there is a reasonable chance that the second facility would also be damaged. In each of the two facilities, two chlorine cylinders are in use. Thus, an earthquake that damages both facilities could release the contents from the four chlorine cylinders in use. Other chlorine cylinders in the facilities are not ordinarily expected to contribute to a release initiated by an earthquake. However, in the unlikely event that a chlorine cylinder is stored without its valve cap in place or is substandard structurally when delivered, it is conservatively postulated that Scenario 10 could involve a release from up to six chlorine cylinders. The magnitude of this chlorine release could be as high as 408 kilograms (900 pounds) (Pantex

1996a). For Scenario 11, the expected release to the environment is no more than the contents of one chlorine cylinder, 68 kilograms (150 pounds), and the frequency classification for this release is also unlikely.

Prior assessments disclose that, if Scenario 11 were to occur, an ERPG–1 concentration of 1 part per million is exceeded out to approximately 10.5 kilometers (6.5 miles), an ERPG–2 concentration of 3 parts per million is exceeded out to 6.5 kilometers (4 miles), and an ERPG–3 concentration of 20 parts per million is exceeded out to almost 3.0 kilometers (2 miles) (Pantex 1996a). Using Pantex-specific demographic and meteorological data, it is estimated that less than 1 percent of the downwind population would be exposed to a concentration exceeding ERPG–1 levels, and that even fewer members of the public would be exposed to higher concentrations. Moreover, since ERPG–1 and higher concentrations are perceptible by humans, persons experiencing ERPG–1 or higher concentrations can move away from the chlorine plume, thus minimizing their exposure duration.

Releasing 408 kilograms (900 pounds) of chlorine to the environment would result in approximately 10 percent of the public downwind from the release being exposed to ERPG–1 or higher concentrations, but less than 1 percent would be exposed to concentrations exceeding ERPG–2. Because of the likelihood that people exposed to concentrations in excess of ERPG–1 would evacuate the area of the chlorine plume, no long-term adverse public health impacts are anticipated for Scenario 10.

No adverse health impacts are expected from Scenario 11 for persons capable of evacuating the area of the chlorine plume.

Workers in the vicinity of a chlorine release (either Scenario 10 or 11) could be exposed to chlorine concentrations in excess of EPRG–3 and threshold levels. No long-term adverse health effects are expected for workers who promptly evacuate the area. For any persons incapable of evacuating the area of the chlorine plume, no serious or irreversible health impacts are expected from EPRG–1 or EPRG–2 exposures since the exposure duration is less than 1 hour. Persons incapable of evacuating an area with EPRG–3 concentrations may experience adverse health impacts depending upon the actual chlorine concentrations encountered and the exposure duration. However, chronic lung disease, electrocardiographic changes, and death have occurred in humans exposed to high concentrations of chlorine as a consequence of industrial accidents (Calabrese 1991).

Ultimate Fate of Radionuclides from Accidental Releases

Potential consequences to the Ogallala aquifer from an accidental plutonium release were investigated in conjunction with a Safety Analysis Report and an Environmental Assessment by Los Alamos National Laboratory (LANL) (LANL 1992:1, 2, 10). The hypothetical accident leading to dispersal of plutonium to the environment around Pantex Plant was assumed to be a high-temperature fire caused by a jet plane impact into a Zone 4 storage magazine containing nuclear weapons components, and subsequent ignition of jet fuel.

LANL envisioned that the hypothetical jet fuel fire could disperse fine particulate plutonium downwind of Pantex Plant for a maximum distance of 80 kilometers (50 miles). Prompt decontamination efforts could reduce radiation levels to 0.2 microcuries per square meter, but surface runoff and wind transport could concentrate contamination at playa lakes, where surface soil radiation levels could be as high as 2.0 microcuries per square meter. Surface water infiltrating through this contaminated soil could carry plutonium and decay products down toward the Ogallala aquifer. The model assumed an average recharge rate of 3 centimeters (1 inch) per year (10 times the High Plains average), and that recharge water would

reach the Ogallala aquifer at a depth of 20 to 100 meters (50 to 400 feet).

With these conservative assumptions in place, LANL performed two analyses. The first, an ultra-conservative non-dispersive piston-flow model, assumed that a contaminated layer of 3 centimeters (1 inch) of water moves downward through a 1-dimensional column in the unsaturated zone to the water table completely intact (i.e., without interacting with any other water or soils). The results of the non-dispersive piston-flow model indicated that plutonium levels would exceed calculated Environmental Protection Agency drinking water limits (1.3 picocuries per liter) in a 20-meter (50-foot) deep aquifer after approximately 76,000 years at an approximate maximum level of 7,700 picocuries per liter.

The second, more realistic analysis accounted for the processes of dispersion (i.e., mixing processes) that effectively change the composition of water as it would move downward through the soil column. The results showed that when the processes of dispersion were taken into account, peak plutonium levels in the 20-meter (50-foot) aquifer would never exceed the most restrictive drinking water dose limits. Additional factors were also qualitatively analyzed. These included colloidal plutonium transport, preferential flow, the effects of perched aquifers, opportunities for "short-circuit" flow through abandoned wells or other conduits, and fate of daughter products.

Of these factors, the one that would appear to produce the greatest effect would be short-circuit recharge paths to the Ogallala aquifer via unintentional flow through improperly constructed or abandoned water wells or intentional flow to the Ogallala aquifer as part of an artificial recharge project. The risk of short-circuiting along improperly constructed or abandoned wells could be mitigated by identification and sealing of these wells. In the event of a plutonium dispersal accident, active groundwater recharge projects should be monitored and, if necessary, shut down (LANL 1992:1, 11-15, 17-18, 31-32).

The final conclusion of these analyses is that the hypothetical plutonium dispersal accident does not pose a significant threat to the Ogallala aquifer. The assumptions of the analyses are extremely conservative because the scenarios were based on a depth to the water table of 20 meters (50 feet) whereas, at Pantex Plant, the typical depth to the top of perched groundwater is approximately 82 meters (270 feet), and the depth to the main Ogallala aquifer ranges from 104 to 140 meters (340 to 460 feet).

For water table depths of 60 and 100 meters (200 and 400 feet), LANL calculated plutonium travel times of 305,000 and 610,000 years, respectively. Interactions with both surficial materials and the unsaturated portion of the Ogallala Formation would be expected to retard the movement of plutonium relative to the infiltrating water (i.e., plutonium would move at a rate slower than the infiltrating water). During the transport time, radioactive decay would be expected to further reduce plutonium concentrations (LANL 1992:10,12). Where the perched aquifer is present, the downward movement of plutonium would be further reduced, because the low-permeability fine-grained zone would impede downward flow and potential contamination would be more likely to move horizontally and follow the course of buried channel sands and gravels, as discussed in section 4.6.1.2.

Conservatisms

The sequence of analyses performed to generate the radiological impact estimates from normal operation and facility accidents include: (1) selection of normal operational modes and accident sequences, (2) estimation of source terms, (3) estimation of environmental transport and uptake of radionuclides, (4) calculation of radiation doses to exposed individuals, and (5) estimation of health effects. There are uncertainties associated with each of these

steps. Uncertainties exist in the way the physical systems being analyzed are represented by computational models and in the data required to exercise the models (due to measurement errors, sampling errors, or natural variability).

In principle, one can estimate the uncertainty associated with each source and predict the remaining uncertainty in the results of each set of calculations. Thus, one can propagate the uncertainties from one set of calculations to the next and estimate the uncertainties in the final results. However, conducting such a full-scale quantitative uncertainty analysis is neither practical nor a standard practice for a study of this type. Instead, the analysis is designed to ensure—through judicious selection of release scenarios, models, and parameters—that the results bound the potential risks. This is accomplished by making conservative assumptions in the calculations at each step.

The models, parameters, and release scenarios used in calculations are selected in such a way that most intermediate results and consequently, the final estimates of impacts are greater than what would be expected. As a result, even though the range of uncertainty in a quantity might be large, the value calculated for the quantity is close to one of the extremes in the range of possible values, so that the chance of the actual quantity being greater than the calculated value is low (or the chance of the quantity being less that the calculated value if the criteria are such that the quantity has to be maximized). This has been the goal of the radiological assessment for normal operation and facility accidents in this study (i.e., to produce results that are conservative).

4.14.2.2 *Impacts of New Facility Construction and Upgrades*

Radiological exposure related to activities associated with new projects and facilities, as described in section 3.1.1, will be small. Additional radiological exposures related to the new projects and facilities are bounded by the Table 4.14.2.1–1 estimates.

The construction of three planned facilities—the Gas Analysis Laboratory, the Materials Compatibility Assurance Facility, and the Nondestructive Evaluation Facility—would reduce risks from operations in current facilities. These facilities would have a reduced risk because they would replace existing facilities used for HE that are susceptible to seismic events.

The Pit Reuse Facility's contribution to risk is expected to be small. As discussed in appendix H, it will introduce a process that breaches the pit tube as part of normal operations, which is not currently undertaken at Pantex Plant. Due to the limited number and nature of pit reuse operations planned, preliminary assessments indicate that incremental risk impacts from the Pit Reuse Facility would be barely perceptible. Further safety assessment would be conducted prior to the pit reuse facility becoming operational.

The human health impacts from the Hazardous Waste Treatment and Processing Facility and the Metrology and Health Physics Calibration and Acceptance Facility are not expected to be significant.

4.14.2.3 *Impacts of Environmental Restoration and Waste Management Activities*

The scope and mission of the Environmental Restoration (ER) program is to assess all inactive solid waste management units, determine the nature and extent of contamination, and perform remediation to eliminate any substantial present or future threat to human health and the environment (Pantex 1995a:15-1 to 15-11). The program is conducted in compliance with all regulatory requirements. All *Resource Conservation and*

Recovery Act Facility Investigation workplans have been approved, and field investigations have been initiated at all sites. Adequate data have been collected on many of the solid waste management units to recommend either no further action or interim corrective action.

The scope and mission of the ER program would not change under any of the alternatives to the Proposed Action. As currently active waste management sites become inactive, they will undergo environmental remediation as required by the *Resource Conservation and Recovery Act* permit (issued jointly by the Environmental Protection Agency and TNRCC) authorizing Pantex Plant to store and process hazardous wastes. Since the purpose of the ER program is to eliminate any substantial present or future threat to human health and the environment, its net impact on human health is to reduce risk.

4.14.3 Impacts from No Action Alternative

Under the No Action Alternative, weapons operations would continue at Pantex Plant to meet the stockpile management requirements. Dismantlement activities would, however, cease when the 12,000 pit storage limit is reached.

The total number of weapons operations under both the Proposed Action and the No Action Alternative are assumed to be similar. Consequently, the frequencies of potential accident scenarios caused by internally initiated events are the same for the Proposed Action and No Action Alternatives. In addition, the impacts from normal operations would be similar.

The main difference between the Proposed Action and No Action Alternatives in terms of potential human health impacts is the number of pits stored in Zone 4 and the effect of this change on the likelihood of an aircraft impact into a storage magazine. The likelihood of an aircraft impact into a pit storage magazine depends on the number of storage magazines in use. The storage of the 12,000 pits associated with the No Action Alternative would require the use of fewer storage magazines than would be required for the 20,000 pit storage level associated with the Proposed Action. The actual number of storage magazines required for 12,000 pits would be dependent on the storage configuration used by the plant. The use of fewer magazines for pit storage reduces the likelihood that an aircraft impact would breach a storage magazine that had pits inside.

An important difference in the impacts of the No Action Alternative is that the following facilities will not be replaced: the Gas Analysis Laboratory, the Materials Compatibility Assurance Facility, and the Nondestructive Evaluation Facility. Without replacing these facilities with upgraded facilities, the existing facilities would remain more susceptible to seismic events.

4.14.4 Impacts of Pit Storage Relocation Alternative

4.14.4.1 *Impacts of Relocating 20,000 Pits*

Relocating 20,000 pits from Pantex Plant would eliminate the risk posed by aircraft crash into pit storage magazines at the plant. Impacts relating to offsite pit shipments are discussed in section 4.12, Intrasite Transportation, and section 4.16, Intersite Transportation of Nuclear and Hazardous Materials.

With the storage of no pits in Zone 4, the societal risk from risk significant accidents is dependent on the level of weapons storage within the 24 SAC magazines: the societal risk from risk dominant accidents is 1.5×10^{-5} excess fatal cancers per year. With no weapon storage within Zone 4, the plant risk is

dominated by Zone 12: the societal risk from risk dominant accidents is 7.8 x 10^{-6} excess fatal cancers per year. Both societal risk estimates presuppose a 42-square-inch release area for cell explosions.

4.14.4.2 *Impacts of Relocating 8,000 Pits*

The significance of relocating 8,000 pits in terms of impacts from potential accidents is similar to the No Action Alternative described above.

With the storage of 12,000 pits, the societal risk is dependent on the level of weapons storage within Zone 4. With the storage of weapons within 24 SAC magazines, the societal risk from risk dominant accidents is 1.5 x 10^{-5} excess fatal cancers per year. With no weapon storage within Zone 4, the plant risk is dominated by Zone 12, the societal risk from risk dominant accidents is 8.1 x 10^{-6} excess fatal cancers per year. Societal risk estimates include 42 sq in release areas for cells.

4.14.4.3 *Summary of Human Health Impacts*

Table 4.14.4.3–1 presents a summary of Pantex Plant-related human health impacts from normal operations. Table 4.14.4.3–2 summarizes the impacts of radiological accidents at Pantex Plant.

4.14.5 Cumulative Impacts

The cumulative impacts presented here include impacts of the continued operations at Pantex Plant combined with impacts associated with activities described in the WM PEIS, SSM PEIS, and S&D PEIS. Since the Pantex Plant EIS Proposed Action and the SSM PEIS No Action Alternative represent a continuum of operations, the impacts associated with any new mission or facility that could be implemented at Pantex Plant are discussed in the context of that continuum. The impacts from the WM PEIS program are combined with those of the Pantex Plant EIS Proposed Action. The impacts from the S&D PEIS are generally combined with those of the SSM PEIS No Action Alternative. A detailed discussion of this methodology is presented in section 4.2.

4.14.5.1 *Impacts of Alternatives in the Waste Management Programmatic Environmental Impact Statement*

Pantex Plant is a potential site for location of the waste management facilities as described in the WM PEIS. If these facilities are located at Pantex Plant, they could result in additional impacts to workers and the public surrounding the plant. However, the WM PEIS has estimated human health impacts from waste management activities to be low; potential fatalities to the offsite population and to workers are essentially zero for treatment and disposal of low-level waste and low-level mixed waste under every alternative (DOE 1996).

The chemical environment for the Maximally Exposed Individual (due to an atmospheric release) is expected to result in chemical-related fatal cancer incidences ranging from 3 x 10^{-14} to 2.9 x 10^{-13}. This is essentially zero risk of fatal cancers from exposure to chemicals.

4.14.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability.

Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, human health impacts from operations are expected to be less than current impacts. The average radiological dose to workers would not be expected to change. The total worker dose, however, would change due to the reduced number of workers associated with a reduction in workload. Potential impacts from accidents, which are essentially independent of the level of operation, would not be expected to change.

Under the downsizing alternative, the average worker dose at Pantex Plant would be approximately 10 mrem per year. This would result in a total worker dose of 3.0 person-rem year, statistically equating to approximately 1 fatal cancer every 833 years. The incremental dose to the population within 80 kilometers (50 miles) would be 4.0×10^{-4} person-rem per year. The probability of a member of the public dying from cancer would be 2.0×10^{-7} year. Potential impacts from accidents were determined using computer modeling. For the composite accident, less than one fatal cancer would be expected for the population within 80 kilometers (50 miles).

4.14.5.3 *Impacts of Alternatives in the Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement*

The S&D PEIS is considering Pantex Plant for long-term storage of inventories of nonsurplus weapons-usable plutonium and highly enriched uranium (HEU), storage of inventories of surplus weapons-usable plutonium and HEU pending disposition, and disposition of surplus weapons-usable plutonium. For storage, the strategy for long-term storage of weapons-usable plutonium and HEU, as well as the storage site(s), would be decided. The storage alternatives include upgrading the existing plutonium storage facilities, consolidation of plutonium from other sites, and collocation of plutonium and HEU storage. The collocation alternative is used for analysis purposes in this EIS as the bounding storage alternative.

Under the S&D PEIS Collocation Alternative, construction of new storage facilities would be required in order to store plutonium and HEU at Pantex Plant. The annual dose to the public from the collocated facility would be 5.3×10^{-5} person-rem. This would cause an estimated 1.3×10^{-6} fatal cancers during 50 years of operation. The alternative of storing surplus pits from RFETS at Pantex Plant in the near-term could cause less than 10^{-2} fatal cancers for affected workers due to repackaging operations. There would be no effect to the public.

The final S&D PEIS will include an alternative that is a refinement of these storage alternatives. As discussed in sections 1.4 and 1.7.3 of this volume, the final S&D PEIS will include an alternative under which pits from Rocky Flats Environmental Technology Site (RFETS) could be transferred to Pantex Plant for storage in Zone 4 as early as 1997. The impacts of this alternative are fully accounted for in this EIS because the pits from RFETS could not cause the total number of pits stored in Zone 4 to exceed the storage limit of 20,000 pits analyzed under the Proposed Action. Furthermore, RFETS pits that could come to Pantex Plant would have the same characteristics, as analyzed in the S&D PEIS, as pits currently or previously stored at Pantex Plant.

For the disposition alternatives in the S&D PEIS, the emphasis at this stage in the NEPA decision process is on the strategy and technology mix rather than the actual site. The evolutionary Light Water Reactor is used for analysis purposes in this EIS as the bounding disposition alternative. Implementation of this disposition alternative would require the construction and operation of a pit disassembly

and conversion facility, plutonium conversion facility, mixed oxide (MOX) fuel fabrication facility, and one or more light water reactors. The bounding alternative also assumes that all of the facilities previously mentioned would be collocated at the same site (potentially Pantex Plant).

During normal reactor operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. All doses would be within radiological limits and well below levels of natural background radiation (DOE 1996a:4.0).

4.14.6 Potential Mitigation Measures

DOE will continue to strive to reduce radiological exposures to plant workers. Radiological exposures incurred from future weapons operations will be controlled and minimized by Pantex Plant procedures, administrative controls, and an active ALARA program that promotes work practices that minimize worker exposures. The magnitude of radiological exposures to workers and safe radiological worker practices are dictated by the Pantex Radiological Control Manual, and ultimately, by 10 CFR 835.

Section 4.14.1.4 contains detailed information about accident mitigation.

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4.15 AIRCRAFT ACCIDENTS

4.15.1 Affected Environment

Aircraft accidents are a concern at Pantex Plant because of the volume of local air traffic, the proximity of Pantex Plant to flight paths into and from the Amarillo International Airport, and overflights. Even though the likelihood of an aircraft crash at Pantex Plant is small, a crash has the potential of releasing radioactive material from Pantex Plant facilities.

The number of annual air operations in the immediate vicinity of Pantex Plant is influenced by several factors. There is a regional air navigational aid, known as a Very High Frequency Omni-Directional Radio Range with Tactical Air Navigation (VORTAC), located within 8 kilometers (5 miles) of Pantex Plant. Because the air traffic in low-altitude and high-altitude air corridors is serviced by the VORTAC, it contributes to the air traffic in the vicinity of Pantex Plant. A significant number of military (primarily Air Force) aircraft conduct instrument approach and landing practice at the Amarillo International Airport. Furthermore, aerial application activities, such as crop dusting for several farm plots near Pantex Plant Site, add to the air traffic volume in the immediate vicinity of Pantex Plant.

4.15.1.1 *Principal Features of Pantex Plant*

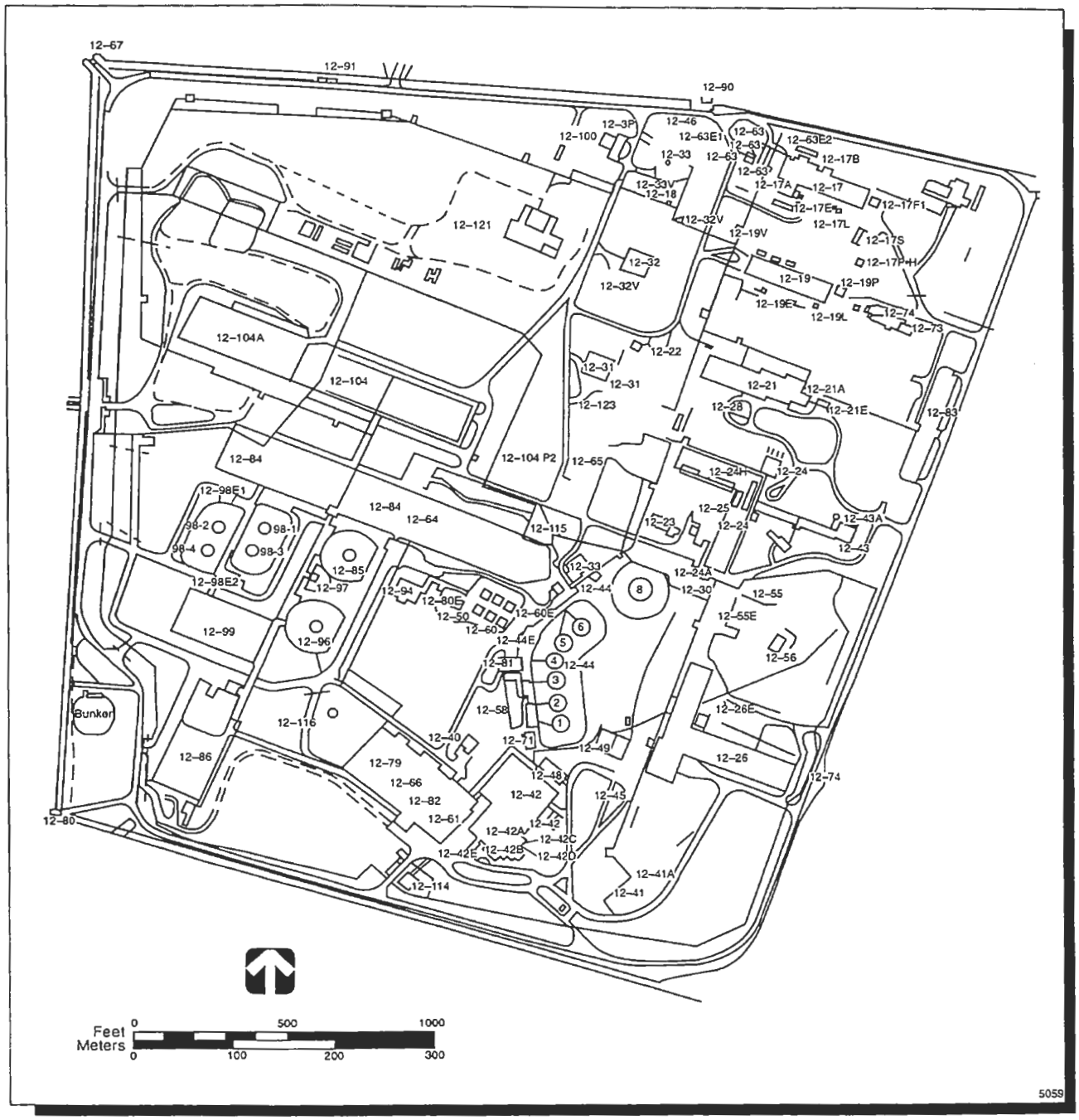
The principal features of Pantex Plant are illustrated in Figure 4.3.1.2–1. With respect to aircraft accidents, the primary concern is with the 42 Steel Arch Construction (SAC) magazines and the 18 Modified Richmond magazines in Zone 4 West, and certain buildings in Zone 12. Figure 4.15.1.1–1 shows the layout of the 60 magazines in Zone 4 West (Pantex 1996a:3.1). Typically, no more than four persons work in a Zone 4 magazine. The Zone 4 Safety Analysis Report limits operations to seven personnel inside the magazine. Moreover, no more than five magazines (counting the A and B sides of the Modified Richmond magazines as separate magazines) can be open at any one time (DOE 1992b:8-21). The buildings of concern in Zone 12 are facilities containing nuclear weapons and nuclear weapon components. These include the bays and cells that represent nuclear explosive facilities, the special purpose buildings, and the Zone 12 staging facilities. A layout of Zone 12 South is shown in Figure 4.15.1.1–2.

4.15.1.2 *Current Aircraft Approaches to the Amarillo Airport*

The current VORTAC location relative to Pantex Plant is illustrated on Figure 4.15.1.2–1 (DOE 1995h:16). Because this location is nearly centered on a line between Pantex Plant and Runway 22, aircraft using the VORTAC intercept the final approach course from the beacon in the vicinity of Pantex Plant and pass over it in a straight line toward the runway. Aircraft using the airport's Instrument Landing System (ILS) utilize the signals from the Back Course Localizer (BCL). This system guides the aircraft such that they fly over the northern portion of Zone 4. The BCL approach to Runway 22 is illustrated in Figure 4.15.1.2–2 (DOE 1995h:15).

4.15.1.3 *Comparison with Previous Aircraft Crash Analyses*

There have been several previous assessments of the risk posed to Pantex Plant due to an aircraft crash. These analyses date back to a 1976 study conducted by Sandia National Laboratories. It should be noted that with the exception of the current analysis, all of the past studies conducted for Pantex Plant aircraft crash risk analyses have used the Solomon model with different data sets. A Safety Analysis Report (SAR) for Zone 4 was completed in 1993. The aircraft crash analysis from the Zone 4 SAR was incorporated into the Environmental Assessment for Zone 4, which was released in



SOURCE: Pantex 1996a:3.1

FIGURE 4.15.1.1–2.—*Layout of Zone 12 South.*

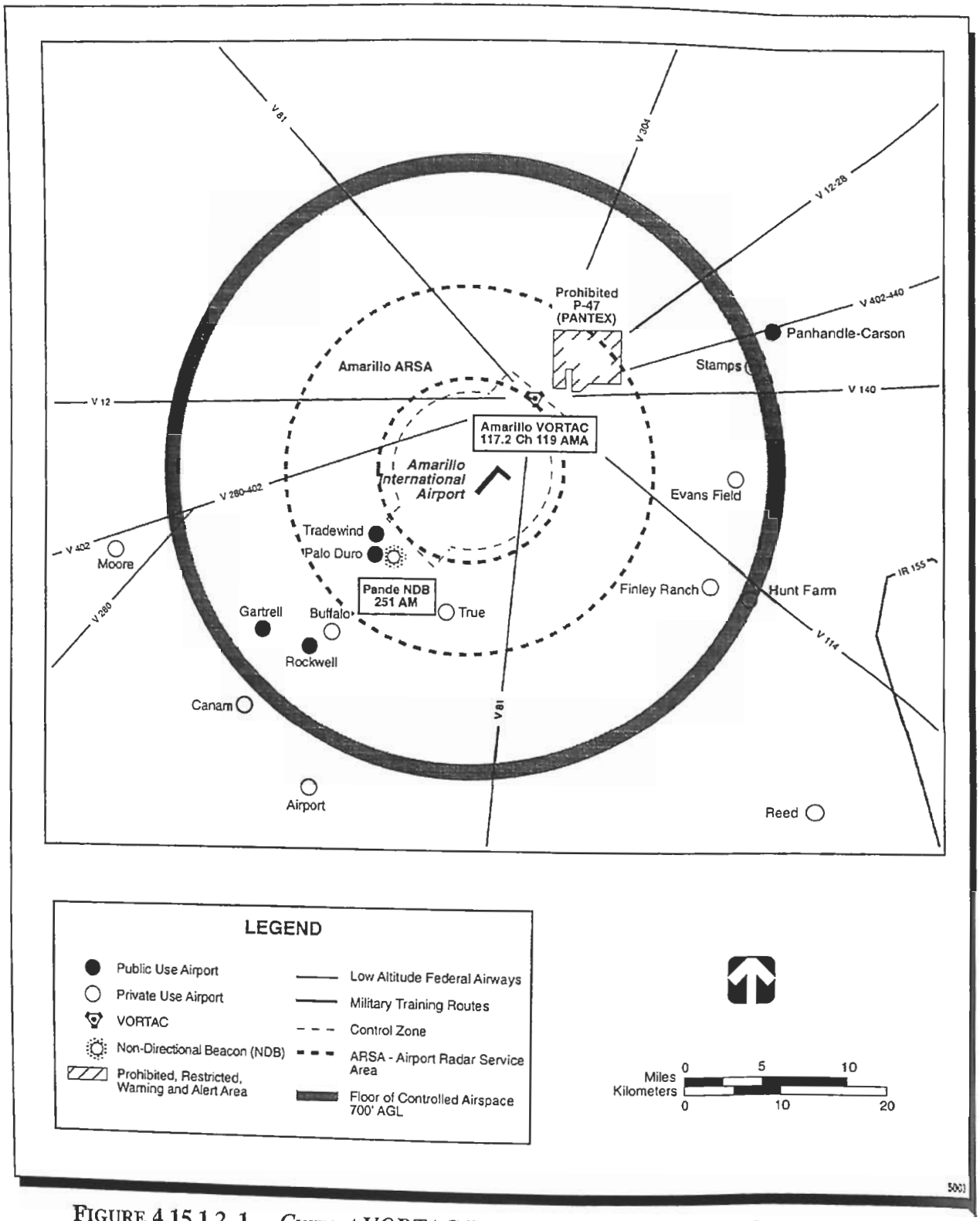
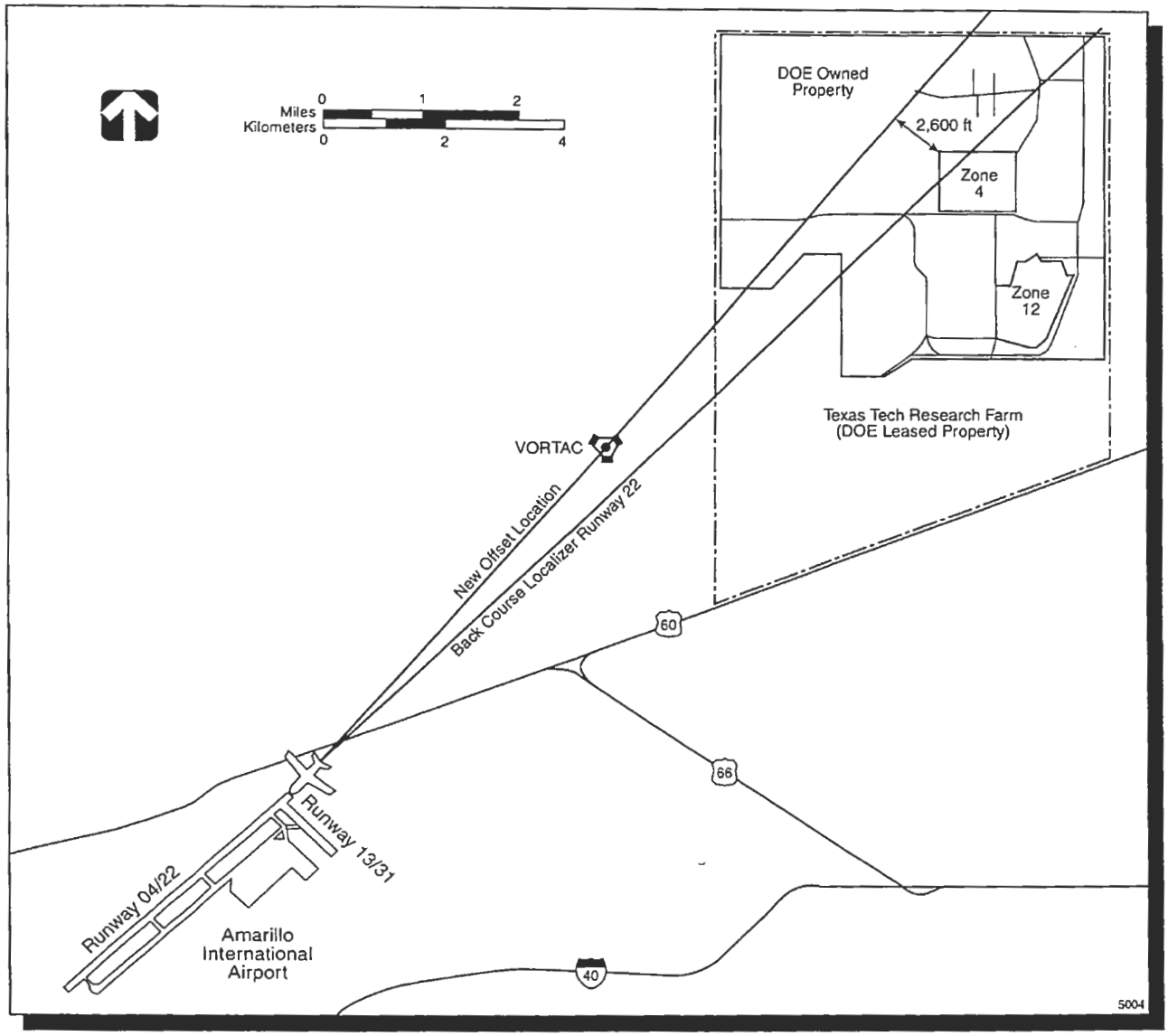


FIGURE 4.15.1.2–1.—*Current VORTAC Location and Low-Altitude Federal Airways.*



SOURCE: DOE 1995h:15, 16

FIGURE 4.15.1.2–2.—*Current and Proposed Back Course Approaches.*

January 1994. This document resulted in a Finding of No Significant Impact (FONSI) for the interim storage of up to 12,000 pits in Zone 4.

At that time, the frequency of an aircraft crash into the storage bunkers, which could result in plutonium release, was reported to be 6.6×10^{-7}, and thus termed "incredible". However, an Unreviewed Safety Question Determination (USQD) for the analysis contained in the Zone 4 SAR was issued in the spring of 1995. This determination questioned the validity of the aircraft overflight data used in the analysis. Additionally, the USQD found that the study used an incorrect application of the Solomon model. As part of the USQD, a corrected analysis was presented which gave a new probability of hitting a Zone 4 facility of approximately 2×10^{-5}.

To obtain up-to-date aircraft overflight data for the study presented herein, DOE, with cooperation from the Federal Aviation Administration (FAA), installed a Radar Airspace Monitoring System (RAMS) at the Amarillo International Airport. This system collects data on the number and type of aircraft operations in the vicinity of Pantex Plant. These new data were used in this EIS to help evaluate the likelihood of an aircraft impact into Pantex Plant nuclear facilities. The new data are also being used to close out the USQD. The results of the past and current aircraft crash studies are presented in Table 4.15.1.3–1. As can be seen from these results, the trend for aircraft crash hit probability is in the low to mid 10^{-5} range.

From a risk perspective, the hit and release probabilities (Table 4.15.1.3–1, Hit and Release Probability column) are the values of interest rather than the hit probabilities alone. Analyses of this type tend to be conservative in nature due to the inherent uncertainties. It is difficult to quantify these conservatisms and as a result, the hit and release probabilities for the Final EIS should be considered a conservative point estimate. The issue of conservatism is discussed in section 4.15.7.

4.15.1.4 *DOE Initiatives to Reduce and Monitor Pantex Overflights*

Due to public concern regarding the risk of aircraft crash at Pantex Plant, the Secretary of Energy committed DOE officials to meet with the City of Amarillo, FAA, the U.S. Air Force, and other stakeholders to discuss alternative civilian and military flight patterns. An Overflight Working Group was formed to address ways to reduce the number of aircraft flying over Pantex Plant. Their recommendations are listed below (DOE 1995h:12, 13, 18).

TABLE 4.15.1.3–1.—*Results of Past Pantex Plant Aircraft Crash Analyses*

STUDY	HIT PROBABILITY	HIT AND RELEASE PROBABILITY
SAND 76-0120 (entire site)	4.7×10^{-5}	—
Zone 4 SAR (DOE 1992f) (an incorrect value)	1.85×10^{-6}	6.63×10^{-7}
Zone 4 USQD (Pantex 1995a) (corrected analysis)	1.95×10^{-5}	—
Pantex Plant Pre-Draft EIS (Zone 4, Solomon)	4.0×10^{-5}	—
Pantex Plant Draft EIS (Zone 4, DOE Draft Standard, July 1995 version)	2.4×10^{-5}	9.0×10^{-6}
Pantex Plant Final EIS (Zone 4, DOE Draft Standard, July 1996 version)	1.3×10^{-5}	1.2×10^{-6}

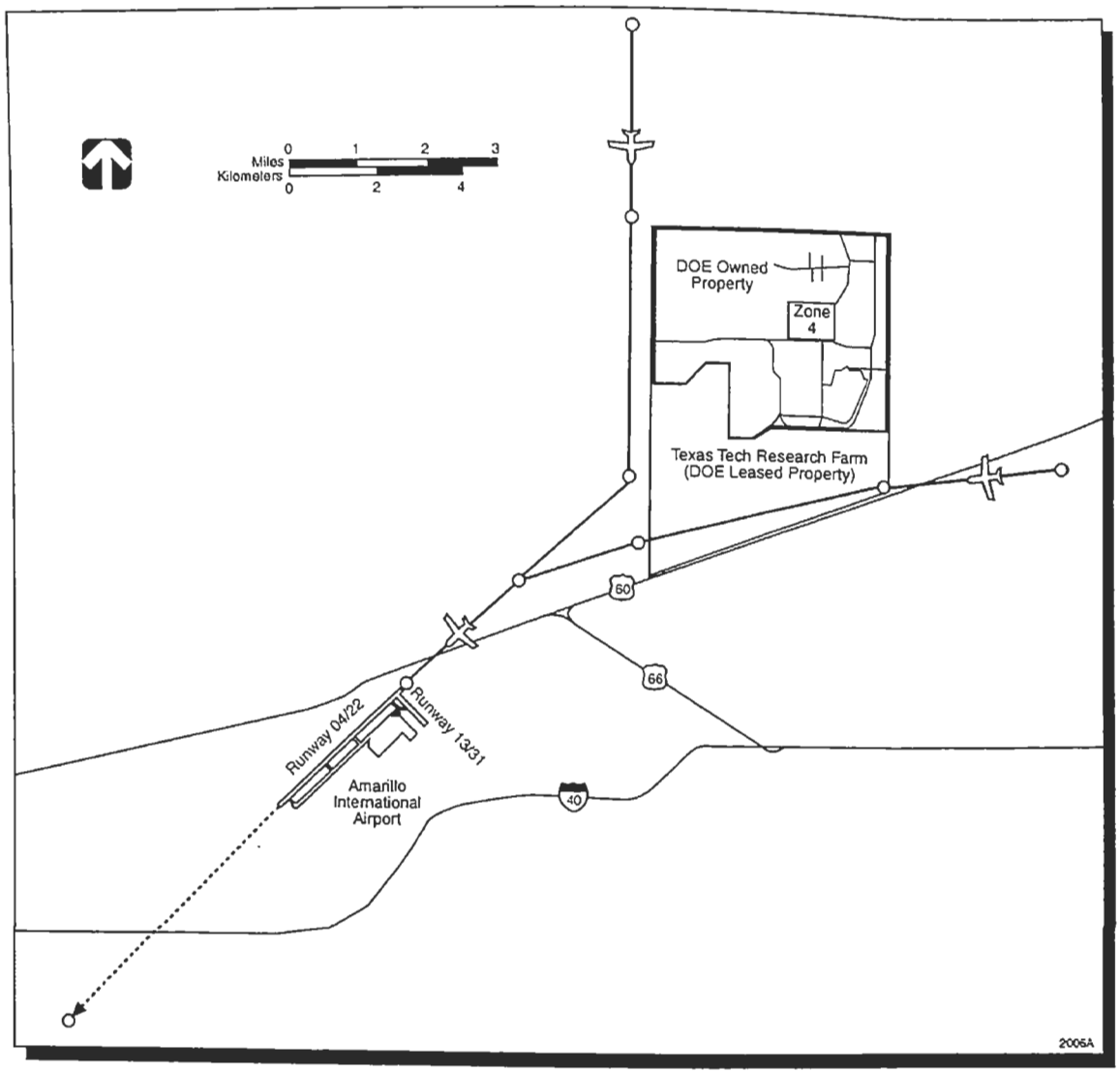
Sources: Studies as listed in table.

- Develop a Memorandum of Understanding (MOU) between DOE's Amarillo Area Office and the local FAA facility. The MOU would permit:
  - — Establishment of a telephone "hot line" between the Approach Control Facility and DOE's Amarillo Area Office Emergency Operations Center. Improved communication would permit the FAA to warn DOE of aircraft nearby with in-flight emergencies. This would allow the plant to modify activities vulnerable to aircraft crashes (completed).
  - — Modified vectoring of approaching aircraft. When aircraft safety will not be affected, air controllers will avoid extended vectoring of aircraft over the plant boundaries (completed).
  - — Use of discretionary holding patterns. When feasible, air controllers would offer a practice holding pattern away from plant boundaries when pilots request such practice (completed).
- Develop and implement a new Global Positioning System (GPS) non-precision approach that tracks around the plant's boundaries. This new navigation system was recently approved by FAA for use in all aircraft. As increasing numbers of aircraft become equipped with GPS, pilots will more frequently request this approach, which routes the aircraft away from plant boundaries (completed). A depiction of this approach is provided in Figure 4.15.1.3–1.
- Build an offset localizer approach with vertical guidance and distance measuring equipment, called an "Localizer Displaced Approach Glide Slope Approach." Because the Runway 22 BCL cannot be angled to the runway, this alternative is suggested. By adding a new antenna array at the end of Runway 22, aircraft equipped with instrument landing systems will be able to arrive along a path angled to the runway. This alternative will move aircraft tracks away from the nuclear materials stored in Zone 4. This new approach is illustrated in Figure 4.15.1.2–2.
- Install a GPS Ground Differential Station that would permit use of GPS precision minimums. FAA indicated that by building a GPS Ground Differential Station near the airfield, navigation accuracy of aircraft will be increased and glide-slope information can be added to the GPS approach mentioned above.
- Install a new enroute-approach navigation aid farther away from the plant (a new VORTAC). After installing this new VORTAC, the older VORTAC located midway between the airfield and the plant would be decommissioned. The new VORTAC station near the airport would permit the moving of existing FAA airways away from the plant. Existing VORTAC approaches that pass over the plant would be eliminated, and if warranted, FAA may elect to develop new approaches to the airport that are angled away from the plant.
- DOE has agreed to study new methods to fortify the areas where nuclear materials are handled or stored. Structures such as "Jersey Walls", fortified bunker entrances, and berms may be considered.

4.15.2 Impacts of Proposed Action

The Proposed Action would include the continued operation of Pantex Plant and the storage of up to 20,000 pits onsite. A quantitative assessment of the frequency (per year) that an aircraft crash could initiate an accidental release of plutonium at Pantex Plant was performed. Three terms were considered in the assessment:

- The frequency of an aircraft impacting the facility (hit probability).



SOURCE: DOE 1995h:14

FIGURE 4.15.1.3–1.—*Global Positioning System Approach.*

- The potential of significantly damaging the building by scabbing or perforation, given the impact.
- The potential of a radioactive release, given significant building damage (release probability).

Facility Impact

Figure 4.15.2–1 is a graphical representation of the three events that must occur to have a radioactive material release from a Pantex Plant facility due to an aircraft crash. The frequency of an aircraft impacting a facility was calculated using the *Draft DOE Standard, Accident Analysis for Aircraft Crash into Hazardous Facilities* (Draft DOE Standard) (DOE 1996g). It should be noted that this analysis is applicable to accidents only, not intentional acts of sabotage or terrorism.

Air traffic data (for 6.5 years of runway operations) for the Amarillo International Airport were obtained from the FAA and used in conjunction with approximately 12 months of RAMS data collected at the Amarillo International Airport Tower (PC 1996h). Air traffic data in the vicinity of the airport on an annual basis are summarized in Table 4.15.2–1. Projected building areas and aircraft crash frequency data were combined with the air traffic data to calculate the aircraft impact

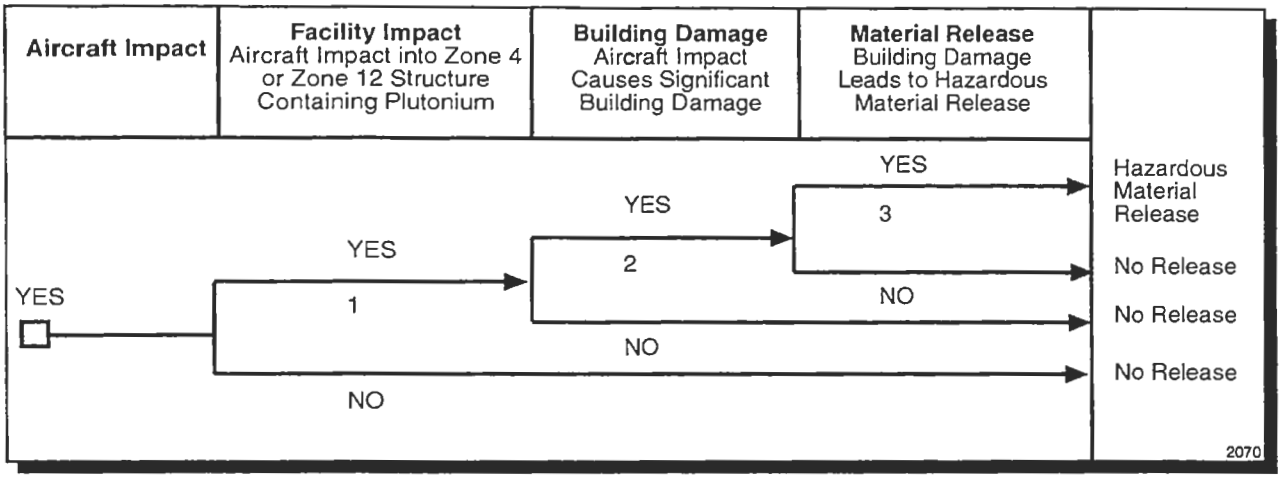


FIGURE 4.15.2–1—*Aircraft Impact Event Tree.*

TABLE 4.15.2–1.—*Maximum Yearly Flight Operations at the Amarillo International Airport*

AIRCRAFT CATEGORY	ANNUAL AIRCRAFT OPERATIONS
Commercial: Air Carrier	13,174
Commercial: Air Taxi	9,938
Military (large and small)	40,640
General (single-engine piston, multi-engine piston, turboprops, turbojets)	29,134
Helicopters	233
Total	93,119

Source: PC 1996h

frequency for Zone 4 and Zone 12 buildings. The likelihood of any aircraft impacting a building in either Zone 4 West or Zone 12 is extremely unlikely (3.2×10^{-5} per year). The likelihood that any aircraft impacts a Zone 12 building is slightly greater than that of impacting a Zone 4 West magazine, primarily due to the fact that the total Zone 12 target area is slightly larger than that of Zone 4 West.

Building Damage

The potential of significant building damage given an aircraft impact is then determined. If an impact occurs, the potential of significant building damage is predicated upon structural analyses that consider the weight and speed of the impacting aircraft compared with the resiliency of the facility. The potential for significant building damage from crashes involving various classes of aircraft was evaluated using the structural evaluation approach presented in the Draft DOE Standard (DOE 1996g). Table 4.15.2–2 presents the building damage matrix for each aircraft class for specific facilities in Zone 4 West and Zone 12. Significant building damage is defined as either *perforation*—when a missile (flying object) generated by an aircraft crash penetrates into a facility—or *scabbing*—when an impact of an aircraft missile on a facility generates a secondary missile inside the facility.

Based on calculations using structural penetration equations provided in the Draft DOE Standard, and given the nature of the heavily reinforced, earth covered structures at Pantex Plant, only about 9 percent of the potential aircraft impacts in Zone 4 West result in significant building damage. Similarly, for Zone 12, approximately 17 percent of the potential aircraft impacts in Zone 12 result in significant building damage.

TABLE 4.15.2–2.—*Aircraft Building Damage Matrix for Zone 4 and Zone 12, Pantex Plant*

BUILDING	AIRCRAFT CLASS								
	COMMERCIAL		MILITARY		GENERAL				
	AIR CARRIER	AIR TAXI	SMALL	LARGE	SINGLE ENGINE	MULTIPLE ENGINE	TURBO-PROP	TURBO-JET	HELICOPTERS
Modified Richmond Magazines	D[1]	ND	D[1]	D[1]	ND	ND	ND	ND	ND
Steel Arch Construction Magazines	D[1]	ND	D[1]	D[1]	ND	ND	ND	ND	ND
12-26 Pit Vault	D[2]	D[2]	D[2]	D[2]	D[3]	D[2]	D[3]	D[2]	D[3]
12-41	D[2]	D[2]	D[2]	D[2]	D[2]	D[2]	D[2]	D[2]	D[2]
12-44	ND	ND	ND	ND	ND	ND	ND	ND	ND
12-44 Cell 8	ND	ND	ND	ND	ND	ND	ND	ND	ND
12-50	D[1]	ND	D[1]	D[1]	ND	ND	ND	ND	ND
12-58	D[1]	ND	D[1]	D[1]	ND	ND	ND	ND	ND
12-60	D[1]	D[1]	D[1]	D[1]	ND	ND	ND	ND	ND
12-64	D[2]	D[1]	D[1]	D[1]	ND	ND	ND	ND	ND
12-84 East	D[1]	ND	D[1]	ND	ND	ND	ND	ND	ND
12-84 West	D[1]	ND	D[1]	ND	ND	ND	ND	ND	ND
12-85	ND	ND	ND	ND	ND	ND	ND	ND	ND
12-94	D[2]	ND	D[2]	ND	ND	ND	ND	ND	ND
12-96	ND	ND	ND	ND	ND	ND	ND	ND	ND
12-98	ND	ND	ND	ND	ND	ND	ND	ND	ND
12-99	D[1]	ND	D[1]	ND	ND	ND	ND	ND	ND
12-104	D[1]	ND	D[1]	ND	ND	ND	ND	ND	ND
12-104A	D[2]	ND	ND	ND	ND	ND	ND	ND	ND
12-116	D[2]	D[2]	D[2]	D[2]	ND	ND	ND	ND	ND
South Vault, North Vault	D[2]	D[2]	D[2]	D[2]	D[2]	D[2]	D[2]	D[2]	D[2]

D = Damage
ND = No Damage
[1]Scabbing or perforation occurs for the roof, but not the walls.
[2]Scabbing or perforation occurs for the roof and the walls.
[3]Scabbing occurs for the walls, but not the roof.
Source: DOE 1995h:14

Material Release

An aircraft impact into a Zone 12 building that causes significant damage may not necessarily lead to a release of radioactive material. Release of radioactive material is *not reasonably foreseeable* for nuclear explosive bays, cells, and special purpose facilities (frequency of occurrence is less than 10^{-6} per year). In addition, the radioactive materials inventory is much less than what would be found in Zone 4 West magazines

Consequently, the probability of a release in Zone 12 is approximately equal to that for Zone 4 West facilities.

A high explosive (HE) detonation in Zone 4 West is possible only in weapon magazines. However, if an aircraft crashes into a magazine and causes significant damage, it is unlikely that the magazine will contain weapons, since most of the storage magazines will be used for pit storage. For the 12,000-pit case, approximately 70 percent of the magazines will contain pits only, whereas for the 20,000-pit case, up to 100 percent of the Zone 4 West magazines could be occupied by pits only.

An aircraft crash that causes significant damage to a weapons magazine would not necessarily lead to an explosive plutonium release. The likelihood of an explosive release is dependent on numerous factors, including the type of explosive contained within weapons stored in the magazine (conventional or insensitive high explosives) and the nature of the crash and damage to the magazine (e.g., if there is a fire inside the magazine or a missile from the crash impacts a weapon).

For this analysis, it was conservatively assumed that significant building damage to a magazine containing HE (in weapons form) would lead to an explosive plutonium release involving the contents of the magazine. The likelihood of an HE detonation in a weapon magazine due to an aircraft impact is *not reasonably foreseeable* (frequency of occurrence is less than 10^{-6} per year). The aircraft crash analysis in this section and in appendix E focuses on release probability only. This probability is combined with other conditional probabilities and consequences to evaluate the risk due to aircraft crash at Pantex Plant. The consequences and risk associated with this event are discussed in section 4.14.2, Human Health.

An aircraft impact into a Zone 4 pit magazine may damage a large fraction of the pit containers, and an ensuing fire could result in a release of plutonium. An aircraft crash that causes significant damage to a pit storage magazine would not necessarily lead to a plutonium release. Pits are currently stored in AL–R8 containers, which provide significant thermal and impact resistance. In the future, pits will be stored in a new container, the AT–400A, that will provide additional thermal and impact protection. Appendix F provides a description of current and potential future pit containers.

Whether perforation of a pit magazine would result in damage to pit containers is uncertain. In this analysis, it is assumed that 25 percent of the pit containers in a magazine contribute to a release (DOE 1994w:App I). Spilled aircraft fuel is likely to cause a fire in a crash that results in perforation of a storage magazine, and for this analysis it is conservatively assumed that a fire occurs 100 percent of the time. Whether or not this fire involves the contents of the magazine is also uncertain. In this analysis, it is assumed that it does. The likelihood of impact depends on the number of pit magazines in use. For the Proposed Action, the maximum number of pits stored will be 20,000. The likelihood of an aircraft impact causing a release is *extremely unlikely* (frequency of occurrence is less than or equal to 10^{-4} per year, but greater than or equal to 10^{-6} per year).

The risk and consequences of aircraft impacts at Pantex Plant are discussed in section 4.14.2.1, Impacts of Continued Operations. The risk to the public from aircraft impact dispersal accidents is low relative to other risks. A person in the vicinity of Pantex Plant has an approximately 4.3×10^{-12} increase in fatal cancer risk from potential aircraft crash plutonium dispersal accidents compared with a baseline annual fatal cancer risk of 1.7×10^{-3}.

4.15.3 Impacts of No Action Alternative

The likelihood of an aircraft impacting either a weapon magazine or a Zone 12 building is the same as discussed under the Proposed Action.

4.15.5.2 *Impacts of Alternatives in the Stockpile Stewardship and Management Programmatic Environmental Impact Statement*

The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. Although the No Action Alternative does not account for the time plutonium is at risk, there would be a reduction in the risk from an aircraft crash because of the reduction in operations. Under the downsizing alternative, there would be a consolidation of facilities and a commensurate reduction in the risk from an aircraft crash due to the fewer number of target facilities. Under the relocation alternative, the risk from an aircraft crash into assembly, disassembly, and HE fabrication facilities would be reduced to zero.

4.15.5.3 *Impacts of Alternatives in the Storage and Disposition of Weapons Usable Fissile Materials Programmatic Environmental Impact Statement*

If any of the three storage alternatives (Upgrade Facilities at Multiple Sites, Consolidate Plutonium in One Facility, or Collocate Plutonium and Highly Enriched Uranium in Two Facilities) were implemented, there would be a change in the aircraft crash probability. Since the result of any of these alternatives would be to remove all pits (plutonium not in weapons) from Zone 4, this would reduce the aircraft crash induced release probability. If the Upgrade Alternative is selected, all plutonium pits would be moved to existing buildings 12–66 and 12–82. This would reduce the aircraft accident probability almost proportionally to the number of Modified Richmond and SAC magazines no longer used in Zone 4. The aircraft crash probability in Zone 4 would be only for those magazines where nuclear weapons are staged. The impact of additional plutonium in Zone 12 would be minimal because buildings 12–66 and 12–82 are adjacent to buildings 12–41 and 12–42.

The Consolidation Alternative has two options at Pantex Plant: (1) to build a new facility and modify existing facilities in Zone 12 South or (2) build a new facility in Zone 12 South. Under the first option, there would be a reduction in the aircraft accident probability due to a reduction in the plutonium inventory in Zone 4 and a minimal increase in Zone 12 South as discussed in the Upgrade Alternative. The new facility in Zone 12 South would have a smaller total area (true, shadow, and skid) compared to the pit storage magazines no longer used in Zone 4. There would be an increase in the hit probability for Zone 12 because of the addition of a new facility, but overall, the aircraft accident probability would be reduced. The impacts from the second option, building a new facility, or from the Collocation Alternative, would be similar to the Upgrade Alternative since material would be moved from Zone 4 to Zone 12 South.

The final S&D PEIS will include an alternative that is a refinement of these storage alternatives. As discussed in sections 1.4 and 1.7.3 of this volume, the final S&D PEIS will include an alternative under which pits from Rocky Flats Environmental Technology Site (RFETS) could be transferred to Pantex Plant for storage in Zone 4 as early as 1997. The impacts of this alternative are fully accounted for in this EIS because the pits from RFETS could not cause the total number of pits stored in Zone 4 to exceed the storage limit of 20,000 pits analyzed under the Proposed Action. Furthermore, RFETS pits that could come to Pantex Plant would have the same characteristics, as analyzed in the S&D PEIS, as pits currently or previously stored at Pantex Plant. However, the receipt of pits from RFETS would require

additional repackaging activities prior to storing them in Zone 4 (see section 4.12 5.3). Appendix Q of the S&D PEIS indicates that these repackaging and intrasite transportation activities could result in less than 10^{-2} additional latent cancer fatalities. Impacts from the disposition alternatives are not assessed since the S&D PEIS will select a technology and strategy, not a site for disposition.

4.15.6 *Potential Mitigation Measures*

Potential mitigation measures either reduce the frequency of an aircraft impact or reduce the probability that the aircraft impact causes a release due to significant building damage, fire, and/or HE detonation. Results from this study indicate that a large fraction of the risk associated with aircraft crash in Zone 12 comes from older facilities that are not heavily reinforced or earth covered. Recommendations of the Overflight Working Group are presented in section 4.15.1.4. DOE has committed to implement the risk reduction measures proposed by the overflight working group. It is estimated that implementation of the MOU, the offset localizer, relocation of the VORTAC, and 65 percent use of the GPS would result in an 82 percent cumulative risk reduction (DOE 1995h:22). This 82 percent reduction was estimated using the Solomon Model. Fortification of areas and structures in which nuclear materials are handled and stored could further reduce the impact of aircraft accidents.

4.15.7 *Conservatisms*

There are many conservatisms included in the Pantex Plant aircraft accident analysis that, if reduced or removed, have the potential to lower the probabilities of an aircraft crash incident substantially. This section presents some of these conservatisms and explains their effect on the aircraft crash risk to the Pantex Plant.

The Draft DOE Standard was created as a tool to be applied to all DOE sites where hazardous materials exist (DOE 1996g). As a result, it was written in a generic form without much site-specific detail. The Pantex Plant is unique in that it is situated close to an international airport. Because of this proximity, and the weapons operations conducted at Pantex Plant, the public has expressed concern regarding aircraft overflying the plant and crashing into nuclear facilities. DOE, in cooperation with the FAA, has responded to these concerns by attempting to reduce Pantex Plant overflights with the mitigation measures discussed in sections 4.15.1.4 and 4.15.6. When fully completed, these measures will reduce the number of aircraft overflying the Pantex Plant and the risk of an aircraft crash.

However, the Draft DOE Standard, as written, does not allow for consideration of these measures in the risk calculation. For the purposes of this analysis, it is assumed that all aircraft are on approach to the airport on the BCL, which intersects Zone 4 West. Even with the mitigation measures in place to move aircraft away from the current BCL, RAMS data indicate that aircraft do not typically fly this route. RAMS data also indicate high-altitude aircraft flying on defined airways, which is not recognized in the DOE Standard's non-airport methodology.

In the event of an aircraft crash, the assumption used in the aircraft accident methodology is that a skidding aircraft will hit a facility with the same velocity that it had when it began the skid. This results in a highly conservative impact velocity since no credit is taken for drag, friction, or other factors that would reasonably be expected to contribute to a reduction in velocity. Additionally, the impact angles given are conservative when applied to facility roof impacts, because at these angles, it is quite possible that the potential penetrating missile from the aircraft would simply ricochet off the facility. Pantex Plant has some structures in Zone 12 that are considered structurally "sup-

stout." No credit is taken for these "super stout" facilities in the analysis.

Other conservatisms in the analysis include the assumption that the entire aircraft engine is the penetrating missile of concern. This is conservative since most of the fan shroud would be expected to tear away after striking a facility, leaving the engine shaft as the secondary penetrator. For the purposes of this analysis, it is also assumed that any facility authorized to contain nuclear explosives is occupied by nuclear explosives 24-hours a day, seven days a week (conservative because none of the authorized facilities contain nuclear explosives on a continual basis), and that the probability of an explosion after an accident resulting in a plutonium release is 1. This assumption is conservative because all impacts would not be expected to cause scabbing or perforation sufficient to cause an explosion and there is no consideration given as to whether high explosives are sensitive or insensitive.

Release assumptions are also considered to be highly conservative for several reasons. Potential impacts that could cause a wall or roof to fail, or a collapse of the whole facility, take no credit for the fact that the overburden would likely suppress any fire and prevent dispersal of materials. Further, no credit was taken for the filtration effects provided by earth covers on bays, cells, and Zone 4 West magazines.

A release of plutonium (from a magazine, for example) due to a fire would require sufficient fuel inside the facility to create a fire that would consume (completely surround) the plutonium container for at least 30 minutes. A sustained fire is unlikely since the assumed penetrators (engines) do not carry sufficient quantities of fuel to produce a sustained fire (fuel is typically contained in the wings of the aircraft). Further, there is a high probability that a skidding aircraft, which represents the majority of the risk, would dispense its fuel contents prior to facility impact.

The analysis takes no credit for the protection provided by the pit container (AL-R8) or the ability of the pits to withstand a fire. Pits, by themselves, have some degree of resiliency to fire, and the AL-R8 containers currently being used were previously certified as type B containers (i.e., were designed to withstand an all-consuming 30-minute fire and various drop and puncture tests). The analysis also assumes that 25 percent of the containers in a magazine would be torn open and their contents released as a result of the fire. Given the size of the penetrator (engine), it is unlikely that 25 percent of pit containers would be involved in an aircraft crash or that a sustained fire could occur.

Considering these many conservative assumptions, which could not be quantified, the actual risk associated with aircraft crash is probably much less than the point estimates presented in this document. Similarly, the actual radiological doses resulting from the aircraft accident scenarios are expected to be much less than those presented in section 4.14, Human Health.

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4.16 INTERSITE TRANSPORTATION OF NUCLEAR AND HAZARDOUS MATERIALS

4.16.1 Affected Environment

Under the Proposed Action or any of the Alternatives the transfer of hazardous material between DOE and Department of Defense (DOD) sites, including nuclear explosives, nuclear components, high explosive(s) (HE), and radioactive wastes would be required. This section discusses the current intersite hazardous material transportation activities related to Pantex Plant. Radiological impacts are emphasized. Nonradiological impacts (i.e., Safe Secure Tractor Trailer [SST] vehicle exhaust) will not be considered; SST traffic will contribute less then one-tenth of 1 percent of the baseline vehicle traffic in the vicinity of Pantex Plant. Appendix F, Transportation Risk Analysis, provides detailed background information on transportation activities.

4.16.1.1 *Radioactive Material Shipments*

Intersite transportation of radioactive materials is governed by the requirements of DOE orders and Nuclear Regulatory Commission and Department of Transportation (DOT) regulations (Code of Federal Regulations [CFR] Titles 10 and 49). The Transportation and Staging Operations Department is responsible for transfers of tritium reservoirs to the Amarillo International Airport. The Transportation Safeguards Division (TSD) is responsible for coordinating offsite transfers of nuclear explosives and nuclear explosive components. The Waste Operations Department is responsible for offsite transfers of radioactive wastes and the Traffic Section of the Packaging and Shipping Department is responsible for coordinating offsite shipments of hazardous material by commercial carriers.

Intersite highway transportation of weapons, nuclear explosive-like assemblies, and weapons components is conducted by the DOE TSD using SSTs. Nuclear explosive-like assemblies not containing plutonium may be transported by air. SSTs are similar in appearance to commercial tractor-trailers but are equipped with unique safety and safeguard features that prevent unauthorized cargo removal and minimize the likelihood of an accidental radioactive material release. SSTs are also equipped with a robust tiedown and restraining system to prevent cargo movement during shipment.

Intersite shipment of tritium reservoirs is conducted by air, or infrequently, by SST. Hardened trailers are used to transport tritium reservoirs between Pantex Plant and the Amarillo Airport. Hardened trailers are similar in design to SSTs. Under contract with DOE and utilizing DOE aircraft, a contractor provides air transportation and related management services in support of the U.S. nuclear weapons program. One of the contractor's main functions is to transport tritium reservoirs to various locations throughout the continental U.S.

Offsite transfers of radioactive wastes and depleted uranium (DU) are performed by commercial trucks. These transfers are conducted in full compliance with Titles 10 and 49 of the CFR, which contain packaging requirements for intersite radioactive material transfers. These requirements are categorized based on the potential hazard of the material being shipped, which, in turn, is based on the type, quantity, and form of the radionuclide(s) being shipped.

Packaging refers to a container and all accompanying components or materials necessary to maintain confinement of radioactive material. For low potential hazard radioactive material, a DOT Type A packaging, designed to retain its contents under normal transportation conditions, is required. For

higher potential hazard materials, such as weapons components, a DOT Type B packaging is required. Type B packages must meet all of the requirements for Type A packages as well as the requirement to prevent the release of radioactive material under all credible accident conditions. These conditions include the following:

- A 9-meter (30-foot) drop onto an unyielding surface.
- A dynamic crush test consisting of a drop of a 500-kilogram (1,100 pound) mass from 9 meters (30 feet) onto the container.
- A puncture test consisting of a free drop (greater than 102 centimeters [40 inches]) onto a 15-centimeter (6-inch) diameter steel pin.
- A 30-minute thermal exposure at 800 degrees Celsius (1,475 degrees Fahrenheit).
- Immersion in water for 8 hours (for fissile materials packaging only).

Appendix F provides a discussion of pit containers currently in use or planned for use at Pantex Plant.

Nuclear Explosives

Intersite nuclear explosive transfers are required for the following reasons:

- Weapons currently stored at classified DOD facilities are returned to Pantex Plant for dismantlement.
- Weapons are returned to Pantex Plant from DOD facilities for testing, modifications, component replacement, or repairs.
- Weapons are returned to DOD facilities from Pantex Plant after completion of testing, modifications, component replacement, or repairs.
- Weapons are shipped between Pantex Plant and DOD sites for field testing of subsystems.

SSTs and weapon-specific handling gear (H-gear) containers are used for intersite transportation of nuclear explosives. For a bounding case weapons shipment, an external dose rate of 3 millirem per hour at the outside surface of the trailer has been measured. Typical weapon shipments produce a much lower dose rate. No measurable radiation exposure occurs within the tractor cab (PC 1995q). Certain types of nuclear explosives are transported as complete units and are attached to their H-gear containers. Nuclear warheads, however, are contained in system-specific H-gear packages. All H-gear is designed to allow secure tiedown within SSTs.

Fully assembled nuclear explosives arrive at and depart from Pantex Plant at Zone 4 West. Loading and unloading activities are discussed in section 4.12, Intrasite Transportation.

Plutonium Pits

As part of stockpile management activities at Pantex Plant, a limited number of pits are shipped to Los Alamos National Laboratory (LANL) for testing. Pits are transported intersite by SSTs in FL containers or other approved Type B packages. FL containers are double-containment stainless steel drums categorized as Type B shipping packages. The FL container has an outer steel containment drum (51 centimeters [22.5 inches] in diameter, 127 centimeters [50 inches] in height) and a stainless steel inner containment drum (35 centimeters [13.8 inches] in diameter, 97 centimeters [38 inches] in height).

When a shipment of pits to LANL is required, the pits are repacked into FL containers, within Zone 12, and sealed with a tamper-indicating device. The containers are loaded onto a pallet and driven by electric forklift to a loading dock within Zone 12. The containers are loaded and

secured into an SST and driven to LANL. Figure 4.16.1.1–1 shows the LANL delivery location with nearby access roads. Further operations involving pits at LANL will be discussed in the *Los Alamos Site-Wide Environmental Impact Statement.* The actual number of surveillance pit shipments from Pantex Plant is classified.

Canned Subassemblies

Canned subassemblies (CSAs) that may contain highly enriched uranium (HEU) and DU removed from dismantled weapons are shipped to the Y–12 Plant at the Oak Ridge Reservation (ORR) for prestorage processing and interim storage of nuclear material. CSAs are transported intersite by SSTs in DOT-criteria Type B packages including DT–23, DT–18, and DT–20. The number of CSAs shipped from Pantex Plant is classified. DOE has assessed the impacts of transporting CSAs to Y–12 in the *Environmental Assessment for the Interim Storage of Enriched Uranium at the Y–12 Plant* (DOE/EA–0919). A Finding of No Significant Impact was issued for this Environmental Assessment (EA) on September 14, 1995 (60 FR 54069).

When a shipment of CSAs is made from Pantex Plant, the containers, staged in an approved storage facility, are loaded onto a pallet and driven by electric forklift to a loading dock within Zone 12. These containers are loaded and secured into an SST that is then driven to the Y–12 Plant. CSAs staged in Zone 4 are loaded into SSTs at the storage magazine. The Y–12 Plant, which receives the uranium components from Pantex Plant, is located within the boundaries of ORR, near Knoxville, Tennessee. Figure 4.16.1.1–2 shows the location of ORR. Vehicular access to the Y–12 Plant is via Bear Creek Valley Road, a two-lane, paved State highway. Following this road, Interstate 40 is approximately 6 kilometers (4 miles) from the ORR site boundary and approximately 18 kilometers (11 miles) from the Y–12 Plant. Figure 4.16.1.1–3 shows the access roads to the Y–12 Plant. Arriving containers are unloaded and brought into a facility where a transfer check is performed. The transfer check confirms the identity and quantity of the shipment and verifies the integrity of the tamper-indicating devices on the containers.

Depleted Uranium

DU components removed from dismantled weapons are shipped to the Y–12 Plant at ORR for prestorage processing and interim storage. These shipments are made by commercial truck carriers using DOT Type A packaging and are made in full compliance with Titles 10 and 49 of the CFR. Table 4.16.1.1–1 presents the DU shipments for the years 1992–1994.

Tritium Reservoirs

Tritium reservoirs are shipped intersite for the following reasons:

- Depleted reservoirs removed from weapons are returned to the Savannah River Site (SRS) for reuse and recycling.

TABLE 4.16.1.1–1.—*Depleted Uranium Shipments from Pantex Plant*

YEAR	ROUTE	NUMBER OF SHIPMENTS	NUMBER OF COMPONENTS
1992	Pantex to ORR	20	2,119
1993	Pantex to ORR	13	794
1994	Pantex to ORR	4	857

Source: PC 1995p:1

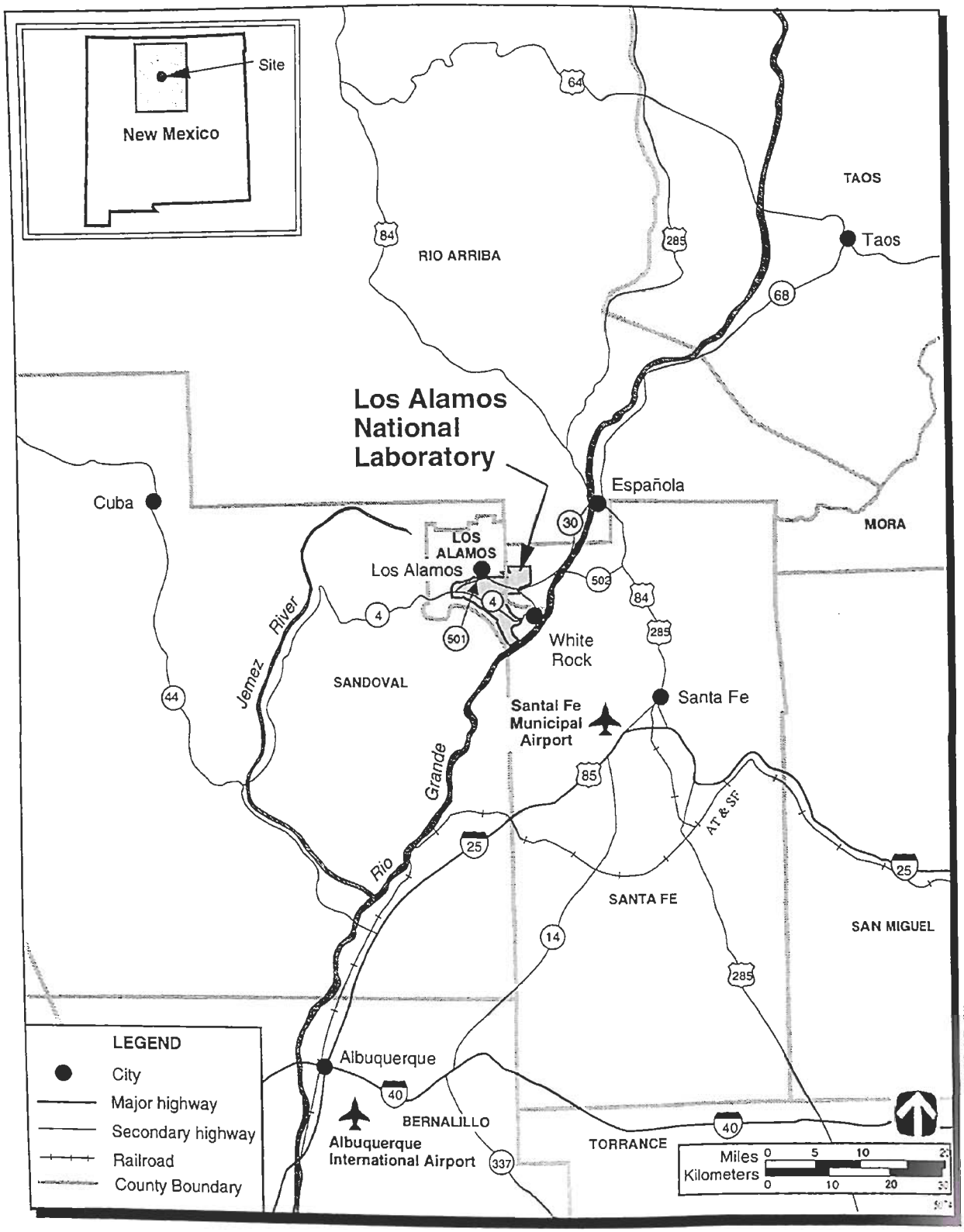
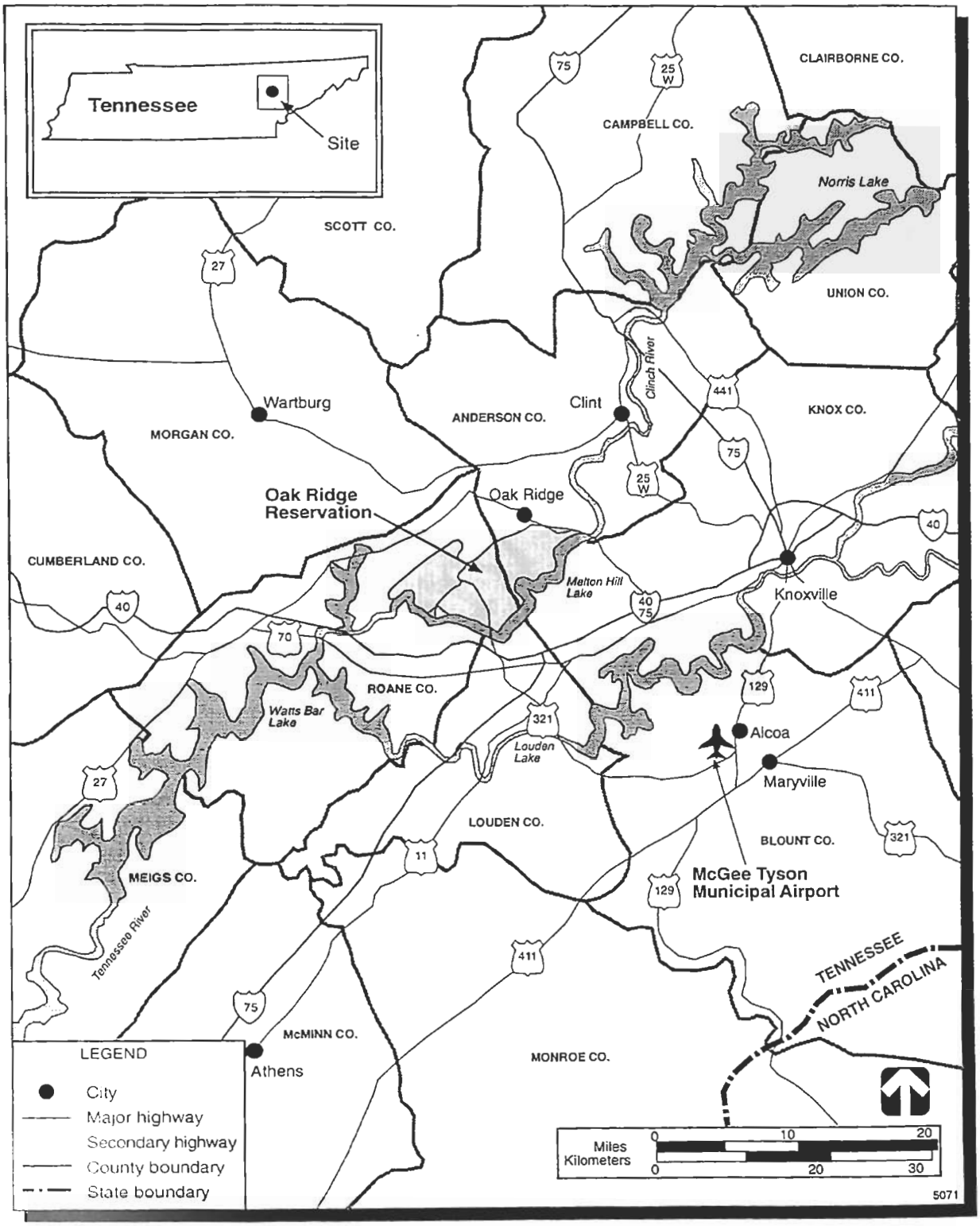


FIGURE 4.16.1.1–1.—*Los Alamos National Laboratory Delivery Location with Nearby Access Roads.*



SOURCE: DOE 1995k:4-176

FIGURE 4.16.1.1–2.—*Oak Ridge Reservation, Tennessee, and Region.*

KNOX CO
LOUDON CO
ANDERSON CO
ROANE CO
LOUDON CO

- Filled reservoirs are shipped from SRS to Pantex Plant for installation in weapon systems.

Tritium reservoirs are transported intersite by air or by highway, in SSTs. Tritium reservoirs are shipped in H1616 containers, which are DOT-approved Type B packages. The H1616 container has an outer drum of stainless steel that is 41.65 centimeters (16.4 inches) in diameter and an inner containment vessel made of stainless steel that is 31 centimeters (12.11 inches) in diameter and 36 centimeters (14.3 inches) in height. Tritium reservoirs within these containers do not pose an external radiation hazard.

When a shipment of depleted reservoirs is made from Pantex Plant by air, the H1616 container is loaded and sealed with a tamper-indicating device at the Tritium Staging Facility. The H1616 container is taken to a loading dock within Zone 12 and loaded and secured within a hardened trailer. The vehicle is driven from Pantex Plant to a "secure" terminal at the Amarillo International Airport where the container is removed from the vehicle, loaded aboard the aircraft, and secured; loading operations are performed under controlled conditions in secured areas at the Amarillo airport. The aircraft is flown to Bush Field in Augusta, Georgia where the H1616 containers are removed from the aircraft and loaded and secured within an SST or similar vehicle. This vehicle is driven to the H-area at SRS, where the package is unloaded. Table 4.16.1.1–2 summarizes air shipments of tritium reservoirs. Further operations with tritium reservoirs at SRS are discussed in the *Environmental Assessment, Tritium Loading Facility* (DOE 1986). Newly filled tritium reservoir transfers from SRS follow a reverse procedure.

The H-area is located approximately 16 kilometers (10 miles) within the northwestern site boundary of SRS. Bush Field is located outside of Augusta, Georgia and is approximately 32 kilometers (20 miles) northwest of the SRS boundary. Vehicular access to SRS from Bush Field is via either South Carolina Highway 125 or U.S. Highway 278. The closest Interstate highway access to SRS is Interstate 20, approximately 32 kilometers (20 miles) northwest of the site boundary.

Radioisotopic Thermoelectric Generator

Radioisotopic thermoelectric generators (RTGs) removed from dismantled weapons are shipped to LANL for prestorage processing and interim storage of nuclear material. RTGs are transported intersite by SSTs in DOT Type 6M containers. The Type 6M container is a DOT-criteria Type B package. The Type 6M container is a standard 37.85-liter (10-gallon), DOT-specification metal package. This package is constructed of 20-gauge carbon steel

TABLE 4.16.1.1–2.—*Pantex Tritium Reservoir Air Shipments, 1992–1994*

YEAR	ROUTE	NUMBER OF FLIGHTS	TOTAL RESERVOIRS PER YEAR
1992	SRS to Pantex	5	52
	Pantex to SRS	12	1,215
1993	SRS to Pantex	6	82
	Pantex to SRS	27	1,055
1994	SRS to Pantex	6	37
	Pantex to SRS	22	2,254

Source: PC 1994b:1

and measures about 33 centimeters (13 inches) in diameter and 61 centimeters (24 inches) in height.

When a shipment of RTGs is made from Pantex Plant to LANL, the Type 6M packages are loaded onto a pallet and transported by electric forklift to a loading dock within Zone 12 where the containers are loaded and secured within an SST. The SST is driven to LANL where it is brought into the TA–55 area. Further operations with RTGs at LANL will be discussed in the *Los Alamos Site-Wide Environmental Impact Statement.*

Low-Level and Low-Level Mixed Radioactive Wastes

Pantex Plant currently ships low-level radioactive materials and wastes by commercial carriers to the Nevada Test Site (NTS) in [illegible]

DOT regulations. Table 4.16.1.1–3 presents the low-level mixed waste shipments for the years 1992–1994.

Transportation impacts associated with intersite transfers of radioactive wastes and alternatives to the current shipping practices are evaluated in the *Draft Waste Management Programmatic Environmental Impact Statement* (DOE 1995)and the Environmental Impact Statement for the Nevada Test Site and Offsite locations in the State of Nevada (DOE/RIS-0243).

4.16.1.2 *Offsite Radioactive Material Shipments*

Nuclear explosives and nuclear explosive components are shipped by SST to and from Pantex Plant. Transportation is conducted by the DOE TSD. Since its establishment in 1975 TSD h [illegible] l t·d th 119 ·ll's

actions to take in conjunction with the actions of the couriers in the rig and escort vehicles.

TSD personnel are briefed on construction, congestion, and severe weather prior to travel. TSD will make every effort to alter a route or change the travel time to avoid potential traffic hazards.

TSD directs and manages an emergency management drill and exercise program that involves facility personnel, resources, and offsite elements. To stay proficient in all aspects of TSD convoy operations, TSD annually plans, implements, monitors, and performs follow-up analysis for couriers, known as in-service training (IST). For each iteration of IST, TSD invites participation from a State police agency. These police agencies train with TSD in all aspects of the program, but TSD's primary interest is in their participation in convoy tactical training with emphasis on law enforcement link-up in the case of an emergency. Both Arkansas and Missouri State Police are participating in the present (fiscal year [FY] 1996) IST program; Oklahoma and Arizona State Police participated in FY 1995, and the Texas Department of Public Safety participated in FY 1994.

TSD's emergency response plans involve a tiered organizational response to radiological incidents. In Tier 0, local law enforcement and TSD couriers assess the severity of the accident and determine the need for radiological assistance. Tier I involves the deployment of Radiological Assistance Teams, a Regional Response Coordinator, and Public Affairs Office personnel. These personnel have appropriate monitoring and communications equipment to assess the radiological status of the incident. At Tier II additional technical expertise is provided to the response group. At Tier III the accident response group will assist in recovery, repackaging, and decontamination activities. These four tiers correspond, respectively, to the following levels:

- 0—no structural damage and no potential for public controversy.
- I—status of unknown or limited damage.
- II—excessive damage of SST or shipment.
- III—radiological release cleanup/ repackaging required.

Additional national emergency response resources from around the Nation are available if the severity of an SST convoy incident warrants such a call. Further details on other Federal agency responsibilities in the event of a radiological emergency can be found in the Federal Radiological Emergency Response Plan (61 FR 20944).

SSTs used for intersite transportation are specially designed semi-trailers that use penetration resistance and delay mechanisms to prevent unauthorized cargo removal. SSTs provide thermal protection for cargo within the trailer. A robust tie-down and restraining system is provided to secure cargo within the trailer.

SSTs are accompanied by escort vehicles equipped with armed couriers, communication and electronics systems, radiological monitoring equipment, and other equipment to enhance safety and security. Redundant communication systems assure that intra-convoy communications and communications between each vehicle and the Security Communications System in Albuquerque, New Mexico, are maintained.

SSTs follow strict procedures during transport and are not allowed to travel when hazardous road conditions exist. When hazardous road conditions are anticipated enroute, the SST stops at a safe haven, usually a predetermined military installation. In addition, SSTs are limited to a maximum 89 kilometer-per-hour (55 mile-per-hour) speed limit, even if the posted limit is greater.

TSD operations are in compliance with the requirements of 49 CFR 177 for selecting, notifying drivers of, and adhering to preferred routes. The majority of TSD travel (90 percent) is over interstate highway; the remaining 10 percent is over routes that meet the conditions for deviating from the preferred route. Regulations permit deviation from the preferred route when safety or security requirements dictate such deviation.

Regulations permit TSD deviation from the requirements regarding notification of the routes used. Routes used are classified, compartmented information that may not be disseminated except to persons with appropriate security clearance and a need to know.

All SST crew members wear radiation dosimeters. Because of the nature of the material and the design of the containers, the transport of both nuclear explosives and plutonium/uranium weapons components has led to ionizing radiation doses to SST crew members. SST crew members are required to inspect the cargo within the trailer prior to shipment. This action is the primary contributor to dose for the crew. Table 4.16.1.2–1 provides the doses received from transport operations for the years 1992–1994.

4.16.1.3 *Intersite Shipments of High Explosive Material*

Intersite transportation of HE material is governed by the requirements of DOE orders and DOT regulations. HE material is packaged and shipped in compliance with applicable regulations by DOE courier, commercial carrier, or by a DOE-contracted air carrier. Highway shipments are performed using the most direct route on interstate and state highways. Air shipments are performed through the Amarillo International Airport. Air transport of Class 1.1 explosives is allowed under DOT exemption number DOT–E–10881. However, Class 1.1 shipments are generally sent by truck.

Most intersite shipments of HE material since 1992 have been bulk shipments involving unprocessed raw material that is no longer needed for weapons production. This material is being sold to commercial end users. Only a very limited amount of raw HE is expected to be shipped to Pantex Plant during the years under evaluation in this EIS.

All other hazardous material shipments are transported via commercial carriers in full compliance with applicable DOT regulations. Pantex Plant type operations do not consume or produce large quantities of hazardous materials. Consequently, the risks associated with Pantex Plant related hazardous material shipments are no greater than those associated with other industrial facilities. Further information on the types and quantities of hazardous material shipments associated with Pantex Plant operations is available in the *Safety Information Document* (Pantex 1996a).

TABLE 4.16.1.2–1.—*DOE Transportation Safeguards Division Dosimeter History*

YEAR	CUMULATIVE DOSE (PERSON-REM)	NUMBER OF PERSONS MONITORED	MAXIMUM INDIVIDUAL DOSE (REM)
1992	0.059	314	0.018
1993	0.067	306	0.021
1994	0.158	297	0.088

Source: PC 1995m

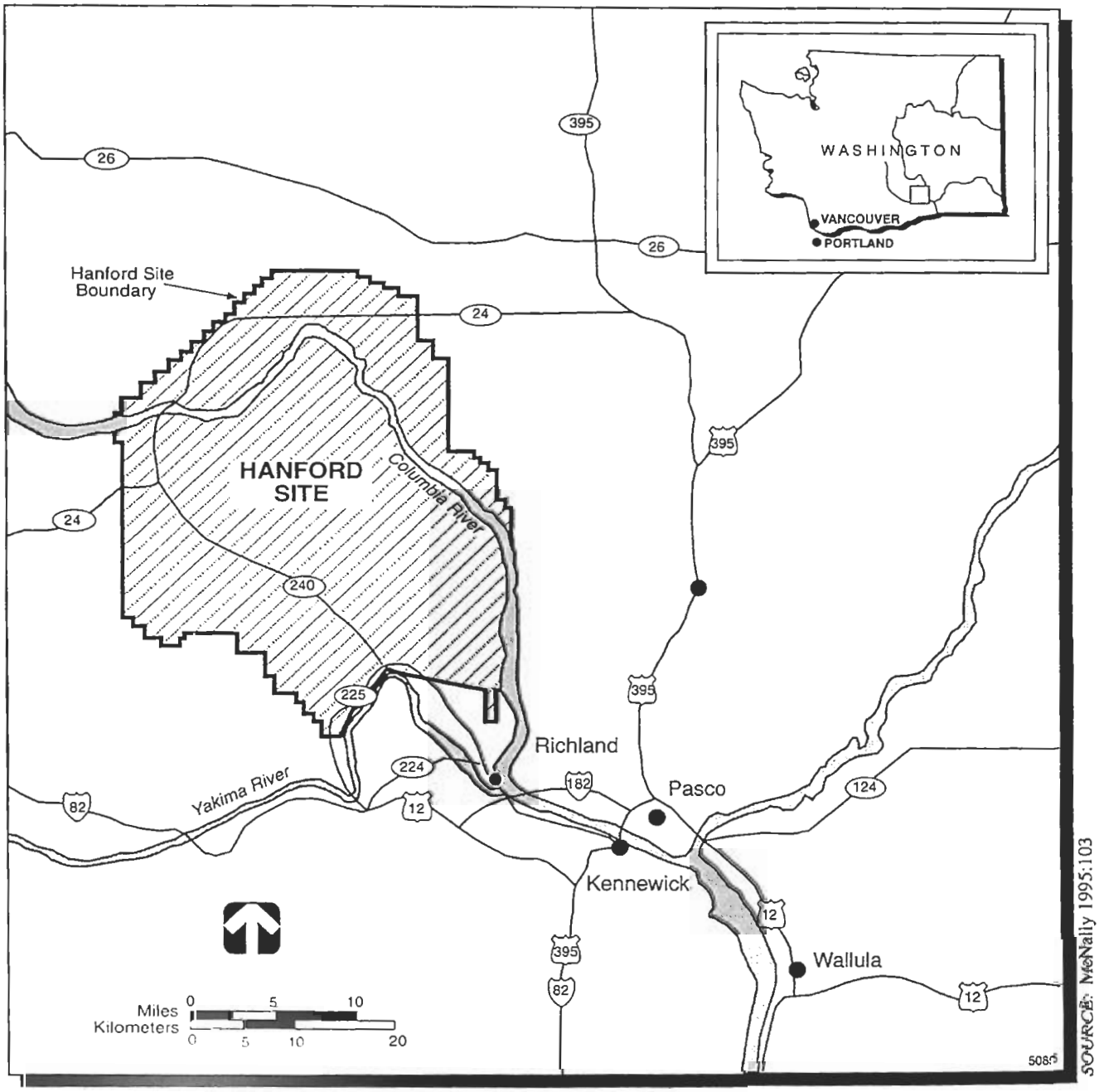


FIGURE 4.16.1.4–2.—*Roadways in the Vicinity of the Hanford Site.*

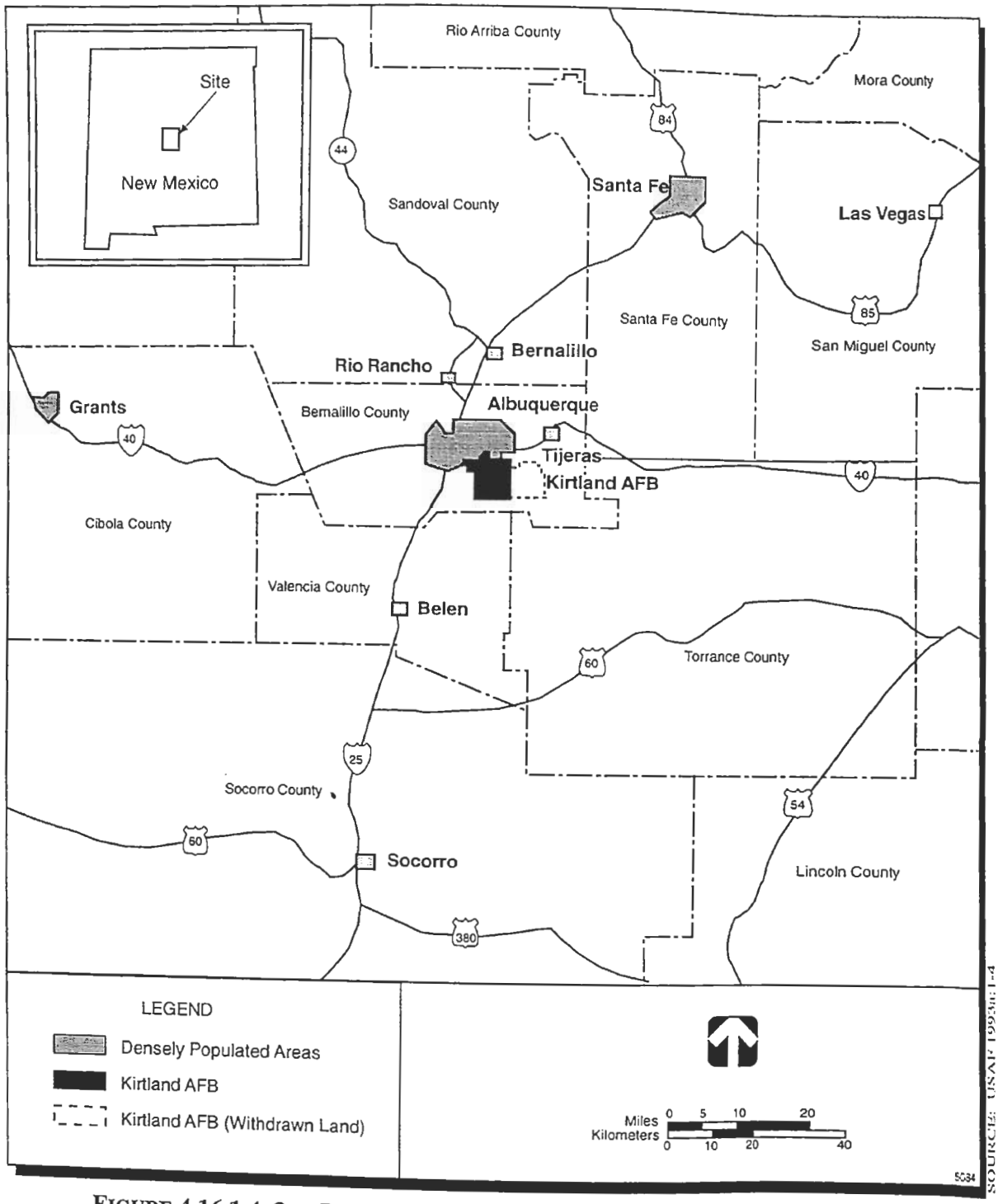


FIGURE 4.16.1.4–3.—*Roadways in the Vicinity of Kirtland Air Force Base.*

TABLE 4.16.2.1–1.—*10-Year Impacts from Proposed Weapon Shipments*

SHIPMENT SCENARIO	PUBLIC EXPOSURE (PERSON-REM)[1]	MAXIMUM EXPOSED INDIVIDUAL (REM)	PUBLIC INCIDENT FREE RISK (EXPECTED NUMBER OF EXCESS LCFs)	PUBLIC ACCIDENT DISPERSAL RISK (EXPECTED NUMBER OF EXCESS LCFs FROM DISPERSAL ACCIDENTS)	CREW EXPOSURE (PERSON-REM)[2]	CREW INCIDENT FREE RISK (EXCESS CANCER FATALITIES)	EXPECTED NUMBER OF TRAFFIC FATALITIES
+100%	4.0	0.01	1.8×10^{-3}	1.6×10^{-6}	3.2	1.3×10^{-3}	1.2×10^{-2}
+ 50%	3.0	7.5×10^{-3}	1.4×10^{-3}	1.2×10^{-6}	2.4	1.0×10^{-3}	9.0×10^{-3}
+ 30%	2.6	6.5×10^{-3}	1.2×10^{-3}	1.0×10^{-6}	2.1	8.0×10^{-4}	7.8×10^{-4}
+ 10%	2.2	5.5×10^{-3}	1.0×10^{-3}	8.8×10^{-7}	1.7	6.6×10^{-4}	6.6×10^{-4}
Base Shipment Schedule	2.0	5.0×10^{-3}	9.0×10^{-4}	8.0×10^{-7}	1.6	6.0×10^{-4}	6.0×10^{-3}
-10%	1.8	4.5×10^{-3}	8.1×10^{-4}	7.2×10^{-7}	1.4	5.6×10^{-4}	5.4×10^{-4}
-30%	1.4	3.5×10^{-3}	6.3×10^{-4}	5.6×10^{-7}	1.1	4.4×10^{-4}	4.2×10^{-4}
-50%	1.0	2.5×10^{-3}	4.5×10^{-4}	4.0×10^{-7}	0.8	3.2×10^{-4}	3.0×10^{-3}

[1]Exposure calculations performed using a conservative external SST dose rate of 3.0 mrem/hr.
[2]Crew exposures based on past DOE TSD Dosimetry.

transport personnel and members of the general public as well as the potential release of radioactive material during an accident. The ADROIT code calculates the impacts from both incident-free transport and potential accidents resulting from pit shipments between Pantex Plant and the alternative pit storage sites. Table 4.16.4.1–1 summarizes the impacts associated with shipments of 20,000 pits.

The incident-free transport of pits would result in a maximum of 1.5×10^{-3} excess LCFs in the exposed population on and along the roadways. The baseline cancer fatality incidence in the general public is 20 percent.

The public risk from dispersal accidents is the expected number of latent cancers caused by accidents involving the dispersal of radionuclides from SSTs. Given a very severe transportation accident, radioactive materials could be dispersed into the atmosphere and subsequently expose the general public in the vicinity of the accident to ionizing radiation. Table 4.16.4.1–1 presents radiological risks from dispersion accidents occurring during intersite weapon shipments. The accidental dispersal of radionuclides from these shipments is estimated to cause 5×10^{-7} excess LCFs in the population along the pit shipment routes with a maximum annual individual excess LCF risk of 1×10^{-10} for the SRS alternative. The annual LCF risk from all causes for an individual in the U.S. is 2.2×10^{-3}.

4.16.4.2 *Impacts of Relocating 8,000 Pits*

Under this option, 8,000 pits would be relocated from Pantex Plant to one or more of four candidate storage sites: NTS, SRS, Hanford Site, and Manzano WSA at KAFB.

Table 4.16.4.2–1 summarizes the impacts associated with 8,000 pit shipments. Impacts related to loading or unloading pits into SSTs are discussed in Section 4.12, Intrasite Transportation.

The incident-free transport of pits would result in a maximum of 6×10^{-4} excess LCFs in the exposed population on and along the roadways.

TABLE 4.16.4.1–1.—*Radiological Exposure and Health Risk from 20,000 Pit Shipments from Pantex Plant to Other Potential Sites*

GENERAL PUBLIC	NEVADA TEST SITE	SAVANNAH RIVER SITE	HANFORD SITE	MANZANO WSA
Cumulative Dose (Person-Rem)[1]	2.0	3.0	NA	0.5
Maximally Exposed Individual (rem)	4×10^{-3}	4×10^{-3}	NA	4×10^{-3}
Expected Excess LCFs from Incident Free Impacts	1×10^{-3}	1.5×10^{-3}	NA	2.5×10^{-4}
Expected Excess LCFs from Plutonium Dispersal Accidents	4×10^{-7}	5×10^{-7}	NA	4×10^{-8}
Maximum Annual Individual LCF Risk from Dispersal Accidents	4×10^{-11}	1×10^{-10}	NA	1×10^{-11}

[1] [illegible] at 1 meter from the surface of the trailer.

provided by the Council on Environmental Quality (CEQ) in April 1996 (CEQ 1996), and also reported in EPA's Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analysis (EPA 1996a), were also applied to the 1990 Census data. Earlier EPA guidelines (59 FR 192), used in the following discussion, identified more Census tracts with minority and low-income populations than the CEQ or later EPA guidelines (EPA 1996a). Therefore, the impacts identified in the subsequent analysis in this document are more conservative (greater) than would have been the case if CEQ guidelines were applied.

The CEQ guidelines define minority populations as an area where either the minority population of the affected area (in this case, the Census tract or Block Numbering Area [BNA]) exceeds 50 percent or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (in this case, the ROI). Using the 50 percent criterion, only 10 Census tracts (all in the Potter County portion of the Amarillo Metropolitan Area) fall in the minority category. The second criterion of minority population being meaningfully greater than the regional average was defined as the average minority population plus one standard deviation that resulted in a minority population greater than 28.5 percent. Application of this criterion resulted in the identification of 19 Census tracts with meaningfully greater than average minority populations. In both cases, fewer than 23 tracts were identified with the application of EPA definition. If the CEQ guidelines are applied, the impacts on minority populations would be lower than those identified in this document.

The CEQ guidelines were also applied to the low-income populations. With the application of the first criterion using the U.S. Department of Health and Human Services definition, the affected Census [illegible] reduced from 27 to 14 (12 in Potter County portion of the Amarillo Metropolitan Area and one each in the towns of Borger and Pampa). The number of Census tracts with low-income populations remained at 14 when the U.S. Department of Housing and Urban Development definition was applied. Once again, the definition applied in the present analysis on subsequent pages is more conservative (resulting in 27 Census tracts with low-income populations), and the impacts on low-income populations would be substantially lower if CEQ guidelines were applied.

Table 4.17.1–1 presents the 1990 Census counts of minority and low-income populations found in the rural BNAs wholly or partially within the ROI. Figure 4.17.1–1 identifies the BNAs where 25 percent or more of the persons, in 1990, were either minority group members or below the poverty level based on their incomes in 1989.

Figure 4.17.1–1 shows that 10 of the rural BNAs within the Pantex Plant ROI exceed the 25 percent thresholds for concentrations of minority and low-income persons. Most of the 10 areas are located in the outer reaches of the ROI, or more than 48 kilometers (30 miles) from Pantex Plant. Only small portions of the BNAs with minority and low-income populations in Briscoe and Castro Counties fall within the ROI. The community of Dumas in Moore County, northwest of the plant, and the rural area in the immediate vicinity of Dumas have resident populations that are more than 25 percent minority. BNA 9508, in the town of Borger in Hutchinson County due north of the plant, also has a more than 25 percent minority population. The remaining six BNAs, represent areas in which both minority and low-income populations have higher than 25 percent concentration.

Figure 4.17.1–2 presents the concentration of minority and low-income populations in the Amarillo metropolitan area, which extends across the Potter/Randall County line. Table 4.17.1–2 presents the 1990 Census counts of

TABLE 4.17.1–1.—*Minority and Low-Income Populations in Rural Areas Within the Pantex Plant Region of Influence, 1990*

COUNTY/BLOCK NUMBERING AREA	TOTAL POPULATION	MINORITY POPULATION	PERCENT OF TOTAL POPULATION	NUMBER OF PERSONS BELOW POVERTY LEVEL	PERCENT OF TOTAL POPULATION
Armstrong County					
BNA 9501	568	15	2.6	85	14.8
BNA 9502	1,453	55	3.8	147	10.6
Briscoe County (part)					
BNA 9501	674	178	26.4	206	30.7
BNA 9502	1,297	261	20.1	309	23.8
Carson County					
BNA 9501	2,907	128	4.4	231	8.1
BNA 9502	3,669	290	7.9	352	9.7
Castro County (part)					
BNA 9501	1,405	419	29.8	369	26.4
Deaf Smith County (part)					
BNA 9501	3,074	1,437	46.7	843	27.7
BNA 9502	1,175	231	19.7	176	15.8
Donley County (part)					
BNA 9501	789	12	1.5	132	16.9
BNA 9502	2,095	198	9.5	425	22.2
Gray County (part)					
BNA 9501	1,574	76	4.8	187	12.2
BNA 9502	1,083	59	5.4	13	1.2
BNA 9503	4,607	202	4.4	183	3.9
BNA 9504	5,222	353	6.8	253	5.0
BNA 9505	2,818	383	13.6	398	13.8
BNA 9506	2,890	771	26.7	793	28.4
BNA 9507	2,683	397	14.8	517	21.0
BNA 9508	1,939	864	44.6	680	32.6
BNA 9509	1,151	21	1.8	187	17.2

TABLE 4.17.1–1.—*Minority and Low-Income Populations in Rural Areas Within the Pantex Plant Region of Influence, 1990*-Continued

COUNTY/BLOCK NUMBERING AREA	TOTAL POPULATION	MINORITY POPULATION	PERCENT OF TOTAL POPULATION	NUMBER OF PERSONS BELOW POVERTY LEVEL	PERCENT OF TOTAL POPULATION
Hartley County (part)					
BNA 9501	730	47	6.5	47	6.5
Hutchinson County (part)					
BNA 9502	3,277	295	9.0	502	15.6
BNA 9503	701	25	3.6	66	8.8
BNA 9504	462	25	5.4	72	15.5
BNA 9505	4,621	253	5.5	404	8.7
BNA 9506	4,481	1,033	23.1	686	15.5
BNA 9507	2,234	848	38.0	783	34.6
BNA 9508	1,428	390	27.3	307	22.8
BNA 9509	4,781	448	9.4	415	9.1
BNA 9510	3,704	274	7.4	191	5.2
Moore County (part)					
BNA 9501	1,963	461	23.5	219	11.2
BNA 9502	3,816	1,874	49.1	577	15.0
BNA 9503	7,247	1,843	25.4	581	8.2
BNA 9504	4,839	1,980	40.9	936	19.6
Oldham County (part)					
BNA 9501	1,971	208	10.6	240	14.9
Roberts County (part)					
BNA 9501	1,025	37	3.6	64	6.2
Swisher County (part)					
BNA 9501	839	151	18.0	163	20.0
BNA 9502	851	134	15.7	42	4.8

Source: TX Cen 1993a:Tables 8 and 19

minority and low-income populations in Potter and Randall Counties.

There are no tracts in Randall County, within or outside of the Amarillo urban area, that had concentrations of 25 percent or more of minority or low-income persons. In Potter County, on the other hand, most tracts in the Amarillo urban area were characterized by one or both of these threshold conditions. These tracts are found primarily in the northeast quadrant of the city, in the general direction of Pantex Plant.

Tracts 125 and 141, the two tracts closest to Pantex Plant, were characterized by minority populations in excess of 25 percent, as were Tracts 107 and 128.97 in the east central and north central part of Amarillo. Tracts 103, 114, and 119, near the center of town, had more than one-fourth of their populations with incomes below the poverty level in 1989. Eighteen tracts, largely situated between the areas with one threshold condition or the other, are characterized by both threshold conditions; that is, more than 25 percent of their populations in 1990 were minority persons, and more than 25 percent of their populations were below the poverty level in 1989.

Thus, the minority and low-income populations specified by Executive Order 12898 are found in sufficient concentrations in 25 tracts in the northeast quadrant of the Amarillo urban area and in 10 rural BNAs within Pantex Plant ROI to warrant an analysis of the possible disproportionately high and adverse health and environmental impacts of the Proposed Action and the Alternatives considered in this EIS. Both Figures 4.17.1–1 and 4.17.1–2 clearly indicate that Pantex Plant is surrounded by rural tracts of white majority populations, and minority and low-income populations are located either in the Amarillo Urban area, approximately 27 kilometers (17 miles) away from Pantex Plant, or in the outer fringes of the ROI.

4.17.2 Impacts of Proposed Action

The Proposed Action includes the continuation of Pantex Plant operations at different levels of activity. Since the future stockpile requirements cannot be accurately predicted, three activities are analyzed to cover the possible range of activities at Pantex Plant: high level of activity which assumes handling of 2,000 weapons operations per year including assembly, disassembly, modifications, and surveillance activities; a moderate activity level to handle 1,000 weapons operations per year; and a low activity level to handle 500 weapons operations per year. To handle 2,000 weapons operations per year, the employment levels at Pantex Plant would remain at its 1995 operations. With no change in employment, the environmental impacts on the general population as well as on the minority and low-income populations would be similar to those currently experienced.

Approximately 60 percent of the total population in the Pantex Plant ROI is located in the City of Amarillo, and 96 percent are located in the Amarillo metropolitan area consisting of Potter and Randall Counties. Since Pantex Plant is located approximately 27 kilometers (17 miles) northeast of Amarillo, none of the biophysical impacts (such as impacts to air quality and water resources) and human health risks are experienced by the total population including the minority and low-income populations living in the metropolitan area. Even outside the Amarillo metropolitan area, most of the minority and low-income population is located in BNAs at the outer reaches of the ROI, more than 48 kilometers (30 miles) from Pantex Plant (Figure 4.17.1–1). The minority and low-income populations are, therefore, not expected to experience any disproportionately high or adverse human health, social, economic, or environmental effects from Pantex Plant operations.

Beneficial economic impacts of Pantex Plant are concentrated in the Amarillo metropolitan

TABLE 4.17.1–2.—*Minority and Low-Income Population in Amarillo Metropolitan Area, Texas, 1990*

CENSUS TRACT	TOTAL POPULATION	MINORITY POPULATION	PERCENT OF TOTAL POPULATION	NUMBER PERSONS BELOW POVERTY	PERCENT OF TOTAL POPULATION
POTTER COUNTY					
101	1,882	153	8.1	157	8.3
102	1,886	60	3.2	40	2.1
103	1,587	340	21.4	493	33.3
104	3,109	163	5.2	375	12.1
105	2,095	384	18.3	353	17.0
106	1,600	1,113	69.6	579	37.3
107	3,247	872	26.9	283	8.9
108	812	199	24.5	192	22.6
109	4,491	2,078	46.3	1,398	31.2
110	2,064	1,123	54.4	575	27.1
111	2,334	1,890	81.0	952	42.0
112	717	381	53.1	301	44.3
113	363	160	44.1	170	55.9
114	1,790	391	21.8	556	31.4
115	3,867	536	13.9	618	16.1
116	3,597	357	9.9	408	11.3
117	3,824	666	17.4	744	22.3
118	3,696	319	8.6	264	7.4
119	2,971	520	17.5	823	27.9
120	1,654	541	32.7	766	49.3
121	563	410	72.8	282	55.6
122	2,959	1,323	44.7	981	33.2
123	597	246	41.2	242	40.7
125	4,670	2,875	61.6	660	14.4
126	2,301	953	41.4	780	32.6
127	4,907	2,096	42.7	1,365	28.1
128.97	100	32	32.0	28	18.3
128.98	3,756	1,899	50.6	1,079	29.3
129	1,853	1,529	82.5	1,032	53.3
130	1,756	1,710	97.4	533	31.9
131	4,036	1,038	25.7	1,381	34.4
132	1,308	103	7.9	132	10.8
133	2,174	284	13.1	221	10.7
134	2,129	149	7.0	154	7.3
135	1,755	103	5.9	176	9.9
136	1,044	92	8.8	92	8.7

TABLE 4.17.1–2.—*Minority and Low-Income Population in Amarillo Metropolitan Area, Texas, 1990*-Continued

CENSUS TRACT	TOTAL POPULATION	MINORITY POPULATION	PERCENT OF TOTAL POPULATION	NUMBER PERSONS BELOW POVERTY	PERCENT OF TOTAL POPULATION
137	1,938	164	8.5	307	16.4
138	888	86	9.7	167	18.3
139	3,218	1,910	59.4	839	26.4
140	794	393	49.5	251	34.3
141	2,543	707	27.8	465	18.0
143	2,713	207	7.6	162	6.1
144	2,286	442	19.3	243	12.4
RANDALL COUNTY					
201	2,176	73	3.4	91	4.1
202	2,145	118	5.5	128	6.3
203	1,812	180	9.9	207	11.1
204	2,008	83	4.1	150	7.6
205	3,536	618	17.5	702	20.0
206	4,118	827	20.1	414	10.1
208	5,519	596	10.8	617	11.3
209	2,793	312	11.2	248	9.1
210	2,450	208	8.5	164	6.6
211	6,228	599	9.6	611	10.0
212	5,395	342	6.3	305	5.7
213	5,649	453	8.0	437	7.7
215	4,480	204	4.6	198	4.4
216.02	5,604	345	6.2	233	4.2
216.03	2,315	144	6.2	100	4.1
216.04	3,441	239	6.9	119	3.6
216.05	1,093	102	9.3	38	3.4
216.06	4,006	238	5.9	89	2.2
216.07	714	62	8.7	118	16.5
217	9,335	714	7.6	614	6.6
218.01	6,247	820	13.1	1,070	17.3
218.02	4,301	710	16.5	681	21.8
219	2,610	92	3.5	362	13.7
220.97	218	9	4.1	0	0.0
220.98	1,480	221	14.9	123	8.5
Total Metro. Area	187,547	39,306	20.9	29,438	15.7

Source: TX Cen 1993c:Tables 8 and 19

area where almost all of the employees working at the plant reside and where most of the local procurement expenditures for Pantex Plant occur. Almost 20 percent of the employees at Pantex Plant belong to the minority populations. This ratio is comparable to the minority population in the Amarillo metropolitan area where 20.9 percent of the total population belongs to minority. Employment at Pantex Plant, therefore, benefits both the majority (White) and minority populations proportionately.

Construction and/or modification of buildings for the six projects identified under the Proposed Action would not affect the minority and low-income populations disproportionately because these facilities do not require additional employees. The Gas Analysis Laboratory, Materials Compatibility Assurance Facility, Nondestructive Evaluation Facility, and Metrology and Health Physics Calibration and Acceptance Facility do not require additional workers; employees performing these functions in the existing facilities would be transferred to new facilities. The Hazardous Waste Treatment and Processing Facility and the Pit Reuse Facility would add 5 and 7 new employees, respectively. The impacts of these additions are considered negligible. In addition, all these facilities, except the Pit Reuse Facility, are intended to replace the existing facilities and to improve the health and safety conditions at the plant.

Overall, the minority and low-income populations in the Pantex Plant ROI are not disproportionately affected by the Proposed Action.

4.17.3 Impacts of No Action

Although the diassembly of weapons would cease at Pantex Plant once the number of pits stored at the site reaches 12,000, the weapons activity levels are assumed to stay at 2,000, 1,000, or 500. As a result, the employment levels and the biophysical impacts of the operations at Pantex Plant would be similar to those identified for the Proposed Action. No disproportionate effects on the minority and low-income populations are anticipated in the Pantex Plant ROI.

4.17.4 Impacts of Pit Storage Relocation Alternative

Even when the pits are relocated to other candidate site(s), the activity levels at Pantex Plant would remain the same as under the Proposed Action; only the activities related to pit storage would be eliminated. This would reduce Pantex Plant employment by approximately 30 workers and would not result in any substantial impacts. However, the pit handling activity at Pantex Plant would increase as pits are transferred to other sites. The impacts of this activity are discussed in sections 4.14, Human Health; 4.15, Aircraft Accidents; and 4.16, Intersite Transportation of Nuclear and Hazardous Materials. After the pits have been transferred to other site(s), human health and aircraft accident risks associated with the pit storage would be substantially reduced at Pantex Plant Site. These impacts are considered to be beneficial to the general population as well as to the minority and low-income populations in the Pantex Plant ROI.

4.17.5 Cumulative Impacts

The cumulative impacts presented here include impacts of the continued operations at Pantex Plant combined with impacts associated with activities described in the WM PEIS, SSM PEIS, and S&D PEIS. Since the Pantex Plant EIS Proposed Action and the SSM PEIS No Action Alternative represent a continuum of operations, the impacts associated with any new mission or facility that could be implemented at Pantex Plant are discussed in the context of the continuum. The impacts from the WM PEIS program are combined with those of the Pantex

decision process is on the strategy and technology mix rather than the actual site. The evolutionary Light Water Reactor is used for analysis purposes in this EIS as the bounding disposition alternative. Implementation of this disposition alternative would require the construction and operation of a pit disassembly and conversion facility, plutonium conversion facility, mixed oxide fuel fabrication facility, and one or more light water reactors. The bounding alternative also assumes that all of the facilities previously mentioned would be collocated at the same site (potentially Pantex Plant).

The analysis of the demographic data indicates that even if there were any health impacts to the communities around the candidate sites, the impacts would not appear to disproportionately affect minority or low-income populations. Wind direction frequencies at all the DOE sites show that any emissions from the sites would not be disproportionately directed at minority or low-income communities (DOE 1996a:4.0).

4.18 Irreversible and Irretrievable Commitments of Resources

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

This section discusses three major resource categories that are committed irreversibly or irretrievably under the Proposed Action: water, materials, and energy.

4.18.1 Water

There are no streams or rivers at or near Pantex Plant; all site water needs are met by groundwater. Regional demand on the Ogallala aquifer continues to exceed recharge. As such, a large portion of the water resources that support the plant represents expenditure of a nonrenewable resource. Taking the difference between the projected water usage and wastewater volumes for the 2,000 weapons scenario and those for FY 1995, this expenditure is estimated to be at least 300 million liters (80 million gallons).

4.18.2 Materials

The irreversible and irretrievable commitment of material resources during the entire life cycle and operation of Pantex Plant in support of assembly and disassembly facilities, high explosive manufacturing and processing facilities, plutonium storage, and operational support facilities includes construction materials (e.g., roofing materials), maintenance materials (e.g., paint), and operational support materials (e.g., chemicals). Consumption of these irretrievable materials is not expected to result in critical shortages.

4.18.3 Energy

The irretrievable commitment of resources during construction and operation of the facilities would include nonrenewable fuels to generate heat and power. Energy would be expended in the form of electricity and natural gas. The maximum consumption of electricity at Pantex Plant from continued operations at the 2,000 weapons level is estimated at 90,400 megawatt-hours per year. Corresponding natural gas consumption is estimated at 16.2 million cubic meters (573 million cubic feet) per year.

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4.19 Unavoidable Adverse Environmental Impacts

Continued operation, construction of new facilities, and an increase in plutonium storage capabilities at Pantex Plant would result in some adverse environmental impacts. The impact assessment conducted in this EIS has identified adverse impacts that cannot be fully mitigated. Residual impacts following mitigation are unavoidable.

Some unavoidable adverse environmental impacts would occur during construction of the new facilities. Natural resources would be impacted during construction as land is cleared for new facilities. However, the extent of the impact has been mitigated by selecting sites that were previously disturbed or are part of existing industrial areas.

During normal operations at Pantex Plant, a minimal amount of radioactive material is released to the environment. However, any radiation dose received by a member of the public from emissions from Pantex Plant is too small to be distinguished from naturally occurring background radiation. During normal operations at Pantex Plant, even with a strong As Low as Reasonably Achievable program and engineering and administrative controls, some radiological exposures to workers are expected.

During the timeframe of this EIS, the cumulative radiological exposure to the Pantex Plant workforce is expected to be essentially the same as for the Proposed Action (330 person-rem). This exposure will result in 0.13 excess cancer fatalities in the group. Maximum individual radiological exposures will be maintained below the DOE administrative goal of 900 millirem per year. Assuming that a single individual is exposed to 900 millirem per year for 10 years, this individual's risk of contracting a fatal cancer will increase by 3.6×10^{-3}.

Since hazardous and toxic chemicals are associated with the construction and operation of Pantex Plant facilities, worker exposure to these chemicals is unavoidable. However, no onsite chemical concentrations exceed the Occupational Safety and Health Administration threshold limit values. No fence line chemical concentrations exceed the TNRCC Effects Screening Levels (ESLs), and thus do not pose a threat to the public

Remote, automated, and robotic production methods (e.g., high explosive machining) are currently in place. Additional development through technology transfer is an ongoing effort. Continued success in the Pollution Prevention and Waste Minimization program (see appendix G) would further reduce the hazard index and could possibly eliminate the cancer risk.

Solid wastes (which include liquids and gases by definition) would be generated as an unavoidable result of Pantex Plant operations. Although Pantex Plant utilizes a Pollution Prevention and Waste Minimization program, generation of low-level, low-level mixed, hazardous, and nonhazardous wastes is unavoidable. No new waste types are expected as a result of the Proposed Action, No Action, or Pit Storage Relocation Alternative scenarios at Pantex Plant.

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4.20 Relationship between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The implementation of the Proposed Action or one of the Alternatives would cause some adverse impacts to the environment and permanently commit some resources to specific plant activities. This section describes the relationship between short-term effects of the continued operations at Pantex Plant and the associated long-term effects on productivity.

The Proposed Action and Alternatives for Pantex Plant would require the short-term use of resources (e.g., fuel, electricity, water, construction materials, land, and labor) to achieve the long-term goal of maintaining a safe nuclear weapons stockpile. Under Presidential direction, the stockpile has been reduced. A large number of weapons are no longer designated for the stockpile. In assembled form these weapons require a great deal of security and monitoring. Disassembled, these weapons are safer, less likely to impact the environment, and less expensive to maintain and secure. Thus the short-term expenditure of resources to disassemble the weapons results in long-term benefits in terms of lowered risk and greater cost efficiency.

The use of land being considered for the continued operations and increasing plutonium storage at Pantex Plant would enhance the long-term productivity in two ways. First, assembly and disassembly of nuclear weapons, high explosive manufacturing and processing, and plutonium storage missions represent a long-term production function compatible with historic nuclear weapons support and require a skilled and stable workforce. Second, since existing facilities suitable to assemble and disassemble nuclear weapons, manufacture and process high explosives, and store plutonium do exist, DOE is able to minimize short-term impacts and selectively construct new, modern support facilities that will enhance the existing productivity and ensure long-term productivity at Pantex Plant.

The only requirements for additional land use are for the construction of six new projects. The continued operations, including existing plutonium storage, do not require additional land at this time. The Pit Reuse Facility would be placed in an existing building, and would enhance the safety and reliability of the plutonium stockpile without a production reactor. The Gas Analysis Laboratory, the Nondestructive Evaluation Facility, the Metrology and Health Physics Calibration and Acceptance Facility, and the Material Compatibility Assurance Facility projects, while requiring additional land for the consolidation and modernization of existing facilities and operations, are expected to enhance long-term productivity.

The Hazardous Waste Treatment and Processing Facility (HWTPF) represents an enhancement and modernization of existing capabilities in Building 11–9S. The HWTPF is part of a major commitment by Pantex Plant for the protection of the environment through the treatment of wastes in agreement with TNRCC and the Environmental Protection Agency (EPA). Through the *Federal Facility Compliance Act* Site Treatment Plan, the plant expects to treat waste to meet the EPA's Land Disposal Restrictions standards.

Losses of terrestrial habitats to accommodate the new facilities and temporary disturbances during construction of these facilities are expected. However, these impacts have been minimized by selecting sites in areas where industrial operations currently exist. Short-term disturbances and impacts on previously disturbed land are expected to be minimal.

Pantex Plant is developing and implementing plans for ecosystem management in specific areas of Pantex Plant (e.g., playa areas) and studying the use of existing surplus facilities for other purposes. The Pantex Plant environmental restoration program and Texas' Clean 2000 program are currently managing cleanup and restoration of 144 solid waste management units. Environmental restoration activities, while causing some short-term impacts, provide for long-term improvement.

4.21 Summary of Cumulative Impacts

Cumulative impacts include the incremental impacts of the actions (usually Proposed or Preferred Action) when added to other past, present, and reasonably foreseeable future actions. The impacts of past actions have been described in the Affected Environment sections of this EIS and are reflected in the Proposed Action impacts at the 2,000 weapons activity level (current operations at Pantex Plant). Additional DOE programs planned or underway at Pantex Plant include the Stockpile Stewardship and Management (SSM), Waste Management (WM), and Storage and Disposition (S&D) programs which are the subject of three separate Programmatic EISs described in section 1.7 of this volume.

In addition to the DOE programs, information on other Federal, State, or local projects, including private developments, was sought through contacts with Federal and State regulatory agencies, the Amarillo Economic Development Corporation, the Panhandle Municipal Water Authority, and the City of Amarillo. This effort yielded only one project (future closure of the Helium Plant) that would contribute to the cumulative impacts in the Pantex Plant Region of Influence. A discussion of its cumulative impacts has been added in section 4.11.5 because cumulative impacts are limited to socioeconomic impacts.

The Pantex Plant EIS and the SSM PEIS both discuss the operations of the entire Pantex Plant but over different time frames. The level of operations, and associated impacts, discussed in the Pantex Plant EIS is for an approximately 10-year time frame beginning in the year 1997. The SSM PEIS discusses a lower level of the same kind of operations for the time frame of approximately the year 2005 and later. The operational levels discussed in the Pantex Plant EIS Proposed Action will evolve over the next 10 years into the level of operations discussed in the No Action Alternative of the SSM PEIS. The cumulative impacts associated with any new mission or facility at Pantex Plant should be placed in the time frame of the overall impacts of Pantex Plant Site at the time those facilities or missions would be implemented.

In chapter 4, the new missions and facilities associated with the WM PEIS are assumed to take place in the same time frame as the Pantex Plant EIS Proposed Action. The new missions and facilities associated with the S&D PEIS are assumed to take place in the same time frame as the SSM PEIS No Action. While these assumptions are well founded, the elements of the different programs could be delayed or moved ahead. In this section, the impacts of the different programs are presented by themselves without being combined with the impacts of either the Pantex Plant EIS Proposed Action or the SSM PEIS No Action. This is done in order that the reader can see in detail the impacts associated with each of the different missions, facilities, and time frames, and can add the impacts in any combination.

The Preferred Alternative for stockpile management is a downsized (rightsized) plant to provide an effective and efficient manufacturing capability for a smaller stockpile. With a smaller stockpile and no new-design weapons production, industrial capacity can be reduced to meet anticipated manufacturing requirements for stockpile repair and replacement activities. If the SSM PEIS decision, as announced in the Record of Decision, is to downsize Pantex Plant, such action would commence in the year 1998 and be completed by approximately the year 2005. Because downsizing would involve internal modifications to existing facilities, no land would be disturbed, and there would be no significant change to any environmental resources during the completion of modifications. Consequently, there would no significant cumulative impacts associated with the downsizing of Pantex Plant facilities.

The SSM column in Table 4.21–1 shows the impacts of downsizing-in-place the assembly/

disassembly and high explosive (HE) fabrication facilities at Pantex Plant. These impacts are not in addition (cumulative) to the impacts identified for the continued operations at the 2,000 weapons activity level. Instead, environmental impacts resulting from SSM activities at Pantex Plant represent a reduced level of impacts after the plant completes its disassembly activities and evolves into a long-term stockpile management facility.

The WM PEIS examines the environmental impacts of alternative configurations for the management of radioactive and hazardous wastes at DOE sites throughout the U.S. Pantex Plant is considered one of 17 "major" sites managing DOE wastes. For Pantex Plant, the PEIS analyzes management of low-level mixed waste (LLMW), low-level waste (LLW), and hazardous waste (HW) in four configuration alternatives: No Action, Decentralized, Regionalized, and Centralized.

The most adverse impacts of activities at Pantex Plant would occur as a result of the Decentralized Alternative. Therefore, only the impacts of this alternative are provided in Table 4.21–1. With this alternative, treatment and disposal facilities would be constructed for LLMW and LLW at Pantex Plant. The treatment facilities needed for LLMW and LLW have already been evaluated in chapter 4 of this volume. The WM PEIS does not provide NEPA analysis for the construction of new disposal facilities, such as a landfill, which would be needed if the Decentralized Alternative is selected as the Preferred Alternative for LLMW and LLW disposal.

For the S&D PEIS, two bounding alternatives (alternatives with the most adverse environmental impacts), one for storage and the other for disposition activities, are considered in this cumulative impact analysis. For the storage alternatives, collocation of plutonium and highly enriched uranium (HEU) facilities generates the most adverse impacts as it would require construction of new storage facilities at Pantex Plant. For the disposition alternatives, the most adverse impacts would occur if the pit disassembly/conversion facility, the plutonium conversion (non-pit) facility, the mixed oxide (MOX) fuel fabrication facility, and the evolutionary light water reactor were all located at Pantex Plant.

As discussed in sections 1.4 and 1.7.3 of this volume, the final S&D PEIS will include an alternative under which plutonium pits from Rocky Flats Environmental Technology Site (RFETS) could be transferred to Pantex Plant for storage in Zone 4 as early as 1997. Impacts related to the intersite transportation of these pits are described in section 4.4 of the S&D PEIS. The total potential fatalities from the intersite transportation of the RFETS pits to Pantex Plant is estimated as 6.4×10^{-3} from both radiological and nonradiological impacts to the public and workers for both routine and accident conditions.

The impacts from the Storage Collocation Alternative and the MOX Fuel/Light Water Reactor Alternative would probably occur during the next seven to 20 years and, therefore, would be cumulative to the impacts discussed in the SSM PEIS No Action Alternative. However, the construction and operation of the S&D facilities could take place within the next five to seven years, and thus could be cumulative to the impacts discussed in the Pantex Plant EIS Proposed Action. So the impacts of the Storage Collocation Alternative, the construction of the MOX Fuel/Light Water Reactor Alternative, and the operation of the MOX Fuel/Light Water Reactor Alternative are presented separately in Table 4.21–1 without being combined with the impacts of either the Pantex Plant EIS Proposed Action or the SSM PEIS No Action.

Table 4.21–1 summarizes the impacts for Proposed Actions at the 2,000 weapons activity level and the most adverse impacts from the SSM, WM, and S&D programs at Pantex Plant.

TABLE 4.21–1.—*Environmental Impacts of Pantex Plant Operations and Other Reasonably Foreseeable Projects*

IMPACTS OF PANTEX PLANT OPERATIONS AT PROPOSED ACTION LEVEL (2,000 WEAPONS LEVEL INCLUDING 20,000 PITS IN STORAGE)	IMPACTS OF PANTEX PLANT OPERATIONS AT STOCKPILE STEWARDSHIP AND MANAGEMENT PEIS LEVEL (SSM PEIS)	IMPACTS OF WASTE MANAGEMENT PROGRAM (WM PEIS)	IMPACTS OF COLLOCATION OF PU AND HEU STORAGE FACILITY (S&D PEIS)	IMPACTS OF CONSTRUCTION OF DISPOSITION FACILITIES (S&D PEIS)	IMPACTS OF OPERATIONS OF DISPOSITION FACILITIES (S&D PEIS)
PLANT FACILITIES AND INFRASTRUCTURE					
The annual utility usage for the plant and six new projects would be: Steam - 181M kg (398M lb) Electricity - 90,400 MWh Natural Gas - 16.2M m^3 (573M ft^3) Utility demand would be substantially less than utility capacity; therefore, no significant impacts to infrastructure are expected.	Under the No Action Alternative, no downsizing or modification of facilities would occur, and there would be no construction impacts. Due to reduced workload expected in the future, infrastructure impacts from current operations would be expected to be less than current impacts. Under the downsizing alternative, all construction activities would be modifications to existing facilities. Facilities would be consolidated and impacts would be expected to be less than current impacts. Under the relocation alternative, the facilities would undergo decontamination and decommissioning.	The utility usage would conservatively be: Steam - 180M kg (392M lb) Electricity - 33,350 MWh Natural Gas - 0.8M m^3 (27M ft^3) Utility demand would be within system capacity; therefore, there are no significant impacts to infrastructure expected	Site infrastructure resources required would be less than resources available onsite. No increases in electricity and gas usage would occur. Oil requirements would increase slightly during construction.	Site infrastructure requirements would be: Electricity - 24,333 MWh Oil - 1,356,233 liters Gas - 0 m^3	Site infrastructure requirements would be: Electricity - 1,154,000 MWh Oil - 844,750 liters Gas - 8,976,000 m^3

TABLE 4.21–1.—*Environmental Impacts of Pantex Plant Operations and Other Reasonably Foreseeable Projects*-Continued

IMPACTS OF PANTEX PLANT OPERATIONS AT PROPOSED ACTION LEVEL (2,000 WEAPONS LEVEL INCLUDING 20,000 PITS IN STORAGE)	IMPACTS OF PANTEX PLANT OPERATIONS AT STOCKPILE STEWARDSHIP AND MANAGEMENT PEIS LEVEL (SSM PEIS)	IMPACTS OF WASTE MANAGEMENT PROGRAM (WM PEIS)	IMPACTS OF COLLOCATION OF PU AND HEU STORAGE FACILITY (S&D PEIS)	IMPACTS OF CONSTRUCTION OF DISPOSITION FACILITIES (S&D PEIS)	IMPACTS OF OPERATIONS OF DISPOSITION FACILITIES (S&D PEIS)
WATER RESOURCES					
Annual wastewater generation and water demand for the plant and six new projects would be: Wastewater - 647M liters (172M gal) Water - 1,011M liters (267M gal) Compliance with current discharge standards would keep levels of contaminants the same. The increase in Pantex Plant annual water usage (currently 0.6 percent of regional withdrawal from the Ogallala aquifer) would not significantly affect the ongoing regional depletion of the aquifer.	Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, impacts to water resources from operations would be expected to be approximately 249M liters (66M gallons) per year. Water requirements would be met without increased aquifer drawdowns. Under the downsizing alternative, the groundwater withdrawals would be approximately 209M liters (55M gallons) per year, a reduction of 16 percent compared to those under the No Action Alternative. Under the relocation alternative, all water use for assembly and disassembly operations and HE fabrication would cease.	Annual wastewater generation and water demands would be: Wastewater - 43,660 liters (11,535 gal) Water - 96,200 liters (25,416 gal) The Pantex Plant water usage (currently 0.6 percent of regional withdrawal from the Ogallala aquifer) would not significantly affect the ongoing regional depletion of the aquifer.	Annual wastewater generation and water usage would be: Wastewater - 13M liters (3.4M gal) Water - 130M liters (34M gal)	Annual wastewater generation and water usage would be: Wastewater - 110.2M liters (29M gal) Water - 130.2M liters (34.4M gal)	Annual wastewater generation and water usage would be: Wastewater - 484.7M liters (128M gal) Water - 572.9M liters (151.3M gal)

TABLE 4.21–1.—*Environmental Impacts of Pantex Plant Operations and Other Reasonably Foreseeable Projects*-Continued

IMPACTS OF PANTEX PLANT OPERATIONS AT PROPOSED ACTION LEVEL (2,000 WEAPONS LEVEL INCLUDING 20,000 PITS IN STORAGE)	IMPACTS OF PANTEX PLANT OPERATIONS AT STOCKPILE STEWARDSHIP AND MANAGEMENT PEIS LEVEL (SSM PEIS)	IMPACTS OF WASTE MANAGEMENT PROGRAM (WM PEIS)	IMPACTS OF COLLOCATION OF PU AND HEU STORAGE FACILITY (S&D PEIS)	IMPACTS OF CONSTRUCTION OF DISPOSITION FACILITIES (S&D PEIS)	IMPACTS OF OPERATIONS OF DISPOSITION FACILITIES (S&D PEIS)
AIR QUALITY					
Offsite concentrations of air pollutants were modeled and compared to screening levels which showed no adverse impacts to human health are expected. The onsite air quality levels are below those that would pose health risks to workers. The impacts from temporary increases in emissions from construction of new facilities would be negligible.	Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, air quality impacts from operations would be expected to be less than current impacts. Air quality would remain within regulatory limits. Under the downsizing alternative, the operations would be consolidated. Air quality impacts would be equivalent to those of the No Action Alternative. Under the relocation alternative, air quality impacts from assembly and disassembly operations and HE fabrication would cease.	Impacts would remain below the National and State air quality standards.	The new Pu and HEU facility would have minimal air quality impacts. Concentrations of criteria, toxic, and hazardous air pollutants are predicted to be in compliance with Federal, State, and local air quality regulations or guidelines.	Construction of facilities would result in emissions of some pollutants. Emissions would typically not exceed Federal, State, or local air quality regulations or guidelines.	Operations of facilities would result in emissions of some pollutants. Emissions would typically not exceed Federal, State, or local air quality regulations or guidelines.
ACOUSTICS					
Except for airblast from HE detonations, noise levels from Pantex Plant activities would be below 65 dBA at the plant boundary. The detonations could be audible at a distance of 5 to 10 kilometers (3 to 6 miles). Due to the size of the site, noise from construction of the new facilities would	Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, noise impacts from operations would be expected to be less than current impacts. Under the downsizing alternative, facilities would be consolidated. The noise impacts would be equivalent to the No Action Alternative. Under the relocation alternative, noise from assembly and disassembly operations	Associated construction activities include heavy construction equipment and increased traffic. Non-traffic noise associated with the operation would be located at sufficient distance that contribution to offsite noise levels would continue to be small.	Noise from construction equipment or operations activities would not be expected to cause annoyance to the public due to size of the site.	Noise from construction equipment would not be expected to cause annoyance to the public.	Noise from operations activities would not be expected to cause annoyance to the public.

TABLE 4.21–1.—*Environmental Impacts of Pantex Plant Operations and Other Reasonably Foreseeable Projects*-Continued

IMPACTS OF PANTEX PLANT OPERATIONS AT PROPOSED ACTION LEVEL (2,000 WEAPONS LEVEL INCLUDING 20,000 PITS IN STORAGE)	IMPACTS OF PANTEX PLANT OPERATIONS AT STOCKPILE STEWARDSHIP AND MANAGEMENT PEIS LEVEL (SSM PEIS)	IMPACTS OF WASTE MANAGEMENT PROGRAM (WM PEIS)	IMPACTS OF COLLOCATION OF PU AND HEU STORAGE FACILITY (S&D PEIS)	IMPACTS OF CONSTRUCTION OF DISPOSITION FACILITIES (S&D PEIS)	IMPACTS OF OPERATIONS OF DISPOSITION FACILITIES (S&D PEIS)
BIOTIC RESOURCES					
There would be no impacts to threatened or endangered species, wetlands, or terrestrial or aquatic resources from Pantex Plant operations. The construction of new facilities would result in loss of 15,900 m^2 (171,000 ft^2) of common plant and animal habitat, but would not impact sensitive species or habitats.	Under the No Action Alternative, no downsizing or modification of facilities would occur. Impacts to biological resources from operations would be expected to remain the same as current impacts. Under the downsizing alternative, all construction activities would be modifications to existing facilities. Consequently, no potential impacts to biota would occur. Under the relocation alternative, decontamination and decommissioning activities of the existing facilities would not impact biotic resources.	Since specific sites for disposal facilities have not yet been identified, no specific impacts can be discussed at this stage.	Construction and operations of new Pu and HEU facility would have minimal impact on biological resources due to use of disturbed area of the site.	Facility construction would adversely affect 429 hectares (1,150 acres) of vegetation from land clearing activities. Animal populations would also be affected.	Facility operations would not result in any additional impacts other than those shown for construction of facilities.

TABLE 4.21–1.—*Environmental Impacts of Pantex Plant Operations and Other Reasonably Foreseeable Projects*-Continued

IMPACTS OF PANTEX PLANT OPERATIONS AT PROPOSED ACTION LEVEL (2,000 WEAPONS LEVEL INCLUDING 20,000 PITS IN STORAGE)	IMPACTS OF PANTEX PLANT OPERATIONS AT STOCKPILE STEWARDSHIP AND MANAGEMENT PEIS LEVEL (SSM PEIS)	IMPACTS OF WASTE MANAGEMENT PROGRAM (WM PEIS)	IMPACTS OF COLLOCATION OF PU AND HEU STORAGE FACILITY (S&D PEIS)	IMPACTS OF CONSTRUCTION OF DISPOSITION FACILITIES (S&D PEIS)	IMPACTS OF OPERATIONS OF DISPOSITION FACILITIES (S&D PEIS)
CULTURAL RESOURCES					
No impacts to cultural, Native American, or paleontological resources are anticipated from the Proposed Action or the construction of new facilities.	Under the No Action Alternative, no downsizing or modification of facilities would occur. Impacts to cultural resources from operations would be expected to remain the same as current impacts. Under the downsizing alternative, all construction activities would be modifications to existing facilities. Consequently, no potential impacts to cultural resources would occur. Under the relocation alternative, decontamination and decommissioning of existing facilities would not impact cultural resources.	Since specific sites for disposal facilities have not yet been identified, no specific impacts can be discussed at this stage. In general, given that future siting priorities would include minimum or no impact to specific cultural resources, significant impacts from these activities are unlikely.	Impacts to prehistoric and historic resources are not anticipated within the previously disturbed construction area of the new facility. Operations would not result in additional impacts.	Facility construction could adversely affect some cultural resources on as much as 429 hectares (1,150 acres) of previously undisturbed lands.	Facility operations would not result in additional impacts other than those shown for construction of facilities.

TABLE 4.21–1.—*Environmental Impacts of Pantex Plant Operations and Other Reasonably Foreseeable Projects*-Continued

IMPACTS OF PANTEX PLANT OPERATIONS AT PROPOSED ACTION LEVEL (2,000 WEAPONS LEVEL INCLUDING 20,000 PITS IN STORAGE)	IMPACTS OF PANTEX PLANT OPERATIONS AT STOCKPILE STEWARDSHIP AND MANAGEMENT PEIS LEVEL (SSM PEIS)	IMPACTS OF WASTE MANAGEMENT PROGRAM (WM PEIS)	IMPACTS OF COLLOCATION OF PU AND HEU STORAGE FACILITY (S&D PEIS)	IMPACTS OF CONSTRUCTION OF DISPOSITION FACILITIES (S&D PEIS)	IMPACTS OF OPERATIONS OF DISPOSITION FACILITIES (S&D PEIS)
SOCIOECONOMIC RESOURCES (CONTINUED)					
	Under the relocation alternative, approximately 1,644 direct and 1,905 indirect jobs would be lost in the regional economic area. The loss of approximately 3,549 total jobs would cause the regional economic area unemployment rate to increase from 4.8 to 6.2 percent. Housing and rental vacancies and public finance expenditures and revenue would change by less than 1 percent.				
INTRASITE TRANSPORTATION					
The Proposed Action would have an estimated worker exposure of 61 person-rem, and a group latent cancer fatality risk for 10-year exposure of 0.024.	Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, impacts from intrasite transportation activities would be expected to be less than current impacts. Under the downsizing alternative, the facilities would be consolidated; this could further reduce the amount of intrasite transportation impacts. Under the relocation alternative, intrasite transportation associated with assembly and disassembly operations and HE fabrication would cease.	Potential fatalities to the offsite population and to workers from waste management activities are essentially zero for every alternative.			

TABLE 4.21–1.—*Environmental Impacts of Pantex Plant Operations and Other Reasonably Foreseeable Projects*-Continued

IMPACTS OF PANTEX PLANT OPERATIONS AT PROPOSED ACTION LEVEL (2,000 WEAPONS LEVEL INCLUDING 20,000 PITS IN STORAGE)	IMPACTS OF PANTEX PLANT OPERATIONS AT STOCKPILE STEWARDSHIP AND MANAGEMENT PEIS LEVEL (SSM PEIS)	IMPACTS OF WASTE MANAGEMENT PROGRAM (WM PEIS)	IMPACTS OF COLLOCATION OF PU AND HEU STORAGE FACILITY (S&D PEIS)	IMPACTS OF CONSTRUCTION OF DISPOSITION FACILITIES (S&D PEIS)	IMPACTS OF OPERATIONS OF DISPOSITION FACILITIES (S&D PEIS)
HUMAN HEALTH					
The Proposed Action would have an estimated worker exposure of 330 person-rem, and a group latent cancer risk for 10-year exposure of 0.13.	Under the No Action Alternative, no downsizing or modification of facilities would occur. Due to the reduced workload expected in the future, human health impacts from operations would be expected to be less than current impacts. The average radiological dose to workers would not be expected to change, although the total worker dose would change due to the reduced number of workers associated with a reduction in workload. Potential impacts from accidents, which are essentially independent of a given operating tempo, would not be expected to change.	Potential fatalities to the offsite population and to workers from waste management activities are essentially zero for every alternative.	The annual dose to the public from the collocated facility would be 5.3×10^{-5} person-rem. This would cause an estimated 1.3×10^{-6} fatal cancers during 50 years of operation. The alternative of storing surplus pits from RFETS at Pantex Plant in the near-term could cause less than 10^{-2} fatal cancers for affected workers due to repackaging operations. There would be no effect to the public.	Facility construction is expected to have negligible human health impacts.	The annual doses resulting from facility operations would be within radiological limits and well below levels of natural background radiation.

TABLE 4.21–1.—*Environmental Impacts of Pantex Plant Operations and Other Reasonably Foreseeable Projects*-Continued

IMPACTS OF PANTEX PLANT OPERATIONS AT PROPOSED ACTION LEVEL (2,000 WEAPONS LEVEL INCLUDING 20,000 PITS IN STORAGE)	IMPACTS OF PANTEX PLANT OPERATIONS AT STOCKPILE STEWARDSHIP AND MANAGEMENT PEIS LEVEL (SSM PEIS)	IMPACTS OF WASTE MANAGEMENT PROGRAM (WM PEIS)	IMPACTS OF COLLOCATION OF PU AND HEU STORAGE FACILITY (S&D PEIS)	IMPACTS OF CONSTRUCTION OF DISPOSITION FACILITIES (S&D PEIS)	IMPACTS OF OPERATIONS OF DISPOSITION FACILITIES (S&D PEIS)
AIRCRAFT ACCIDENT					
An aircraft accident capable of causing a release from a pit storage or weapons storage magazine is extremely unlikely (frequency of occurrence less than 10^{-4} but greater than or equal to 10^{-6}). A person in the vicinity of the plant has an approximately 3.0×10^{-12} increase in fatal cancer risk from potential aircraft crash plutonium dispersal accidents for the bounding Zone 4 storage configuration.	The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. Although the No Action Alternative, does not account for the time plutonium is at risk, there would be a reduction in the risk from an aircraft crash because of the reduction in operations. Under the downsizing alternative, there would be a consolidation of facilities and a commensurate reduction in the risk from an aircraft crash due to the fewer number of facilities. Under the relocation alternative, the risk from an aircraft crash into assembly and disassembly and HE fabrication facilities would be reduced to zero.	The impacts resulting from an aircraft accident to waste management facilities were not calculated in the WM PEIS.	The collocated storage facility would result in a reduction in the probability of an aircraft crash into a building or magazine containing plutonium. This reduction is due to the reduced number of buildings and magazines that would be utilized.	Facility construction was not analyzed for aircraft accidents. No plutonium release would occur in the event of an aircraft crash.	No aircraft accident analysis was conducted in the S&D PEIS.

TABLE 4.21–1.—*Environmental Impacts of Pantex Plant Operations and Other Reasonably Foreseeable Projects*-Continued

IMPACTS OF PANTEX PLANT OPERATIONS AT PROPOSED ACTION LEVEL (2,000 WEAPONS LEVEL INCLUDING 20,000 PITS IN STORAGE)	IMPACTS OF PANTEX PLANT OPERATIONS AT STOCKPILE STEWARDSHIP AND MANAGEMENT PEIS LEVEL (SSM PEIS)	IMPACTS OF WASTE MANAGEMENT PROGRAM (WM PEIS)	IMPACTS OF COLLOCATION OF PU AND HEU STORAGE FACILITY (S&D PEIS)	IMPACTS OF CONSTRUCTION OF DISPOSITION FACILITIES (S&D PEIS)	IMPACTS OF OPERATIONS OF DISPOSITION FACILITIES (S&D PEIS)
ENVIRONMENTAL JUSTICE					
Minority and low-income populations would not be disproportionately affected.	The SSM PEIS includes three alternatives that apply to Pantex Plant: No Action, Downsize Existing Capability, and Relocate Capability. None of the alternatives would result in impacts that would disproportionately affect minority or low-income populations in the Pantex Plant area.	No disproportionate effects on minority or low income populations were identified in the WM PEIS.	Minority and low-income populations would not be disproportionately affected.	Minority and low-income populations would not be disproportionately affected.	Minority and low-income populations would not be disproportionately affected.

M - Million
LLW - Low-level waste
HW - Hazardous waste
dBA - Decibel A-weighted scale
MWh - Megawatt hours
LLMW - Low-level mixed waste
NHW - Nonhazardous nonradioactive waste

CHAPTER 5

Affected Environment and Environmental Consequences at Alternative Pit Storage Sites

CHAPTER 5
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES AT ALTERNATIVE PIT STORAGE SITES

Chapter 5 focuses on the affected environment and impacts of relocating pit interim storage to the candidate sites. The candidate sites, in order of presentation, are Nevada Test Site, Savannah River Site, Hanford Site, and Kirtland Air Force Base. For each of these sites, the affected environment and impacts of relocating storage (for either 20,000 or 8,000 pits) are addressed by type of affected resource or other issue area—just as is done in chapter 4 for Pantex Plant.

5.1 INTRODUCTION

This chapter discusses the affected environment and the potential environmental impacts at the four sites being considered for the interim storage of pits under the Pit Storage Relocation Alternative. The discussion of the general information associated with relocation of pit storage operations is followed by discussions of each site, which focus on the facilities being considered for interim pit storage. Subsequently, the site's affected environment and the environmental impacts due to interim pit storage are presented.

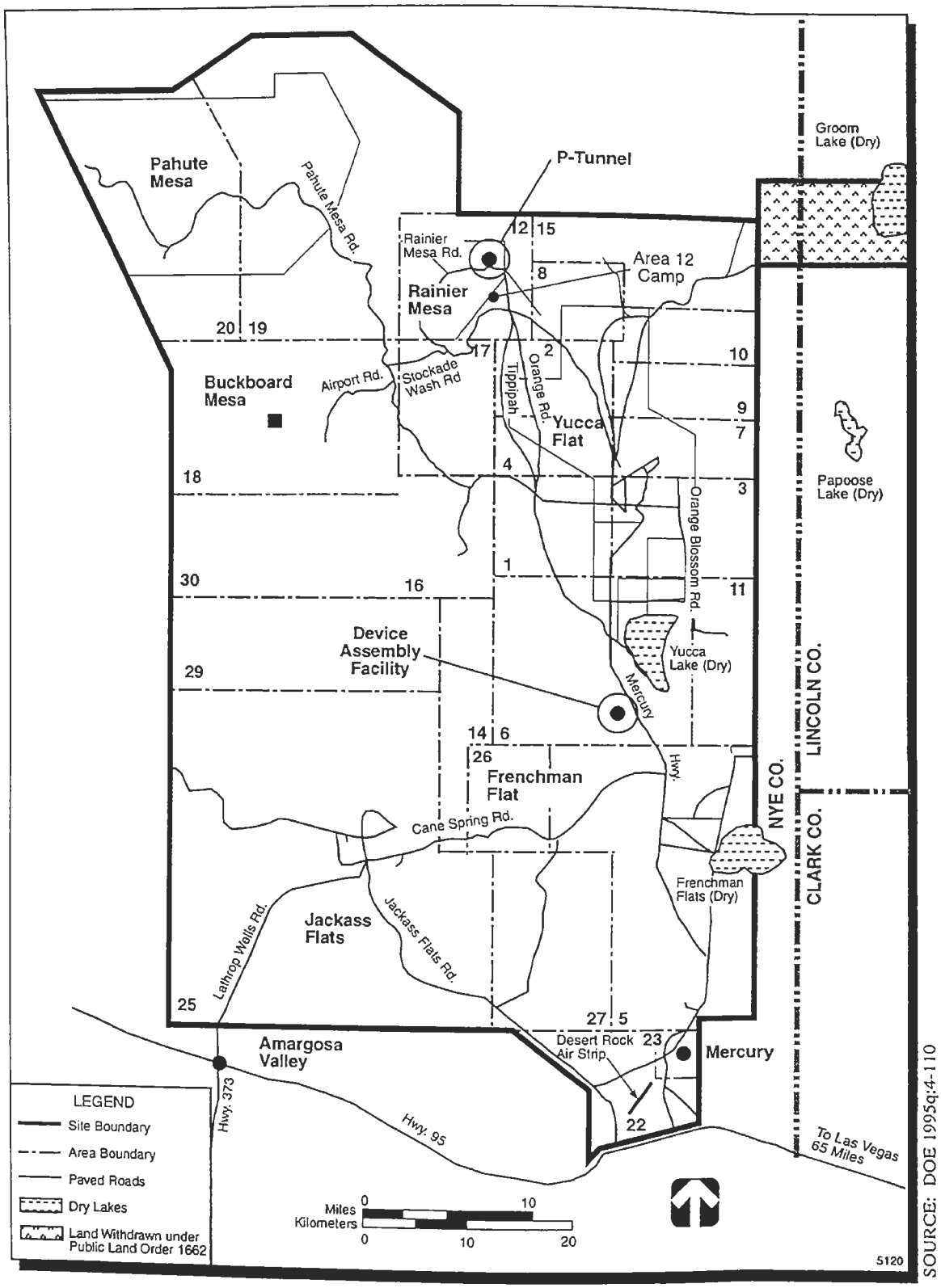
General Information on Relocation of Pit Storage Operations

The AL–R8 pit packaging that is currently used for storing pits at Pantex Plant is no longer used for intersite transportation of pits. A new storage and transport container, known as AT–400A, is being developed by Sandia National Laboratories and could be used for relocation of pits to an alternative interim storage site. This container or any other containers certified by the Department of Transportation for shipment of pits to the alternative site would be transported from Pantex Plant to an alternative site by the DOE Transportation Safeguards Division's Safe Secure Tractor Trailers. The impacts of transporting pits to the candidate facilities are discussed in section 4.16, Intersite Transportation of Nuclear and Hazardous Material.

In the candidate facilities at any of the relocation sites, the pit transportation and storage containers would be stored in a manner similar to the Stage Right pit storage system currently used at Pantex Plant (i.e., a multiple stacking configuration of containers placed horizontally on pallets) (see section 4.12.1.1). The pallets for this configuration have been designed to ensure structural integrity and stability in a maximum credible earthquake scenario. The pallets are lifted into place using a commercially available turret forklift that has been modified to provide radiation shielding that reduces operator exposure to extremely low levels (essentially background level). This electric forklift would be used for storage, retrieval, and inventory operations.

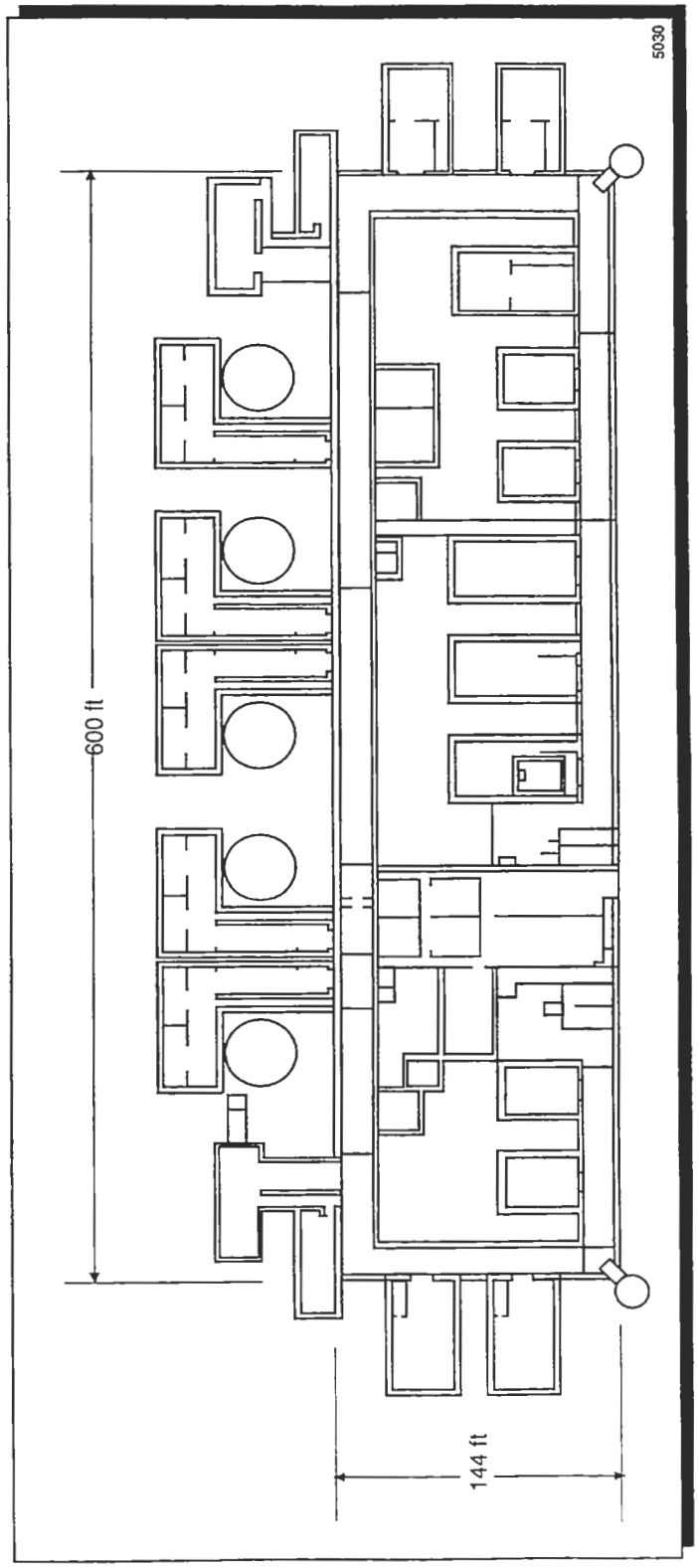
Efforts are currently underway to develop Automated Guided Vehicles (AGVs) that could be used both to place pits in the interim storage facilities and to assist in taking inventories using bar code readers. The use of AGVs could virtually eliminate any need for humans to enter the interim pit storage area. The AGVs would be utilized at the candidate sites as soon as the system becomes available.

THE NEVADA TEST SITE



SOURCE: DOE 1995q:4-110

FIGURE 5.2–1.—*Location of Device Assembly Facility and P-Tunnel at the Nevada Test Site.*



SOURCE: SNL 1992 [illegible]

FIGURE 5.2–2.—*Simplified Layout of Device Assembly Facility at the Nevada Test Site.*

handling and inventory system would be developed.

P-Tunnel. P-Tunnel is one of several tunnels at Rainier Mesa (Area 12 of NTS) previously used by the Defense Nuclear Agency for conducting underground nuclear experiments (Figure 5.2–3). This tunnel has approximately 5 kilometers (3 miles) of usable tunnel length and approximately 240 meters (800 feet) of protective overburden. The tunnel is large enough to accommodate more than 20,000 pits. The tunnel portal area currently has several support structures, but there is no security fence to protect the tunnel area. A security system to protect the tunnel portal can be developed within the already disturbed area without disturbing new lands.

P-Tunnel would require minimal facility upgrades (primarily the installation of guide rails for a Stage Right forklift). No new pit placement, retrieval, and inventory system development effort would be required to accept a pit storage mission. The P-Tunnel alternative is well suited for the Stage Right equipment and techniques successfully implemented at Pantex Plant.

P-Tunnel is also being proposed for the long-term storage of weapons-usable fissile materials. The *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic EIS* (DOE/EIS–0229) will address the long-term storage options including the P-Tunnel.

5.2.1 Environmental Resources Not Discussed in Detail

Each of the following environmental resources at NTS has been assessed. The analyses show that the impacts to these resources from the potential storage of pits at either DAF or P-Tunnel are small enough to warrant a limited discussion. Therefore, these resources are discussed briefly below and will not be addressed further in this section.

5.2.1.1 *Facilities and Infrastructure*

The infrastructure operations at NTS that could be impacted by or be expected to directly support pit storage operations include security, vehicle and building maintenance, utilities, administration, safety and health protection, and general support (e.g., cafeteria, general stores, etc.). Waste management and transportation support are discussed below and in sections 5.2.1.10 and 5.2.1.11, respectively.

Direct impacts from the implementation of pit storage include a small increase in the NTS security force. Electrical usage due to interim pit storage (estimated to be 4,110 megawatthours per year) represents a 2.4 percent increase over the site's fiscal year 1993 usage of 168,000 megawatthours and 1.2 percent of the site's fiscal year 1993 system capacity of 350,000 megawatthours (DOE 1995k:A-8). Maintenance support and the indirect impacts resulting from pit storage worker requirements (e.g., water, wastewater treatment, and fuel), would increase minimally in comparison to the current and historical onsite infrastructure support levels and system capacities. Neither facility is currently being utilized at historical or design levels. P-Tunnel modifications would involve construction of a secure access control system at the tunnel portal. There would only be a insubstantial temporary impact to infrastructure services during this construction.

5.2.1.2 *Land Resources*

No land disturbance is projected for DAF under the Pit Storage Relocation Alternative, and only limited soil disturbance in an already disturbed area is being considered for P-Tunnel (installation of a security system at the portal to P-Tunnel). The Pit Storage Relocation Alternative does not include any new land uses

at NTS. Impacts to land use would not be expected.

5.2.1.3 *Geology and Soils*

The only aspects of geology and soils that could be affected by or have an effect on the implementation of interim pit storage at NTS are soil disturbances and the risks associated with earthquakes. The risks due to earthquakes were assessed and found to be bounded by other accidents, as discussed in section 5.2.2.1. The only impact to soils would be from the construction of a secure access control system at the P-Tunnel portal. This area has already been repeatedly disturbed by the original mining of the tunnel and the subsequent activities associated with nuclear testing. Upgrades to DAF that would involve land disturbance are not anticipated; therefore, impacts to soils are not anticipated.

5.2.1.4 *Water Resources*

Because of the nature of pit storage activities, operations at DAF or P-Tunnel would not impact surface water or groundwater. The construction of a secure access control system at the P-Tunnel portal is expected to minimally impact surface water and groundwater because of the currently disturbed state of the ground surface. No surface waters are withdrawn for use at NTS. Wastewater is discharged to sewage lagoons, ponds, or septic tank/leach field systems and not to natural surface waters. Wastewater would not have a measurable effect on groundwater quality because of the combined effects of a deep water table (152 to 732 meters [500 to 2,400 feet] below land surface), low discharge volumes, high evaporation rates, and a composition consistent with treated and sanitary wastewater regulations. The water demands of pit storage operations are attributed to personnel usage and are considered negligible in comparison to the 2,400 million liters (633 million gallons) used annually at NTS (DOE 1995k:4-116, 4-147).

5.2.1.5 *Air Quality*

NTS air quality is well within all applicable local, State, and Federal ambient air quality standards except for particulate matter of aerodynamic diameter less than 10 micrometers (PM_{10}). The 24-hour PM_{10} standard is exceeded due to moderate background concentrations of dust and contributions from operations at NTS. The impacts to air quality from normal pit storage operations would be due entirely to vehicle emissions (approximately 150 vehicles per day) and are considered negligible relative to the overall vehicular emissions at NTS.

5.2.1.6 *Acoustics*

The major sources of noise at NTS include equipment, machines, blasting and explosives testing, and military aircraft operations. At the NTS boundary, away from most facilities, noise from most sources is barely distinguishable above background sources. The only sources of noise that would be associated with pit storage operations would be from transportation vehicles and air conditioning and heating equipment for the occupied areas of the facility. These impacts would be minimal and are not expected to be discernible offsite.

5.2.1.7 *Biotic Resources*

The threatened desert tortoise (*Gopherus agassizii*) is the only Federally listed threatened or endangered species that permanently resides on NTS, although the bald eagle (*Haliaeetus leucocephalus*) and American peregrine falcon (*Falco peregrinus anatum*) may occur on an incidental basis (DOE 1995p). DAF is in an area of infrequent desert tortoise activity, and P-Tunnel is outside the range of the desert tortoise at NTS. Though the existing U.S. Fish and Wildlife Service Biological Opinion for NTS requires a preactivity survey for any project that would result in soil disturbance, no soil

disturbance is projected for interim storage of pits at DAF, where desert tortoise activity is infrequent (DOE 1995n:10). The existing U.S. Fish and Wildlife Service Biological Opinion requires all personnel at NTS to complete the DOE Nevada Area Office Desert Tortoise Education Program to minimize the risk to desert tortoises from construction, maintenance, and transportation activities (Letter 1992:7-8). No wetlands beyond those associated with isolated springs have been identified at NTS (DOE 1993g:4-12, 4-27). As a result, impacts to biotic resources would not be expected.

5.2.1.8 *Cultural Resources*

No historic or prehistoric sites have been found at P-Tunnel (DOE 1992d:1-4, 8). Nine sites, seven of which were single, isolated artifacts, were located at DAF. These sites were not recommended for eligibility to the National Register of Historic Places (DRI nd:1-3; DOE 1994s). The Pit Storage Relocation Alternative does not include any action that would disturb these sites. Therefore, no direct impacts to cultural or paleontological resources would be expected.

DOE has ongoing consultation with 13 Native American tribes and one pan-tribal organization (the Owens Valley Board of Trustees) that have cultural ties to NTS. Native American groups including the American Indian Writers Subgroup of the Consolidated Group of Tribes and Organizations at NTS have expressed concern regarding areas containing Traditional Cultural Properties (DOE 1995k:4-123). The Pit Storage Relocation Alternative is not expected to adversely affect these areas of concern. However, the Consolidated Group of Tribes and Organizations would be consulted prior to initiation of any activities.

5.2.1.9 *Socioeconomic Resources*

Approximately 150 additional personnel (including 120 security personnel) would be required for interim storage of pits at NTS. This number represents less than a 3 percent increase in the total NTS workforce. Most of these workers can be locally hired; therefore, no significant site or regional population and workforce increases are anticipated. According to the 1990 Census, 150 workers represent 0.03 percent of the employed workforce in the socioeconomic Region of Influence, which includes the Las Vegas metropolitan area (NV Cen 1993:Table 145). No socioeconomic impacts would be anticipated.

5.2.1.10 *Waste Management*

NTS currently manages mixed waste, low-level waste, hazardous waste, and nonhazardous waste in accordance with a number of Federal and State regulations, permits obtained under these regulations, and DOE orders. These requirements are primarily under the authority of the Environmental Protection Agency, DOE, and the State of Nevada Department of Environmental Protection's Bureau of Waste Management (DOE 1995k:Chapter 5). NTS anticipates disposal of 14,100 cubic meters (18,500 cubic yards) of mixed waste and 28,300 cubic meters (37,000 cubic yards) of low-level waste annually (DOE 1993h:63). Pit storage operations would generate less than 1 cubic meter (1.3 cubic yards) each of mixed, low-level, and hazardous waste, which would not impact the current waste management at NTS.

5.2.1.11 *Intrasite Transportation*

Mercury Highway is the primary route into NTS from U.S. Highway 95 (Figure 5.2-1). Vehicular access to the DAF is via the Mercury Highway, which is a 7.8-meter (26-foot) wide paved road. DAF is approximately 1.5 kilometers (4,900 feet) west of the Mercury Highway and is served by a paved access road. The Mercury Highway is a controlled access road within the NTS boundaries and is not open to the public.

P-Tunnel is located in Area 12 of NTS, north of the Area 12 camp. Vehicular access to P–Tunnel is via the Mercury Highway, Tippipah Highway, Rainier Mesa Road, and Road 12–01, as shown in Figure 5.2–1. The traffic on these roads is controlled by NTS personnel; no public traffic is allowed on these roads. Because a release of plutonium from an intersite pit shipment would require a severe accident (e.g., an accident with a fuel tanker or train [see section 4.16.4.2]), the controlled transportation environment within NTS does not pose a significant threat to pit shipments. Consequently, the contribution to overall transportation risk from onsite transportation is negligible.

Radiological impacts of unloading pits at the two facilities are described in section 5.2.2.1, Human Health.

5.2.1.12 *Aircraft Accidents*

The airspace above NTS, designated as R4808, is a special-use airspace identified by Federal Aviation Administration regulations. This designation applies to all aircraft and is unlimited in height. Clearance to enter the restricted airspace above NTS must be obtained from DOE. Aircraft pilots desiring to fly through NTS airspace are required to contact the DOE Operations Coordination Center at NTS; information regarding the type of aircraft and nature of flight into the restricted airspace must be provided. DOE does authorize flights into the restricted airspace.

There are four airports and five landing strips in the vicinity of DAF and P-Tunnel. Las Vegas McCarran International Airport is the major commercial airfield in the State of Nevada. This airport, located approximately 122 kilometers (76 miles) southeast of NTS, is used by commercial (air carrier and air taxi), military, and general aviation aircraft. In 1994, McCarran International Airport had 488,347 aircraft operations (take-offs and landings). North Las Vegas Airport is located just north of McCarran International Airport and is used by commercial air taxi, military, and general aviation aircraft. In 1994, North Las Vegas Airport had 188,707 aircraft operations (take-offs and landings). Table 5.2.1.12–1 summarizes the total number of airfield operations at the McCarran International and North Las Vegas Airports (PC 1996j). Nellis Air Force Base, located 107 kilometers (67 miles) from NTS, is also north of McCarran International Airport and is only used by military aircraft.

The closest airfield to NTS, Indian Springs Auxiliary Field, approximately 48 kilometers (30 miles) southeast of DAF, has two runways used only by military aircraft. Beatty Airfield,

TABLE 5.2.1.12–1.—*Las Vegas McCarran International and North Las Vegas Airport Operations for 1994*

AIRCRAFT CATEGORY	NUMBER OF OPERATIONS	
	MCCARRAN	N. LAS VEGAS
Air Carrier	229,497	0
Air Taxi	104,395	9,928
Military	17,280	1,164
General Aviation	137,175	177,615
Total Airfield Operations	488,347	188,707

Source: PC 1996j

techniques to identify the specific scenarios that dominate risk (i.e., scenarios that contribute an appreciable fraction of the total risk), where risk is the product of frequency and consequence. Rigorous consequence evaluations are only performed for the identified risk-dominant scenarios.

Two types of accident consequences are examined:

- Worker and public exposure.
- The probability of the accident causing fatal cancer in a worker or the public.

If DOE chooses to relocate pits to NTS, two aspects of this relocation contribute to a potential for environmental impacts. They are the impacts associated with:

- Transferring pits from the transporter to their storage location inside the facility.
- Storage itself (i.e., potential impacts resulting from having the pits reside inside the facility).

Each time pits are transferred from the transporter to their storage location inside the facility, there is a small probability that an accidental release could occur due to a handling accident. In addition, the transfer of pits from the transporter to their storage location would result in radiological exposures to involved workers.

Affected Environment

The release of radioactivity and toxic chemicals to the environment from a DOE facility is an important issue for onsite workers and the public. Since the human environment contains many sources of radioactivity and toxic chemicals, it is essential to understand the sources of these substances and how effectively they are controlled.

Table 5.2.2.1–1 summarizes the major sources of radiation exposure in the vicinity of NTS. The average annual probability of developing a fatal cancer for a resident of Nevada is 1.4×10^{-3}. Using a nominal fatal cancer risk factor of 5×10^{-4} cancer fatalities per person rem and the environmental radioactivity data for NTS in Table 5.2.2.1–1, it is calculated that fatal cancers attributable to environmental radioactivity released from NTS constitute a negligible fraction of the average yearly fatal cancer probability in the vicinity of NTS (DOE 1994t:4-20).

Figures 5.2.2.1–1 and 5.2.2.1–2 depict the offsite population within an 80-kilometer (50-mile) radius of DAF and P-Tunnel, respectively. Wind speeds and directions in the NTS vicinity are presented in Figure 5.2.2.1–3. Winds are predominately from the southwest during the summer and from the northeast during the winter.

Impacts of Facility Upgrades

There is no significant impact on human health associated with NTS facility upgrades. The only upgrade required is to modify P-Tunnel and DAF to accept Stage Right transfer and storage equipment. The facility impact involves modifying floor space to accept Stage Right guide rails and fastening Stage Right attachment fixtures to storage facility walls. These are standard industrial operations that do not expose workers to any special hazards (e.g., radionuclides, toxic chemicals, or high explosives).

Impacts of Storing 20,000 Pits

Human health impacts from pit storage activities could potentially result from normal operations and potential accident scenarios. Normal operations would impact only onsite workers. Normal operational impacts result from the unloading of pits from Safe Secure Tractor Trailers (SSTs) at the P-Tunnel access area. Unloading operations would result in radiological exposure to cargo handlers. Based on conservative calculations made for the

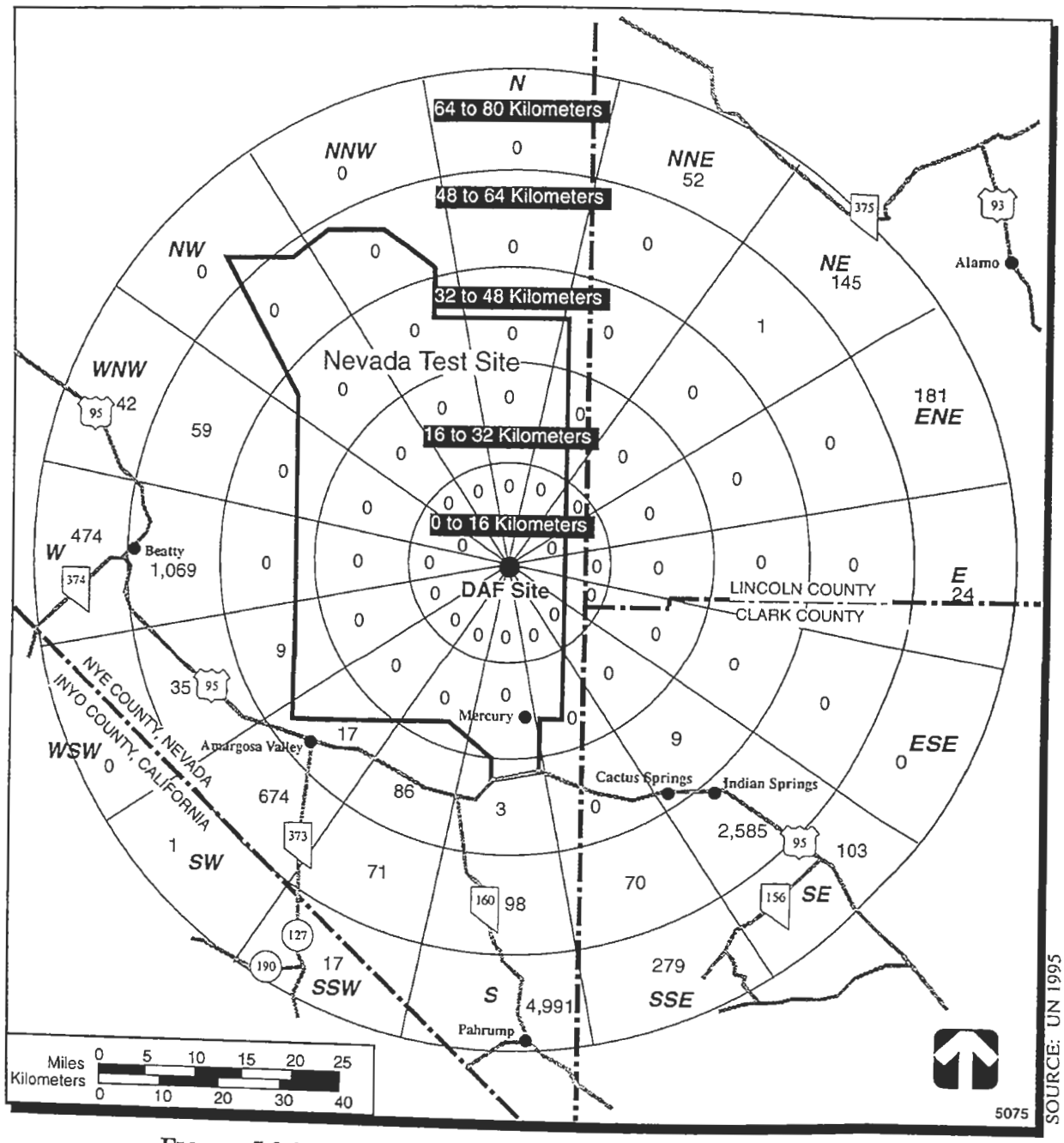
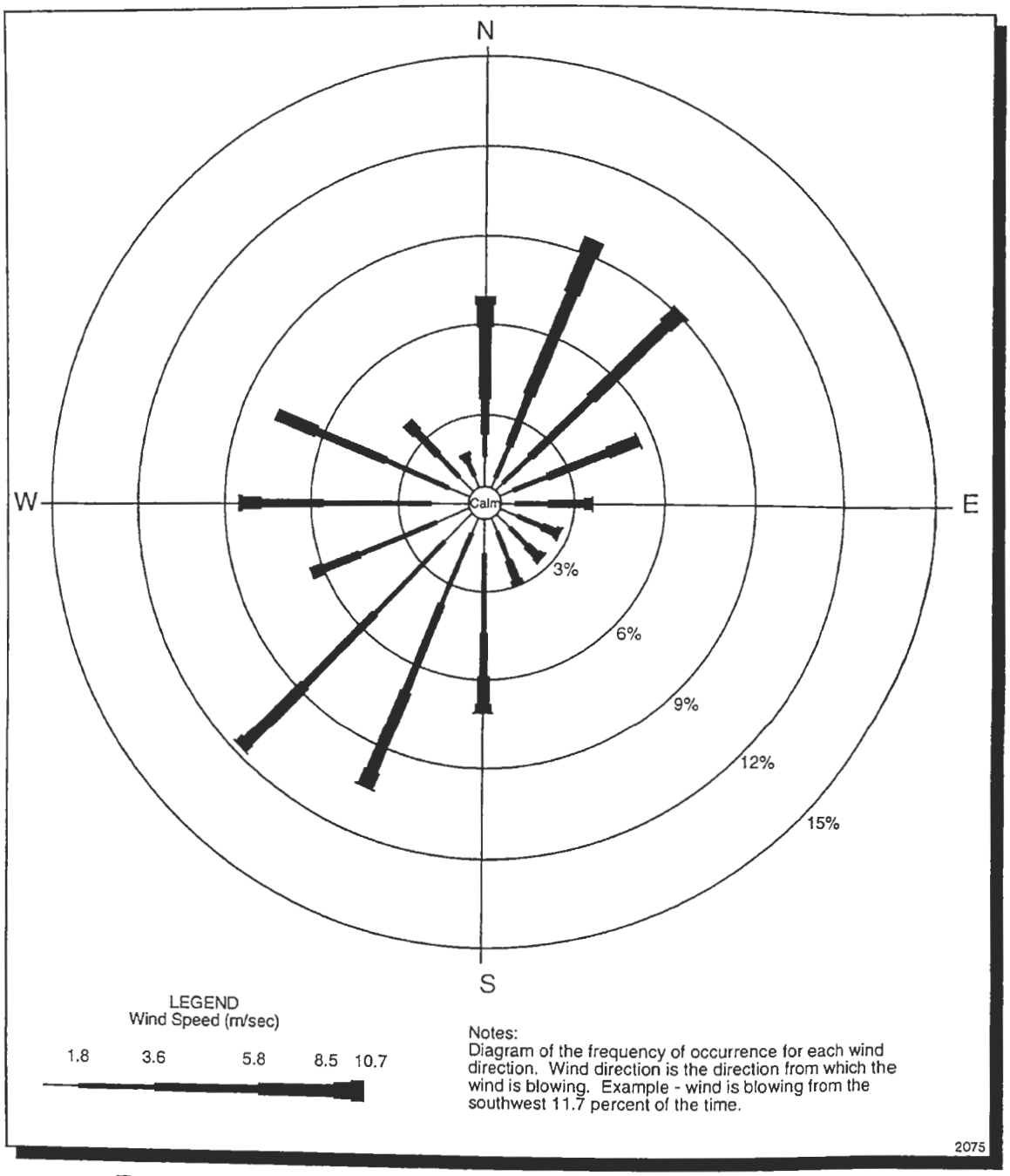


FIGURE 5.2.2.1–1.—*Population Within 80 kilometers (50 miles) of Device Assembly Facility.*



SOURCE: EPA 1995a

FIGURE 5.2.2.1–3.—*Wind Speed and Direction at the Nevada Test Site.*

pit storage activities was calculated using a fatal cancer risk factor of 4 x 10^{-4} LCF per person-rem, and the cumulative worker dose was estimated from previous historical doses resulting from similar operations (ICRP 1991).

The risk screening methodology indicates that the radiological health risk from accidents associated with the storage of 20,000 pits in P-Tunnel is dominated by handling accidents that could occur when the pits are being transferred from the transporter. A standard tine forklift is likely to be used to remove pit containers from an SST. Using DOE's methodology, the probability of a standard tine forklift causing a puncture during a single handling operation is in the extremely unlikely range (i.e., 10^{-4} to 10^{-6}) (DOE 1992h). For handling 2,000 pits annually, the accident frequency is approximately 10^{-3} per year. This relatively low accident frequency results from the robust construction of AT–400A shipping containers.

Pit container inventories at NTS are expected to be performed using either shielded or automated techniques and equipment. Consequently, these normal operations are not expected to result in any significant radiological exposure to workers.

Other storage activities that may occur within the timeframe evaluated in this EIS include:

- Restacking a limited number of pits to comply with design laboratory temperature goals.
- A limited number of pit movements and/or instrumentation placements to facilitate third-party inspections.

Impacts of these routine activities are also considered to be negligible.

Earthquakes offer the greatest threat from natural phenomena (see appendix D). Available seismology studies show that active faults such as the Mine Mountain Fault, the Carpetbag Fault, Yucca Flat Fault, and the Cane Spring Fault in the NTS vicinity are capable of generating earthquakes of up to 0.85 *g* (Raytheon 1995:2-36). NTS has a natural background seismicity (Raytheon 1995:2-33). The Cane Springs fault, located 5 to 8 kilometers (3 to 5 miles) south-southeast of DAF, has been identified as the most significant feature from the standpoint of seismic risk. However, a large proportion of seismic events occurring near NTS may have been aftershocks from past nuclear explosions.

The proposed pit storage area in P-Tunnel is only a few hundred feet away from the site of some past nuclear explosions. Since the tunnel has survived these explosions without noticeable degradation, it is not reasonably foreseeable that the proposed pit storage area would be damaged by an earthquake. However, if the tunnel collapses, the impact forces could breach some certified shipping containers. The collapse would also seal the containers inside the tunnel, resulting in no significant short-term radionuclide releases to the exterior environment. Thus, the consequences to the public and workers are considered negligible. Some mitigation of a tunnel collapse would be needed after a major seismic event. A separate assessment of the risk associated with the mitigation would be necessary in order to address the specific magnitude of the collapse and the applicable mitigation technology.

Impacts of Storing 8,000 Pits

Storage of 8,000 pits could be accomplished at either P-Tunnel or DAF. The risks associated with storing 8,000 pits in P-Tunnel are similar to but less than those of the 20,000-pit storage alternative. The total worker doses from unloading and pit transfer operations would be below 113 person-rem over 4 years. This exposure would result in an additional 0.04 LCF in this group. With an additional 0.04 LCF from pit handling, the total risk of LCFs among workers at NTS would increase by 0.7 percent.

Risk screening methodology also indicates that the risk from storage of 8,000 pits in DAF is dominated by forklift handling accidents. Note that the risk screening methodology evaluated all potential threats to pit container integrity, such as fire, aircraft crash, earthquake, flood, and other internal and external events.

Although DAF is more vulnerable to external events and natural phenomena than P-Tunnel, the contribution from these events to overall risk remains negligible as discussed in appendix D. Compared to the risk from a forklift accident during pit handling, the risk from aircraft accidents and earthquakes at DAF is low. To a significant extent, the low seismic risk at DAF is attributable to the robust construction of the facility (Raytheon 1995:5-7). Aircraft accidents are negligible risk contributors because of the extremely low probability of an impact.

It is estimated that a forklift puncture of a pit container would release 9.2×10^{-5} curies of plutonium. This is a conservative estimate of the respirable, airborne release caused by a puncture of one shipping container (DOE 1992f:7-39).

Given such a release, an involved worker (the forklift driver) would receive a dose of 6.6 rem, corresponding to an incremental increase in lifetime fatal cancer probability of 2.6×10^{-3}. In addition, a non-involved worker 100 meters (328 feet) downwind along the center line of the plutonium dispersion plume would received a 6.3×10^{-2} rem exposure, corresponding to an incremental increase in lifetime fatal cancer probability of 2.5×10^{-5}. The maximally exposed member of the public would receive a 3.9×10^{-5} rem exposure, corresponding to an incremental increase in lifetime fatal cancer probability of 2×10^{-8}. The lifetime fatal cancer probability for an average individual from all other causes is approximately 0.2 (20 percent).

This event would result in an exposure to the public of 3.3×10^{-5} person-rem. Considering the likelihood and consequence of this event, on the average, a member of the public will have an increased annual risk of developing a fatal cancer from this potential accident of 1.1×10^{-15} fatal cancers per year. The annual fatal cancer risk to a person in Nevada from all other causes is 1.4×10^{-3} fatal cancers per year.

5.2.2.2 *Environmental Justice*

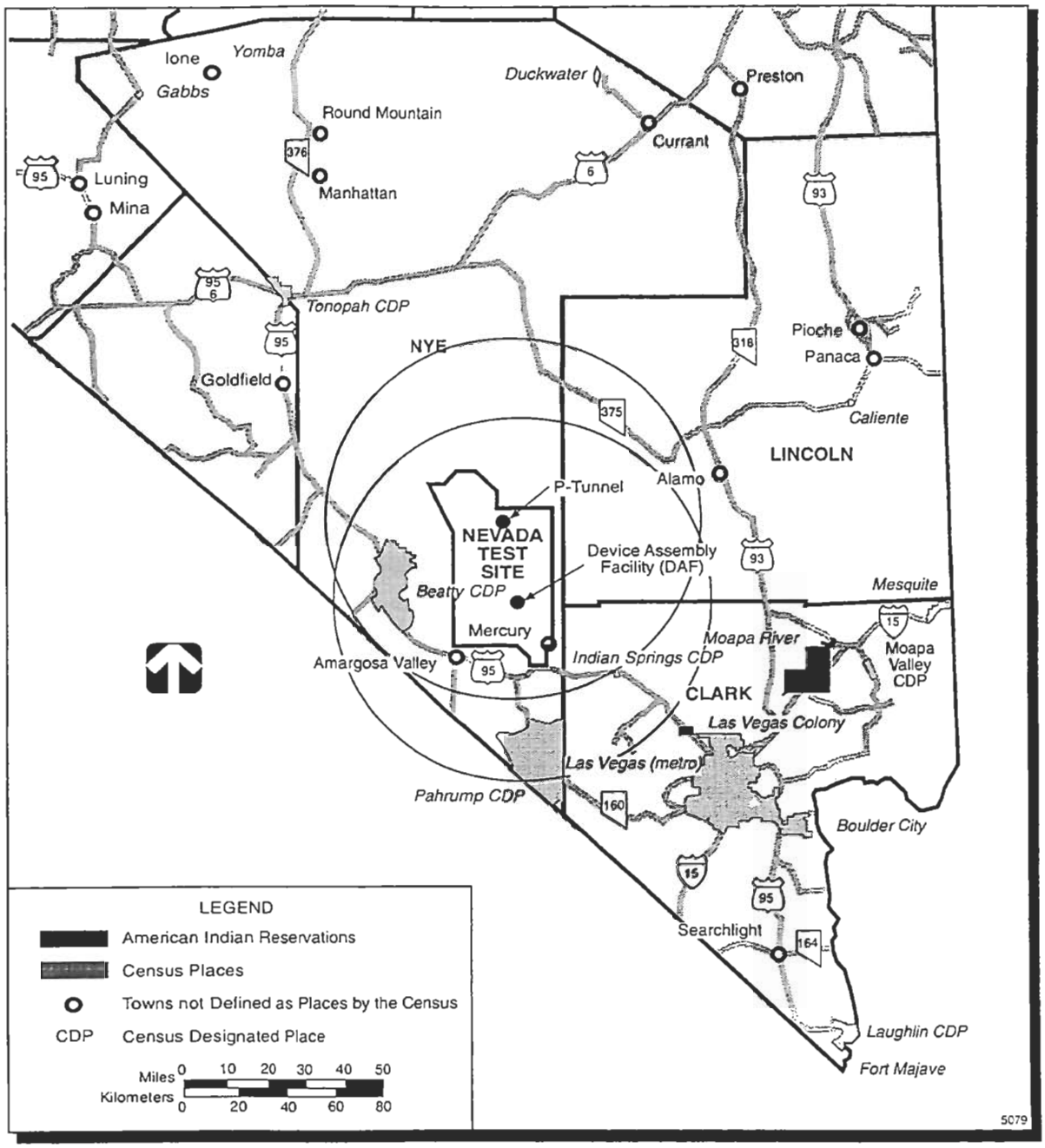
Affected Environment

In order to identify the target populations covered by Executive Order 12898, 80-kilometer (50-mile) radius circles centered on DAF and P-Tunnel were overlaid on 1990 Census tract maps (UN 1995). The communities that lie within these 80-kilometer (50-mile) circles, hereafter called the DAF and P-Tunnel Regions of Influence (ROIs), are shown in Figure 5.2.2.2–1.

Population. According to the 1990 Census, there were 11,741 persons within the DAF ROI. White persons comprised nearly 84 percent of the population, Hispanics were the second largest group with slightly more than 7 percent, and Blacks accounted for slightly less than 7 percent of the total population in the ROIs. American Indians, Asians, Pacific Islanders, and other racial groups totaled less than 3 percent of the total population within 80 kilometers (50 miles) of the DAF ROI in 1990 (UN 1995).

In 1990, nearly 96 percent of the population in the DAF ROI lived in the communities of Beatty, Pahrump, Mercury, and Indian Springs; the remaining population lived in the Amargosa Valley area (NV Cen 1992:Table 1; UN 1995). Thus, the entire population within the DAF ROI lived west, south, and southeast of the DAF site.

According to the 1990 Census, there were 4,386 persons within the P-Tunnel ROI. White persons comprised 84 percent of the population, Hispanics were the second largest group with 8 percent, and Blacks accounted for 5 percent of



SOURCE: UN 1995

FIGURE 5.2.2.2–1.—*The Device Assembly Facility and P-Tunnel Regions of Influence in Nevada.*

the total population in the circle. American Indians, Asians, Pacific Islanders, and other racial groups totaled less than 3 percent of the total population within the P-Tunnel ROI in 1990 (UN 1995).

In 1990, nearly 87 percent of the population in the P-Tunnel ROI lived in the communities of Beatty, Mercury and Indian Springs; the remaining population lived in the Amargosa Valley area (NV Cen 1992:Table 1; UN 1995). Thus, the entire population within the P-Tunnel ROI lived south, southwest, and southeast of P-Tunnel.

Minority Population. Figure 5.2.2.2–2 shows the 1990 Census block groups within the DAF ROI. The block groups are shaded if 25 percent or more of their populations were minority persons in 1990 and/or if 25 percent or more of their populations were below the poverty level based on their incomes in 1989. The 25 percent threshold levels for minority or low-income persons are based on the working definitions contained in the notice of the EPA's Office of Environmental Justice (59 FR 192). Three block groups within the DAF ROI have populations which were at least 25 percent minority or non-White in 1990. These concentrations of minority persons are found primarily in the communities of Indian Springs, Cactus Springs, and Mercury. In the P-Tunnel ROI, the distribution of minority population is similar to that of the DAF ROI (Figure 5.2.2.2–3).

Low-Income Population. Three block groups within the DAF ROI have populations in which at least 25 percent of persons were below the poverty level based on their incomes in 1989. These concentrations of low-income persons are found primarily at the eastern edge of Pahrump, in the western portion of Amargosa Valley, and in the Death Valley Junction area in California. In the P-Tunnel ROI, only one block group (the western portion of the Amargosa Valley area) has a population in which at least 25 percent of persons were below the poverty level.

Impacts of Storing 20,000 Pits

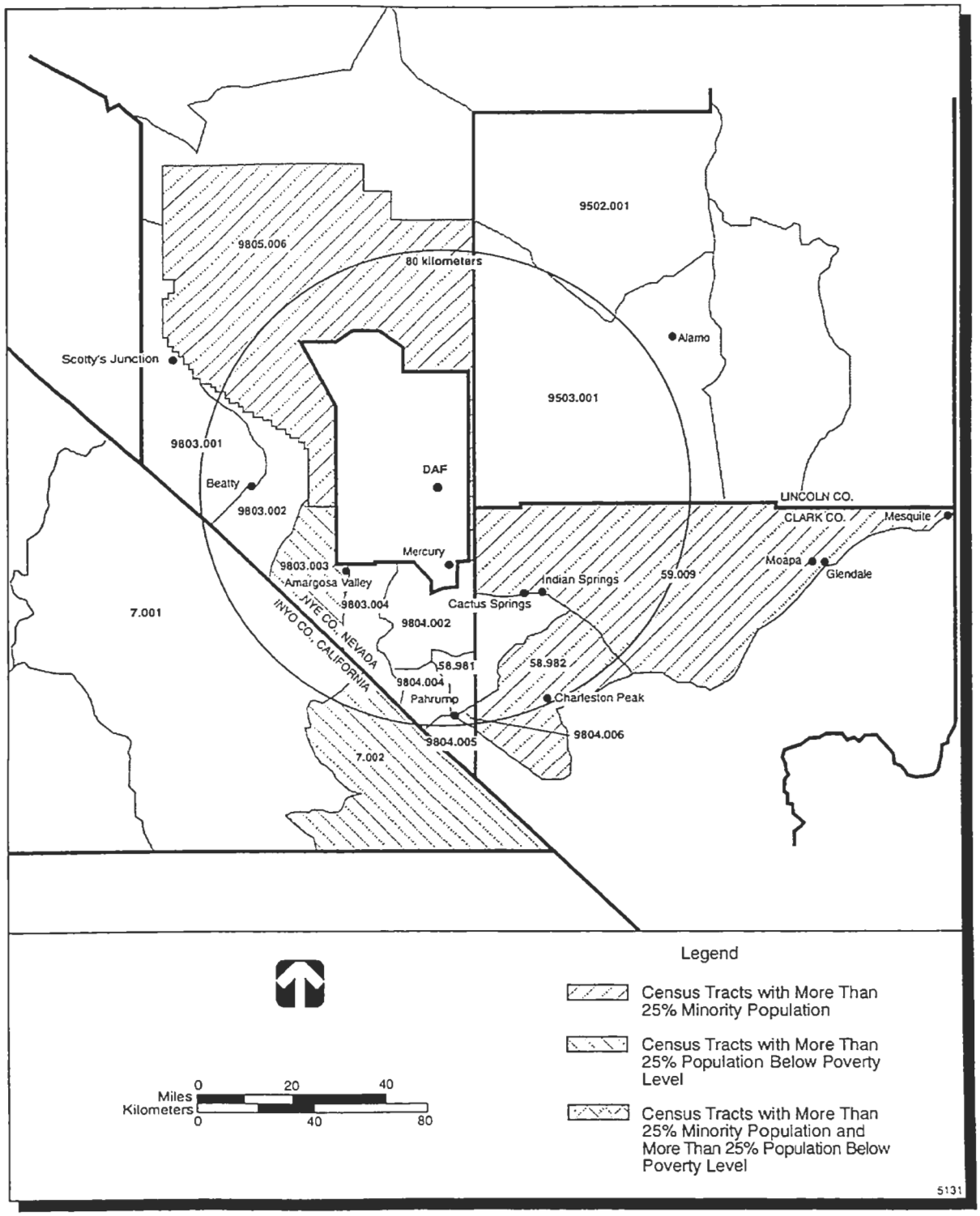
Because the interim storage of pits at the P-Tunnel would not require any major construction and because all facility modifications would take place inside existing facilities, impacts to the natural environment would be minimal. Under normal operating conditions, there would be minor increases in air pollutants associated with vehicles used during pit storage activities. Also, a minor increase in PM_{10} concentrations would be expected. These increases are associated with the operation of forklifts which are used to move the pits from the unloading area to the storage area.

These impacts are not likely to affect the surrounding population. Radiological releases from normal pit storage operations would have no measurable effect on an individual occupying a position near the NTS boundary for an entire year. Levels at the site boundary would be indistinguishable from natural background radiation. No adverse health effects would be expected among the general public, including minority and low-income populations, as a result of normal storage operations.

An abnormal event, such as accidental puncture of a pit storage container by a forklift, has the potential of exposing the general public to radiation. The analysis in the section 5.2.2.1, Human Health, indicates that the risk to the public from such an accident would be negligible. With no measurable impacts on the general population, the minority and low-income populations would not be disproportionately impacted.

Impacts of Storing 8,000 Pits

The human health impact of storing 8,000 pits in P-Tunnel would be lower than those identified for the storage of 20,000 pits. No significant adverse impacts are expected, and minority and



SOURCE: UN 1995

FIGURE 5.2.2.2–2.—*Distribution of Minority and Low-Income Populations in the Device Assembly Facility Region of Influence.*

low-income populations would not be disproportionately impacted.

The human health impacts of storing 8,000 pits in DAF would be negligible to the general public in the DAF ROI. Since impacts to the general public are expected to be negligible, minority and low-income populations would not be disproportionately impacted.

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THE SAVANNAH RIVER SITE

5.3 SAVANNAH RIVER SITE

Under the Pit Storage Relocation Alternative (see section 3.1.3), the pit storage function currently carried out at Pantex Plant would be transferred to another site. The Savannah River Site (SRS) is one of the candidate sites for the storage of pits (Figure 5.3–1). The P-Reactor building is the specific facility being considered for the interim pit storage at SRS. This section discusses the P-Reactor facility, the affected environment at SRS, and the potential impacts that would be associated with pit storage.

Each aspect of the affected environment at SRS has been assessed and the potential environmental impacts to each have been evaluated. Each environmental resource is discussed commensurate with the degree to which the resource could be impacted by or have an effect on interim pit storage at the candidate facility.

Savannah River Site. SRS is a government-owned and contractor-operated facility, managed by Westinghouse Savannah River Company (DOE 1993d:3-42). DOE owns approximately 780 square kilometers (300 square miles) in Aiken and Barnwell Counties, South Carolina, approximately 26 kilometers (16 miles) southeast of Augusta, Georgia and 19 kilometers (12 miles) south of Aiken, South Carolina (DOE 1993f:1). Less than 5 percent of the site is developed; the remaining area (approximately 73,300 hectares [181,000 acres]) is primarily forest land (DOE 1995q:A-25).

The primary mission at SRS from the 1950's until the recent end of the Cold War was the production and processing of nuclear materials to support defense programs. Major categories of activities at the site include tritium recycling, the processing of plutonium-238 for space missions, processing of irradiated targets and spent nuclear fuel, the interim storage of plutonium, environmental restoration actions, waste management, and research and development. P-Reactor is one of five reactors (C, K, L, P, and R) at SRS (DOE 1995q:A-25).

P-Reactor. P-Reactor is the candidate pit storage facility at SRS; it is located within a controlled area about 4 kilometers (2.6 miles) east-southeast of the geographical center of the site and about 6.5 kilometers (4 miles) west of the closest site boundary (Figure 5.3–1). P-Reactor was built in 1954 and was shut down in August 1988 for maintenance. In February 1991, it was placed in cold standby so that it could be used to provide spare parts for L-Reactor and K-Reactor. P-Reactor is now permanently shut down. The reactor building is a reinforced concrete building that houses four major process areas; the reactor area, the assembly area, the disassembly area, and the purification area (Figure 5.3–2).

The assembly area within the P-Reactor building is the proposed facility for pit storage. The assembly area was originally built for receiving, handling, and preparing fresh fuel and target assemblies for P-Reactor. Separated from the reactor building by a reinforced concrete wall and steel doors, the assembly area is a large warehouse-type facility that is divided into three large rooms; the receiving bay, process zone, and final storage area. Up to 20,000 pits could be stored in this building if appropriate modifications are made. A Perimeter Intrusion Detection and Alarm System already exists around the building. No construction involving new land disturbance would be required at the site.

If DOE chooses to store pits at the P-Reactor facility at SRS, a pit placement, retrieval, and inventory system would be developed. It is expected that an automated or shielded pit movement and inventory system would be developed for this site.

The P-Reactor facility would require some internal facility modifications to enable a pit storage mission. Pit storage would require the installation of seismically qualified racks, and

the development of an automated or shielded pit placement and retrieval system utilizing a bridge crane or high-lift forklift.

5.3.1 Environmental Resources Not Discussed in Detail

The environmental resources discussed below have been assessed at SRS. The analyses have shown that the impacts to these resources from potential pits storage activities at the P-Reactor facility would be small enough to warrant limited discussion. Therefore, these resources are discussed briefly below and will not be addressed further in this section.

5.3.1.1 *Facilities and Infrastructure*

The infrastructure operations at SRS that could be impacted by or be expected to directly support pit storage operations include security, vehicle and building maintenance, utilities, administration, safety and health protection, and general support (e.g., cafeteria, general stores). Waste management and transportation support are discussed below and in sections 5.3.1.10 and 5.3.1.11, respectively.

The direct impacts from the implementation of pit storage would include a small increase in the site's security force. Electrical usage due to interim pit storage (estimated to be 4,110 megawatthours per year) represents a 0.6 percent increase over the site's 1993 usage of 659,000 megawatthours and just under 0.2 percent of the site's remaining fiscal year 1993 system capacity of 2,980,000 megawatthours (DOE 1995p:C.4-66). Maintenance support and the indirect impacts resulting from pit storage worker requirements (e.g., water, wastewater treatment, and fuel) would increase minimally in comparison to the current and historical onsite infrastructure support levels and system capacities. The P-Reactor facility is not currently being utilized at historical or design levels; therefore, the utility systems generally have excess capacity available to support pit storage activity.

5.3.1.2 *Land Resources*

No land disturbance is projected under the Pit Storage Relocation Alternative for SRS. The Pit Storage Relocation Alternative does not include any new land uses at SRS. Impacts to land use would not be expected.

5.3.1.3 *Geology and Soils*

The only aspects of the geology and soils resource area that could be affected by or have an effect on the implementation of interim pit storage at SRS are the risks associated with earthquakes. P-Reactor is not anticipated to require upgrades that would involve land disturbance; therefore, impacts to soils are not anticipated. The risk due to earthquakes was assessed and found to be bounded by other accidents, as discussed in section 5.3.2.1.

5.3.1.4 *Water Resources*

Because of the nature of the pit storage activities, operations at the P-Reactor would not impact surface water, groundwater, or floodplains. The pit storage activities would not use surface waters at SRS and the nearest 100-year floodplain is 2.4 kilometers (1.5 miles) to the south and would not be impacted by pit storage activities. The increase in discharge of sanitary sewer waste due to a larger number of workers than presently utilized at the P-Reactor would be negligible in comparison to the site's annual wastewater treatment of 708 million liters (187 million gallons) and capacity of 2,043 million liters (540 million gallons). Since the site-wide compliance for SRS in 1993 was 99.9 percent, and because all sanitary discharges are regulated by National Pollutant Discharge Elimination System permits, no impacts to surface water quality are expected (WSRC 1994:16). No wastewater is discharged

5.3.1.9 *Socioeconomic Resources*

Approximately 150 additional personnel (including 120 security personnel) would be required for interim storage of pits at SRS. This number represents less than a 1.0 percent increase in the total SRS workforce. Most of these workers can be hired locally; therefore, no significant site or regional population and workforce increases are anticipated. According to the 1990 Census, 150 workers represent 0.07 percent of the workforce employed within the SRS Region of Influence (SC Cen 1993:Table 145; GA Cen 1993:Table 145). No socioeconomic impacts would be anticipated.

5.3.1.10 *Waste Management*

Currently, SRS manages high-level waste, mixed transuranic waste, transuranic waste, mixed waste, low-level waste, hazardous waste, and nonhazardous wastes in accordance with the requirements of a number of Federal and State regulations, permits obtained under these regulations, and DOE orders. These requirements are primarily under the authority of the Environmental Protection Agency, DOE, and the South Carolina Department of Health and Environmental Control. SRS anticipates generating 18,000 cubic meters (23,500 cubic yards) of low-level waste, approximately 2,000 cubic meters (2,600 cubic yards) of mixed waste, and 1,400 cubic meters (1,800 cubic yards) of hazardous waste in 1996 (DOE 1995m:A-1). The pit storage operations would generate less than 1 cubic meter (1.3 cubic yards) of mixed, low-level, and hazardous waste. This amount of waste would not impact current waste management at SRS.

5.3.1.11 *Intrasite Transportation*

The P-Reactor facility is located approximately 4 kilometers (2.6 miles) east-southeast of the geographical center of SRS and approximately 6.5 kilometers (4 miles) west of the closest site boundary (Figure 5.3–1). State Highway 125 provides access to the P-Reactor facility from the Augusta region; State Highway 64 provides access from Snelling. The P-Reactor facility is located on SRS primary Road F. All roads within SRS are suitable for passage in all weather conditions. Although some roads within the SRS boundaries are public access roads, the DOE would control access during passage of Safe Secure Tractor Trailer (SST) convoys. Because a release of plutonium from an intersite pit shipment would require a severe accident (e.g., an accident with a fuel tanker or train [see section 4.16.4.2]), the controlled transportation environment within SRS does not pose a significant threat to pit shipments. Consequently, the contribution of overall intersite transportation risk from onsite transportation is negligible.

5.3.1.12 *Aircraft Accidents*

There are four airports in the vicinity of P-Reactor. Bush Field, the major commercial airfield in the area, has two runways and is approximately 38 kilometers (24 miles) west-northwest of P-Reactor. The airport is used by commercial (air carrier and air taxi), military, and general aviation aircraft. In 1994, Bush Field had 39,461 aircraft operations (take-offs and landings). Table 5.3.1.12–1 summarizes the total number of airfield operations at Bush Field (PC 1996j). The closest airport, the

TABLE 5.3.1.12–1.—*Bush Field Operations for 1994*

AIRCRAFT CATEGORY	NUMBER OF OPERATIONS
Air Carrier	6,473
Air Taxi	5,961
Military	5,677
General Aviation	21,350
Total Airfield Operations	39,461

Source: (PC 1996j)

county airport near Barnwell, has three runways and is located approximately 18 kilometers (11 miles) east of P-Reactor. This airport is used by general aviation aircraft. Similarly, Aiken Airport, approximately 46 kilometers (29 miles) north-northwest, has three runways, used only by general aviation aircraft.

The North Army Base, approximately 61 kilometers (38 miles) northeast, has one runway used by military aircraft only. All four airports are outside the probability density function boundary for all categories of aircraft, and were therefore not included in the aircraft crash analysis. Only non-airport (in-flight) aircraft were included in the analysis as required by the Draft DOE Standard (DOE 1996g). Further details on these four facilities are contained in volume II, appendix E.

P-Reactor was modeled conservatively as a facility with a length of 69 meters (225 feet), a width of 57 meters (187 feet), and a height of 9 meters (30 feet). Using the Draft DOE Standard for determining the probability of aircraft crashes and 1994 data from the FAA, the frequency of hitting P-Reactor was calculated as 1.2×10^{-6} for all types of aircraft (DOE 1996g). It should be noted that the frequency calculation represents a conservative upper bound. Since this frequency is greater than 10^{-7}, in accordance with the Draft DOE Standard, further analysis was required. A local response structural analysis was performed according to the Draft DOE Standard, for the facility with a wall thickness of 76 centimeters (30 inches).

The analysis was performed for the maximum penetrator missile for each of the aircraft categories mentioned in section 4.15.2, except for helicopters. The commercial air carrier and large military aircraft categories were the only two aircraft missiles capable of penetrating the facility; the frequency of releasing material from P-Reactor was $\leq 9.2 \times 10^{-9}$. Since this frequency is less than 10^{-7}, in accordance with the Draft DOE Standard, no further analysis was required. Further details of the frequency of hitting P-Reactor and the frequency of relea material are contained in volume II, append

5.3.2 Resources Discussed in Det

5.3.2.1 *Human Health*

The basic approach used in assessing hu health concerns is to first identify the affe environments and establish a baseline represents the risk from current operati Changes in this baseline risk resulting from Pit Storage Relocation Alternative are t examined. Impacts from both nor operations and potential accidents estimated.

Assessing the human health risk impact fi potential accidents resulting from the reloca of pits to SRS and storing them in the P-Rea facility involves a risk screening process. first step in this process is to identify a br spectrum of potential accident scenarios. second step in the process uses screen techniques to identify the specific scenarios dominate risk (i.e., scenarios that contribute appreciable fraction of the total risk). Fina risk is the product of frequency consequence. Rigorous consequence eval tions are only performed for the identified dominant scenarios.

Two types of accident consequences examined:

- Worker and public exposure.
- The probability of the accident caus fatal cancer in a worker or the public.

If DOE chooses to relocate pits to SRS, aspects of this relocation would contribute potential for environmental impacts. Th impacts are associated with:

- Transferring pits from the transporte their storage location inside the facili

- Storage itself (i.e., potential impacts resulting from having the pits reside inside the facility).

Each time pits are transferred from the transporter to their storage location inside the facility, there is a small probability that an accidental release could occur due to a handling accident. In addition, the transfer of pits from the transporter to their storage location would result in radiological exposures to involved workers.

Affected Environment

The release of radioactivity and toxic chemicals to the environment from a DOE facility is an important issue for onsite workers and the public. Since the human environment contains many sources of radioactivity and toxic chemicals, it is essential to understand the sources of these substances and how effectively they are controlled.

Table 5.3.2.1–1 summarizes the major sources of radiation exposure in the vicinity of SRS. Cancer statistics for the States of Georgia and South Carolina indicate that annually, an average person in those states has a 1.7×10^{-3} probability of contracting a fatal cancer (DOE 1990a:4-36). Using nominal fatal cancer risk factor of 5×10^{-4} cancer fatalities per person rem and the environmental radioactivity data for SRS in Table 5.3.2.1–1, it is calculated that fatal cancers within 80 kilometers (50 miles) of SRS attributable to environmental radioactivity released from SRS constitute 0.005 percent of

TABLE 5.3.2.1–1.—*Major Sources of Radiation Exposure in the Vicinity of the Savannah River Site*

SOURCE OF EXPOSURE	DOSE TO AVERAGE INDIVIDUAL (mrem/yr)[1]	PERCENTAGE OF TOTAL EXPOSURE
NATURAL BACKGROUND RADIATION		
Cosmic and external terrestrial	72	
Internal terrestrial	40	
Radon in home	200	
Total natural	312	82.8
MEDICAL RADIATION		
Diagnostic x-rays	39	
Nuclear medicine	14	
Total medical	53	14.0
OTHER SOURCES		
Weapons test fallout	<1	
Consumer and industrial products	10	
Air travel	1	
Nuclear facilities (other than SRS and transportation of radioactive materials)	<0.1	
SRS—environmental radioactivity	<0.1	
Total other	12	3.2
Total—all sources	377	100

[1]Effective dose equivalent.
Sources: NCRP 1987:15, 53; DOE 1990a:3-52

the average yearly fatal cancer probability in Georgia and South Carolina (DOE 1994o:4-20).

Figure 5.3.2.1–1 depicts the offsite population within an 80-kilometer (50-mile) radius of SRS. Meteorological data for the P-Area are presented in Figure 5.3.2.1–2 (DOE 1994v:4-25; DOE 1993a:12). Winds from the northeast sector occurred most often, with southwest and northeast quadrants more frequent than northwest and southeast quadrants.

Impacts of Facilities Upgrades

There is no significant impact on human health associated with SRS facility upgrades. The principal upgrade required is to modify P-Reactor to accept Stage Right transfer and storage equipment. The facility impact involves modifying floor space to accept Stage Right guide rails and fastening Stage Right attachment fixtures to storage facility walls. These are standard industrial operations that do not expose workers to any special hazards (e.g., radionuclides, toxic chemicals, or high explosives).

Impacts of Storing 20,000 Pits

Human health impacts from pit storage activities could potentially result from normal operations and accident scenarios. Impacts from normal operations would be confined to onsite workers. Normal operational impacts result from unloading of pits from SSTs at the P-Reactor facility. Unloading operations would result in radiological exposure to cargo handlers. Based on conservative calculations made for handling of pits at Pantex Plant, the worker doses from unloading of 2,000 pits per year are estimated to be 27 person-rem per year or 270 person-rem for the unloading of 20,000 pits (the maximum number of pits which may be stored at the P-Reactor facility).

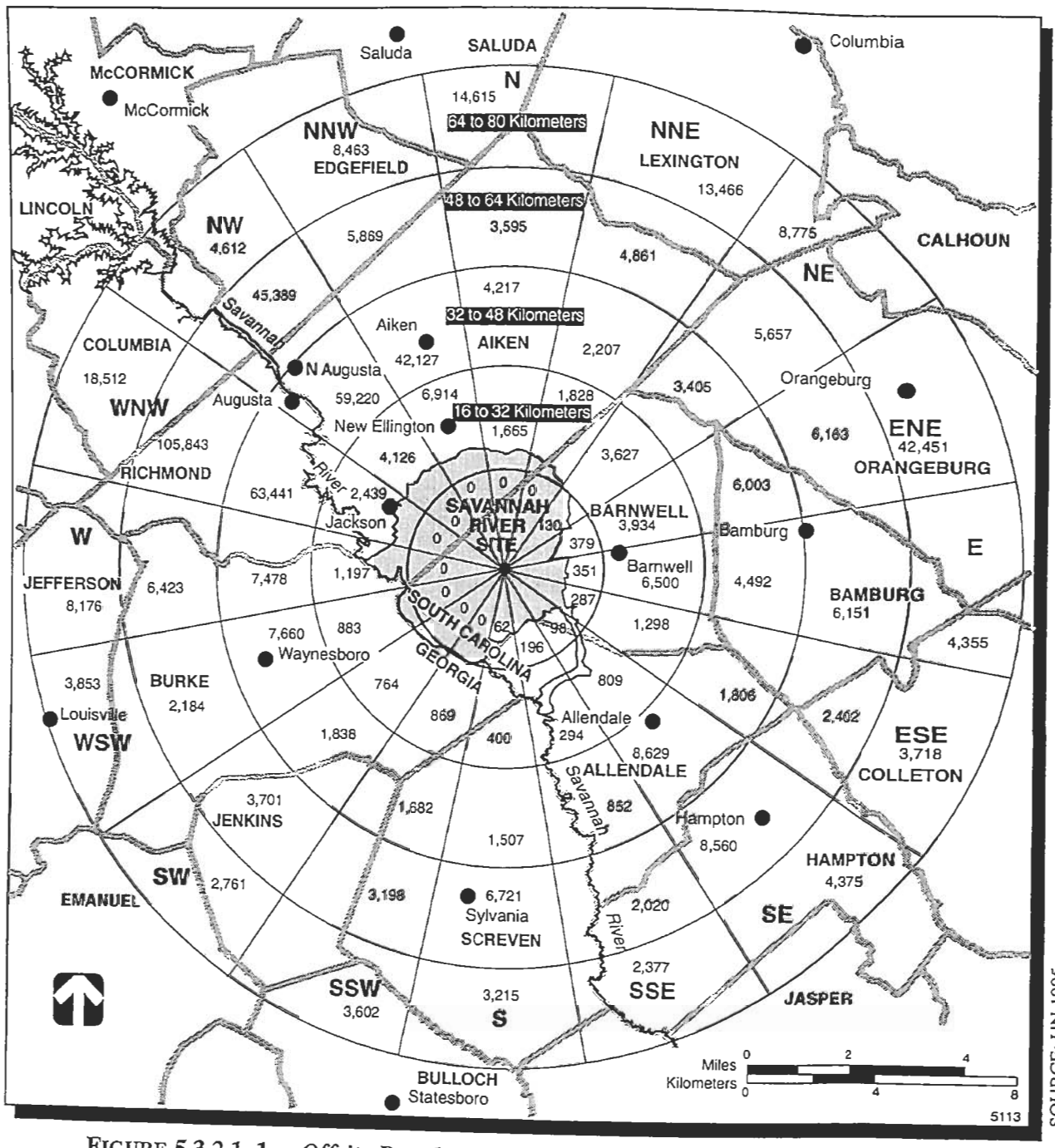
Once removed from SSTs, pits would be transferred into the P-Reactor facility for storage. Pit transfers within the P-Reactor facility would result in radiological exposure onsite workers handling the pits. The transfe pits would result in worker doses of less th person-rem per year for handling 2,000 pits about 13 person-rem for the placement 20,000 pits. The combined worker dose f unloading and storage of 20,000 pits at P-Reactor facility would be 283 person- distributed over the 30 people directly invol in material handling. Assuming that the s 30 people continue to handle 20,000 pits ov period of 10 years and using a dose-to- conversion factor of 4 x 10^{-4} latent can fatality (LCF) per person-rem, there would an additional 0.11 LCF experienced by group due to radiological exposure from handling.

The probability of LCFs from all causes in general population is estimated at 20 perc which implies that 6 of 30 workers wo develop cancer from all other causes. With additional 0.11 LCF from pit handling, the t risk of latent cancer among workers at P-Reactor site would increase by 1.8 percent

Some operational accidents could result impacts to both onsite workers and the off general population. Radiological exposures a the resultant risk of latent cancers have b evaluated and described in paragraphs t follow.

The risk screening methodology indicates t the radiological health risk from accide associated with the storage of 20,000 pits in Reactor is dominated by handling accidents t could occur when the pits are being transfer from the transporter. A standard tine forklif likely to be used to remove pit containers fr an SST. The probability of a standard t forklift causing a puncture during a sin handling operation is in the extremely unlik range (i.e., 10^{-4} to 10^{-6}).

It is estimated that a forklift puncture of a container would release 9.2 x 10^{-5} curies plutonium. This is a conservative estimate



SOURCE: UN 1995

FIGURE 5.3.2.1–1.—*Offsite Population in the Vicinity of the Savannah River Site.*

the respirable, airborne release caused by a puncture of one shipping container (DOE 1992f:7-39).

Given such a release, an involved worker (the forklift driver) would receive a dose of 6.6 rem, corresponding to an incremental increase in lifetime cancer probability of 2.6×10^{-3}. In addition, a non-involved worker 100 meters (328 feet) downwind along the center line of the plutonium dispersion plume would received a 5.2×10^{-2} rem exposure, corresponding to an incremental increase in lifetime fatal cancer probability of 2.1×10^{-5}. The maximally exposed member of the public would receive a 1.1×10^{-5} rem exposure, corresponding to an incremental increase in lifetime fatal cancer probability of 5.5×10^{-9}. The lifetime fatal cancer probability for an average individual from all other causes is approximately 0.2 (20 percent).

This event would result in an exposure to the public of 4.6×10^{-3} person-rem. Considering the likelihood and consequence of this event, on the average, a member of the public will have an increased annual risk of developing a fatal cancer from this potential accident of 3×10^{-15} fatal cancers per year. The annual fatal cancer risk to a person in the States of South Carolina and Georgia from all other causes is 1.7×10^{-3} fatal cancers per year.

Pit container inventories at P-Reactor are expected to be performed using either shielded or automated techniques and equipment. Consequently, these normal operations are not expected to result in any significant radiological exposure to workers.

Other storage activities that may occur within the time frame evaluated in this EIS include:

- Restacking a limited number of pits to comply with design laboratory temperature requirements.
- A limited number of pit movements and/or instrumentation placements to facilitate third-party inspections.

Impacts of these routine activities are also considered to be negligible.

The greatest threat to pit containers from natural phenomena is from natural earthquakes. Analysis of available seismology studies and estimates of the reactor building's seismic capacity indicate that the relative risk from earthquakes is over two orders of magnitude below the risk from a forklift accident, (3.0×10^{-15} LCF per year to an average member of the public) (DOE 1994v:4-24; DOE 1994u:C-25; NRC 1985:C-45).

Impacts of Storing 8,000 Pits

The risks associated with storing 8,000 pits in P-Reactor are similar to but less than those of the 20,000-pit storage alternative. If DOE chooses to store only 8,000 pits at SRS, the worker dose from unloading and pit transfer operation would be below 113 person-rem over 4 years This exposure would result in an additional 0.0 LCF in this group. With 0.04 LCF from p handling, the total risk of LCFs among worker at SRS would increase by 0.7 percent.

Risk screening methodology also indicates th the risk from storage of 8,000 pits in P-React is dominated by forklift handling accident These impacts would be similar to tho described for the storage of 20,000 pits (i.e., LCF risk of 3.0×10^{-15} latent fatal cancers p year to an average member of the public).

5.3.2.2 *Environmental Justice*

Affected Environment

P-Reactor is located at SRS in west-cen South Carolina along the Savannah River wh forms the border between South Carolina anc western neighbor, Georgia. A 1990–1

survey of the SRS workforce found that 90.5 percent of onsite workers reside in four South Carolina counties and two Georgia counties (DOE 1992g). In order to identify the target resident populations covered by Executive Order 12898, an 80-kilometer (50-mile) radius circle centered on the P-Reactor facility at SRS was overlaid on 1990 Census maps. The communities which lie within the 80-kilometer (50-mile) circle, hereafter called the P-Reactor Region of Influence (ROI), are shown in Figure 5.3.2.2–1.

Population. According to the 1990 Census, 621,677 persons reside within the P-Reactor ROI. The population is 61 percent White and 37 percent Black (UN 1995). Twenty-seven counties are wholly or partially included within the ROI. Blacks are a majority of the population in ten of these counties; 7 of 14 counties in South Carolina and 3 of 13 counties in Georgia. The largest population concentration within the ROI is northwest of SRS in Aiken, Columbia, and Richmond Counties (GA Cen 1992:Tables 1 and 8; SC Cen 1992:Tables 1 and 8).

Communities with 1990 populations greater than 10,000 persons within the ROI are: Augusta, Georgia (44,639), the South Augusta Census Designated Place (CDP) (55,998), the West Augusta CDP (27,637), Aiken, South Carolina (19,872), North Augusta, South Carolina (15,351), and Orangeburg, South Carolina (13,739). There are also eight towns and CDPs within the ROI whose 1990 population counts are between 1,000 and 10,000 persons. The combined 1990 population for all communities within the ROI that are greater than 1,000 persons is 213,968, or 34.4 percent. Thus, nearly two-thirds of the 1990 population within the ROI lived in rural areas and in towns with populations less than 1,000 persons (GA Cen 1992:Table 6; SC Cen 1992:Table 6).

Minority Population. Figure 5.3.2.2–2 shows 1990 Census tracts within the ROI. The tracts are shaded if 25 percent or more of their populations were minority persons in 1990 or if 25 percent or more of their populations below the poverty level based on their inc in 1989. The 25 percent threshold level minority or low income persons are based c working definitions contained in the noti the Environmental Protection Agency's C of Environmental Justice (59 FR 192).

With the exception of five tracts northeast P-Reactor facility and a number of ROI tra the northwest, in Augusta and Aiken Cou virtually every tract within the ROI has at a 25 percent minority population. All c tracts in the largely rural counties west, and east of the P-Reactor facility—na Burke, Emanuel, Jefferson, Jenkins and Sc in Georgia; and Allendale, Bamberg, Bar Colleton and Hampton in Carolina—have populations that are 25 p or more minority or non-White. In the Au urban area, including the City an unincorporated neighbors, West and Augusta, most tracts contain 25 p minority populations; Blacks compris percent of the total population (GA 1992:Tables 5 and 6; SC Cen 1992:Tables 6).

Low-Income Population. The g concentration of low-income population the ROI is found in the largely rural cc west, south and east of SRS. With the exc of seven tracts, all of Burke, En Jefferson, Jenkins and Screven coun Georgia have populations in which at le in four persons live below the povert based on their incomes in 1989. In Carolina, threshold levels of low- persons are not as widespread. Port Allendale, Hampton, Bamberg and B counties in South Carolina are the areas to the P-Reactor facility where 25 pe more persons lived below the poverty 1989.

Several cities and towns within the R poverty rates which are characteristic neighboring areas. In Georgia, Augus

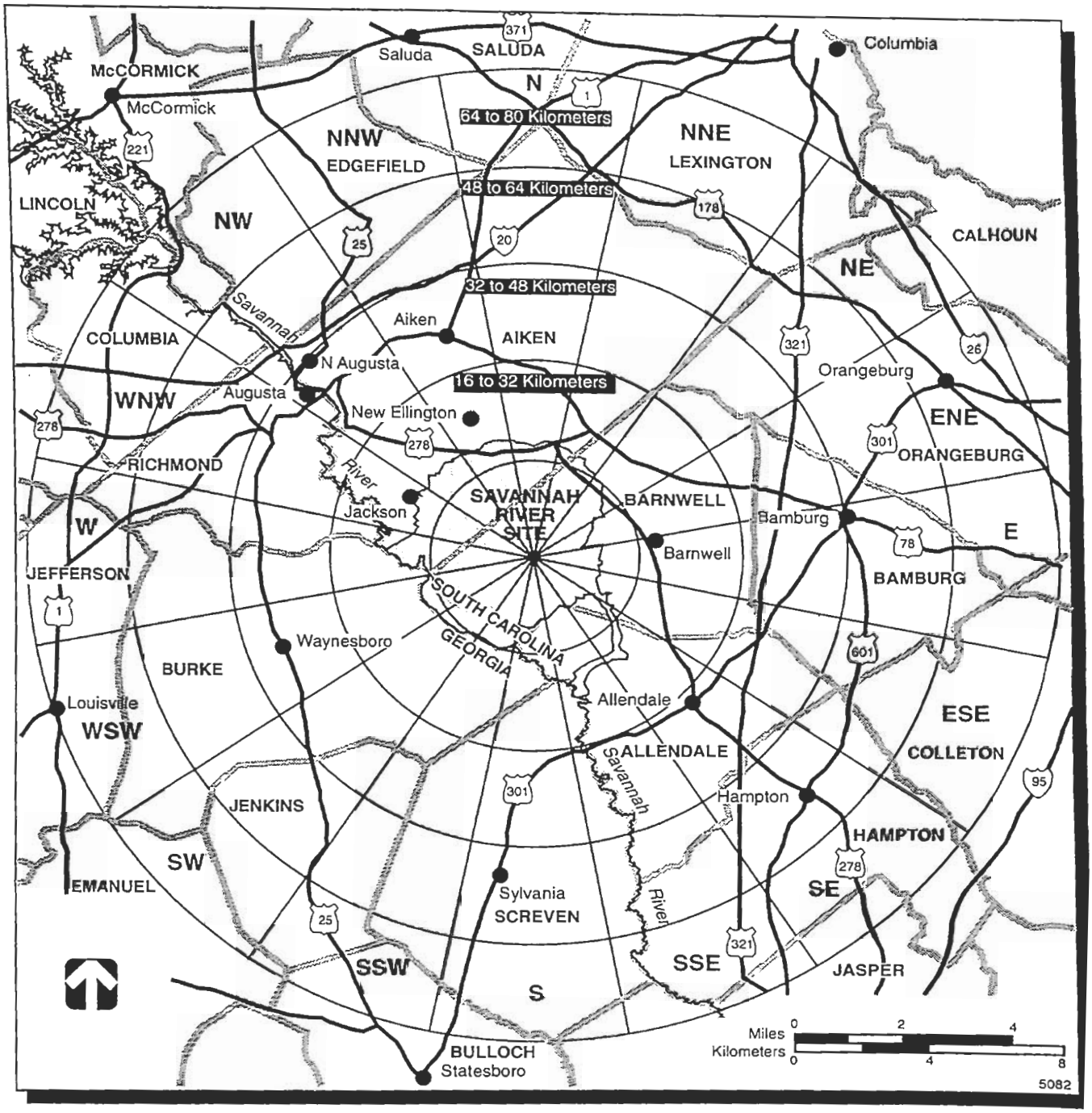
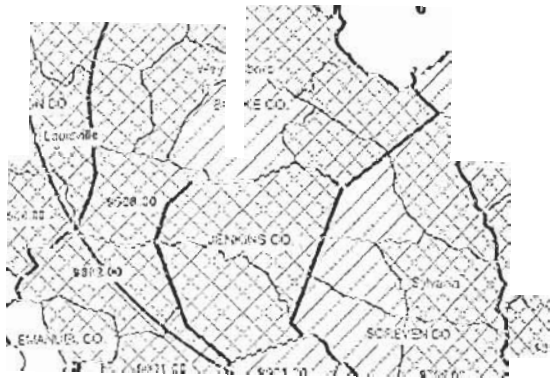


FIGURE 5.3.2.2–1.—*P-Reactor Region of Influence.*


Louisville
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SCREVEN CO

33 percent rate, while Sylvania and Waynesboro had 26 and 34 percent rates, respectively. In South Carolina, Allendale had a 44 percent poverty rate, while Bamberg, Barnwell and Orangeburg had poverty rates of 34, 26, and 25 percent, respectively (GA Cen 1993:Tables 178 and 203; SC Cen 1993:Tables 178 and 203).

Impacts of Storing 20,000 Pits

Because the interim storage of 20,000 pits at the P-Reactor facility would not require any construction activities and because all facility modifications would take place inside existing facilities, impacts to the natural environment would be minimal. Under normal operating conditions, there would be minor increases in air pollutants associated with vehicles used during pit storage activities. Also, a minor increase in particulate matter of aerodynamic diameter less than 10 micrometers concentrations would be expected. These increases are associated with the operation of forklifts which are used to move the pits from the unloading area to the storage area. These impacts are not likely to affect the surrounding population.

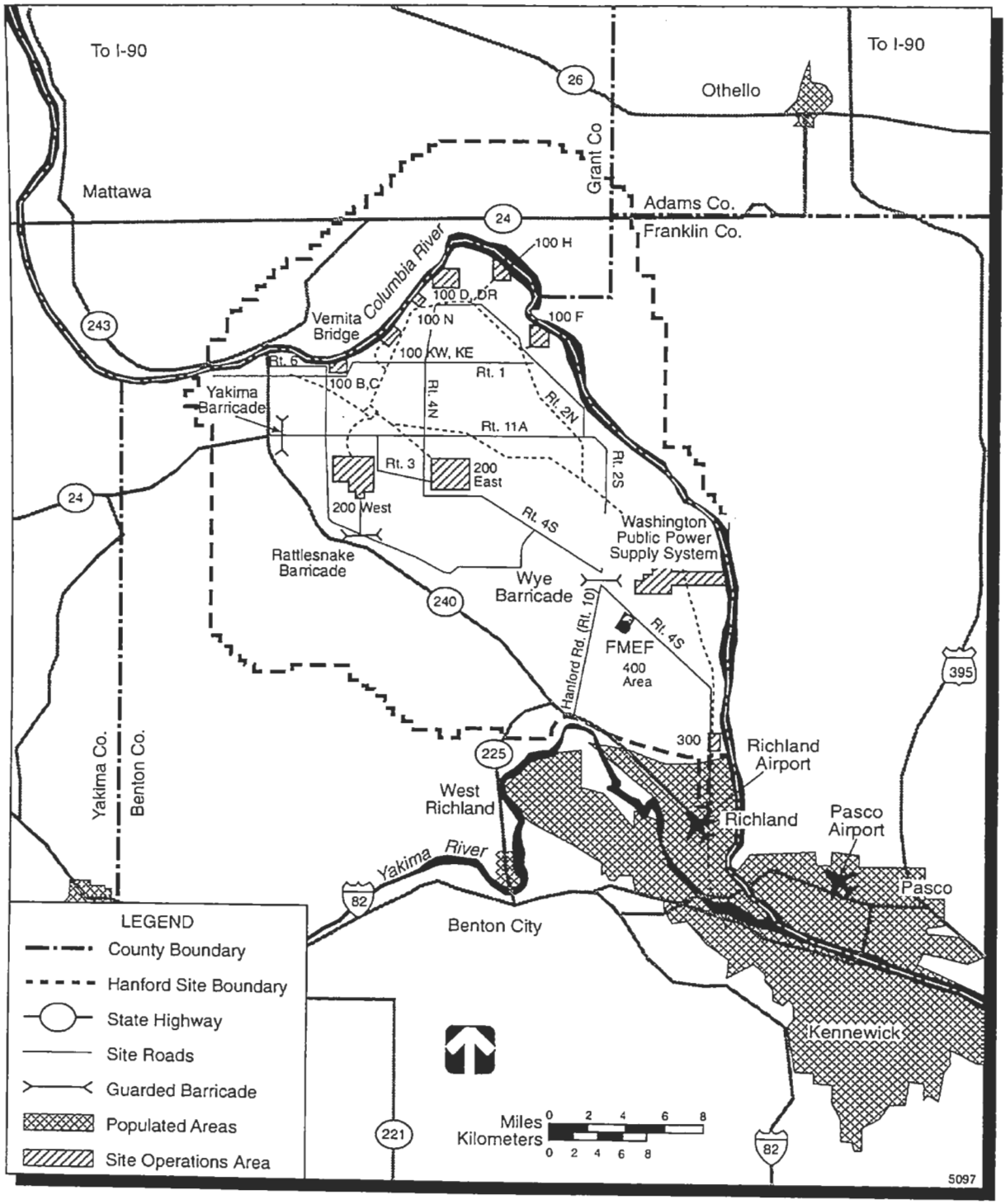
Radiological releases from normal pit storage operations would have no measurable effect on an individual occupying a position near the SRS boundary for an entire year. Levels at the site boundary would be indistinguishable from natural background radiation. No adverse health effects would be expected among the general public, including minority and low-income populations, as a result of normal storage operations.

An abnormal event, such as accidental puncture of the transport container from a forklift, has the potential of exposing the general public tc radiation. The analysis in the section 5.3.2.1 Human Health, indicates that the risk to th public from such an accident would b negligible. With no measurable impacts on th general population, the minority and low income populations would not b disproportionately impacted.

Impacts of Storing 8,000 Pits

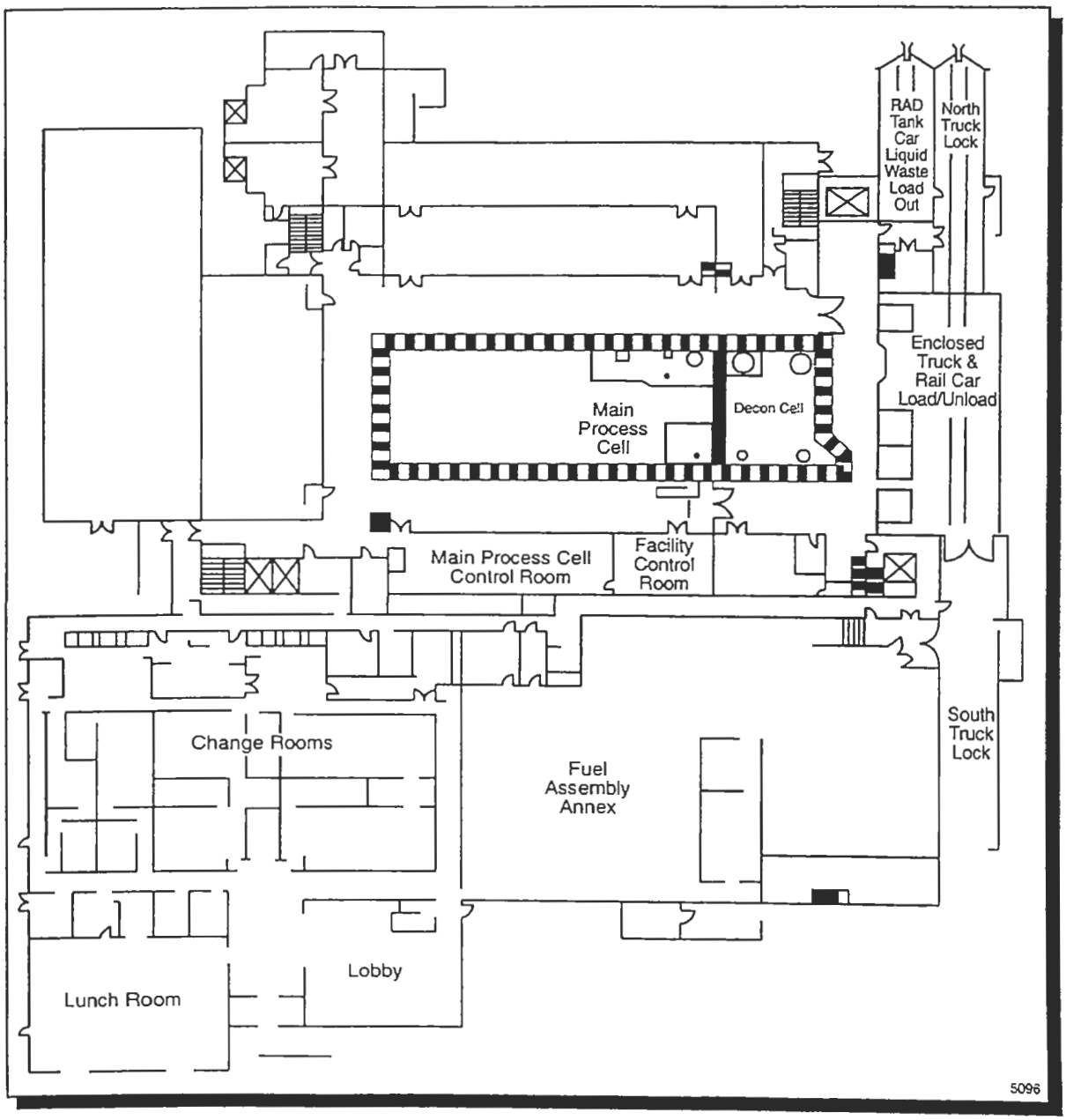
The human health impact of storing 8,000 pits the P-Reactor facility would be lower than tho identified for the storage of 20,000 pits. N significant adverse impacts are expected, a minority and low-income populations would r be disproportionately impacted.

THE HANFORD SITE



SOURCE: DOE 1995I: 3-79, 3-91

FIGURE 5.4–1.—*Location of the Fuels and Materials Examination Facility at the Hanford Site.*



SOURCE: DOE 1995I: F-115

FIGURE 5.4–2.—*Layout of the Fuels and Materials Examination Facility.*

construction involving new land disturbance would be required at this Site. If DOE chooses to store pits at FMEF, a pit placement, retrieval, and inventory system would be implemented. It is expected that an automated or shielded pit movement and inventory system would be developed.

5.4.1 Environmental Resources Not Discussed in Detail

The following environmental resources at the Hanford Site have been assessed. The analyses have shown that the impacts to these resources from the potential storage of pits at the FMEF facility are small enough to warrant only limited discussion. Therefore, these resources are discussed briefly below and will not be addressed further in this section.

5.4.1.1 *Facilities and Infrastructure*

The infrastructure operations at the Hanford Site that could be impacted by or be expected to directly support pit storage operations include security, vehicle and building maintenance, utilities, administration, safety and health protection, and general support (e.g., road maintenance, general stores). Waste management and transportation support are discussed below in sections 5.4.1.10 and 5.4.1.11, respectively.

The direct impacts from the implementation of pit storage would include an increase in the Site's security force. Electrical usage due to interim pit storage (estimated to be 4,110 megawatthours per year) represents a 1.2 percent increase over the Site's 1994 usage of 345,500 megawatthours (DOE 1995s:Table B). Maintenance support and the indirect impacts resulting from pit storage worker requirements (e.g., water, wastewater treatment, and fuel) would increase minimally in comparison to current and historical onsite infrastructure support levels and system capacities. FMEF is not currently being utilized at design levels; therefore, the utility systems generally have excess capacity available to support pit storage activity.

5.4.1.2 *Land Resources*

No land disturbance is projected under the Pit Storage Relocation Alternative for FMEF. The Pit Storage Relocation Alternative does not include any new land uses near the FMEF. Impacts to land use would not be expected.

5.4.1.3 *Geology and Soils*

FMEF is not anticipated to require modifications that would involve land disturbance; therefore, impacts to soils are not anticipated. The risks due to earthquakes were assessed and found to be bounded by other accidents, as discussed in section 5.4.2.1.

5.4.1.4 *Water Resources*

Because of the nature of the pit storage activities, operations at FMEF would not impact surface water or groundwater. The pit storage activities would not use surface waters at the Hanford Site. The sanitary sewer waste from FMEF would be discharged first to an existing septic tank, then to the 400 Area sanitary leaching pond; therefore, no impacts to water quality are expected (DOE 1987:3-111). The wastewater generated by pit storage activity would not have a measurable effect on groundwater quality because of the combined effects of a deep water table (approximately 43 meters [140 feet]), low discharge volumes (less than 50 liters [14 gallons] per minute), and composition and concentrations consistent with existing treated and sanitary wastewater (DOE 1977:2.2-113, 3.2-4).

The water demands of pit storage operations are solely due to use by storage personnel. In comparison with the designed usage at FMEF of

142 million liters (37.5 million gallons) of groundwater from two vicinity wells, and the total quantity of surface water and groundwater used at the Hanford Site annually, the water demands for pit storage are negligible (DOE 1995p:4-65). Flooding at FMEF is not expected because it is located outside of the Probable Maximum Flood and dam failure floodplains.

5.4.1.5 *Air Quality*

The Hanford Site is well within all applicable local, State, and Federal ambient air quality standards (DOE 1994p). The impacts to air quality from normal pit storage operations would be due entirely to vehicle emissions (approximately 150 vehicles per day). The air impacts caused by vehicles involved in pit storage would be negligible relative to the overall vehicular emissions at the Hanford Site.

5.4.1.6 *Acoustics*

At the Hanford Site boundary, away from most facilities, noise from most sources is barely distinguishable above background sources. The only sources of noise that would be associated with pit storage operations would be from transportation vehicles and air conditioning and heating equipment for the occupied areas of the facility. These impacts would be minimal.

5.4.1.7 *Biotic Resources*

The bald eagle (*Haliaeetus leucocephalus*) is the only Federally listed threatened or endangered species that resides on the Hanford Site, although the Aleutian Canada goose (*Branta canadensis leucopareia*) and the peregrine falcon (*Falco peregrinus*) may occur on an incidental basis (DOE 1994r). The use of FMEF for interim storage of pits, would not disturb bald eagle roosting sites on the Hanford Site (DOE 1994p:28). Further, no wetlands at the Hanford Site would be disturbed by the Pit Storage Relocation Alternative (WHC 1986:3.4-8). As a result, impacts to biotic resources are not expected.

5.4.1.8 *Cultural Resources*

No historic, prehistoric, or paleontological sites have been found at or in the immediate vicinity of FMEF at the Hanford Site. Further, no National Register of Historic Places-eligible buildings are located at FMEF (DOE 1994q:4-89). The Pit Storage Relocation Alternative does not involve new land disturbance and would not adversely affect cultural or paleontological resources at the Hanford Site. Therefore, impacts to cultural and paleontological resources would not be expected.

Native American groups have retained traditional secular and religious ties to the region. Members of the Yakama, Umatilla, Warm Springs, and Nez Perce still adhere to the Washane religion, which has its origins on the Hanford Site. The secular and non-secular ties to this portion of the Columbia River Basin could make the entire area potentially eligible for the National Register of Historic Places based on its traditional cultural significance to Native Americans (DOE 1994q:4-80). However, the area containing FMEF has been completely disturbed by previous facility construction, and no impact to Traditional Cultural Properties is anticipated from the Pit Storage Relocation Alternative.

5.4.1.9 *Socioeconomic Resources*

Approximately 150 additional personnel (including 120 security personnel) would be required for the interim storage of pits at the Hanford Site. This number represents less than 1.0 percent increase in the total Hanford Site workforce. Most of the workers can be hired locally; therefore no significant Site or regional population and workforce increases are anticipated. According to the 1990 Census, 150

workers represent 0.1 percent of the employed workforce within the Hanford Site Region of Influence (WA Cen 1993:Table 145). No socioeconomic impacts would be anticipated.

5.4.1.10 *Waste Management*

Currently, the Hanford Site manages high-level waste, spent nuclear fuel, plutonium materials, mixed transuranic waste, transuranic waste, mixed waste, low-level waste, hazardous waste, and nonhazardous waste in accordance with the requirements of a number of Federal and State regulations, permits obtained under these regulations, and DOE orders. These requirements are primarily under the authority of the Environmental Protection Agency, DOE, and the Washington State Department of Ecology.

The Hanford Site generated approximately 2,300 cubic meters (3,000 cubic yards) of low-level waste, approximately 2,000 cubic meters (2,600 cubic yards) of mixed waste, and approximately 700 cubic meters (900 cubic yards) of hazardous waste in 1992 (DOE 1994d:248). The pit storage operations would generate less than 1 cubic meter (1.3 cubic yards) of mixed, low-level, and hazardous waste. This amount of waste would not impact the current waste management at the Hanford Site.

5.4.1.11 *Intrasite Transportation*

The Hanford Site onsite road system consists of a number of rural highway routes (see Figure 5.4–1). The majority of onsite travel, however, occurs on Route 4 and Route 11A, which are barricaded at the Yakima and Wye barricades, respectively, to control public access. Public Highways 240 and 24 provide access to the Site from the north and west up to the security control points at the Yakima and Rattlesnake Barricades. Although some roads within the Hanford Site are public access roads, the DOE would control access during passage of Safe Secure Tractor-Trailer (SST) convoys. Because a release of plutonium from an intersite pit shipment would require a severe accident (e.g., an accident with a fuel tanker or a train [see section 4.16.4.2]), the controlled transportation environment within the Hanford Site does not pose a significant threat to pit shipments. Consequently, the contribution to overall intersite transportation accident risk from onsite transport is negligible.

5.4.1.12 *Aircraft Accidents*

The Federal Aviation Administration (FAA) maintains a Very High Frequency Omni-Directional Radio (VOR) navigation aid at the Tri-Cities Airport. This VOR is used for en route navigation along airways as well as for instrument approaches to the airport. Several Federal airways pass in the proximity of FMEF. However, the FAA reports that these routes have low usage (WHC 1991). There are no military installations or training routes that would place military aircraft in the vicinity of FMEF.

There are five airports and one landing strip in the vicinity of FMEF. The Tri-Cities Airport, the major commercial airfield in the area is approximately 27 kilometers (17 miles) southeast of FMEF. The airport's two runways are used by commercial (air carrier and air taxi), military, and general aviation aircraft. In 1994, the Tri-Cites Airport had 81,867 aircraft operations (take-offs and landings). Table 5.4.1.12–1 summarizes the total number of airfield operations at the Tri-Cities Airport (PC 1996j).

The closest airport, Richland Airport, approximately 13 kilometers (8 miles) southeast of FMEF, has three runways used only by general aviation aircraft. Similarly, Vista Field in Kennewick, approximately 26 kilometers (16 miles) south-southeast, has two runways, also used by general aviation aircraft. Beardsley Field, near Prosser, approximately

TABLE **5.4.1.12–1.**—*Tri-Cities Airport Operations for 1994*

AIRCRAFT TYPE	NUMBER OF OPERATIONS
Air Carrier	2,645
Air Taxi	21,807
Military	2,597
General Aviation	54,818
Total Airfield Operations	81,867

Source: (PC 1996j)

! kilometers (26 miles) southwest, has one nway used only by general aviation aircraft. innyside Airport is located 48 kilometers (30 iles) west-southwest and has one runway used general aviation aircraft only. There is an nnamed landing strip near Horse Heaven Hills, proximately 32 kilometers (20 miles) south-uthwest, which has one runway used only by neral aviation aircraft.

! four general aviation airports and the ding strip are outside the probability density ction boundary for general aviation aircraft d were therefore not included in the aircraft sh analysis. Only small military aircraft in landing mode at the Tri-Cities Airport and n-airport (in-flight) aircraft were included in analysis as required by the Draft DOE ndard (DOE 1996g). Further details on these facilities are contained in volume II, ndix E.

EF was modeled conservatively as a facility h a length of 98 meters (320 feet), a width of meters (155 feet), and a height of 21 meters feet). (DOE 1994bb). Using the Draft DOE ndard for determining the probability of raft crashes and 1994 data from the FAA, frequency of hitting FMEF was calculated as $\times 10^{-6}$ for all types of aircraft (DOE 1996g). ould be noted that the frequency calculation esents a conservative upper bound. Since frequency is greater than 10^{-7}, in ordance with the Draft DOE Standard, further analysis was required. A local response structural analysis was performed according to the Draft DOE Standard for the facility with a wall thickness of 122 centimeters (48 inches).

The analysis was performed for the maximum penetrator missile for each of the aircraft categories mentioned in section 4.15.2, except for helicopters. None of the eight aircraft missiles was capable of penetrating the facility. Therefore, since this frequency is 0, in accordance with the Draft DOE Standard, no further analysis was required. Further details of the frequency of hitting FMEF and the frequency of releasing material are contained in volume II, appendix E.

5.4.2 Resources Discussed in Detail

5.4.2.1 *Human Health*

The basic approach used in assessing human health impacts is first to identify the affected environment and establish a baseline representing the risk from current operations. Changes in this baseline risk resulting from potential pit storage activities are then examined. Impacts from both normal operations and potential accidents are estimated.

Assessing the human health risk impact from potential accidents resulting from the storage of pits in FMEF at the Hanford Site involves a risk screening process. The first step in this process is to identify a broad spectrum of potential accident scenarios. The second step in the process uses screening techniques to identify the specific scenarios that dominate risk (i.e., scenarios that contribute an appreciable fraction of the total risk), where risk is calculated as the product of frequency and consequence. Rigorous consequence evaluations are only performed for the identified risk-dominant scenarios.

Two types of accident consequences are examined:

- Worker and public exposure.
- The probability of an accident causing fatal cancer in a worker or the public.

If DOE chooses to relocate pits to the Hanford Site, two aspects of relocation would contribute to potential environmental impacts. These impacts are associated with:

- Transferring pits within FMEF from the transporter to their storage location inside the facility.
- Storage itself (i.e., potential impacts resulting from having the pits reside inside the facility).

Each time pits are transferred within the facility from the transporter to their storage location, there is a small probability that an accidental release could occur due to a handling accident. In addition, the transfer of pits from the transporter to their storage location would result in radiological exposures to involved workers.

Affected Environment

The release of radioactivity and toxic chemicals to the environment from a DOE facility is an important issue for onsite workers and the public. Since the human environment contains many sources of radioactivity and toxic chemicals, it is essential to understand the sources of these substances and how effectively they are controlled.

Table 5.4.2.1–1 summarizes the major sources of radiation exposure in the vicinity of the Hanford Site. A person in the State of Washington has an average annual cancer probability of 1.4×10^{-3} (DOE 1994i:4-110). Using nominal fatal cancer risk factors and the data in Table 5.4.2.1–1, it is calculated that fatal cancers attributable to environmental radioactivity released from the Hanford Site constitute less than one ten-thousandth of one percent of the average yearly fatal cancer probability in the State of Washington (DOE 1994l:4-20).

Figure 5.4.2.1–1 depicts the offsite population within an 80-kilometer (50-mile) radius of FMEF at the Hanford Site. Wind speeds and directions in the Hanford Site vicinity are presented in Figure 5.4.2.1–2. The prevailing wind direction is from the south and southwest in the summer months and from the northwest in the winter months.

Impacts of Facility Upgrades

Numerous facility modifications are necessary before FMEF is suitable for pit storage. They include plugging cell penetrations, moving doors, and installing vault doors and electronic equipment. An additional upgrade required is to modify FMEF to accept Stage Right transfer and storage equipment. However, these are standard industrial operations that do not expose workers to any special hazards (e.g., radionuclides, toxic chemicals, or high explosives). No significant impacts from facility upgrades are anticipated.

Impacts of Storing 20,000 Pits

Hanford Site is not being considered for the storage of 20,000 pits; hence, there are no impacts for this option.

Impacts of Storing 8,000 Pits

Unloading operations would result in radiological exposure to cargo handlers. Based on conservative calculations made for handling of pits at Pantex Plant, the worker doses from unloading of 2,000 pits per year are estimated to be less than 11 person-rem per year or 108 person-rem for the unloading of 8,000 pits (the maximum number of pits which may be stored at FMEF). Once removed from the SSTs, pits would be transferred within FMEF for storage. Pit transfers within FMEF would result in radiological exposures to onsite workers

TABLE 5.4.2.1–1.—*Major Sources of Radiation Exposure in the Vicinity of the Hanford Site*

SOURCE OF EXPOSURE	DOSE TO AVERAGE INDIVIDUAL (mrem/yr)[1]	PERCENTAGE OF TOTAL EXPOSURE
NATURAL BACKGROUND RADIATION		
Cosmic and external terrestrial radiation	78	
Internal terrestrial	39	
Radon in home	200	
Total natural	317	83.2
MEDICAL RADIATION		
Diagnostic x-rays	39	
Nuclear medicine	14	
Total Medical	53	13.9
OTHER SOURCES		
Weapons test fallout	<1	
Consumer and industrial products	10	
Air travel	1	
Nuclear fuel cycle	<1	
Hanford Site - environmental radioactivity	.002	
Total other	11	2.9
Total - all sources	381	100

[1]Effective dose equivalent.
Sources: NCRP 1987:15, 53; DOE 1992e:139

dling the pits. The transfer of pits would ılt in worker doses of less than 2 person-rem year for handling 2,000 pits and about 5 son-rem for the placement of 8,000 pits.

combined worker dose from unloading and age of 8,000 pits at FMEF would be 113 on-rem distributed over the 30 people ctly involved in material handling. ıming that the same 30 people continue to lle 8,000 pits over a period of 4 years and g a dose-to-risk conversion factor of 10^{-4} latent cancer fatality (LCF) per person- there would be an additional 0.04 LCF in group due to radiological exposure from pit lling.

probability of LCFs from all causes in the ral population is estimated at 20 percent. h implies that 6 of 30 workers would develop a fatal cancer from all other causes. With an additional 0.04 LCF from pit handling, the total risk of latent cancers among workers at the FMEF site would increase by 0.7 percent.

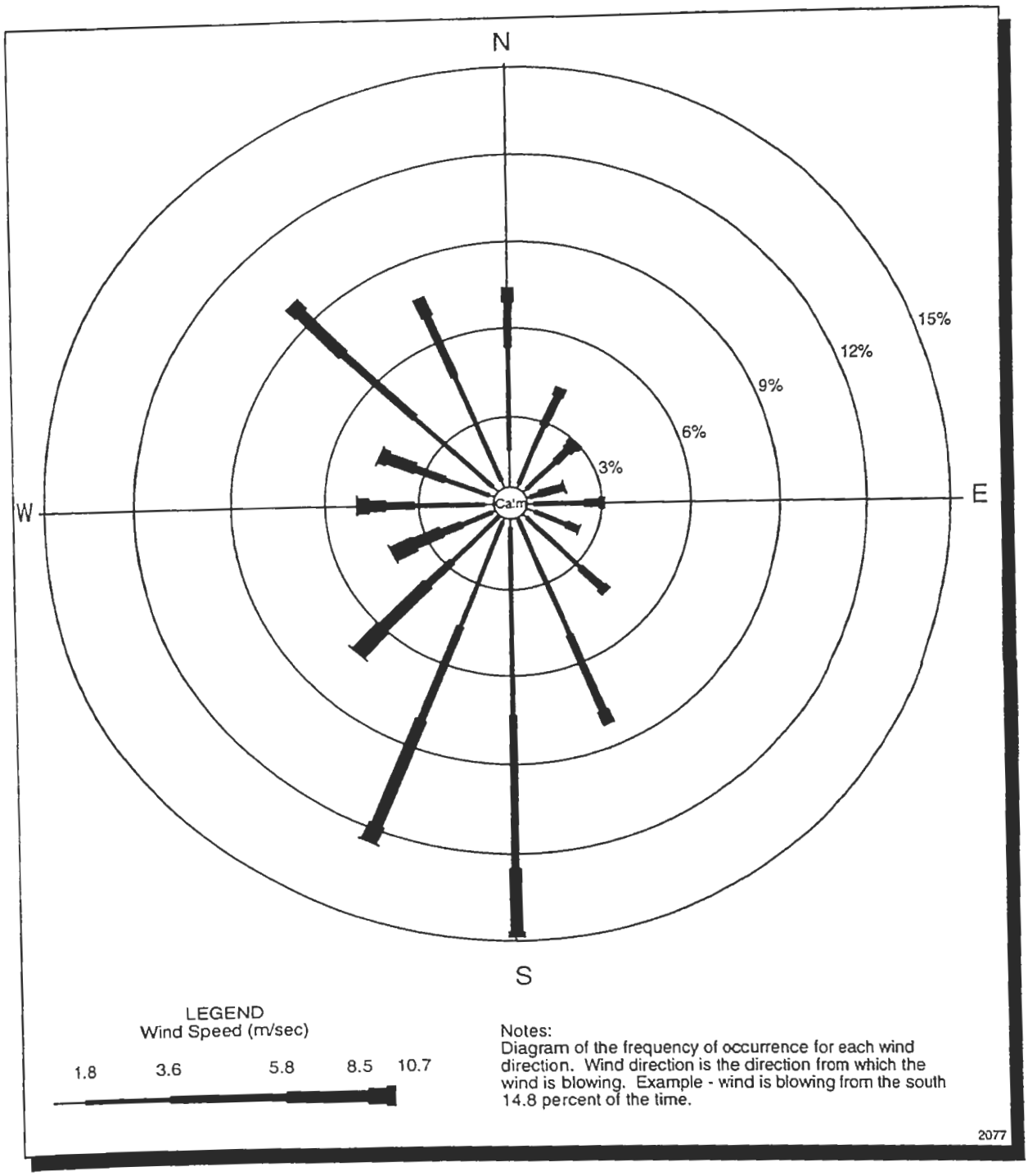
Storage of 8,000 pits could be accomplished at FMEF. Pit container inventories at the Hanford Site are expected to be performed using either shielded or automated techniques and equipment. Consequently, these normal operations are not expected to result in any significant radiological exposure to workers.

Other storage activities that may occur within the time frame evaluated in this EIS include:

- Restacking a limited number of pits to comply with design laboratory temperature requirements.

20,12
97
Yakama
Indian
Reservation
291
WSW

32,427
Pasco
60,368



SOURCE: PC 1995f

FIGURE 5.4.2.1–2.—*Wind Direction and Speed at the Hanford Site, Washington, 1994.*

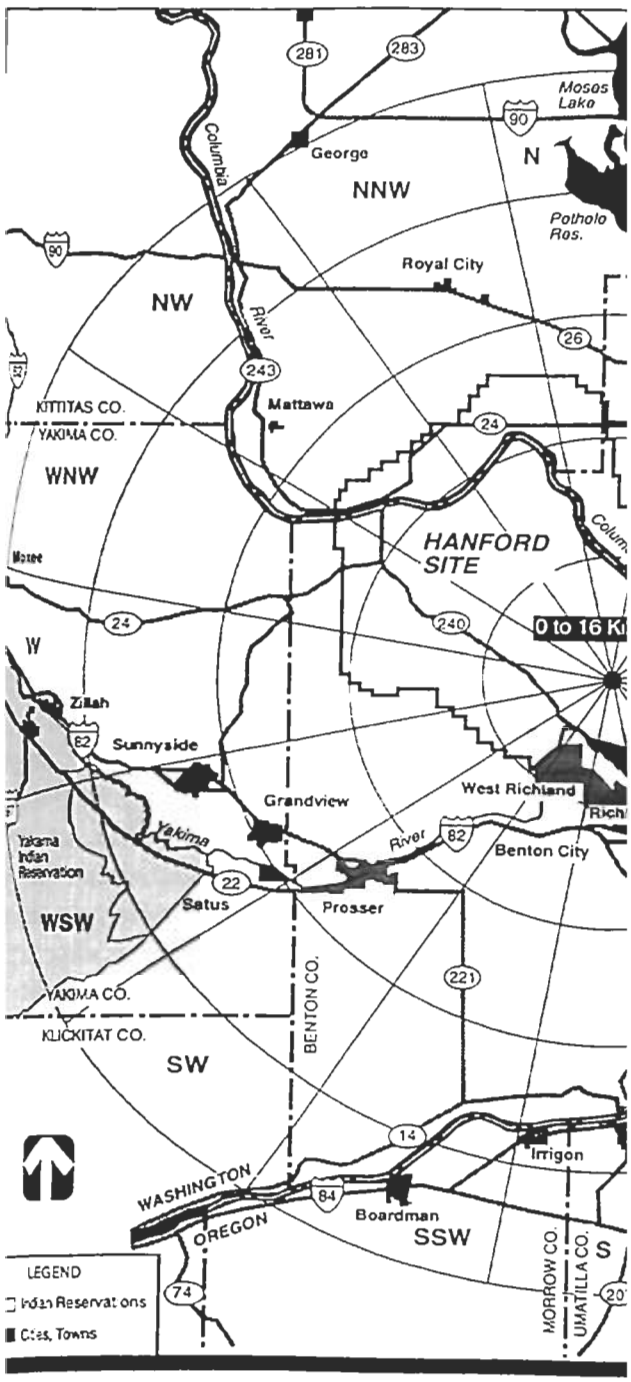


FIGURE 5.4.2.2–1.—*The Fue*
Facility Regio

the population; Hispanics were the second largest group with 22 percent; and Asians, Pacific Islanders, American Indians, and Blacks accounted for the remaining 3 percent (UN 1995).

The largest concentration of the population in the FMEF ROI is in the Tri-Cities, which accounts for 94,807 or 34.6 percent of the total ROI population in 1990. Outside this urban concentration, two communities had populations of 10,000 or more. These were: Sunnyside (11,238 persons), located approximately 50 kilometers (32 miles) west of FMEF; and Moses Lake (11,235 persons), located approximately 72 kilometers (45 miles) north of FMEF. About 20 communities account for an additional 58,800 persons and the remaining 43,484 persons live in rural areas of the FMEF ROI. A portion of the Yakama Indian Reservation is located in the southwestern part of the ROI. Of the 26,961 persons counted on this Reservation in 1990, 6,110 were American Indians (WA Cen 1992:Tables 6 and 17; OR Cen 1992 Table 6).

Minority Population. Figure 5.4.2.2–2 shows 1990 Census tracts within the FMEF ROI. The tracts are shaded if minority populations comprised 25 percent or more of the total population in 1990 or if 25 percent or more of the persons in a tract were below the poverty level based on their incomes in 1989. The 25 percent threshold levels for minority or low-income persons are based on the working definitions contained in the notice of the Environmental Protection Agency's Office of Environmental Justice (59 FR 192).

The census tracts with 25 percent or more minority population are located north and southwest of the Site at a minimum distance of 16 kilometers (10 miles) from FMEF. Four tracts in Pasco and one in Kennewick also have minority populations greater than 25 percent. A number of tracts with primarily white populations are located closer to FMEF than the tracts with minority populations (UN 1995).

Low-Income Population. Low-income population tracts in the FMEF ROI are not as widely distributed as the tracts with minority populations. Concentration of low-income population is to the northwest and southwest of FMEF at a distance of more than 32 kilometers (20 miles). All four tracts in Pasco and one in Kennewick also have greater than 25 percent population below poverty level. Forty-six percent of American Indians in the Yakama Reservation had incomes below the poverty level (UN 1995; WA Cen 1992).

Impacts of Storing 20,000 Pits

FMEF is not being considered for storing 20,000 pits; therefore, there would be no impacts for this option.

Impacts of Storing 8,000 Pits

Because the interim storage of pits at FMEF would not require any construction activities and because all facility modifications would take place inside existing facilities, impacts to the natural environment would be minimal. Under normal operating conditions, there would be minor increases in air pollutants associated with vehicles used during pit storage activities. Also, a very minor increase in particulate matter of aerodynamic diameter less than 10 micrometers concentrations would be expected. These increases are associated with the operation of forklifts within FMEF that are used to move the pits from the unloading area to the storage area.

These impacts are not likely to effect the surrounding population. Radiological releases from normal pit storage operations would have no measurable effect on an individual occupying a position near the Hanford Site boundary for an entire year. Levels at the Site boundary would be indistinguishable from natural background radiation. No adverse health effects would be expected among the general public, including minority and low-

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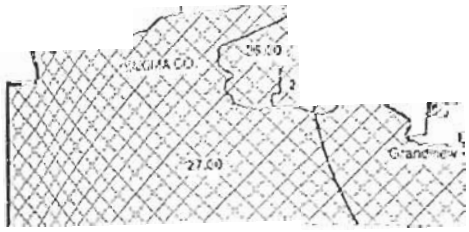
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income populations, as a result of normal storage operations.

An abnormal event, such as accidental puncture of a pit storage container by a forklift or seismic event, has the potential of exposing the general public to radiation. The analysis in section 5.4.2.1, Human Health indicates that the risk to the public from such accidents would be negligible. With no measurable impacts on the general population, the minority and low-income populations would not be disproportionately impacted.

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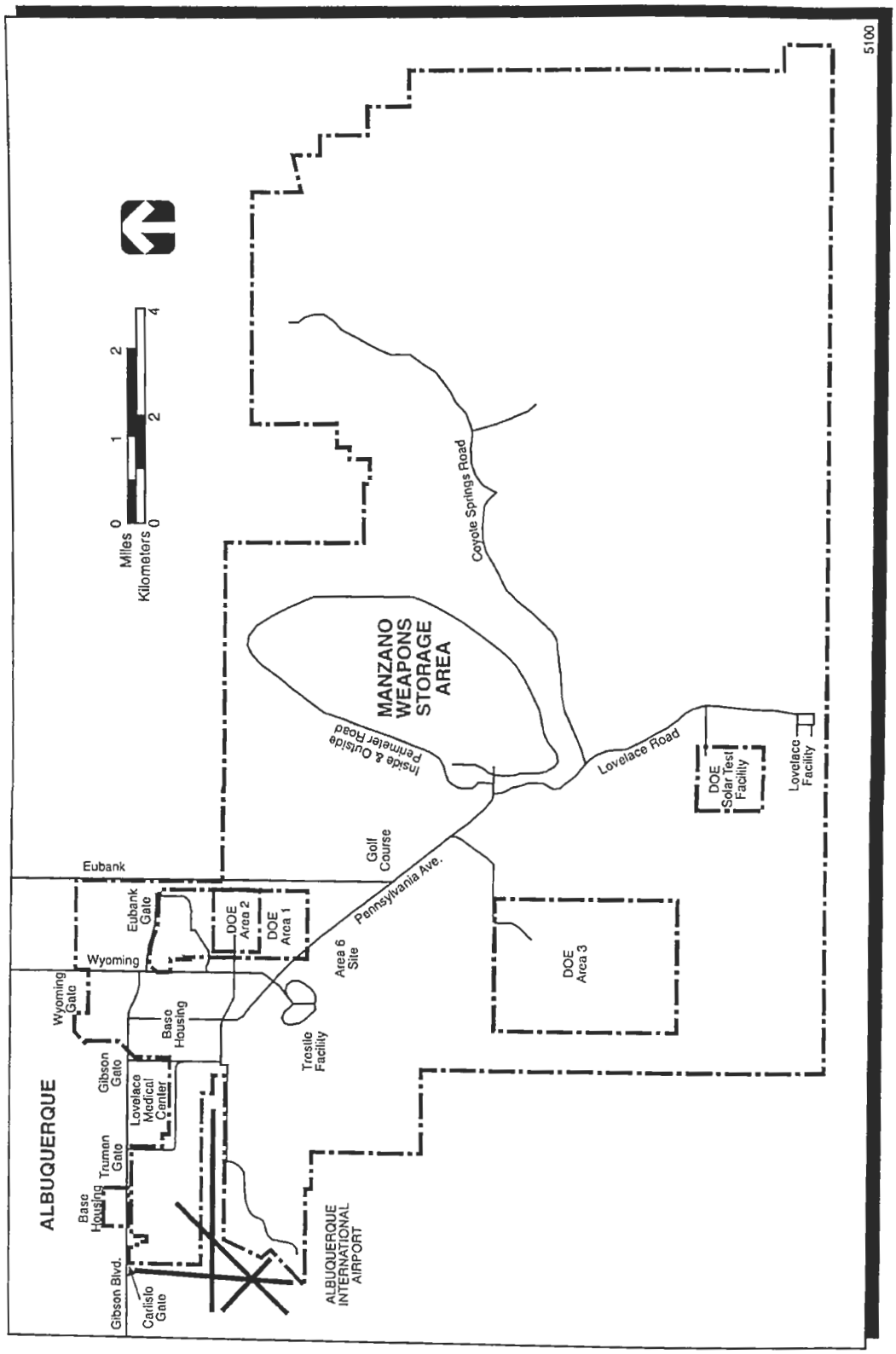
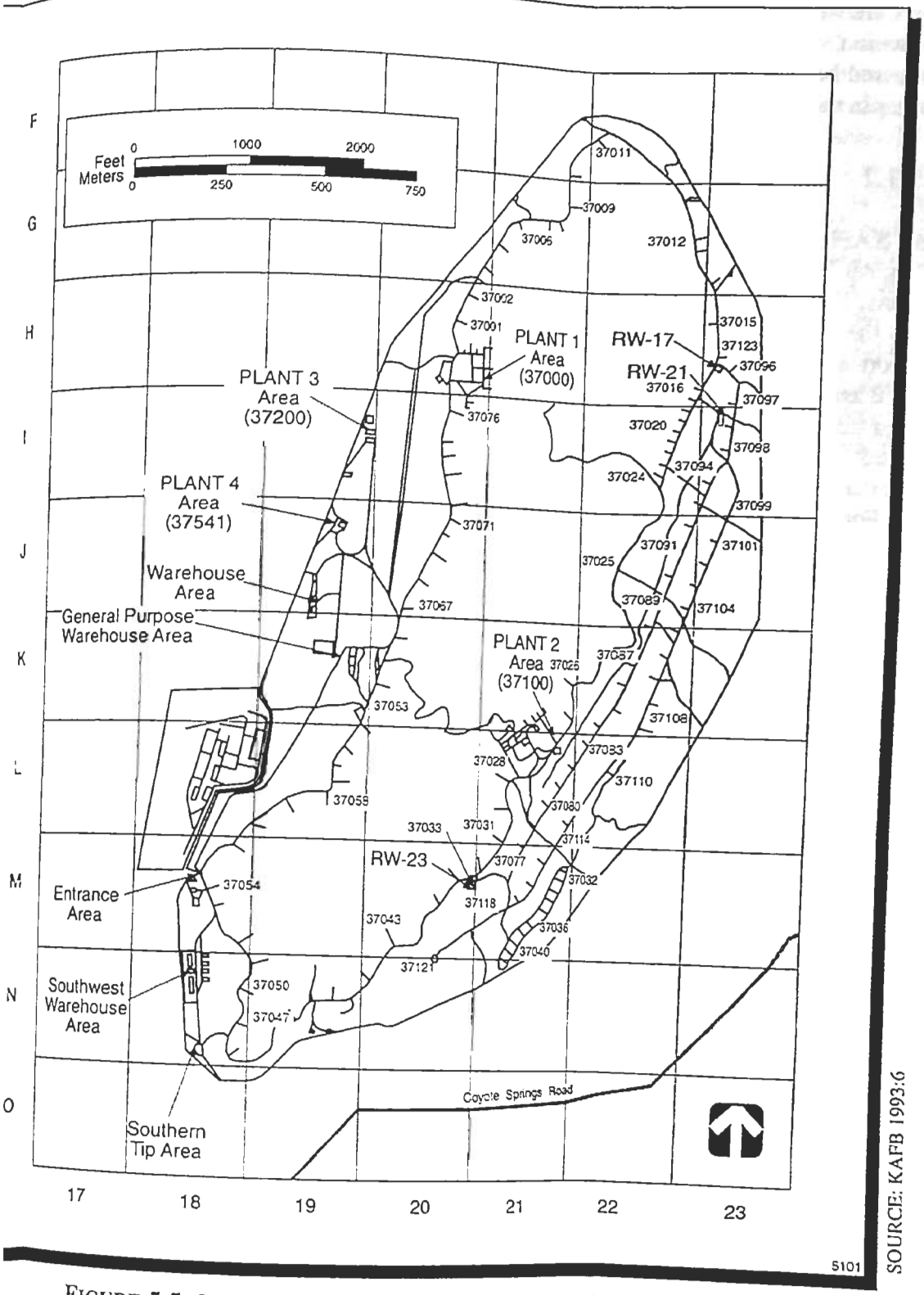


SOURCE: KAFB 1993:16

FIGURE 5.5–1.—*Albuquerque International Airport and the Manzano Weapons Storage Area at Kirtland Air Force Base, New Mexico.*



SOURCE: KAFB 1993:6

FIGURE 5.5–2.— *Layout of the Manzano Weapons Storage Area at Kirtland Air Force Base.*

WSA are small enough to warrant only limited discussion. Therefore, these resources are discussed briefly below and are not addressed further in this section.

5.5.1.1 *Facilities and Infrastructure*

The KAFB infrastructure is managed by the 377th Air Base Wing and includes support to all tenants. As the Manzano WSA is not a DOE site, the exact breakdown of infrastructure support activities that would be performed by KAFB and DOE personnel has yet to be worked out in detail. Should this site be selected for interim pit storage, a Memorandum of Understanding between the Department of the Air Force and DOE would be developed detailing these duties. The infrastructure operations at KAFB that could be impacted by or be expected to directly support pit storage operations include security, vehicle and building maintenance, safety and health protection, utilities, administration, and general support (e.g., cafeteria, general stores). Waste management and transportation support are discussed below and in sections 5.5.1.10 and 5.5.1.11, respectively.

The direct impacts from the implementation of pit storage would include a small increase in the site's security force. Electrical usage due to interim pit storage (estimated to be 4,110 megawatthours per year) represents a 0.8-percent increase over the site's fiscal year 1993 usage of 490,000 megawatthours and 0.4 percent of the fiscal year 1993 system capacity of 1,095,000 megawatthours (USAF 1993a:3-17). Maintenance support and indirect impacts resulting from pit storage worker requirements (e.g., water, wastewater treatment, and fuel) would increase minimally in comparison to the current and historical onsite infrastructure support levels and system capacities. The Manzano WSA is not currently being utilized at historical or design levels; therefore, the utility systems supporting this facility generally have excess capacity available to support pit storage activity.

5.5.1.2 *Land Resources*

The Manzano WSA is currently being used in part for storage of a variety of items such as furniture and document boxes. These items can easily be removed and space made available for storage of pits if such a decision were made. The use of some storage magazines for the interim storage of 8,000 to 20,000 pits would not change the array of potential storage materials for which these weapon storage magazines are designed. Additionally, no land disturbance is projected under the Pit Storage Relocation Alternative as it pertains to the Manzano WSA. Impacts to land use would not be expected.

5.5.1.3 *Geology and Soils*

The only aspects of geology and soils that could be affected by or have an effect on the implementation of interim pit storage at the Manzano WSA are the risks associated with earthquakes. The earthquake risk was assessed and found to be bounded by other accidents, as discussed in section 5.5.2.1. The Manzano WSA is not anticipated to require upgrades that would involve land disturbance; therefore, impacts to soils are not anticipated.

5.5.1.4 *Water Resources*

Because of the nature of the pit storage activities, operations at the Manzano WSA would not impact surface water or groundwater. The pit storage activities would not use surface waters at the Manzano WSA. The Manzano WSA has several springs and seeps. Four springs are located on the mountains that make up the Manzano WSA (USCOE 1995c:22, 23, 27). Some magazines show evidence of water intrusion (KAFB 1993:48). These magazines were designated as unsuitable for interim pit

›rage and would not be used. The sanitary wer waste from the Manzano WSA would be :charged to approved septic systems. The ıstewater would not have a measurable affect groundwater quality because of the nbined effects of a deep water table (15 to 30 ters [50 to 100 feet]), low additional charge volumes, high evaporation rates, and ›mposition and concentration consistent with ıted and sanitary wastewater.

: water demands of pit storage operations are ly due to use by storage personnel. The er demands would be less than historical ;e at the Manzano WSA and negligible in parison to the 6.4 billion liters (1.7 billion ›ns) used annually at KAFB (USAF 1994:3- The Manzano WSA is located outside of 100-year and 500-year floodplains (USAF ').

1.5 *Air Quality*

:ano WSA is in an attainment area for ı monoxide (CO). A more detailed air y analysis for this site is provided in n 5.5.2.3.

.6 *Acoustics*

najor sources of noise within KAFB e blasting and explosives testing, aircraft ions, and equipment and machine ons. The only additional sources of noise ould be associated with pit storage ons would be from transportation s. These impacts would be minimal.

' *Biotic Resources*

:erally listed threatened or endangered ıd animal species have been reported : Manzano WSA, although the peregrine *Falco peregrinus*) and the bald eagle :tus *leucocephalus*) may be occasional nigrants (USAF 1994:3-8, 3-9). The burrowing owl (*Athene cunicularia hypergea*),
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paraphernalia (Argonne 1995:1-1, 1-2). The Pit Storage Relocation Alternative is not expected to adversely affect these concerns.

5.5.1.9 *Socioeconomic Resources*

Approximately 150 additional personnel (including 120 security personnel) would be required to operate the storage magazines at the Manzano WSA if pit storage activities are moved to this facility. This number represents less than a 0.8 percent increase in the total Federal workforce at KAFB. Most of these workers can be hired locally; therefore the increase to the KAFB workforce or the regional population would not be significant. According to the 1990 Census, 150 workers represent 0.06 percent of the of the workforce employed within the KAFB Region of Influence (NM Cen, 1993:Table 145). No socioeconomic impacts would be anticipated.

5.5.1.10 *Waste Management*

For the purpose of this assessment, it is assumed that DOE would manage the wastes from pit storage at the Manzano WSA. Waste management figures from SNL are used for comparison. SNL manages mixed transuranic waste, transuranic waste, mixed waste, low-level waste, hazardous waste, and nonhazardous wastes in accordance with the requirements of a number of Federal and State regulations, permits obtained under these regulations (e.g., New Mexico unilateral FFCA order), and DOE orders. These requirements are primarily under the authority of the Environmental Protection Agency, DOE, and the New Mexico Environment Department.

SNL generated an estimated 90 cubic meters (110 cubic yards) of low-level waste and an estimated 1.7 cubic meters (2.2 cubic yards) of mixed waste in 1994. In addition, SNL currently stores approximately 70 cubic meters (91 cubic yards) of mixed waste onsite (DOE 1995:6-4; DOE 1993d:3-71). The new Radioactive Mixed Waste Management Facility for handling these wastes is due to become operational in the near future. SNL generated 751 cubic meters (198,450 gallons) of liquid and 127 cubic meters (166 cubic yards) of solid hazardous waste in 1991 (DOE 1993d:3-71). The pit storage operations would generate less than 1 cubic meter (1.3 cubic yard) of mixed, low-level, and hazardous wastes. Compared to the amounts of waste generated and stored at SNL, the wastes generated by the pit storage activities would be minimal and would not impact the current waste management at SNL.

5.5.1.11 *Intrasite Transportation*

Interstate 40 and Interstate 25 provide access to the Albuquerque metropolitan area. Access to KAFB from Interstate 40 is provided from either the Wyoming or Eubank gate entrances (Figure 5.5–1). Access to KAFB from Interstate 25 is via Gibson Boulevard.

The onsite road system at KAFB consists of paved streets and access roads. The Manzano WSA is located on the east side of KAFB. Access to the Manzano WSA is via Pennsylvania Avenue. The Manzano WSA is surrounded by fencing. Access to facilities within the area is provided via a ring road which encircles the mountain (Figure 5.5–1). Traffic within the KAFB boundaries is strictly controlled and the roads are not open to public traffic. Base personnel traffic would be controlled as Safe Secure Tractor Trailer (SST) convoys pass through the base roads. Because a release of plutonium from an intersite pit shipment would require a severe accident (e.g., an accident with a fuel tanker or a train [see section 4.16.4.2]), the controlled transportation environment at KAFB does not pose a significant threat to pit shipments. Consequently, the contribution to overall intersite transportation accident risk from onsite transport is negligible.

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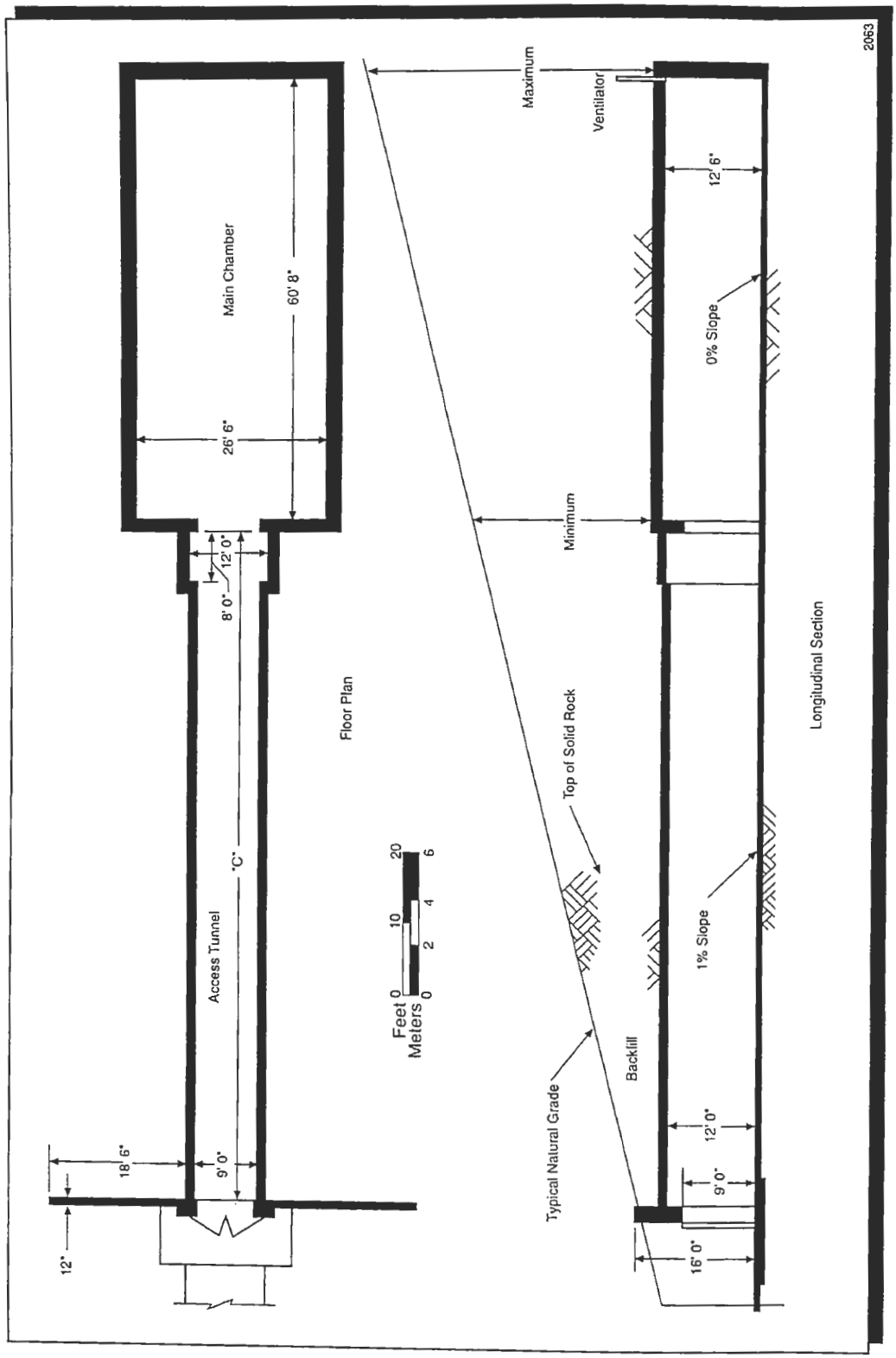


SOURCE: Manzano 1994

FIGURE 5.5.1.12–1.—*Type D Storage Facility at the Manzano Weapons Storage Area.*

pe D facilities are tunneled into the untainside, which provides significant earth rburden protection from penetrating aircraft. many as 35 magazines have overburden ater than 9 meters (30 feet) and are ntially available for pit storage.

the 20,000-pit storage option, oximately 25 Type D magazines would be ed. For the 8,000-pit storage option, oximately 10 Type D magazines would be ed. The frequency of an aircraft impact at lanzano WSA is relatively high compared other potential storage sites. However, the overburden of Type D magazine provides lete protection against potential damage aircraft impacts.

lanzano WSA, the potential exists for nes overflying the area to be carrying ntional bombs. An analysis was med to determine whether expected bomb (one to four 909-kilogram [2,000-pound]) could damage the Manzano WSA e magazines in the event of an airplane With the minimum overburden cover of ers (30 feet) of granite and earth, the ines can not be damaged by any able aircraft events (PC 1995e).

he Draft DOE Standard for determining bability of aircraft crashes and 1994 data e FAA, the frequency of hitting one of Type D magazines was calculated as $)^{-5}$ for all types of aircraft (DOE 1996g). d be noted that the frequency calculation its a conservative upper bound. Since equency is greater than 10^{-7}, in nce with the Draft DOE Standard, nalysis was required. A local response l analysis was performed according to t DOE Standard for the facility with a 30-foot) overburden. The analysis was d for the maximum penetrator missile of the aircraft categories mentioned in .15.2, except for helicopters. None of ft missiles was capable of penetrating ity. Since this frequency is 0, in accordance with the Draft DOE Standard, no further analysis was required. Further details of the frequency of hitting a magazine and the frequency of releasing material are contained in volume II, appendix E.

5.5.2 Resources Discussed in Detail

5.5.2.1 *Human Health*

The basic approach used in assessing human health concerns is to first identify the affected environments and establish a baseline that represents the risk from current operations. Changes in this baseline risk resulting from the Pit Storage Relocation Alternative are then examined. Impacts from both normal operations and potential accidents are estimated.

Assessing the human health risk impact from potential accidents that result from the relocation of pits to KAFB and storing them in the Manzano WSA involves a risk screening process. The first step in this process is to identify a broad spectrum of potential accident scenarios. The second step in the process uses screening techniques to identify the specific scenarios that dominate risk (i.e., scenarios that contribute an appreciable fraction of the total risk). Finally, risk is calculated as the product of frequency and consequence. Rigorous consequence evaluations are only performed for the identified risk-dominant scenarios.

Two types of accident consequences are examined:

- Worker and public exposure.
- The probability of the accident causing fatal cancer in a worker or the public.

If DOE chooses to relocate pits to KAFB, two aspects of this relocation contribute to a potential for environmental impacts. They are the impacts associated with:

ioactivity data for Manzano/Sandia in Table .2.1-1, it is calculated that fatal cancers ibutable to environmental radioactivity ased in the vicinity of the Manzano WSA SNL constitute an extremely small fraction 0.01 percent) of the average yearly fatal er probability in the State of New Mexico ter 1995).

re 5.5.2.1–1 depicts the offsite population in an 80-kilometer (50-mile) radius of the zano WSA. Wind speeds and directions in Manzano WSA vicinity are presented in e 5.5.2.1-2. Winds are predominantly erly during the summer and northerly g the winter.

cts of Facility Upgrades

is no significant impact on human health iated with Manzano facility upgrades. The upgrade required is to modify storage ines to accept Stage Right transfer and e equipment. The facility impact involves ving floor space to accept Stage Right rails and fastening Stage Right attachment s to storage facility walls. These are rd industrial operations that do not expose s to any special hazards (e.g., uclides, toxic chemicals, or high ves).

ts of Storing 20,000 Pits

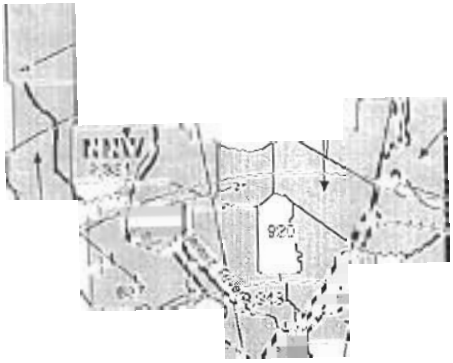
health impacts from pit storage s could potentially result from normal ons and accident scenarios. Impacts ormal operations would be confined to workers. Normal operational impacts om the unloading of pits from SSTs at nzano WSA. Unloading operations esult in radiological exposure to cargo . Based on conservative calculations r handling of pits at Pantex Plant, the loses from unloading of 2,000 pits per estimated to be 27 person-rem per year erson-rem for the unloading of 20,000 pits (the maxin stored at the M

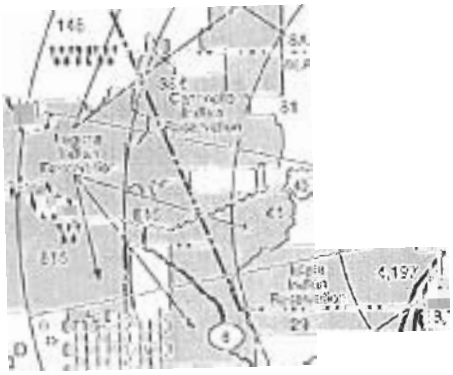
Once removec transferred int Pit transfers w result in rad workers handli would result i person-rem per about 13 pers 20,000 pits. T unloading and Manzano WS distributed ove in material mov 30 people conti period of 10 y conversion fac fatality (LCF) p an additional C group due to r handling.

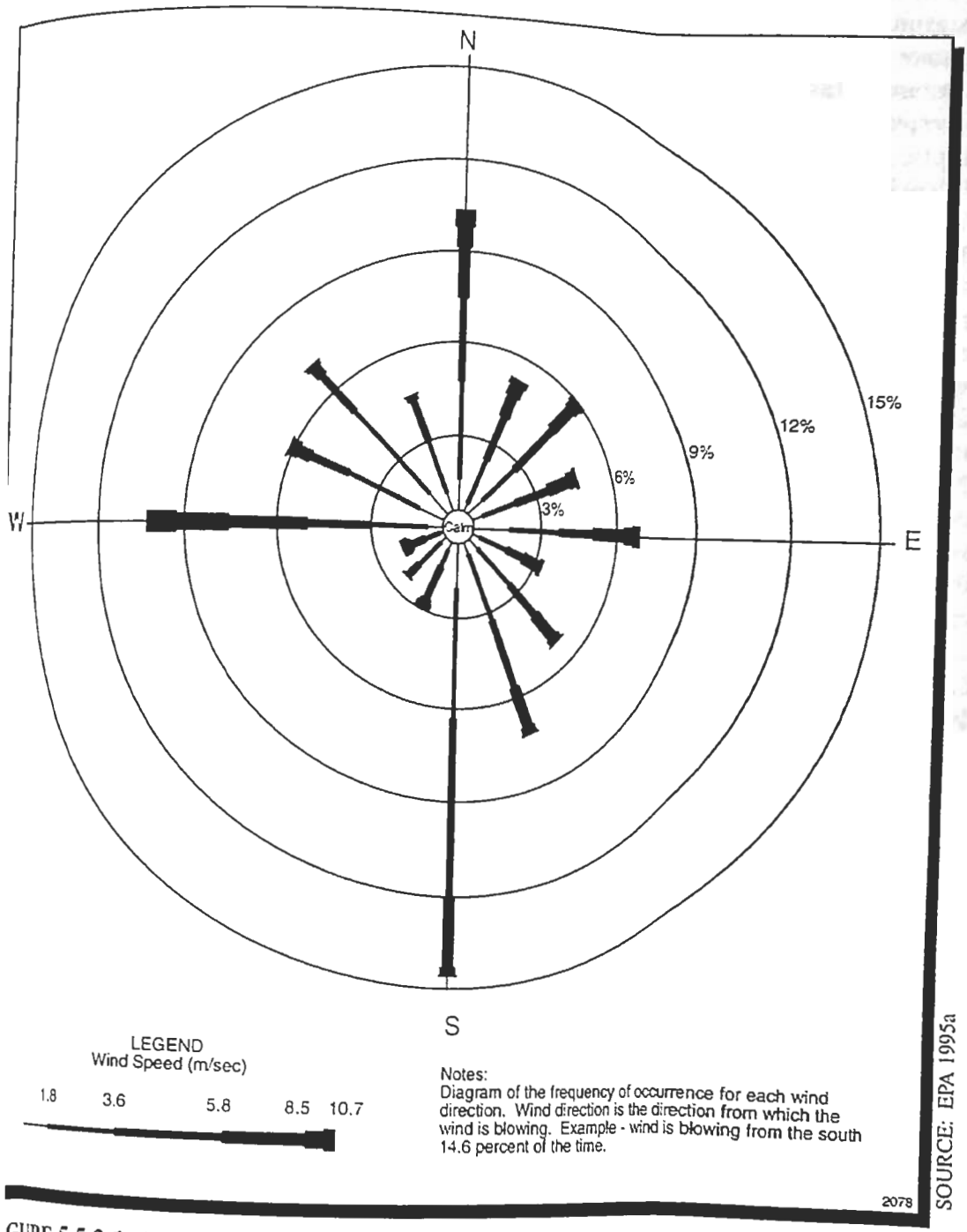
The probability general populati which implies develop cancer f additional risk o the total risk of Manzano WSA v

Some operation impacts to both general populatio the resultant risk evaluated.

The Manzano W KAFB for stori screening metho radiological he associated with t dominated by ha occur when the p the transporter. A to be used to remo The probability







SOURCE: EPA 1995a

GURE 5.5.2.1–2.—*Wind Direction and Speed at Albuquerque International Airport.*

causing a puncture during a single handling operation is in the extremely unlikely range (i.e., 10^{-4} to 10^{-6}).

It is estimated that a forklift puncture of a pit container would release 9.2×10^{-5} curies of plutonium. This is a conservative estimate of the respirable, airborne release caused by a puncture of one shipping container (DOE 1992f:7-39).

Given such a release, an involved worker (the forklift driver) would receive a dose of 6.6 rem, corresponding to an incremental increase in lifetime fatal cancer probability of 2.6×10^{-3}. In addition, a non-involved worker 100 meters (328 feet) downwind along the center line of the plutonium dispersion plume would receive a 5.2×10^{-2} rem exposure, corresponding to an incremental increase in lifetime fatal cancer probability of 2.1×10^{-5}. The maximally exposed member of the public would be expected to receive an exposure of 1.7×10^{-3} rem, corresponding to an incremental increase in lifetime fatal cancer probability of 8.5×10^{-7}. The lifetime fatal cancer probability for an average individual from all other causes is approximately 0.2 (20 percent).

This event would result in an exposure to the public of 4.0×10^{-2} person-rem. Considering the likelihood and consequence of this event, on the average, a member of the public will have an increased annual risk of developing a fatal cancer from this potential accident of 2.6×10^{-14} fatal cancers per year. The annual fatal cancer risk to a person in the State of New Mexico from all other causes is 1.4×10^{-3} fatal cancers per year.

Pit container inventories at the Manzano WSA are expected to be performed using either shielded or automated techniques and equipment. Consequently, these normal operations are not expected to result in any significant radiological exposure to workers.

Other storage activities that may occur within the timeframe evaluated in this EIS include:

- Restacking a limited number of pits to comply with design laboratory temperature requirements.
- A limited number of pit movements and/or instrumentation placements to facilitate third party inspections.

Impacts of these routine activities are also considered to be negligible.

Impacts of Storing of 8,000 Pits

The risks associated with storing 8,000 pits are similar to those of the 20,000-pit storage alternative. If DOE chooses to store 8,000 pits at the Manzano WSA, the total worker doses from unloading operations would be below 113 person-rem over 4 years. This exposure would result in an additional 0.04 LCF from pit handling. With an additional risk of 0.04 latent cancers from pit handling, the total risk of latent cancers among workers at the Manzano WSA would increase by 0.6 percent.

Risk screening methodology also indicates that the risk from storing 8,000 pits in the Manzano WSA is dominated by forklift handling accidents. Note that the risk screening methodology evaluated all potential threats to pit container integrity, such as fire, aircraft crash, earthquakes, flood, and other internal and external events.

The relative risk contribution from earthquakes at the Manzano WSA could not be assessed due to insufficient storage facility fragility data. Since the Type D storage facilities are buried inside solid rock, a breach of a storage and shipping container would not result in a radionuclide release outside the facility as long as the rock overburden remains intact and the doors leading to the storage facility remain closed. Moreover, due to the robust design of the storage and shipping containers, a plutonium release caused by a seismic event is considered

x reasonably foreseeable unless part of the
k overburden collapses and impacts a
pping container. Hence, the frequency of a
tonium release from a Manzano Type D
age facility is dependent upon the seismic
acity of the rock overburden.

e impacts of a forklift puncture at Manzano
SA would be the same whether 20,000 or
00 pits are stored at the site.

2.2 *Environmental Justice*

cted Environment

Manzano WSA is located on KAFB, which
djacent to the southeastern city limits of
querque, in central New Mexico. Besides
Air Force and other Department of Defense
ties, KAFB is also the location of various
operations, including SNL. Nearly 20,000
ry and civilian personnel work on the base
B 1995). In order to identify the target
tions covered by Executive Order 12898,
-kilometer (50-mile) radius circle centered
e Manzano WSA was overlaid on 1990
s tract maps. The communities that lie
the 80-kilometer (50-mile) circle,
ter called the Manzano Region of
nce (ROI), are shown in Figure 5.5.2.2–1.

ation. According to the 1990 Census,
ere 606,446 persons within the Manzano
White persons comprised 55 percent of
pulation, Hispanics were the second
group with 37 percent, and American
accounted for just over 4 percent of the
pulation. Indian Reservations and trust
elonging to 10 Native American tribes
ated within the Manzano ROI, and
nately half of the American Indians
in the area in 1990 resided on Indian
Blacks, Asians, Pacific Islanders and
ial groups totaled less than 4 percent of
population in 1990 (UN 1995).

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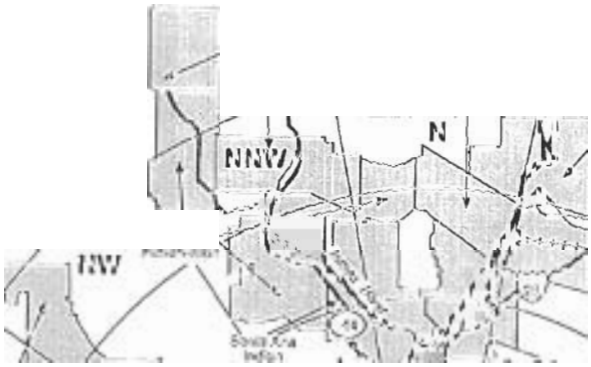
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otential of exposing the general public to adiation. The analysis in section 5.5.2.1, luman Health, indicates that the risk to the ublic from such an accident would be egligible. With no measurable impacts on the eneral population, the minority and low-ncome populations would not be lisproportionately impacted.

mpacts of Storing 8,000 Pits

The human health impact of storing 8,000 pits at he Manzano WSA would be lower than those dentified for the storage of 20,000 pits. No ignificant adverse impacts are expected, and ninority and low-income populations would not e disproportionately impacted.

5.5.2.3 *Air Quality*

Affected Environment

The Manzano WSA at KAFB is located in Bernalillo County, which is situated in the Albuquerque-Mid Rio Grande Intrastate Air Quality Control Region 152. The Manzano WSA lies outside the City of Albuquerque and s classified as "better than national standards" or sulfur dioxide (SO_2), "unclassifiable/ attainment" for ozone (O_3), "unclassifiable" for articulate matter, "cannot be classified or etter than national standards" for nitrogen lioxide (NO_2), "attainment for CO, and "not esignated" for lead. For CO, Bernalillo County has not had a violation during the past 3 ears. As of July 15 1996, the Environmental Protection Agency redesignated Bernallilo County from nonattainment to attainment for CO. The nearest Prevention of Significant Deterioration Class I area to the Manzano WSA s the Bandelier Wilderness, approximately 80 ilometers (50 miles) to the north. The Manzano WSA has no emission sources subject o Prevention of Significant Deterioration equirements.

Impacts of Facility Upgrades

Project-related air quality impacts can t divided into two distinct categories. The fir category is short-term construction-relate impacts. The second category of impacts characterized as long-term operations impact Long-term impacts would occur onc construction is completed and the facility is operation.

Facility upgrades would not be required at th Manzano WSA. Therefore, there would be n air quality impacts related to constructic activities.

Impacts of Storing 20,000 Pits

There are no direct criteria pollutant emissior from the pits during storage. Indirect pollutai emissions would be produced from the exhaus of the vehicles used by employees used t commute to and from work. Also, exhau emissions from the SSTs used to transport th pits from Pantex Plant to the Manzano WS would contribute a small amount of pollution t the overall pollutant burden in Bernalill County, New Mexico.

The calculation of emission rates of exhau pollutants from employee and pit deliver vehicles was made based on emission facto obtained from the EPA Mobile Source Emissio Factor Model (MOBILE 5a). The followin assumptions were used in calculating th exhaust pollutant emissions:

- 120 vehicles would be used by securit employees (365 days per year).
- 30 vehicles would be used by operatior staff employees (255 days per year).
- Average round-trip commute distanc 48 kilometers (30 miles).
- Pit delivery truck round-trip distance Bernalillo County: 80 kilometers (miles).

Table 5.5.2.3–1 presents the estimated annual pollutant emissions from employee and pit delivery vehicles. A comparison of these emissions with those in Bernalillo County is also provided in the table.

Table 5.5.2.3–1 shows that the resulting increase in the CO emission due to storage of pits at the Manzano WSA would be 0.08 percent. Also, these emissions from mobile sources would be distributed over a relatively large area. The increases in the ambient concentrations would, therefore, probably not be detectable. Bernalillo County was in a maintenance for attainment area for CO, and has recently been designated an attainment area for CO. Nor would these negligible increases cause any violations of the National Ambient Air Quality Standards for the other criteria pollutants. The air quality impacts resulting from the long-term storage of pits at the Manzano WSA would therefore be negligible.

Impacts of Storing 8,000 Pits

Pollutant emission resulting from the storage of 8,000 pits would be less than those resulting from the storage of 20,000 pits. Since the air quality impacts from the storage of 20,000 pits were found to be negligible, the air quality impacts resulting from the storage of 8,000 pits would also be negligible.

General Conformity Determination

The EPA published the General Conformity Rule 40 CFR parts 6, 51, and 93 on November 30, 1993 to implement section 176(c) of the *Clean Air Act* as amended in 1990. This section requires that Federal action conform to the appropriate State Implementation Plan. Conformity, as defined in the *Clean Air Act*, is conformity to the State Implementation Plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards and achieving expeditious attainment of such standards.

A formal conformity determination is required for federal actions occurring in nonattainment areas when the total direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specified annual de minimis (threshold) values. Because O_3 is a secondary pollutant, the conformity determination for O_3 uses the precursor emissions of volatile organic compounds (VOCs) and NO_2 as surrogate pollutants. The de minimis thresholds are presented in Table 5.5.2.3–2.

TABLE 5.5.2.3–1.—*Pollutant Emission Rates Related to Storage of Pits at the Manzano Weapons Storage Area (metric tons [tons] per year)*

SOURCE	POLLUTANT EMISSION RATE		
	CO	NO_2	VOC
Employee Vehicles	19.94 (21.98)	3.62 (3.99)	2.08 (2.80)
Pit Delivery Vehicle	0.04 (0.04)	0.05 (0.06)	0.01 (0.01)
Total	19.98 (22.02)	3.67 (4.05)	2.09 (2.31)
Bernalillo County (1993)	26303 (29458)		
% of County Emission	0.08		

NA - Emission factors not available.

TABLE 5.5.2.3–2.—*De Minimis Thresholds*

CRITERIA POLLUTANT	DEGREE OF NONATTAINMENT	METRIC TONS (tons/year)
Ozone (VOCs and NO_2)	Serious Severe Extreme Other ozone nonattainment areas (outside of ozone transport region)	45.4 (50) 22.7 (25) 9.1 (10) 90.7 (100)
VOCs	Marginal/moderate nonattainment (within ozone transport region)	45.4 (50)
NO_2	Marginal/moderate nonattainment (within ozone transport region)	90.7 (100)
Carbon monoxide (CO)	All	90.7 (100)
Particulate matter (PM_{10})	Moderate Serious	90.7 (100) 63.5 (70)
Sulfur/nitrogen dioxide (SO_2/NO_2)	All	90.7 (100)
Lead (Pb)	All	22.7 (25)

ince the Manzano WSA was in a maintenance :: attainment area for CO, the de minimis alue for CO was 90.7 metric tons (100 tons) per ear. As shown in Table 5.5.2.3–1, the emission ate for CO is well below the de minimis value.

Therefore, a general conformity analysis is not required for the Manzano WSA. Further, the County has recently been designated attainment area for CO.

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CHAPTER 6

Environmental Compliance Requirements for Implementing the Proposed Action and the Alternatives

As a successor agency to the AEC, DOE has inherited these responsibilities. Other Federal environmental statutes and regulations have been established to protect the environment and to control the generation, handling, treatment, storage, and disposal of hazardous materials and waste substances. Table 6.3.1–1 (all tables are presented at the end of this chapter) lists the Federal environmental statutes, regulations, and Executive orders applicable to Pantex Plant. It also identifies the associated permit, approval, and consultation requirements generally required to site, construct, or operate the facilities discussed in this EIS. DOE is committed to fully complying with all applicable environmental statutes, regulatory requirements, and Executive and internal orders; many of these requirements and standards are established through DOE orders. Table 6.3.1–2 lists selected DOE orders that apply to all sites; however, they may affect each site differently.

DOE has entered into agreements with some regulatory agencies on behalf of Pantex Plant facilities. These agreements normally establish a schedule for achieving full compliance with regulations at Pantex Plant. Table 6.3.1–3 lists Texas State environmental statutes, regulations, and orders.

6.3.2 Environmental Consultations

The *National Environmental Policy Act* (NEPA) requires the proponent to involve a number of Federal, State, and local agencies with jurisdiction over various aspects of the Proposed Action and Alternatives to be consulted. The *Endangered Species Act* (16 U.S.C. 1531) and *National Historic Preservation Act* (16 U.S.C. 470) require consultation in regard to endangered species, critical habitat, and prehistoric and historic resources. Chapter 9 lists Federal and State agencies that have been offered an opportunity to comment on the Draft EIS. Appendix J contains letters pertaining to *Endangered Species Act* and *National Historic Preservation Act* consultations, together with others providing comments on the Draft EIS.

6.3.3 Environmental Permits

Pantex Plant has applied for various air, solid waste, and water permits in accordance with the Federal and State regulatory requirements outlined in Tables 6.3.1–1 and 6.3.1–3. Section 6.4 summarizes the status of permits and other important regulatory issues at Pantex Plant Site. The status of regulatory issues at alternative interim pit storage sites is briefly summarized in section 6.5.

6.4 Environmental Regulatory Setting at Pantex Plant

In 1989, the Secretary of Energy invited the host State of each DOE facility to independently determine and verify any impacts of plant operations to the environment. In response to this initiative, DOE entered into an Agreement-in-Principle with the State of Texas to focus on waste management, emergency response, and environmental monitoring. DOE provides required information to the State of Texas, and the State conducts sampling and research activities. DOE also issued a Grant-in-Aid for the hydrogeologic characterization studies at Pantex Plant. The plant provides office space for TNRCC officials who are assigned to this site.

Generally, Pantex Plant operations are currently in full compliance with applicable Federal and State regulations. However, since this facility existed prior to the promulgation of many current environmental laws and regulations, both the Environmental Protection Agency (EPA) and the State of Texas have allowed DOE to continue operations while taking actions to achieve full compliance with all applicable environmental regulatory requirements.

May 31, 1994, EPA announced in the *eral Register* that, effective June 30, 1994, tex Plant would be listed on the National rities List as a Superfund site pursuant to the ision of the *Comprehensive Environmental onse, Compensation, and Liability Act* RCLA) (59 FR 27989). This determination based on the presence of contamination due past practices. Pantex Plant officials, RCC, and EPA Region 6 are in the process of loping a Federal Facility Compliance ement to address Pantex Plant Superfund s (Pantex 1995a:15-4).

ion 107 of CERCLA provides for the nation of Federal and State trustees who sponsible for assessing damages for injury struction of, and loss of natural resources. Pantex Plant's primary Federal Natural urce Trustee, DOE has participated with s Federal and State Trustees including the Fish and Wildlife Service, the U.S. ogical Survey, TNRCC, and the Texas ral Land Office (DOE 1996f:12). As letion of the Federal Facility Agreement e Pantex Plant approaches, consultation ncrease.

Air

uming Ground is the term used to describe rmal treatment units. These units are used at, demilitarize, and sanitize explosives, sive components, and explosive materials. Burning Ground is operated under rce *Conservation and Recovery Act* A) (42 U.S.C. 6901) interim status and a grant of authority from TNRCC.

Water

1980, pursuant to the Texas Water Code, C has permitted the plant to discharge its vater under a Wastewater No Discharge (Permit Number 02296), which allows vater discharges not going to "Waters of te." In 1980, the State did not consider playas to be "Waters of the State," and, on December 26, 1990, DOE filed a permit application to modify its permit. The permit application was resubmitted in May 1992, at the request of TNRCC, to change the permit from a No Discharge to a Discharge Permit. EPA Region 6 National Pollutant Discharge Elimination System (NPDES) Permit No. TX-0107107 and TNRCC Permit 02296, as amended, authorize the plant to discharge to the waters of the United States and Texas, under specified effluent limitations and monitoring requirements.

6.4.3 Land

Pantex Plant currently operates RCRA units under its Hazardous Waste Permit and under Interim Status. On April 25, 1991, TNRCC and EPA issued a permit to Pantex Plant to store containers and tanks and to treat hazardous waste in tanks and containers. The permit specifically excluded 17 RCRA units at the Burning Ground, but continued Interim Status of those units. Explosive waste and explosive-contaminated waste are thermally treated at the Burning Ground, which operates as a RCRA Interim Status unit and under a written Grant of Authority from TNRCC. In November 1991, DOE formally submitted a request to TNRCC for a Class 3 Modification to add the units at the Burning Ground to the permit. Pursuant to the public notice published on October 31, 1991, interested parties requested a hearing before a hearing examiner on the permit. On May 31, 1992, the TNRCC Office of Air Quality recommended draft hazardous waste permit provisions for the Burning Ground. TNRCC, DOE, and parties to the hearing process are continuing discussions on terms of the proposed permit modification.

EPA issued DOE a draft RCRA Administrative Order of Consent in September 1989 requiring Pantex Plant to conduct a RCRA Facility Investigation (RFI) to identify, assess, and correct actual and potential threats to human

TABLE 6.3.1–1.—*Federal Environmental Statutes, Regulations, and Orders Applicable to Pantex Plant*

SOURCE CATEGORY	STATUTE/ REGULATION/ ORDER	CITATION	RESPONSIBLE AGENCY	EIS-LEVEL POTENTIAL APPLICABILITY: PERMITS, APPROVALS, CONSULTATIONS, AND NOTIFICATIONS
Sources	*Clean Air Act* (CAA), as amended	42 U.S.C. §§7401 et seq.	EPA	Requires sources to meet standards and obtain permits to satisfy: National Ambient Air Quality Standards (NAAQS), Standards of Performance for New Stationary Sources, National Emission Standards for Hazardous Air Pollutants (NESHAP), and Prevention of Significant Deterioration (PSD).
	National Ambient Air Quality Standards/State Implementation Plans	42 U.S.C. §§7409 et seq.	EPA	Requires compliance with primary and secondary ambient air quality standards governing SO_2, NO_x, CO, O_3, Pb, and PM_{10} and emission limits/reduction measures designated in each State.
	Standards of Performance for New Stationary Sources	42 U.S.C. §7411	EPA	Establishes control/emission standards and record keeping requirements for new or modified sources specifically addressed by a standard.
	National Emission Standards for Hazardous Air Pollutants	42 U.S.C. §7412	EPA	Requires sources to comply with emission levels of hazardous air pollutants; may require a preconstruction approval, depending on the process being considered and the level of emissions that will result from the new or modified source.
	Prevention of Significant Deterioration	42 U.S.C. §§7470 et seq.	EPA	Requires comprehensive preconstruction review and the application of Best Available Control Technology to major stationary sources (emissions of 100 tons/year) and major modifications; requires a preconstruction review of air quality impacts and the issuance of a construction permit from the responsible State agency setting forth emission limitations to protect the Prevention of Significant Deterioration increment.
[illegible]	Noise Control Act of 1972	42 U.S.C. §§4901 et seq.	EPA	Requires facilities to maintain noise levels that do not jeopardize the health and safety of the public.
[illegible]	*Clean Water Act* (CWA)	33 U.S.C. §§1251 et seq.	EPA	Requires EPA or State-issued permits and compliance with provisions of permits regarding discharge of effluents to surface waters.

TABLE 6.3.1–1.—*Federal Environmental Statutes, Regulations, and Orders Applicable to Pantex Plant*-Continued

RESOURCE CATEGORY	STATUTE/ REGULATION/ ORDER	CITATION	RESPONSIBLE AGENCY	EIS-LEVEL POTENTIAL APPLICABILITY: PERMITS, APPROVALS, CONSULTATIONS, AND NOTIFICATIONS
Soil Resources	RCRA/ Hazardous and Solid Waste Amendments of 1984	42 U.S.C. §§6901 et seq./PL 98-616	EPA	Requires proper management and, in some cases, permits for current operations involving hazardous waste and remediation of contamination from past activities (not addressed by CERCLA); changes to site hazardous waste operations could require amendments to RCRA hazardous waste permits involving public hearings.
	CERCLA/ *Superfund Amendments and Reauthorization Act of 1986* (SARA)	42 U.S.C. §§9601 et seq./PL 99-499	EPA	Requires cleanup and notification if there is a release or threatened release of a hazardous substance; requires DOE to pursue Interagency Agreements with EPA and State to control the cleanup of each DOE site on the National Priorities List (NPL).
	Community Environmental Response Facilitation Act	PL 102-426	EPA	Amends CERCLA (40 CFR 300) to establish a process for identifying, prior to the termination of Federal activities, property that does not contain contamination. Requires prompt identification of parcels that will not require remediation to facilitate the transfer of such property for economic redevelopment purposes.
	Farmland Protection Policy Act of 1981	7 U.S.C. §§4201 et seq.	Natural Resource Conservation Service	DOE shall avoid any adverse effects to prime and unique farmlands.
	Federal Facility Compliance Act of 1992	42 U.S.C. §6961	States	Eliminates RCRA waiver of sovereign immunity for Federal facilities and requires DOE to develop plans and enter into agreements with States as to specific management actions for specific mixed waste streams (e.g., New Mexico Unilateral FFC Order).
[illegible] sources	*Fish and Wildlife Coordination Act*	16 U.S.C. §§661 et seq.	FWS	Requires consultation on the possible effects on wildlife if there is construction, modification, or control of bodies of water in excess of 10 acres in surface area.
	Bald and Golden Eagle Protection Act	16 U.S.C. §§668 et seq.	FWS	Consultations should be conducted to determine if any protected birds are found to inhabit the area. If so, DOE must obtain a permit prior to moving any nests due to mission requirements.
	Migratory Bird Treaty Act	16 U.S.C. §§703 et seq.	FWS	Requires consultation to determine if there are any impacts on migratory bird populations due to mission requirements. If so, DOE will develop mitigation measures to avoid adverse effects.

TABLE 6.3.1–1.—*Federal Environmental Statutes, Regulations, and Orders Applicable to Pantex Plant*-Continued

RESOURCE CATEGORY	STATUTE/ REGULATION/ ORDER	CITATION	RESPONSIBLE AGENCY	EIS-LEVEL POTENTIAL APPLICABILITY: PERMITS, APPROVALS, CONSULTATIONS, AND NOTIFICATIONS
Biotic Resources (cont'd)	*Endangered Species Act of 1973*	16 U.S.C. §§1531 et seq.	USFWS/National Marine Fisheries Service	Requires consultation to identify endangered or threatened species and their habitats, assess DOE impacts thereon, obtain necessary biological opinions and, if necessary, develop mitigation measures to reduce or eliminate adverse effects of construction or operation.
Cultural Resources	*National Historic Preservation Act of 1966*, as amended	16 U.S.C. §§470 et seq.	Advisory Council on Historic Preservation	DOE shall consult with the State Historic Preservation Office (SHPO) prior to construction to ensure that no historic properties will be affected.
	Archeological and Historical Preservation Act of 1974	16 U.S.C. §§469 et seq.	DOI	DOE shall obtain authorization for any disturbance of archeological resources.
	Archeological Resources Protection Act of 1979	16 U.S.C. §§470aa et seq.	DOI	DOE shall obtain authorization for any excavation or removal of archeological resources.
	American Indian Religious Freedom Act of 1978	42 U.S.C. §1996	DOI	DOE shall consult with local Native American Indian tribes prior to construction to ensure that their religious customs, traditions, and freedoms are preserved.
	Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. §3001	DOI	DOE shall consult with local Native American Indian tribes prior to, and during as necessary, construction to guarantee that Native American human remains are not disturbed.
	Executive Order 11593: Protection and Enhancement of the Cultural Environment	3 CFR 154, 1971-1975 Comp., p. 559	DOI	DOE shall aid in the preservation of historic and archeological data that may be lost during construction activities.
Worker Safety and Health	*Occupational Safety and Health Act* (OSHA)	5 U.S.C. §5108	OSHA	Agencies shall comply with all applicable worker safety and health legislation (including guidelines of 29 U.S.C. §660) and prepare, or have available, Material Safety Data Sheets.
	Hazard Communication Standard	29 CFR 1910.1200	OSHA	DOE shall ensure that its workers are informed of, and trained to handle, all chemical hazards in the workplace.

TABLE 6.3.1–1.—*Federal Environmental Statutes, Regulations, and Orders Applicable to Pantex Plant*-Continued

RESOURCE CATEGORY	STATUTE/ REGULATION/ ORDER	CITATION	RESPONSIBLE AGENCY	EIS-LEVEL POTENTIAL APPLICABILITY: PERMITS, APPROVALS, CONSULTATIONS, AND NOTIFICATIONS
	Atomic Energy Act of 1954	42 U.S.C. §2011	DOE	DOE shall follow its own standards and procedures to ensure the safe operation of its facilities.
	NEPA	42 U.S.C. §§4321 et seq.	CEQ	DOE shall comply with NEPA implementing procedures in accordance with 10 CFR 1021.
	Toxic Substances Control Act (TSCA)	15 U.S.C. §§2601 et seq.	EPA	DOE shall comply with inventory reporting requirements and chemical control provisions of TSCA to protect the public from the risks of exposure to chemicals; TSCA imposes strict limitations on use and disposal of PCB-contaminated equipment.
	Hazardous Materials Transport Action Act	49 U.S.C. §§1801 et seq.	DOT	DOE shall comply with the requirements governing hazardous materials and waste transportation.
	Hazardous Materials Transportation Uniform Safety Act of 1990	49 U.S.C. §1801	DOT	Restricts shippers of highway route-controlled quantities of radioactive materials to use only permitted carriers.
	Emergency Planning and Community Right-To-Know Act of 1986	42 U.S.C. §§11001 et seq.	EPA	Requires the development of emergency response plans and reporting requirements for chemical spills and other emergency release, and imposes right-to-know reporting requirements covering storage and use of chemicals which are reported in toxic chemical release forms.
	Pollution Prevention Act of 1990	42 U.S.C. 11001-11050	EPA	Establishes a national policy that pollution should be reduced at the source and requires a toxic chemical source reduction and recycling report for an owner or operator of a facility required to file an annual toxic chemical release form under section 313 of SARA.

TABLE 6.3.1–1.—*Federal Environmental Statutes, Regulations, and Orders Applicable to Pantex Plant*-Continued

RESOURCE CATEGORY	STATUTE/ REGULATION/ ORDER	CITATION	RESPONSIBLE AGENCY	EIS-LEVEL POTENTIAL APPLICABILITY: PERMITS, APPROVALS, CONSULTATIONS, AND NOTIFICATIONS
Other (cont'd)	Executive Order 12843: Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances	April 21, 1993	EPA	Requires Federal agencies to minimize procurement of ozone depleting substances and conform their practices to comply with Title VI of CAA Amendments reference stratospheric ozone protection and to recognize the increasingly limited availability of Class I substances until final phaseout.
	Executive Order 12856: Federal Compliance with Right-To-Know Laws and Pollution Prevention Requirements	August 3, 1993	EPA	Requires Federal agencies to achieve 50% reduction of agency's total releases of toxic chemicals to the environment and offsite transfers, to prepare a written facility pollution prevention plan not later than 1995, and to publicly report toxic chemicals entering any waste stream from Federal facilities, including any releases to the environment, and to improve local emergency planning, responses and accident notification.
	Executive Order 12873: Federal Acquisition, Recycling, and Waste Prevention	October 20, 1993	EPA	Requires Federal agencies to develop affirmative procurement policies and establishes a shared responsibility between the system program manager and the recycling community to effect use of recycled items for procurement.
	Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	February 11, 1994	EPA	Requires Federal agencies to identify and address as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.
	Executive Order 12088: Federal Compliance with Pollution Control Standards	3 CFR, 1978 Comp., p. 243	Office of Management and Budget (OMB)	Requires Federal Agency landlords to submit to OMB an annual plan for the control of environmental pollution and to consult with EPA and State agencies regarding the best techniques and methods.

TABLE 6.3.1–1.—*Federal Environmental Statutes, Regul*
Orders Applicable to Pantex Plant-Continued

SOURCE ATEGORY	STATUTE/ REGULATION/ ORDER	CITATION	RESPONSIBLE AGENCY	EIS-1 APPLI APPROVAI N
(cont'd)	Executive Order 11514: Protection and Enhancement of Environmental Quality	3 CFR, 1966-1970 Comp., p. 902	CEQ	Requires Feder leadership in ac quality goals o: consultation wi local agencies i they affect the
	Nuclear Waste Policy Act of 1982	42 U.S.C. §§10101 et seq.	EPA	DOE shall disp standards of 4C
	Low-Level Radioactive Waste Policy Act	42 U.S.C. §§2021b-2021d	Nuclear Regulatory Commission	DOE shall disp states in which

TABLE 6.3.1–2.—*Selected DOE Environment, Safety, and*

DOE ORDER	ORDER TITLE
451.1	National Environmental Policy Act Compliance Program
5400.1	General Environmental Protection Program
5400.5	Radiation Protection of the Public and the Environment
5480.1B	Environment, Safety, and Health Program for Department
5480.19	Conduct of Operations Requirements for DOE Facilities
5480.21	Unreviewed Safety Questions
5480.22	Technical Safety Requirements
5480.23	Nuclear Safety Analysis Reports
5482.1B	Environment, Safety, and Health Appraisal Program
5530.1A	Accident Response Group
5530.4	Aerial Measuring System
5630.11B	Safeguards and Security Program
5630.12A	Safeguards and Security Inspection and Assessment Prog
5632.1C	Protection and Control of Safeguards and Security Intere:
5700.6C	Quality Assurance
5820.2A	Radioactive Waste Management

TABLE 6.5–1.—*Nevada State Environmental Statutes, Regulations, and Orders Applicable to the Nevada Test Site*

RESOURCE CATEGORY	LEGISLATION	CITATION	RESPONSIBLE AGENCY	POTENTIAL APPLICABILITY/ PERMITS
Resources	Nevada Air Pollution Control Law	NV Statutes, Title 40	NV State Environmental Commission	Permit required prior to construction or modification of an air contaminant source.
	Nevada Air Quality Regulations	NV Admin. Code, Chapter 445	NV State Environmental Commission	Permit required prior to the construction or modification of an air contaminant source.
Resources	Nevada Water Pollution Control Law	NV Statutes, Title 40, Chapter 445	NV Department of Environmental Protection	Permit required prior to construction or modification of a water discharge source.
	Nevada Water Pollution Control Regulations	NV Admin. Code, Chapter 445	NV Department of Environmental Protection	Permit required prior to construction or modification of a water discharge source.
Resources	Nevada Underground Storage Tank Rules	NV Admin. Code, Chapter 459	NV Department of Environmental Protection	Permit required prior to construction or modification of an underground storage tank.
	Nevada Solid Waste Disposal Law	NV Statutes, Title 40, Chapter 444	NV Department of Environmental Protection	Permit required prior to construction or modification of a solid waste disposal facility.
	Nevada Solid Waste Disposal Regulations	NV Admin. Code, Chapter 44	NV Department of Environmental Protection	Permit required prior to construction or modification of a solid waste disposal facility; permit for septage hauling may be required.
	Nevada Hazardous Waste Disposal Law	NV Statutes, Title 40, Chapter 459	NV Department of Environmental Protection	Permit required prior to construction or modification of a hazardous waste disposal facility.
	Nevada Hazardous Waste Facility Regulations	NV Admin. Code, Chapter 444	NV Department of Environmental Protection	Permit required prior to construction or modification of a hazardous waste disposal facility.
Resources	*Nevada Non-Game Species Act*	NV Admin. Code, Title 45, Chapter 503	NV Department of Wildlife	Consult with NV Department of Wildlife and minimize impact.
Resources	Historic Preservation and Archaeology Regulations	NV Statutes, Title 26, Chapter 381-383	NV Advisory Board for Historic Preservation and Archaeology	Permit required prior to the investigation, exploration, or excavation of an historic or prehistoric site.

TABLE 6.5–2.—*South Carolina State Environmental Statutes, Regulations, and Orders Applicable to the Savannah River Site*

RESOURCE CATEGORY	LEGISLATION	CITATION	RESPONSIBLE AGENCY	POTENTIAL APPLICABILITY/ PERMITS
Air Resources	*South Carolina Pollution Control Act/* South Carolina Air Pollution Control Regulations and Standards	SC Code, Title 48, Chapter 1	SC Department of Health and Environmental Control (SCDHEC)	Permit required prior to construction or modification of an air contaminant source.
	South Carolina Atomic Energy & Radiation Control Act	SC Code, Title 13, Chapter 7	SCDHEC	Establishes standards for radioactive air emissions.
Water Resources	*South Carolina Pollution Control Act*	SC Code, Title 48, Chapter 1	SCDHEC	Permit required prior to construction or modification of a water discharge source.
	South Carolina Water Quality Standards	SC Code, Title 61, Chapter 68	SCDHEC	Permit required prior to construction or modification of a water discharge source.
	South Carolina Safe Drinking Water Act	SC Code, Title 44, Chapter 55	SCDHEC	Establishes drinking water standards.
Soil Resources	*South Carolina Underground Storage Tanks Act*	SC Code, Title 44, Chapter 2	SCDHEC	Permit required prior to construction or modification of an underground storage tank.
	South Carolina Solid Waste Regulations	SC Code, Title 61, Chapter 60	SCDHEC	Permit required to store, collect, dispose, or transport solid wastes.
	South Carolina Industrial Solid Waste Disposal Site Regulations	SC Code, Title 61, Chapter 66	SC Pollution Control Authority	Permit required for industrial solid waste disposal systems.
	South Carolina Hazardous Waste Management Act	SC Code, Title 44, Chapter 56	SCDHEC	Permit required to operate, construct, or modify a hazardous waste treatment, storage, or disposal facility.
	South Carolina Solid Waste Management Act	SC Code, Title 44, Chapter 96	SCDHEC	Establishes standards to treat, store, or dispose of solid waste.

TABLE 6.5–2.—*South Carolina State Environmental Statutes, Regulations, and Orders Applicable to the Savannah River Site*-Continued

RESOURCE CATEGORY	LEGISLATION	CITATION	RESPONSIBLE AGENCY	POTENTIAL APPLICABILITY/ PERMITS
Resources	*South Carolina Nongame and Endangered Species Conservation Act*	SC Code, Title 50, Chapter 15	SC Wildlife and Marine Resources Department	Consult with SC Wildlife and Marine Resources Department and minimize impact.
Resources	South Carolina Institute of Archaeology and Anthropology	SC Code, Title 60, Chapter 13-210	SC State Historic Preservation Office	Consult with SC Historic Preservation Office and minimize impact.
Safety and	No State-level legislation identified			

TABLE 6.5–3.—*Washington State Environmental Statutes, Regulations, and Orders Applicable to the Hanford Site*

RESOURCE CATEGORY	LEGISLATION	CITATION	RESPONSIBLE AGENCY	POTENTIAL APPLICABILITY/ PERMITS
Air Resources	*Washington State Clean Air Act*	WA State regulations (WAC 246-247)	WA State Department of Health, Division of Radiation Protection	Permit required to construction or modification of stacks emitting radiation.
	Nuclear Energy and Radiation Act	WA State regulations (WAC 402-80)	WA State Department of Health, Division of Radiation Protection	Monitoring and enforcement of air quality and emission standards for radionuclides.
Water Resources	*Washington Water Pollution Control Act*	WA State regulations (WAC 173-201, 173-216, 173-218, 173-220)	WA State Department of Health	Establishes water quality standards, a State waste discharge program, an underground injection control program, and a NPDES permit program.
	Washington Water Well Construction Act	WA State regulations (WAC 173-160)	WA State Department of Ecology	Minimum standards for construction and maintenance of water wells.
Soil Resources	*Washington Solid Waste Management, Recovery and Recycling Act*	WA State regulations (WAC 173-304)	WA State Department of Health	Minimum functional standards for solid waste handling; management of PCB waste.
	Washington Hazardous Waste Management Act	WA State regulations (WAC 173-303)	WA State Department of Health	Dangerous waste regulations.
	Nuclear Energy and Radiation Act	WA State regulations (WAC 402-61)	WA State Department of Health	Licensing requirements for land disposal of radioactive waste.
Biotic Resources	*Washington State Endangered Species Act*	WAC 232-12-014	WA State Department of Fish and Wildlife	Consult with WA State Department of Wildlife to minimize impact.
Worker Safety and Health	*Nuclear Energy and Radiation Act*	WA State regulations (WAC 402-24)	WA State Department of Health	Standards for protection against radiation.

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CHAPTER 7

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CHAPTER 8

List of Preparers

Everest V
B.A., Br
University
Years of

Edward R
M.A., E
B.S., En
Years of

James
Technica
B.S., Ch
Years of

Gary L.

Years

Ange
Years

Cec
M.P.A
M.M.A

Bolin, John M., Frequency Assessment Analyst, Scientech, Inc.
B.S., Nuclear Engineering, 1982, University of Cincinnati, Cincinnati, Ohio
Years of Experience: 14

Brasier, Robert I., Senior Technical Advisor, Tetra Tech, Inc.
M.B.A., Business Administration, 1980, University of New Mexico, Albuquerqu Mexico
Sc.D., Engineering (Mechanical and Nuclear), 1965, University of New M Albuquerque, New Mexico
M.S., Mechanical Engineering, 1958, University of New Mexico, Albuquerque, New M
B.S., Mechanical Engineering, 1949, University of Missouri, Columbia, Missouri
Years of Experience: 47

Brownlie, William R., P.E., Quality Assurance Manager, Tetra Tech, Inc.
Ph.D., Civil Engineering, Hydraulics, 1981, California Institute of Technology, Pas California
M.S., Civil Engineering, Hydraulics/Water Resources, 1976, State University of New Buffalo, New York
B.S., Civil Engineering, 1975, State University of New York, Buffalo, New York
Years of Experience: 21

Butler, Rebecca, Document Production Supervisor, Tetra Tech, Inc.
B.A., Advertising, 1991, Marquette University, Milwaukee, Wisconsin
Years of Experience: 5

Cantrell, Robert T., Frequency Assessment Analyst, Scientech, Inc.
M.S., Nuclear Engineering, 1974, University of California, Berkeley, California
B.S., Physics, 1972, University of California, Berkeley, California
Years of Experience: 22

Carrara, Pier L., Human Health Risk Assessment Author, Scientech, Inc.
B.S., Mathematics and Statistics, 1974, University of New Mexico, Albuquerque, Mexico
Years of Experience: 22

Chung, Donald T., Consequence Assessment Task Leader, Scientech, Inc.
Ph.D., Nuclear Engineering, 1988, University of Maryland, College Park, Maryland
B.S., Materials Science and Nuclear Engineering, 1979, University of Maryland, C Park, Maryland
Years of Experience: 17

Clauss, David B., Transportation Risk Modeling, Sandia National Laboratories
M.S., Mechanical Engineering, 1980, University of Michigan, Ann Arbor, Michigan
B.S., Mechanical Engineering, 1979, University of Michigan, Ann Arbor, Michigan
Years of Experience: 17

Ervin R., Transportation Risk Modeling, Sandia National Laboratories
M.S., Nuclear Engineering, 1975, Texas A&M University, College Station, Texas
B.S., Nuclear Engineering, 1974, Texas A&M University, College Station, Texas
Years of Experience: 22

R. Jack, P.E., Human Health Risk Assessment Technical Lead, Scientech, Inc.
M.S., Mechanical Engineering, 1978, University of Nebraska, Lincoln, Nebraska
B.S., Mechanical Engineering, 1977, University of Nebraska, Lincoln, Nebraska
Years of Experience: 18

Sean B., Biotic Uptake Analysis, Tetra Tech, Inc.
M.S., Biology, 1987, West Virginia University, Morgantown, West Virginia
B.S., Biology, 1985, Fairmont State College, Fairmont, West Virginia
B.S., Mathematics, 1985, Fairmont State College, Fairmont, West Virginia
Years of Experience: 11

Chester J., Risk Assessment Project Manager, Scientech, Inc.
B.S., Nuclear Science and Engineering, 1972, Rensselaer Polytechnic Institute, Troy, New York
Years of Experience: 24

Donald G., Socioeconomics and Environmental Justice Technical Lead, Tetra Tech, Inc.
Ph.D., Sociology and Quantitative Research Methods, 1969, University of Wisconsin, Madison, Wisconsin
M.S., Sociology and Quantitative Research Methods, 1964, University of Wisconsin, Madison, Wisconsin
B.S., Mathematics (Major) and Physics (Minor), 1961, University of Wisconsin, Madison, Wisconsin
Years of Experience: 35

Kimberly D., Land Resources Technical Lead, Cultural Resources and Pollution Prevention Author, Advanced Sciences, Inc.
Ph.D., American Government, Public Administration, Environmental and Energy Policy, 1990, Texas Tech University, Lubbock, Texas
M.P.A., Public Administration, 1982, Texas Tech University, Lubbock, Texas
B.S., Political Science, 1980, University of Wyoming, Laramie, Wyoming
Years of Experience: 16

Nanette D., Project Manager, U.S. Department of Energy, Albuquerque Operations Office
B.S., Aeronautical Engineering, 1983, U.S. Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio
B.S., Chemistry, 1980, Nebraska University, Lincoln, Nebraska
Years of Experience: 16

Anthony E., Word Processor, Tetra Tech, Inc.
B.S., Psychology (Major) and Computer Science (Minor), 1991, University of New Mexico, Albuquerque, New Mexico
Years of Experience: 8

Greenly, Davin G., Aircraft Crash, Transportation, and Biota Analyses, Tetra Tech, Inc.
B.S., Environmental Engineering, 1994, California Polytechnic State University, Obispo, California
Years of Experience: 2

Greenspan, Jay, Technical Editor/Computer Network Administrator, Tetra Tech, Inc.
B.A., English, 1990, State University of New York at Albany, Albany, New York
Years of Experience: 6

Griffith, Richard O., Project Manager/SMTS, Modeling and Analysis Department, Sandia National Laboratories
Ph.D., Nuclear Engineering, 1990, Texas A&M University, College Station, Texas
M.S., Nuclear Engineering, 1986, Texas A&M University, College Station, Texas
B.S., Nuclear Engineering, 1984, Arizona State University, Tempe, Arizona
Years of Experience: 12

Hare, Gustin L., Air Quality Modeling, Water Quality, Soils, and Waste Management Analy Comment Management, Tetra Tech, Inc.
B.S., Environmental Science, 1994, West Texas A&M University, Canyon, Texas
Years of Experience: 2

Hauquitz, George A., Quality Assurance Officer, Tetra Tech, Inc.
Years of Experience: 43

Jarman, Clifford J., Document Manager, Physical Sciences Group Manager, Tetra Tech, Inc.
M.S., Geophysics, 1989, New Mexico Institute of Mining and Technology, Socor Mexico
B.S., Geology, 1985, University of New Mexico, Albuquerque, New Mexico
Years of Experience: 11

Jensen, Kari J., Word Processor, Tetra Tech, Inc.
Years of Experience: 2

Jessen, James P., Transportation Risk Assessment Technical Lead, Human Health and Aircra Analyses, Tetra Tech, Inc.
Ph.D. Candidate, Environmental Engineering, University of Washington, Seattle, Wasl
M.S., Nuclear Engineering and Radiological Health (Health Physics Emphasis) University of Washington, Seattle, Washington
B.S., Chemical and Nuclear Engineering, 1988, University of New Mexico, Albuq New Mexico
Years of Experience: 8

Johns, Lisa A., Socioeconomics, Environmental Justice, Water Resources Research Analy Document Integrator, Tetra Tech, Inc.
B.A., Sociology, 1982, University of Pittsburgh, Pittsburgh, Pennsylvania
Years of Experience: 14

William H., Manager of Environmental Sciences, Tetra Tech, Inc.
B.S., Geography, 1988, Texas A&M University, College Station, Texas
Years of Experience: 14

Marshall C., Floristic Survey, Consultant
Ph.D., Botany, 1955, University of Texas, Austin, Texas
M.S., Botany, 1952, University of Texas, Austin, Texas
B.S., Geology, 1951, University of Texas, Austin, Texas
Years of Experience: 26

Rebecca L., Public Information Center Librarian and Technical Assistant, Tetra Tech, Inc.
B.A., Radio, Television, and Film, 1987, West Texas State University, Canyon, Texas
Years of Experience: 9

Lee A., Geology and Soils Technical Lead, Tetra Tech, Inc.
M.S., Geology, 1991, New Mexico State University, Las Cruces, New Mexico
B.S., Geology, 1987, Lake Superior State University, Sault Ste. Marie, Michigan
Years of Experience: 9

L., P.E., Water Resources and Infrastructure Author, Tetra Tech, Inc.
M.S., Civil Engineering (Environmental), 1993, New Mexico State University, Las Cruces, New Mexico
B.S., Mechanical Engineering, 1989, Texas Tech University, Lubbock, Texas
Years of Experience: 7

Terry L., Cultural Resources Technical Lead, Land Resources Technical Lead, and Document Integrator, Tetra Tech, Inc.
B.A., Anthropology, 1979, New Mexico State University, Las Cruces, New Mexico
Years of Experience: 20

Mary C., Land Resources Author, Advanced Sciences, Inc.
M.S., Geology, 1984, University of New York—Fredonia, Fredonia, New York
B.S., Geology, 1976, Edinboro University of Pennsylvania, Edinboro, Pennsylvania
Years of Experience: 9

Radar Aircraft Monitoring System Data Collection and Processing, Sandia National Laboratories
Ph.D., Electrical Engineering, 1974, Ohio State University, Columbus Ohio
M.S., Electrical Engineering, 1966, Virginia Polytechnic Institute and State University, Blacksburg, Virginia
Years of Experience: 30

M.Eng., Noc
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chel E., L.S
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orge K.,
Ph.D., En

ck W.
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Years

David
Office
B.S., N
Years

Mathi

Sinha, Raji, Air Quality and Acoustics Modeling Technical Lead, Tetra Tech, Inc.
Ph.D., Nuclear Engineering, 1990, University of New Mexico, Albuquerque, New M
M.S., Physics, 1976, Polytechnic Institute of Brooklyn, Brooklyn, New York
M.S., Bioengineering, 1976, Polytechnic Institute of Brooklyn, Brooklyn, New York
M.S., Physics (Electronics), 1964, Patna University, Patna, India
B.S., Physics (with Honors), 1962, Patna University, Patna, India
Years of Experience: 34

Schwendenman, Kathryn D., Waste Management Author, Advanced Sciences, Inc.
B.S., Mechanical Engineering, 1984, Virginia Polytechnic Institute and State U
Blacksburg, Virginia
Years of Experience: 12

Tadios, Eden L., Thermal-Hydraulics Analyst, Sandia National Laboratories
M.S., Mechanical Engineering, 1987, University of Michigan, Ann Arbor, Michigan
B.S., Mechanical Engineering, 1985, California State University, Fresno, California
Years of Experience: 10

Torres, Gilbert V., Waste Management Author, Advanced Sciences, Inc.
B.S., Mechanical Engineering, 1980, University of New Mexico, Albuquerque, New
Years of Experience: 7

Turonek, Marianne V., Illustrator, Tetra Tech, Inc.
Years of Experience: 20

Uedoi, Tammy M., Program Management Support, Tetra Tech, Inc.
M.B.A., Business Administration, 1994, University of San Francisco, San Fr
California
B.S., Mechanical Engineering, 1989, University of Hawaii at Manoa, Honolulu, Haw
Years of Experience: 7

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CHAPTER 9

List of Agencies, Organizations, and Individuals to Whom Copies of this EIS are Sent

CHAPTER 9

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Yakima Indian Nation, WA
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Texas

Amarillo Economic Development Corp·
Pantex Office, TX
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Virginia

Energy Communities Alliance, VA
National Water Resources Association, ˙

Washington

Government Accountability Project, WA
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Heart of America Northwest, WA

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Mr. Gene Barber, TX
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Mr. Walter D. Blair, WA
Mr. David Bolling, TN
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Dr. R. Danford, MN

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Faich, NM
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A. Karam, GA
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CHAPTER 10

Glossary

CHAPTER 10
GLOSSARY

This glossary lists terms of art or scientific expression that may not be familiar to some readers of this document. Should a reader need a definition for a term that is not in this list, please contact the Department of Energy, Albuquerque Operations Office, at the address shown on the cover page of this document.

dent sequence: An initiating event ed by system failures or operator errors can result in significant core damage, tainment system failure, and/or radionuclide es.

exposure: The exposure incurred during shortly after a radiological release. ally, the period of acute exposure ends long-term interdiction is established, as ary. For convenience, the period of acute re is normally assumed to end 1 week the inception of a radiological accident.

ory Council on Historic Preservation: member body appointed to advise the dent and Congress in the coordination of s by Federal agencies on matters relating oric preservation.

Quality Control Region: An interstate designated by the Environmental ction Agency for the attainment and enance of National Ambient Air Quality ards.

quality standards: The level of pollutants air prescribed by regulations that may not eeded during a specified time in a defined .

-R8 Pit Packaging: Currently the primary er used at Pantex Plant for pit staging. L-R8 containers are constructed of 18- carbon steel. Each AL–R8 container s Celotex (high-density cane-fiber board) insulation. These containers do not s an inner containment vessel.

Alluvial deposits: Deposits of earth, sand, gravel, and other materials carried by moving surface water deposited at points of weak water flow.

Ambient air: Ambient air is that portion of the atmosphere, external to the buildings, to which the general public has access.

Ambient sound: At a specified time, the all-encompassing sound associated with a given environment, being usually a composite of sound from many sources at many directions, near and far, including the specified sound source(s) of interest.

Aquatic biota: The sum total of living organisms within any designated aquatic area.

Aquifer: Rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.

Aquitard: A less-permeable geologic unit in a stratigraphic sequence. The unit is not permeable enough to transmit significant quantities of water. Aquitards separate aquifers.

Archaeological sites (resources): Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.

Artifact: An object produced or shaped by human workmanship of archaeological or historical interest.

As low as reasonably achievable: A concept applied to the quantity of radioactivity released in routine operation of a nuclear system or facility, including "anticipated operational occurrences." It takes into account the state of technology, economics of improvements in relation to benefits to public health and safety, and other societal and economic considerations in relation to the use of nuclear energy in the public interest.

Assembly: The process of putting together a nuclear weapon or nuclear weapon component. This process takes place at Pantex Plant.

Atmospheric dispersion: The process of air pollutants being dispersed into the atmosphere. This occurs by the wind that carries the pollutants away from their source and by turbulent air motion that results from solar heating of the Earth's surface and air movement over rough terrain and surfaces.

Attainment area: An area considered to have air quality as good as or better than the National Ambient Air Quality Standards as defined in the *Clean Air Act.* An area may be an attainment area for one pollutant and a non-attainment area for others.

Background Noise: The total acoustical and electrical noise from all sources in a measurement system that may interfere with the production, transmission, time averaging, measurement, or recording of an acoustical signal.

Background radiation: Ionizing radiation present in the environment from cosmic rays and natural sources in the Earth; background radiation varies considerably with location.

Biological dose: The radiation dose absorbed in biological material measured in rem or millirem (one-thousandth of a rem).

Biomass: Literally, "living weight", r mass having its origin as living organis plants or animals).

Biota: Living organisms including pla animals.

Blackwater Draw Formation: Qua formation consisting primarily of pedoge modified eolian sands and silts interbedd numerous caliche layers. The Blackwate Formation overlies the Tertiary C Formation at Pantex Plant.

Burning Ground: The place at Pante: where high explosive(s) (HE) are bur trays. They are defined as Trays Hemi: Trays wet HE, and Trays HE.

Burning Ground upgrade: A facility th be used to decontaminate the high exp contaminated components.

Caliche: Gravel, sand, or desert cemented by porous calcium carbonate; a calcium carbonate itself. Found in Mexi Southwest U.S., calcium carbonate preci as surface or near-surface crusts b evaporation of moisture in the pore spa soils.

Cancer: The name given to a group of di characterized by uncontrolled cellular g with cells having invasive characteristic that the disease can transfer from one or another.

Canned Subassemblies: A compone certain nuclear explosives that may c natural, depleted, or highly enriched urani

Capable fault: A fault that has exhibited more of the following characteristics (10 100, Appendix A): 1) Movement at or ne ground surface at least once within the 35,000 years or movement of a recurring r within the past 500,000 years, 2) m seismicity instrumentally determined

geographical area occupied by the species... that are essential for the conservation of the species."

Cultural Resources: Districts, sites, structures, and objects and evidence of some importance to a culture, a subculture, or a community for scientific, traditional, religious, and other reasons. These resources and relevant environmental data are important for describing and reconstructing past lifeways, for interpreting human behavior, and for predicting future courses of cultural development.

Curie: A unit of radioactivity equal to 37 billion disintegrations per second; also a quantity of any nuclide or mixture of nuclides having 1 curie of radioactivity.

Day-night average sound (total): The sound exposure for a 24-hour calendar day calculated by adding the sound exposure obtained during the daytime (0700–2200 hours) to 10 times the sound exposure obtained during the nighttime (000–0700 and 2200–2400 hours).

Day-night sound exposure level (total): Ten times the common logarithm of the ratio of the (total) day-night sound exposure to the reference sound exposure (E0) of 400 micropascals-squared seconds ($400mPa^2s$). Measured in decibel (dB).

Decay (radioactive): The decrease in the amount of any radioactive material with the passage of time, due to the spontaneous transformation of an unstable nuclide into a different nuclide or into a different energy state of the same nuclide; the emission of nuclear radiation (alpha, beta, or gamma radiation) is part of the process.

Decibel: A unit of sound measurement. In general, a sound doubles in loudness for every increase of 10 decibels.

Decibel, A-weighted: A unit of weighted sound pressure level measured by the use of a metering characteristic and the "A" wei specified by the American National St Institute (S1.4-1971[R176]).

Decontamination: The removal of radic or chemical contamination from fac equipment, or soils by washing, h chemical or electrochemical action, mech cleaning, or other techniques.

Demilitarization: An irreversible modifi or destruction of a weapons component of a component to the extent required to p use in its original weapon purpose.

Depleted uranium: Uranium whose cont the isotope uranium-235 is less than 0.7 pe which is the uranium-235 content of nat occurring uranium.

Deposition: In geology, the laying do potential rock-forming mat sedimentation. In atmospheric transpor settling out on ground and building surfa atmospheric aerosols and particles deposition") or their removal from the air ground by precipitation ("wet depositio "rainout").

Dismantlement: The process of taking a nuclear weapon or nuclear weapon compo This process takes place at Pantex Plant.

Dockum Group: Triassic sedimentary that underlie the Ogallala Formation at P Plant. The Dockum Group rocks consi shale, clayey siltstone, and sandstone.

Dose: The energy imparted to matte ionizing radiation. The unit of absorbed d the rad.

Dose equivalent: The product of absorbed in rad (or gray) and the effect of this ty radiation in tissue and a quality factor. equivalent is expressed in units of re Sievert, where 1 rem equals 0.01 Sievert. dose equivalent to an organ, tissue, or the w

will be that received from the direct ure plus the 50-year committed dose lent received from the radionuclides into the body during the year.

meter: A small device (instrument) d by a radiation worker that measures ative radiation dose (e.g., film badge or ion chamber).

age basin: An aboveground area that es the water to a particular stream.

down: The height difference between the d water level in a formation and the d water level in the formation caused by withdrawal of groundwater.

king-water standards: The prescribed of constituents or characteristics in a ng water supply that cannot be exceeded by.

ystem: Living organisms and their ing (abiotic) environment functioning ter as a community.

hant: A gas or fluid discharged into the nment.

sion standards: Legally enforceable on the quantities and/or kinds of air taminants that can be emitted into the sphere.

ronmental Restoration (ER) program: gram at Pantex Plant responsible for tigation and remediation of Solid Waste agement Units (SWMUs).

an: Pertaining to the wind; especially said th deposits as loess and dune sand, of sentary structures such as wind-formed e marks, or of erosion and deposition plished by the wind.

ameral stream: A stream that flows only a period of heavy precipitation.

Epicenter: The point on the Earth's surface directly above the focus of an earthquake.

Epidemiology: The science concerned with the study of events that determine and influence the frequency and distribution of disease, injury, and other health-related events and their causes in defined human population.

Equivalent sound (pressure) level (L_{eq}): The equivalent steady sound level that, if continuous during a specified time period, would contain the same total energy as the actual time-varying sound. For example, L_{eq} (1-h) and L_{eq} (24-h) are the 1-hour and 24-hour equivalent sound level, respectively.

Exceedance level: Sometimes used instead of the term "percentile level".

Exposure limit: The level of exposure to a hazardous chemical (set by law or a standard) at which or below which adverse human health effects are not expected to occur: 1) reference dose is the chronic exposure dose (mg/kg/day) for a given hazardous chemical at which or below which adverse human non-cancer health effects are not expected to occur. 2) Reference concentration is the chronic exposure concentration (mg/m^3) for a given hazardous chemical at which or below which adverse human non-cancer health effects are not expected to occur.

Facultative species: Plant species that are more or less equally likely to occur in wetlands or uplands (i.e., a species that is classified as facultative would be found in wetlands from 33 percent and 66 percent of the time). (Symbol used for these plants is FAC).

Fault: A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred. A normal fault occurs when the hanging wall has been depressed in relation to the footwall. A reverse fault occurs when the hanging wall has been raised in relation to the footwall.

Fissile material: Plutonium-239, uranium-233, uranium-235, or any material containing any of the foregoing.

Floodplain: The lowlands adjoining inland and coastal waters and relatively flat areas, including at a minimum that area inundated by a 1-percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical action floodplain is defined as the 500-year (0.2 percent) floodplain.

H-gear: Short for "Handling Gear". A container-like structure constructed at a metal frame, possibly containing casters. All have provisions for forklift tines or towing. There are many different sizes for different weapons systems. Some H-gear is for fully assembled weapons. This H-gear cradles the weapon around its mid-section

Hazardous material: A material, including a hazardous substance, as defined by 49 CFR 171.8 which poses a risk to health, safety, and property when transported or handled.

Hazardous waste: Defined by 40 CFR Part 261, as any material that (a) is a solid waste and (b) is a listed hazardous waste (Subpart D), or (c) exhibits any of the characteristics of ignitibility, corrosivity, reactivity, or toxicity (Subpart C).

High explosive: Any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, shock, or other suitable initiation stimulus undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases that exert pressure in the surrounding medium. Defined by 40 CFR Part 261.23 as any material that exhibits the characteristic of reactivity.

Highly enriched uranium: Uranium in which the abundance of the isotope uranium-235 is increased well above normal (naturally occurring) levels.

Hydraulic conductivity: A coef describing the rate at which water can through a permeable medium.

Hydrostratigraphic unit: A formation,] a formation, or a group of formations in there are similar hydrologic characteristic allow for a grouping into aquifers associated confining layers.

Infrastructure: The basic services, fac and equipment needed for the functionin growth of an area.

Injection wells: A well that takes water the surface into the ground, either th gravity of by mechanical means.

Insolation: A word contracted from the p incoming solar radiation that refers, in ge to solar radiation received at the earth's su Insolation on a horizontal surface is meas langleys (1 langley = 1 gram calorie per s centimeter).

Interfluvial: Falling in the area betwee streams.

Intersite: Transportation activities invo offsite activities.

Invertebrate: Animals characterized b having a backbone or spinal column, inclu a wide variety of organisms such as ins spiders, worms, clams, crayfish, etc.

Intrasite: Transportation activities occu solely within the boundaries of a facility.

Isolated Occurrence: A grouping of less ten artifacts or a single undatable feature. T often consists of redeposited materia questionable locational context that are related to nearby archaeological sites.

Isotope: Nuclei of the same element different numbers of neutrons are isotopes o element. For example, oxygen has 3 st isotopes containing 8, 9, and 10 neutrons.

...dy Kit: Container primarily used for ...ansport at tritium reservoirs. It is a light ...metal briefcase style container measuring ...10" x 8" with a methane foam liner.

...strine: Found or formed in lakes; also, a ...of wetland situated on or near a lake.

...: A stone artifact that has been modified ...ed by human hands.

...Income population: A population that is ...fied by the U.S. Bureau of the Census as ...g an aggregated mean income level for a ...y of four that correlates to $13,359, ...ed through the poverty index using a ...rd of living percentage change where ...able, and whose composition is at least 25 ...nt of the total population of a defined area ...isdiction.

...Estacado: Spanish for "staked plain", ...to refer to the Southern High Plains in ...and New Mexico.

...: A rich, permeable soil composed of a ...re of clay, silt, sand, and organic matter.

...level mixed waste: Waste containing ...radionuclides as defined by the *Atomic ...Act*, and hazardous constituents as ...ed by 42 U.S.C. 6901 et seq. and 40 CFR

...level waste: Waste that contains ...activity but is not classified as high-level ..., transuranic waste, spent nuclear fuel, or ...) by-product material" as defined by ... Order 5820.2A, Radioactive Waste ...gement. Test specimens of fissionable ...al irradiated for research and ...pment only, and not for the production of ... or plutonium, may be classified as low-... waste, provided the concentration of ...ranic waste is less than 100 nanocuries per ... Some low-level waste is considered ...fied because of the nature of the generating process and/or constituents, because the waste would tell too much about the process.

Magazine: A warehouse where explosives and ammunition are stored.

Mammal: Animals in the class Mammalia that are distinguished by having self regulating body temperature, hair, and in females, milk-producing mammary glands to feed their young.

Maximum contaminant level: The maximum permissible level of a contaminant in water delivered to any user of a public water system. Maximum contaminant levels are enforceable standards.

Megawatt: A unit of power equal to 1 million watts. Megawatt thermal is commonly used to define heat produced, while megawatt electric defines electricity produced.

Minority Population: A population that is classified by the U.S. Bureau of the Census as African American, Hispanic American, Asian and Pacific American, American Indian, Eskimo, Aleut, and other non-White persons, whose composition is at least 25 percent of the total population of a defined area or jurisdiction.

Meteorology: The science dealing with the atmosphere and its phenomena, especially as relating to weather.

Migration: The natural movement of a material through the air, soil, or groundwater; also, seasonal movement of animals from one area to another.

Mitigation: The alleviation of adverse impacts on cultural resources by avoidance through project redesign or project relocation, by protection, or by adequate scientific study.

National Ambient Air Quality Standards: Air quality standards established by the *Clean Air Act*, as amended. The primary National Ambient Air Quality Standards are intended to protect the public health with an adequate

margin of safety, and the secondary National Ambient Air Quality Standards are intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.

National Emission Standards for Hazardous Air Pollutants: A set of National emission standards for listed hazardous pollutants emitted from specific classes or categories of new and existing sources. These standards were implemented in the *Clean Air Act Amendments of 1977*.

National Pollutant Discharge Elimination System (NPDES) Permit: Federal regulation (40 CFR Parts 122 and 125) that requires permits for the discharge of pollutants from any point source into the waters of the U.S. regulated through the *Clean Water Act*, as amended.

National Register of Historic Places: A list maintained by the Secretary of the Interior of districts, sites, buildings, structures, and objects of prehistoric or historic local, state, or National significance. The list is expanded as authorized by Section 2(b) of the *Historic Sites Act of 1935* (16 U.S.C. 462) and Section 101(a)(1)(A) of the *National Historic Preservation Act of 1966*, as amended.

Native American: A tribe, people, or culture that is indigenous to the U.S.

Noise: Unwanted or undesirable sound, usually characterized as being so loud as to interfere with, or be inappropriate to, normal activities such as communication, sleep, study or recreation. (See background noise.)

Non-criteria pollutant: A pollutant with an effects screening level guideline. Some non-criteria pollutant have a state standard as well.

Nonattainment area: An air quality control region (or portion thereof) in which the Environmental Protection Agency has determined that ambient air concentrations exceed National Ambient Air Quality Sta for one or more criteria pollutants.

Nuclear weapon: Device with a r component that can produce damage to m and injury or death to personnel upon detc or ignition.

Obligate species: Plant species that always occur in wetlands (i.e., greater tl percent of the time).

Occupational Safety and H Administration: Oversees and reg workplace health and safety, created b *Occupational Safety and Health Act of 19*

Ogallala Formation: Tertiary forr consisting of gravel, sand, silt, and clay. principal geologic unit in the High aquifer, comprises the Ogallala aquifer Texas Panhandle, the primary sourc groundwater in the region. The top c Ogallala Formation in large areas of Texa New Mexico consists of a resistant c layer. The Ogallala Formation at F overlies the Triassic Dockum Group strat underlies the Quaternary Blackwater Formation.

Offsite: Outside the Pantex Plant boundary.

Onsite: Within the Pantex Plant Site boun

Ozone: The triatomic form of oxygen; i stratosphere, ozone protects the Earth fro sun's ultraviolet rays, but in lower levels c atmosphere ozone is considered an air poll

Paleontology: The study of fossils.

Pattern (Aircraft operations): The followed by an aircraft in the course of landing and take-off combination. An pattern is one in which an aircraft arrives i airport traffic, lands, takes off and leave airport traffic. A closed pattern is one in w

...craft performs touch-and-go landing and ...off one or more times, as in training flights.

...ched aquifer: Groundwater separated from ...underlying main body of groundwater, or ...fer, by unsaturated rock.

...pheral zone: The zone surrounding the ...s which is just higher in elevation than the ...floor.

...meability: The ability of rock or soil to ...mit a fluid.

...nian: The last period of the Paleozoic era ...r the Pennsylvanian) thought to have ...ed the span of time between 280 and 225 ...n years ago; also, the corresponding ...m of rocks. It is named after the province ...m, Russia, where rocks of this age were ...studied.

...-rem: The unit of collective radiation ...commitment to a given population; the ...of the individual doses received by a ...lation segment.

... An assembly at the center of a nuclear ...e containing a sub-critical mass of ...able material.

... A term used in the southwestern U.S. for ..., barren area in the lowest part of an ...ed desert basin, underlain by clay, silt, ..., and commonly by soluble salts. It may ...ked by an ephemeral lake.

...: The elongated pattern of contaminated ...water originating at a point source, such as ...kestack or a hazardous waste disposal site.

...nium: A heavy, radioactive, metallic ...ent with the atomic number 94. It is ...ced artificially in a reactor by ...ardment of uranium which neutrons and is ...in the production of nuclear weapons.

Pollution prevention: Involves recycling or reduction of any hazardous substance, pollutant, or contaminate before generation.

Potable: Suitable for drinking.

Potentiometric surface: An imaginary surface defined by the level that water will rise to in a tightly-cased well.

Prehistoric: Of, relating to, or existing in times antedating written history. Prehistoric cultural resources are those that antedate written records of the human cultures that produced them.

Programmatic Agreement: A proposed document outlining specific plans for the interim management of cultural resources at Pantex Plant until a comprehensive, long-term Cultural Resource Management Plan is implemented. The parties to the agreement will be the U.S. Department of Energy, the President's Advisory Council on Historic Preservation, and the Texas State Historic Preservation Office.

Pullman soil series: Silty clay loams; soils found in the interplaya areas at Pantex Plant.

Quaternary: The second period of the Cenozoic era, following the Tertiary; also, the corresponding system of rocks. It began two to three Ma and extends to the present. It consists of two epochs, the Pleistocene and the Holocene.

Radiation: The emitted particles or photons from the nuclei of radioactive atoms. Some elements are naturally radioactive; others are induced to become radioactive by bombardment in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.

Radioactive: The state of emitting radiation energy in forms of waves (rays) or particles.

Radioactive waste: Materials from nuclear operations that are radioactive or are contaminated with radioactive materials, and

Tritium: A radioactive isotope of the element hydrogen with two neutrons and one proton. Common symbols for the isotope are H–3 and T.

Vertebrate: Animals that are members of the subphylum Vertebrata, including the fishes, amphibians, reptiles, birds, and mammals, all of which are characterized by having a segmented bony or cartilaginous spinal column.

Waste acceptance criteria: Requirements established by treatment, storage, and disposal facilities for the acceptance of waste into the facility.

Waste generator: Any individual or group of individuals that generate radioactive, mixed, hazardous, or other types of wastes at Pantex Plant.

Waste Minimization: Refers to a pract reduces the environmental or health l associated with hazardous wastes, pollut contaminants after generation.

Water Table: Water under the surface ground occurs in two zones, an unsaturated zone and the deeper saturate The boundary between the two zones water table.

Weapon Component: An item in a r weapon that can be either an assem individual subset of an assembly. Com can be used interchangeably with "pa "assembly".

Wetland: Land or areas exhibiting hydr concentrations, saturated or inundate during some portion of the year, and species tolerant of such conditions.

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CHAPTER 11

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