4.4 PANTEX SITE

The following sections describe the affected environment at Pantex for land use, visual resources, site infrastructure, air quality and noise, water resources, geology and soils, biological resources, cultural and paleontological resources, and socioeconomics. In addition, radiation and hazardous chemical environment, transportation, and waste management are described.

4.4.1 Land Use and Visual Resources

4.4.1.1 Land Use

Pantex is a 6,111-ha (15,100-ac) facility approximately 27 km (17 mi) east-northeast of Amarillo, Texas, in Carson County (see Figure 4.4.1.1–1). DOE owns 60 percent of the land area or approximately 3,642 ha (9,000 ac). The remainder (approximately 2,428 ha [6,000 ac]) is owned by Texas Tech University and is leased to DOE. In addition, DOE owns the detached property around Pantex Lake, approximately 4 km (2.5 mi) northeast of the main plant. The 436 ha (1,077 ac) of undeveloped land around Pantex Lake is held by DOE to retain water rights.

Historically, Pantex was divided into functional areas referred to as zones. The only current functional areas that retain this designation are Zone 12, which contains fabrication, assembly/disassembly, technical areas, and administrative support areas; Zone 11, which contains the high explosives development area; Zone 10, which serves as an excess property storage site; and Zone 4, which includes the weapons/high explosives magazine and interim pit storage area (see Figure 4.4.1.1–2). Generalized land use categories at Pantex are depicted in Figure 4.4.1.1–3. These include industrial, rangeland, open space, agricultural, and playas.

Industrial operations at Pantex are currently limited to approximately 809 ha (2,000 ac) on the DOE-owned property (Figure 4.4.1.1–2). Within the industrialized area, facilities are provided for production, storage, administration, and supporting infrastructure. Outside of the industrial area, Pantex has a burning ground, firing sites, and other outlying areas occupying 198 ha (489 ac). Operations at Pantex are conducted for DOE/NNSA by a management and operating contractor, BWXT Pantex LLC and Sandia National Laboratories.

Texas Tech University owns the land south of and contiguous to the DOE-owned land and uses it for a variety of agricultural research programs, including dry-land farming and livestock grazing. Most of this property is considered prime farmland when irrigated. DOE uses this land as a safety and security buffer. Texas Tech also uses approximately 2,144 ha (5,300 ac) of DOE-owned land for agricultural purposes under a service agreement with DOE.

The reference location for the MPF at Pantex is a 36-ha (90-ac) tract of land just north of Zone 11 and south of Zone 4 West and Zone 4 East. The land was cultivated until 1993 and replanted with native grasses in 1996. This tract of land is surrounded on all sides by a similar land use—open space. It is now considered a non-industrial low maintenance area within the Protected Area boundaries. From the center of the 36-ha (90-ac) tract, the center of Playa #2 is approximately 1,585 m (5,200 ft) west, while the center of Playa #1 is approximately 1,176 m (3,860 ft) northeast.

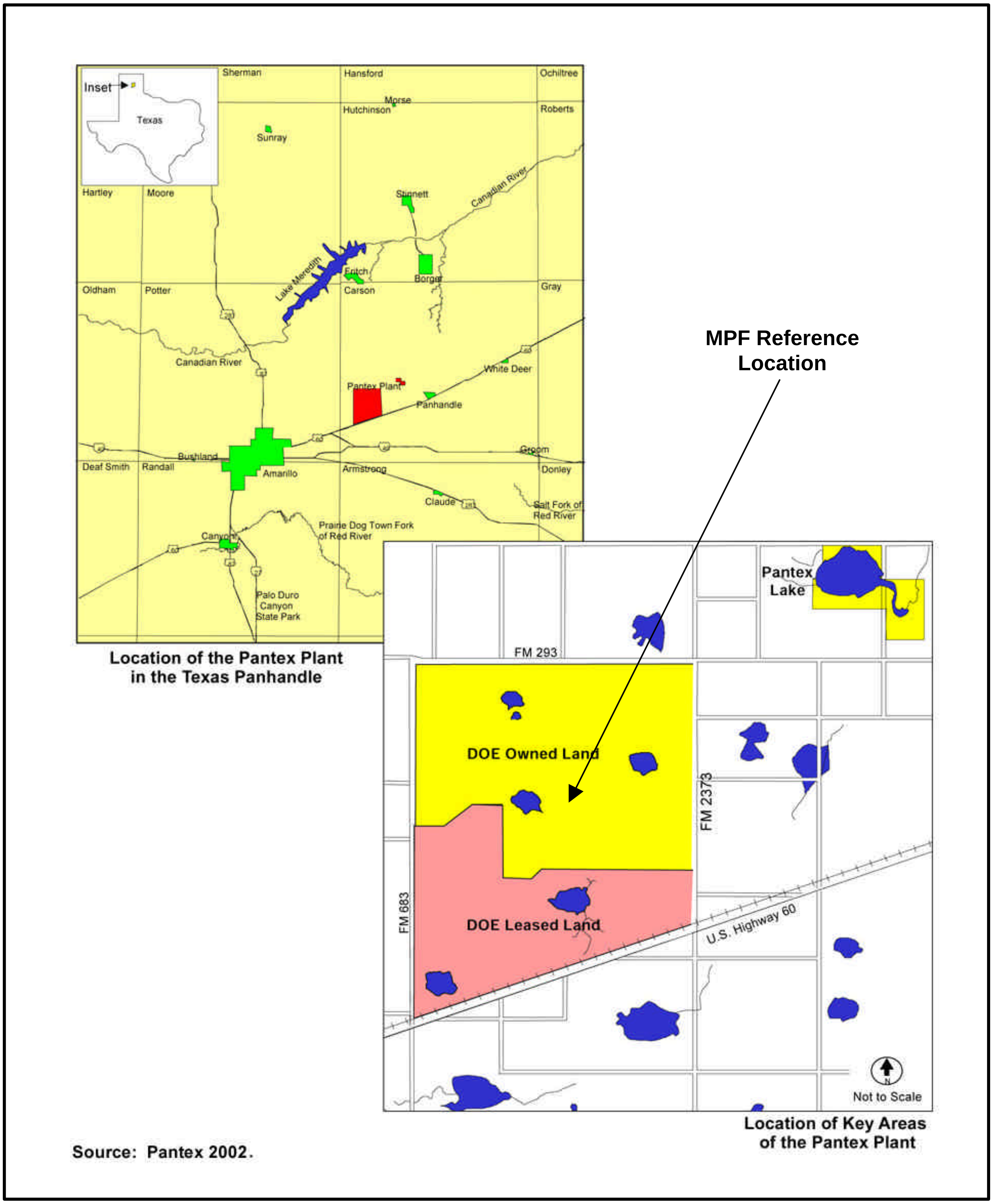
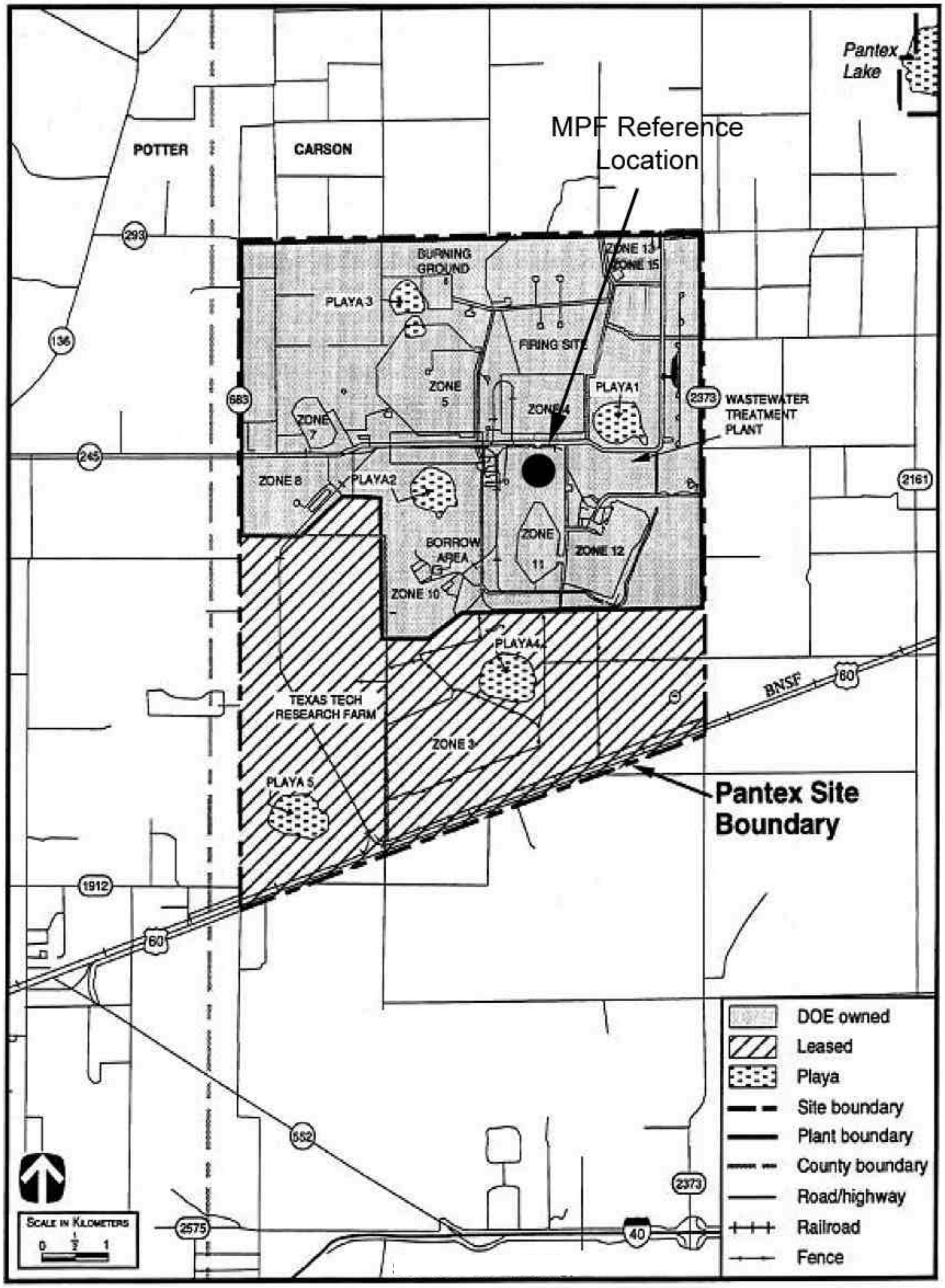


Figure 4.4.1.1–1. Location of the Pantex Site



Source: DOE 2002e.

Figure 4.4.1.1–2. Pantex Site

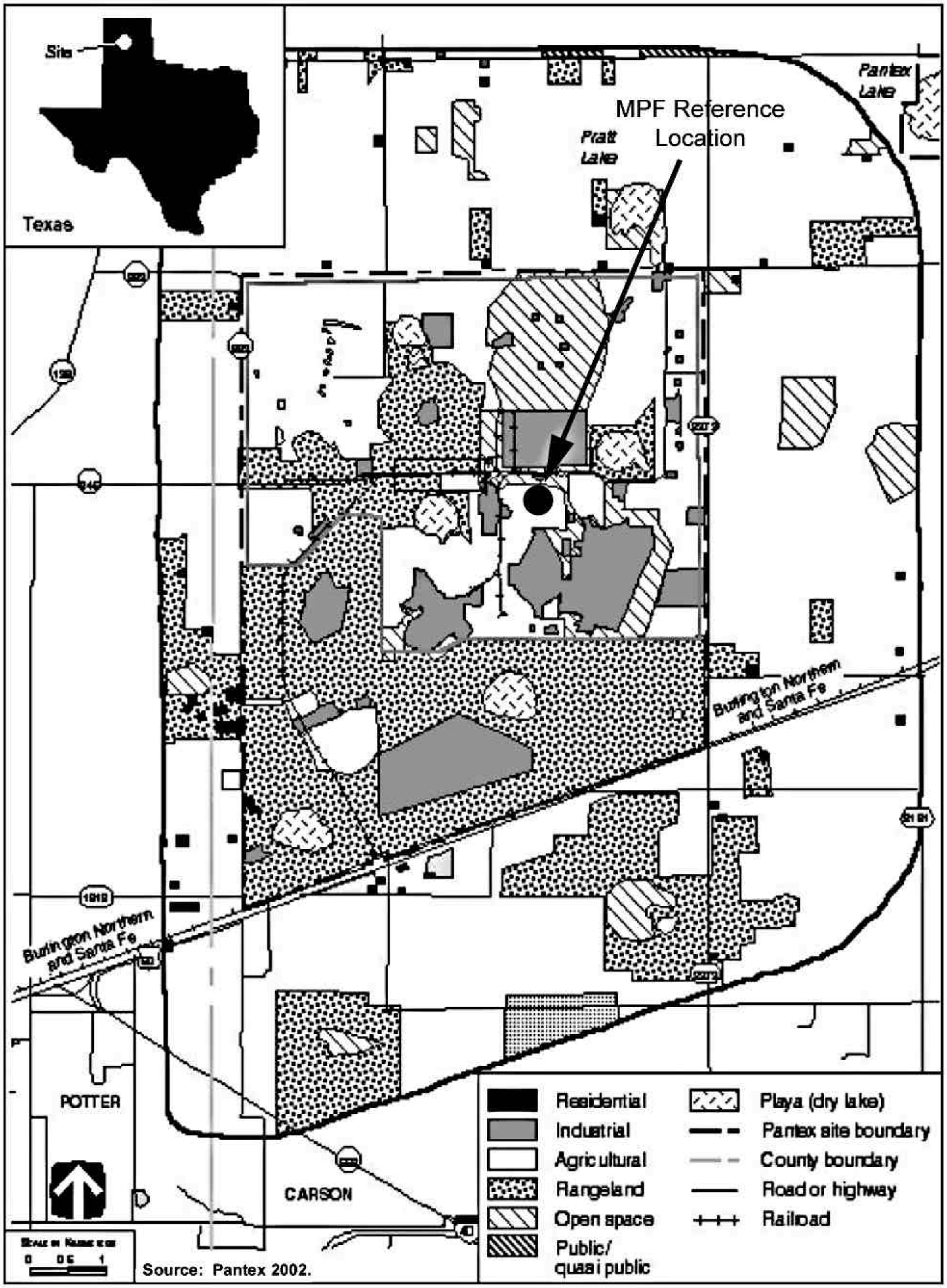


Figure 4.4.1.1–3. Generalized Land Use at Pantex Site

DOE will manage future land and facility use at Pantex through the *Pantex Plant FY2003 10-Year Comprehensive Site Plan* (Pantex 2002). Land resources are expected to remain constant with continued leasing of the Texas Tech land. The *Integrated Plan for Playa Management at Pantex Plant* (BWXT 2002b) provides land use guidelines for the playas and surrounding areas. This plan is being implemented as a best management plan to protect and manage cultural and natural resources.

In the area near Pantex, residences occur mostly in the small town of Panhandle, 18 km (11 mi) east of Pantex. Other concentrations of residences are at Highland Park Village, approximately 11 km (7 mi) southwest and Washburn 10 km (6.5 mi) south. The closest residences are approximately 30 m (100 ft) west and north of the plant boundary along Texas Farm-to-Market Road (FM) 683 and 293, and within 0.8 km (0.5 mi) east of the Plant Boundary along FM 2373. Most of the land surrounding the plant is prime farmland (when irrigated) with some rangeland to the northwest. The Iowa Beef Packers, Inc., packing plant is the only industrial facility within 3 km (2 mi).

Within the State of Texas, land-use planning occurs only at the municipal level. The *City of Amarillo Comprehensive Plan* (City of Amarillo 1989) includes land near Pantex in its East Planning Area. This area has been a slower-growing area because of some of the industrial facilities already in the area, including the airport. The Plan encourages growth in the East Planning Area to be compatible with the industrial nature of the current use.

4.4.1.2 Visual Resources

Pantex is in a treeless plain of a shortgrass prairie ecosystem. The plant consists of approximately 700 operational buildings. These industrial uses are surrounded by cropland and rangeland that blend into the offsite viewshed. As mentioned above, the reference location for the MPF was cultivated until 1993 and replanted with native grasses in 1996. It is surrounded on all sides by a similar land use—open space. There is a radio tower planned for construction near the eastern perimeter of this location.

The developed areas at Pantex are consistent with a Visual Resource Management Class IV designation, as defined by the BLM (DOI 2001). The remainder of Pantex is consistent with a Visual Resource Management rating of Class III or IV. (See Table 4.2.1.2–1 for descriptions of the Visual Resource Management Rating System). Plant facilities are visible from U.S. 60 and the local Farm-to-Market roads adjacent to Pantex's boundaries. At night, Pantex lights are visible from the aforementioned roads and I-40. However, the MPF reference location is in the midst of the industrial complex. With the possible exception of the 30-m (100-ft) HEPA filter exhaust stacks, no MPF facility structures would be visible from areas offsite because the existing buildings and infrastructure would obstruct the view.

4.4.2 Site Infrastructure

An extensive network of existing infrastructure provides services to Pantex activities and facilities as shown in Table 4.4.2–1. These services are discussed in detail in the following sections. Two categories of infrastructure—transportation access and utilities—are described below for Pantex. Transportation access includes roads, railroads, and airports while utilities include electricity and fuel (e.g., natural gas, gasoline, and coal).

Table 4.4.2–1. Pantex Site-Wide Infrastructure Characteristics

Resource	Current Usage	Site Capacity
Transportation		
Roads (km)	76	76
Railroads (km)	27	27
Electricity		
Energy consumption (MWh/yr)	81,850	201,480
Peak load (MWe)	13.6	47.5
Fuel		
Natural gas (m^3/yr)	12,910,000	289,000,000
Oil (L/yr)	59,960	Not limited[a]
Coal (t/yr)	0	0

NA = not applicable
[a] Low supplies can be replenished by truck or rail.
Source: King 1997; DOE 1999h; DOE 2002e.

4.4.2.1 Transportation

Access to the site is provided by the Texas Farm-to-Market roads bounding the site on the north, east, and west and by U.S. 60, 1.6 km (1 mi) to the south. I-40 and I-27 provide access to the interstate highway system. Additionally, 76 km (47 mi) of roads exist within Pantex boundaries.

Roads within Pantex are classified as primary, secondary, and tertiary roadways. Primary roads are the main distribution arteries for all onsite and offsite traffic. Secondary roads are collector roadways that supplement the primary roads. Primary and secondary roads are paved, two-lane roadways. Tertiary roads are generally single-lane roads, but some heavily traveled tertiary roads are two lanes (M&H 1996, DOE 1999h).

Pantex is connected to the Burlington Northern and Santa Fe railroad system via a spur that enters from the southwest. This spur provides access to the entire system as well as to other railroads (M&H 1996, DOE 1999h).

The Amarillo International Airport is located approximately 12 km (7.5 mi) southwest of Pantex. Pantex leases a small facility at the airport for its own transportation use (DOE 1996e).

4.4.2.2 Electrical Power

Electrical power is supplied by XCEL Energy to the nine-county region surrounding Pantex with the exception of Donley County, which is serviced by West Texas Utilities. Generation is primarily from coal, oil, and gas. Other sources include nuclear and hydroelectric. Pantex draws its power from the West Central Power Pool.

Current site electricity consumption and site capacity are approximately 81,850 MWh/yr and 201,480 MWh/yr, respectively. The peak load capacity for the entire site is 47.5 MWe with peak load usage at approximately 13.6 MWe.

4.4.2.3 Fuel

The Texas Panhandle is one of the major oil and gas producing regions in the country with considerable reserves. Oil is used as a backup for Building 16-13 steam boiler. Oil capacity is limited by number of deliveries and onsite storage capacity of 89,300 L (23,600 gal) (DOE 1999h).

Natural gas is supplied to Pantex by ATMOS Energy. The natural gas is delivered through a 25-cm (10-in) main supply line, which is capable of supplying 289 million m^3 (10.2 billion ft^3), sufficient capacity for all future plant requirements (DOE 1995a). Annual site availability of natural gas is about 289 million m^3/yr (10.2 billion ft^3/yr) with current usage about 12.9 million m^3/yr (456 million ft^3/yr) (King 1997, DOE 1999h, DOE 2002e).

4.4.3 Air Quality and Noise

4.4.3.1 Climate and Meteorology

The climate at Pantex 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 km (40 mi) 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.

The average annual temperature in the Amarillo region is 13.8°C (56.9°F); temperatures range from an average daily minimum of -5.7°C (21.8°F) in January to an average daily maximum of 32.8°C (91.1°F) in July. The average annual precipitation is 49.8 cm (19.6 in). Seventy-five percent of the total annual precipitation falls between April and September. The average annual snowfall is 42.9 cm (16.9 in). The snow usually melts in a few days.

Average wind speeds at Amarillo are relatively high. The average annual windspeed is 6 m/s (13.5 mi/hr). 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 is located in an area with a relatively high frequency of tornadoes. Fifty-three tornadoes were recorded in Carson County from 1950-1994. The estimated probability of a tornado striking a point at Pantex is 2.3×10^{-4} per year (DOE 1995a).

4.4.3.2 Nonradiological Releases

Pantex operations can result in the release of nonradiological air pollutants that may affect the air quality of the surrounding area. Pantex is located within the Amarillo-Lubbock Intrastate AQCR. The Amarillo-Lubbock Intrastate AQCR is classified as an attainment area for all six criteria pollutants (i.e., carbon monoxide, nitrogen dioxide, lead, ozone, sulfur dioxide, and PM_{10}) (40 CFR 81.344).

In addition to the NAAQS established by the EPA, the State of Texas has established ambient air quality standards for total suspended particulate matter, inorganic fluoride compounds calculated as hydrogen fluoride, hydrogen sulfide, sulfuric acid, and beryllium.

The nearest PSD Class I areas to Pantex are the Salt Creek Wilderness in New Mexico, approximately 274 km (170 mi) to the southwest, and the Wichita Mountains Wilderness in Oklahoma, approximately 290 km (180 mi) to the east-southeast (40 CFR 81.421 and 81.424). Pantex has no sources subject to PSD requirements.

The primary emission sources of criteria pollutants at Pantex are the steam plant boilers, the explosives-burning operation, and emissions from onsite vehicles. Emission sources of hazardous or toxic air pollutants include the high-explosives synthesis facility, the explosives-burning operation, paint spray booths, miscellaneous laboratories, and other small operations. With the exception of thermal treatment of high explosives at the burning ground, most stationary sources of nonradioactive atmospheric releases are fume hoods and building exhaust systems, some of which have HEPA filters for control of particulate emissions.

Pantex air quality monitoring stations measure organic pollutants, PM_{10}, and hydrogen fluoride. 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. During 2000, ambient air monitoring was conducted for hydrogen fluoride, PM_{10}, and 39 species of VOCs. The results of the 2000 ambient air monitoring are summarized in Table 4.4.3.2–1.

Table 4.4.3.2–1. Nonradiological Ambient Air Monitoring Results, 2000

Pollutant	Averaging Period	Most Stringent Standard[a] (micrograms per m^3)	Ambient Concentration (micrograms per m^3)
PM_{10}	Annual	50[b]	37.46
	24-hour	150[b]	118.32
Hydrogen fluoride	24-hour	2.18[c]	0.085
Benzene[d]	24-hour	4 (ppbv)[c]	2.500 (ppbv)

PM_{10} = particulate matter less than or equal to 10 microns in aerodynamic diameter.
[a] The more stringent of the Federal and state standards is presented if both exist for the averaging period.
[b] Federal and state standard.
[c] TCEQ effects screening levels (ESL) are "tools" used by the Toxicology and Risk Assessment Staff to evaluate impacts of air pollutant emissions. They are not ambient air standards. If ambient levels of air contaminants exceed the screening levels, it does not necessarily indicate a problem, but would trigger an in-depth review. The levels were set where no adverse effect is expected.
[d] Thirty-nine VOC species were monitored. The largest measurement "normalized" to ESLs was that for a 2.500 ppbv measurement of Benzene which is 62.5% of the ESL for that substance.
Source: Pantex 2001b.

Table 4.4.3.2–2 presents the ambient air concentrations attributable to sources at Pantex, which are based on emissions for 1993. These emissions were modeled using meteorological data from 1988 and represent maximum output conditions. Actual annual emissions for some pollutants are somewhat less than these levels, and the estimated concentrations bound the actual Pantex contribution to ambient levels. Concentrations of nonradiological air pollutants shown in Table 4.4.3.2–2 are in compliance with applicable regulations or are below applicable health effects screening levels (the concentration of hazardous air pollutants determined by the TCEQ to have minimal effect on human health and the environment).

Table 4.4.3.2–2. Nonradiological Ambient Air Concentrations from Pantex Sources, 1993

Pollutant	Averaging Period	Most Stringent Standard[a] (micrograms per m^3)	Ambient Concentration (micrograms per m^3)
Carbon monoxide	8-hour	10,000[b]	161
	1-hour	40,000[b]	924
Nitrogen dioxide	Annual	100[b]	0.90
Sulfur dioxide	Annual	80[b]	<0.01
	24-hour	365[b]	<0.01
	3-hour	1,300[b]	<0.01
	30-minute	1,048[c]	<0.01
Ozone	8-hour[e]	157[d]	[e]
	1-hour	235[b]	[e]
PM_{10}	Annual	50[b]	8.73
	24-hour	150[b]	88.5
$PM_{2.5}$	Annual	15 [d]	[e]
	24-hour	65 [d]	[e]
Total suspended particulates	3-hour	200[c]	[f]
	1-hour	400[c]	[f]
Hydrogen sulfide	30-minutes	112[c]	[g]
Benzene	24-hour	4 (ppbv)[h]	[f]
	1-hour	75 (ppbv)[h]	19.4 (ppbv)[i]
Ethylene glycol	24-hour	26 (ppbv)[h]	[f]
	1-hour	260 (ppbv)[h]	[f]

PM_{10} = particulate matter less than or equal to 10 microns in aerodynamic diameter.
$PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in aerodynamic diameter.
[a] The more stringent of the Federal and state standards is presented if both exist for the averaging period.
[b] Federal and state standard.
[c] State standard.
[d] The 8-hour ozone and the $PM_{2.5}$ standards are undergoing judicial review.
[e] No data is available for assessment of ambient concentrations.
[f] No site boundary concentrations from Pantex facilities are available.
[g] No sources identified at site.
[h] TCEQ effects screening levels are "tools" used by the Toxicology and Risk Assessment Staff to evaluate impacts of air pollutant emissions. They are not ambient air standards. If ambient levels of air contaminants exceed the screening levels, it does not necessarily indicate a problem, but would trigger an in-depth review. The levels were set where no adverse effect is expected.
[i] Concentration reported as a 30-minute average. No 24-hour concentration reported.
Source: DOE 1996d.

4.4.3.3 Radiological Releases

In normal operating situations, little potential exists for exposure of Pantex personnel, the public, or the environment from release of radioactive materials. Small amounts of tritium escape as a gas or vapor during normal operations, and some tritium residual is present onsite as a result of an accidental release in 1989 that occurred during a routine disassembly operation in Cell 1, Zone 12. The accidental release of tritium was conservatively estimated as 40,000 curies (Ci) (DOE 1996d). Radionuclide releases to the environment during 2000 are summarized in Table 4.4.3.3–1. These releases represent the maximum possible release from a point (stack or vent) and/or area source. The source term for releases to air was estimated based upon process knowledge, the number of operations conducted during the year and other modifying factors. The actual releases are much smaller than the estimates presented in Table 4.3.3.3–1.

Table 4.4.3.3–1. Radiological Airborne Releases at Pantex in 2000

Radionuclide	Release (Curies)
Tritium (Hydrogen-3)	2.714
Thorium-232	2.76×10^{-7}
Uranium-234	6.47×10^{-11}
Uranium-238	6.73×10^{-7}
All other	3.28×10^{-6}

Source: Pantex 2001b.

4.4.3.4 Noise

The major noise sources at Pantex include various industrial facilities, equipment, and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, construction and materials-handling equipment, vehicles), as well as small arms firing, alarms, and explosives detonation. Most Pantex industrial facilities are far enough from the site boundary that noise levels from these sources at the boundary are barely distinguishable from background noise. However, some noise from explosives detonation can be heard at residences north of the site, and small arms weapons firing can be heard at residences to the west (DOE 1996d).

The acoustic environment along the Pantex boundary and at nearby residences away from traffic noise is typical of a rural location. The day-night average sound levels are in the range of 35 to 50 dBA. Noise survey results in areas adjacent to Pantex indicate that ambient sound levels are generally low, with natural sounds and distant traffic being the primary sources. Traffic is the primary source of noise at the site boundary and at residences near roads.

Traffic noise is expected to dominate sound levels along major roads in the area, such as U.S. 60. The residents most likely to be affected by noise from plant traffic along Pantex access routes are those living along FM 2373 and FM 683. Measurements of equivalent sound levels for traffic noise and other sources along the roads bounding Pantex are 53 to 62 dBA for FM 2373 at about 400 m (1,300 ft) from the road; 51 to 58 dBA for FM 293 at about 70 m (230 ft); 44 to 65 dBA for FM 683 at about 40 m (130 ft); and 51 dBA for U.S. 60 at about 225 m (740 ft). These levels are based on a limited number of 30-minute samples taken during peak and off-peak traffic periods, mostly at locations within the site boundary. The levels represent the range of daytime traffic noise levels at residences near the site. Other sources of noise include aircraft, wind, insect activity, and agricultural activity (DOE 1996d).

Except for the prohibition of nuisance noise, neither the State of Texas nor local governments have established any regulations that specify acceptable community noise levels applicable to Pantex (DOE 1996d). The EPA guidelines for environmental noise protection recommend an average day-night sound level of 55 dBA as sufficient to protect the public from the effects of broadband environmental noise in typically quiet outdoor and residential areas (EPA 1974). Land use compatibility guidelines adopted by the Federal Aviation Administration and the Federal Interagency Committee on Urban Noise indicate that yearly day-night average sound levels less than 65 dBA are compatible with residential land uses and levels up to 75 dBA are compatible with residential uses if suitable noise reduction features are incorporated into structures (14 CFR 150). It is expected that for most residences near Pantex, the day-night average sound level is less than 65 dBA and is compatible with the residential land use (DOE 1999h).

4.4.4 Water Resources

4.4.4.1 Surface Water

Pantex is situated on a flat portion of the Southern High Plains of Texas. No streams or rivers flow through Pantex. Major surface water in the vicinity includes the Canadian River, 27 km (17 mi) to the north, Sweetwater Creek and the Salt Fork of the Red River, respectively 80 km (50 mi) and 32 km (20 mi) to the east, and the Prairie Dog Fork of the Red River, 56 km (35 mi) to the south. The Canadian River flows north into Lake Meredith, about 40 km (25 mi). Water from Lake Meredith is mixed with water pumped from the Ogallala Aquifer for use as drinking water for several Southern High Plains cities. No hydrologic connections exist to transport contaminants from Pantex into either the Canadian River or Lake Meredith (DOE 1999h).

The only naturally occurring waterbodies on or adjacent to the site are six playas and very small, unnamed, intermittent channels and ditches that may feed stormwater into them. There are three playas (Playas 1, 2, and 3) on Pantex property, two (Playas 4 and 5) on the Texas Tech University property, several playas adjacent to Pantex, and one, called Pantex Lake, on DOE-owned property about 4 km (2.5 mi) northeast of the main portion of Pantex. Pantex Lake received discharges from the old sewage treatment facility from 1942 until the early 1970s. Playa 1 has received continuous discharges from Pantex Wastewater Treatment Facility (WWTF), with the only continuous flow occurring in the associated discharge outfall ditch. Playa 1 has also received wastewater effluent and stormwater via discharge points originating from plant operations. Playa 3 receives stormwater runoff from the Burning Ground. Currently, only Playa 1 receives treated wastewater discharges (BWXT 2002a). All of the playas receive stormwater runoff from precipitation events.

Studies have suggested that most of the recharge of the underlying Ogallala Aquifer within the Southern High Plains originates from water stored in the playas. However, the playas are frequently dry because of the high, naturally occurring evaporation rate combined with a rate of infiltration that normally exceeds the rate of inflow. Playas in the area of the plant may be as large as 1,220 m (4,000 ft) in diameter and more than 9 m (30 ft) deep. Most of the playas are floored with a clay accumulation at the bottom that is lens shaped, being thickest in the middle and thinning out toward the edges. These clay floors may contain desiccation cracks up to 1.8 m (6 ft) deep when the floor is dry (Pantex 2001b).

The only surface water that flows throughout the year is the one that receives flow from the WWTF and discharges into Playa 1. The WWTF consists of a facultative lagoon and an irrigated storage pond. The facultative lagoon has a compacted clay liner and the storage pond has a synthetic liner. The facultative lagoon is 9.7 ha (3.9 ac) and has a capacity of (41.6 million L) (11.0 million gal). The irrigation storage pond is the same size and capacity. Facultative treatment involves bacteria that live in normal-oxygen and reduced-oxygen environments. Total detention time is 35 days. In 2002, sampling was conducted at both the incoming weir of the lagoon (before treatment) and at the permitted discharge point (after treatment) to evaluate the lagoon's efficiency.

Domestic and treated industrial effluent discharges are authorized by Texas Commission on Environmental Quality (TCEQ) permit. In September 1998, EPA issued an Administrative

Order to Mason & Hanger Corporation requiring certain changes and corrective actions for violations of its NPDES permit limitations at Playa 1. In September 2001, the TCEQ and NPDES permits were combined into a single permit. This combined permit resulted from the State of Texas assuming permitting authority from the EPA in September 1998. The new permit authorizes discharge of treated domestic and industrial effluent to the environment through only one outfall from the permit. Industrial stormwater discharges are regulated by the Texas Pollutant Discharge Elimination System (TPDES) Multi-Sector General Permit (MSGP). Pantex filed for coverage under the TPDES MSGP in November 2001.

In January 2001, the U.S. Supreme Court issued a decision that significantly limited the scope of the CWA as it applied to Pantex. The Supreme Court held that isolated waterbodies like the Playa Lakes into which Pantex effluent and stormwater discharges flow are not under the jurisdiction of the CWA. As a result, these discharges are regulated only if the State of Texas has applicable regulations. Stormwater discharges involving construction activities are regulated by the TCEQ. The TCEQ issued Pantex a new general permit for construction stormwater discharges in 2003. Pantex adheres to the standards set forth in this permit during construction activities.

Surface Water Quality

In 2001, surface water was monitored for radioactive and nonradioactive parameters at 20 locations. Sampling at the WWTF was conducted in 2001 in accordance with Pantex's NPDES permit. Nonradiological sampling includes metals, organics, explosives, pesticides, and PCBs. Radiological sampling at the playas includes gross alpha/beta and tritium. Metals were below state Inland Water Quality Parameters and consistent with historical values. Due to an extremely dry year, Playas 2 and 4 were predominantly dry throughout 2001. The playas never contained enough water to collect a representative sample. A VOC, acetone, was detected at Playas 1 and 3. The explosive HMX and RDX were detected in Playas 1 and 3. The Playa 1 February 2001 sample results were below the Practical Quantitation Limit (PQL) of 0.002 mg/L, while the October 2001 results were slightly above PQLs with HMX at 0.0013 mg/L and RDX at 0.0018 mg/L. The Playa 3 sample results were below PQLs for HMX and RDX (Pantex 2001b). Table 4.4.4.1–1 summarizes the constituents that were above the PQL except for the gross alpha measurement, which is defined as the Maximum Contaminant Level (MCL). A PQL is the lowest level that can be accurately and reproducibly quantified (DOE 1999h).

In 2002, construction of the new wastewater treatment facility was completed. Construction of the new system was designed to allow Pantex to use treated effluent for irrigation purposes. In 2001, an application for a Texas Land Application Permit was filed with the TCEQ. This application has not been approved, thus Pantex continues to discharge to Playa 1. If the pending application is approved, Pantex will design and build an irrigation system to allow beneficial use of the treated effluent.

Water rights in Texas fall under the Doctrine of Prior Appropriations. However, since Pantex does not use any surface water, it exerts no surface water rights. Figure 4.4.4.1–1 shows the surface water drainage basins for each of the playas (DOE 1999h). Stormwater runoff from the industrialized areas of Pantex collects within the playas and does not flow offsite. During heavy precipitation events in 2000, Playa 1 also received flow, via a pump, from the tailwater pit near the old Sewage Treatment Plant at the northeast corner of Pantex (Pantex 2001b). Flooding of some low-lying portions of Pantex could occur as a result of runoff associated with precipitation and the subsequent filling of the playas. There has been no major flooding at the Pantex site (DOE 1999h).

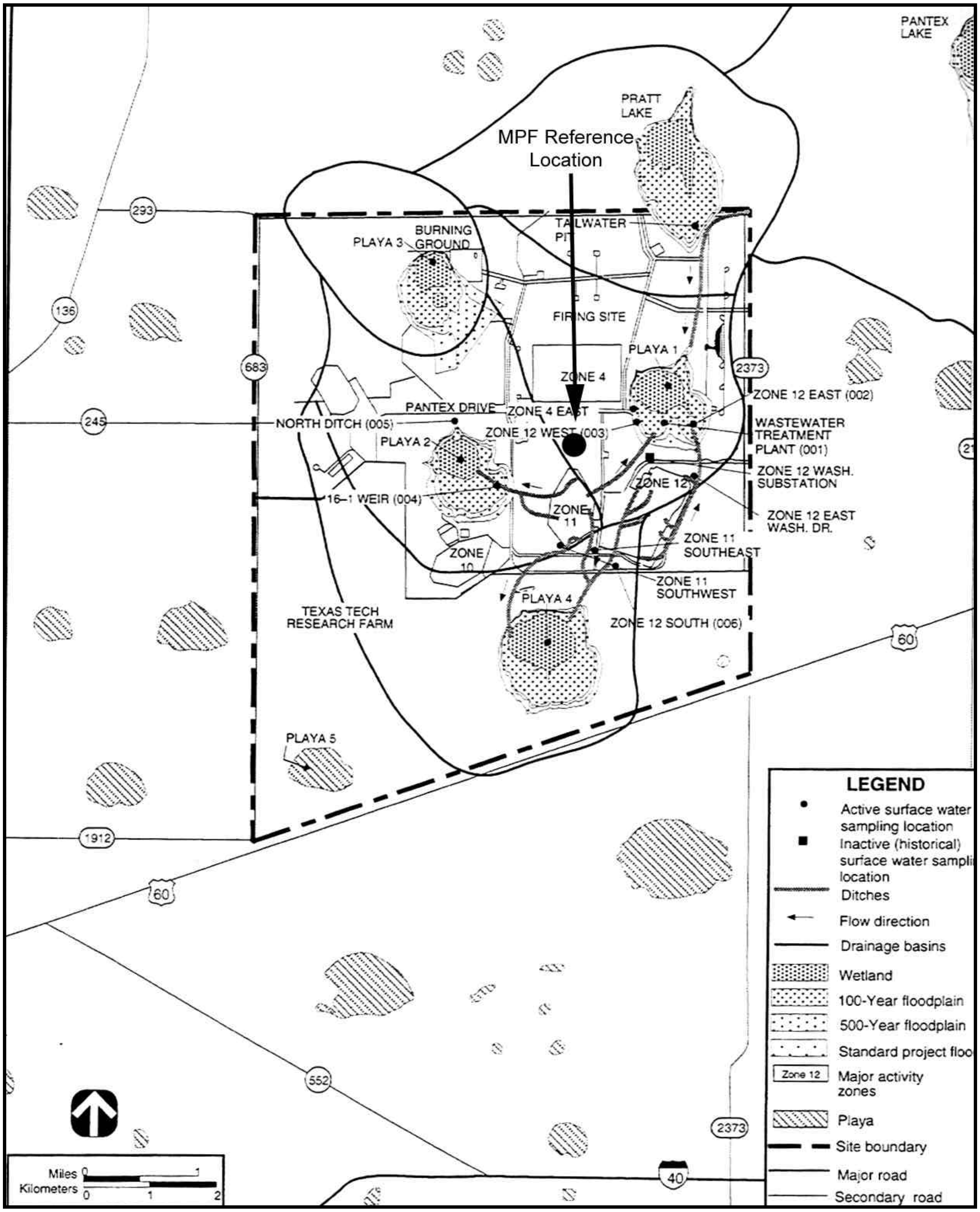
Table 4.4.4.1-1. Summary of Constituents Sampling Results above Practical Quantitation Limit for Pantex Plant Surface Water

Location and Constituent	Date	Sample Result (mg/L)	PQL (mg/L)
Playa 1 Basin			
HMX	October 2001	0.0013	0.002
RDX	October 2001	0.0018	0.002
Wastewater Treatment Facility			
Chlorine	October 2001 and December 2001	4.3, 4.1 respectively	4.0
Oil and Grease	May, August, December	26.0, 16.0, 23.0 respectively	15.0
Ammonia	February 2001, March 2001, April 2001	5.05, 5.22, 5.38 respectively	5.0
Playa 2 Basin			
Playa 2 never contained enough water to collect samples in 2001			
Playa 3 Basin			
Gross alpha	February 2001	93 pCi/L	15.0 pCi/L*
Gross beta	February 2001	160 pCi/L	50 pCi/L*
Playa 4 Basin			
Playa 4 never contained enough water to collect samples in 2001			
Pantex Lake			
Pantex Lake never contained enough water to collect samples in 2001			

* denotes MCL standard
Source: Pantex 2001b.

Floodplains at Pantex were delineated by the U.S. Army Corps of Engineers (USACE) in accordance with Executive Order 11988 (E.O. 11988). This assessment also addressed DOE's environmental review requirement under *Compliance with Floodplain/Wetlands Environmental Review Requirements* (10 CFR 1022). The USACE delineated floodplain boundaries for Playas 1 though 4, Pantex Lake, and Pratt Lake, located north of the site, using criteria for 100-year, 500-year, and Standard Project Flood boundaries (see Figure 4.4.4.1–1). The reference location is not within any of these flood boundaries.

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 cm [1 ft]) flooding of the drainage basins for Playas 1 and 2 (DOE 1999h).



Source: DOE 1996e.

Figure 4.4.4.1–1. Locations of Primary Outfalls and Floodplains at Pantex

4.4.4.2 Groundwater

The three primary hydrostratigraphic units (i.e., separate layers of water) in the vicinity of Pantex are the Blackwater Draw Formation, the Ogallala Formation, and the Triassic Dockum Group. The units as a whole constitute an upper vadose (unsaturated) zone, a saturated perched aquifer zone, the lower vadose zone above the Ogallala Aquifer, and the Ogallala Aquifer.

The Blackwater Draw Formation has been identified as the most widespread post-Ogallala unit throughout the Southern High Plains. It consists of modified eolian sands and silts interbedded with numerous caliches composed of variably cemented carbonate layers and nodules. The thickness of the Blackwater Draw Formation at Pantex is variable, ranging from 15-24 m (50-80 ft) (DOE 1999h).

The lower part of the Ogallala Formation is saturated and commonly referred to as the Ogallala Aquifer. Perched groundwater also occurs beneath parts of Pantex, and overlies the Ogallala Aquifer. Recharge occurs from precipitation and subsequent infiltration of surface water either through surface soils or through focused recharge from the numerous playas that occur across the area. Direct recharge of the aquifer can occur in those limited areas where the aquifer formation is at the surface, but no outcrops exist at Pantex. Recent evidence supports significant recharge of the aquifer below the playas in the Southern High Plains; however, evidence of such recharge has not been determined for the Ogallala Aquifer at Pantex (DOE 1999h).

The Ogallala Aquifer is the principal aquifer and major source of water in the vicinity of Pantex and the surrounding region. The Ogallala Aquifer can yield 2,650-4,542 L (700-1,200 gal) per minute of high quality waters to the wells in the area. Depths to the Ogallala Aquifer generally run parallel to the regional land surface, which dips gently from northwest to southeast and varies at Pantex from about 105 m (344 ft) at the southern boundary to 151 m (496 ft) at the northern boundary (DOE 2002e). This south-to-north groundwater flow contrasts with the regional northwest-to-southeast trend of the remaining portion of the Southern High Plains. The current data reflect a decline in the Ogallala water table elevation of up to 9 m (30 ft) beneath portions of Pantex. This is due to the drawdown and attests to the continued regional state of overdraft (DOE 2002e).

The Triassic Dockum Group underlying the Ogallala Formation is believed to be as thick as 30 m (100 ft) under Pantex (DOE 1999h). Limited data from regional hydrogeologic studies of the Triassic Dockum Group divide it into an upper and a lower section, with only the Lower Dockum Group inferred to exist beneath portions of Carson County, including the southwest portion where Pantex is located. The Lower Dockum Group consists predominantly of fine- to coarse-grained sandstones and granular and pebble conglomerate along with mudstone sequences of alluvial, deltaic, and lacustrine origin. It has a thickness of less than 61 m (200 ft) beneath southwestern Carson County (DOE 1999h). The water-bearing stratum of the Lower Dockum Group is the Lower Dockum Aquifer. Regionally, the surface of the aquifer lies 91-213 m (300-700 ft) below the base of the Ogallala Formation (DOE 1999h).

The two main water-bearing units beneath Pantex are the Tertiary Ogallala Formation and the Triassic Dockum Group. Two water-bearing zones in the Ogallala Formation are present beneath Pantex. The first is a perched water zone above the main zone of saturation. One of these is present beneath Playa 1. The perched water zone consists of discontinuous perched water lenses, the lateral extent of which has not been fully determined. Extensive hydrogeological studies of the perched groundwater have been conducted by the University of Texas at Austin, Bureau of Economic Geology, the USACE, Battelle Memorial Institute, and the Texas Higher Education Consortium. As it is currently understood, the perched aquifers underlying Pantex are believed to be the result of operational and industrial discharges from the site (Pantex 2001b). Runoff from buildings, streets, parking lots, and fields at Pantex flows through unlined ditches and accumulates in playas, mainly in Playa 1. All industrial discharges that historically flowed through these ditches have been plumbed to the sanitary sewer. However, the WWTF continues to discharge to an open ditch before entering Playa 1. Water from the ditches and playas that are not lost to evaporation infiltrates to the perched aquifers. The contamination in the perched aquifer is believed to be the result of Pantex operations conducted between the early 1950s through the early 1980s. At Pantex, perched groundwater is not used for industrial activities or for human consumption (Pantex 2001b).

Four production wells in the northeast corner of Pantex provide water for the site's needs. In 2001, Pantex used approximately 492 million L (130 million gal) of water. The city of Amarillo produced approximately 98 billion L (26 billion gal) of water from the Ogallala Aquifer via the Amarillo-Carson County wellfield.

Groundwater is controlled by individual landowners in Texas through the Doctrine of Prior Appropriations. TCEQ and the Texas Water Development Board are the two state agencies with major involvement in groundwater fact finding, data gathering, and analysis. Groundwater management is the responsibility of local jurisdictions through Groundwater Management Districts. Pantex is in the Panhandle Groundwater Conservation District, which has the authority to require permits and limit the quantity of water pumped. Historically, the Panhandle Groundwater Conservation District has not limited the quantity of water pumped.

However, for wells drilled after July 19, 1995, that produce more than 1.3 million L/yr (350,000 gal/yr) per acre owned, landowners are required to obtain a High Production Permit from the Panhandle Groundwater Conservation District (DOE 1999h). The DOE-owned portion of Pantex is approximately 4,100 ha (10,131 ac) in area. Therefore, a High Production Permit would be required if DOE were to exceed approximately 13 billion L/yr (3.4 billion gal/yr) of groundwater withdrawals. In 2001, water usage at Pantex was approximately 492 million L/yr (130 million gal/yr), with a system capacity of approximately 3.8 billion L/yr (1 billion gal/yr) (DOE 2002e).

Groundwater Quality

Monitoring of the groundwater to identify impacts, both past and present, of Pantex operations is performed according to DOE Order 450.1, Environmental Protection Program, and the requirements of TCEQ Hazardous Waste Permit, HW-50284. The groundwater monitoring network at Pantex is composed of 125 wells. Ninety-one wells are completed into the perched aquifer. Seventy-eight wells are onsite; and the remainders are offsite, on the Texas Tech University Property (nine) or on various private properties (four). Ten wells are dry; however, they are checked on a regular basis for the presence of groundwater.

Thirty-four wells were completed in the Ogallala Aquifer. Twenty-six wells are located onsite; the remainder are offsite on the Texas Tech University Property (two), on various private properties (five) and a single (one) control well located at the United States Department of Agriculture's Agricultural Research Service Conservation and Production Research Laboratory near Bushland, Texas.

Twenty-nine wells are used for investigative purposes and five are permitted monitoring wells. One monitor well and two investigation wells were plugged and abandoned in 2001. Ten investigation wells (nine perched and one Ogallala) have been parked (dropped from the sampling plan at this time) in agreement with the TCEQ. The parked wells are not sampled, but are in close proximity to wells that are sampled.

The Risk Reduction Rule Guidance for Pantex Plant is a guide used to identify the quantifiable detection limit for sampled constituents. The detection limit is defined as the PQL (lowest level that can be accurately and reproducibly quantified) for all constituents except hexavalent chromium (CR-6). The limit for CR-6 is defined as the MCL. Groundwater investigation wells were sampled quarterly, semiannually, or annually, depending on the analyte for which the sampling was performed. Pantex Production wells are also monitored on a quarterly and annual basis, depending upon the analyte being sampled.

The control well location near Bushland, Texas, was sampled quarterly in 2001. Sampling at the Bushland location allows Pantex technicians to obtain comparative data for the Ogallala in a cross- gradient location. It is unaffected by Pantex Plant operations.

In 2002, 196 samples were collected from the Ogallala and 92 samples from the perched aquifers. The results of the sampling efforts are discussed below.

Perched Aquifer Groundwater Investigation/Monitor Wells

Analytical results for compounds detected in 2002 in all perched investigation and monitor wells are summarized in Table 4.4.4.2-1. The calculated means included in the tables are not inclusive of sample results that were below the PQLs.

Metals Results. Of the 24 metals analyzed for in the perched aquifer, 18 were detected at or above their respective PQLs at least once during 2002. Metals, with the exception of hexavalent chromium, are naturally occurring in the soils and sediments at the Pantex Plant.

Metals concentrations can be attributed to the fact that they have been detected in perched groundwater at Pantex, due to heavy sediment loads that often occur in perched groundwater samples. In addition to this, impacts from historic plant operations are also contributing factors to some of the detected metals results in the perched aquifer. All but seven of the metals (antimony, molybdenum, calcium, iron, magnesium, potassium, and selenium) detected in the perched aquifer during 2002 have been previously identified as contaminants of potential concern in the perched aquifer.

High Explosives Results. Of the 15 high explosives that were analyzed for in the perched, 13 were detected at or above their respective PQLs at least once during 2002. These detections are indicative of impacts from historic plant operations. The majority of the explosives detected in the perched during 2002 have been previously identified as contaminants of potential concern in the perched aquifer; 2-nitrotoluene and 4-nitrotoluene have been sporadically detected in perched groundwater across Pantex, but contamination has never been confirmed based on trending and validation results.

Pesticides Results. The analysis of pesticides was removed from the groundwater monitoring program in the second quarter of 2001, per agreement with the TCEQ, based upon the characterization being complete for this class of compounds.

Volatile Organic Compounds Results. Sixty-one volatile organic compounds (VOCs) were analyzed for in the perched aquifer during 2002. Of these 61, only fourteen were detected at levels at or above their respective PQLs. These detections are indicative of impacts from historic Plant operations. Of the fourteen, all of the VOCs, except two (freon-113 and trichlorofluromethane), have been previously identified as contaminants of potential concern in the perched aquifer. Freon-113 and trichlorofluromethane were added into the groundwater monitoring program in 2001, due to previous detections in soil-gas samples taken from the Burning Ground area. Analysis of these compounds will continue for nature and extent determination of these constituents.

Semi-volatile Organic Compounds Results. One hundred and nineteen semi-volatile organic compounds were sampled for in 2002. Two were detected at or above their respective PQLs.

Miscellaneous Factors. This category of analytes is made up of various water quality indicator analyses and the analysis of perchlorate. The water quality indicators are background constituents. These detections are expected in all the wells. The analysis of water quality indicators is performed on all perched aquifer wells in order to give an indication of well problems, sampling problems, and potential contamination. The levels detected in 2002 are what are expected of these types of analyses. Perchlorate was detected in eleven out of 109 samples. Perchlorate has been detected previously in the perched, at levels comparable to the previous detections.

The average concentrations of selected contaminants of potential concern at selected investigation wells for 2002 are shown in Table 4.4.4.2-1. The selected investigation wells are located within identified plumes. Investigation wells representative of the chrome plume are: PTX06-1011, PTX06-1052, PTX08-1008, and PTX08-1009. Investigation wells PTX06-1003, PTX06-1005, PTX06-1014, and PTX06-1038 are representative of the high explosives plume. Investigation wells OW-WR-45, PTX06-1010, PTX10-1013, and PTX10-1014 are in a volatile organic compound plume (TCE). The selection criteria show an approximate extent of the areas of contamination.

Ogallala Aquifer Investigation/Monitor Wells

Analytical results for compounds detected in all Ogallala investigation and monitor wells are summarized in Table 4.4.4.2-2. Though some constituents have been detected in the Ogallala Aquifer, these detections are either one-time detections (i.e. not reproduced upon confirmation sampling), attributable to sediments in the groundwater, or an artifact of the multi-level sampling systems. Analytical results are further discussed below.

Metals Results. Of the 25 metals analyzed for in the Ogallala Aquifer, 20 were detected at or above their respective PQLs at least once during 2002. Metals, with the exception of hexavalent chromium, are naturally occurring in the soils and sediments at Pantex. The metals concentrations that have been detected in Ogallala groundwater at Pantex have been attributed to heavy sediment loads that often occur in the groundwater samples.

High Explosives Results. Of the 15 high explosives analyzed for in the Ogallala Aquifer, two were detected at or above the PQL. Neither compound could be confirmed with repeated sample analysis.

Pesticides Results. The analysis of pesticides was removed from the groundwater monitoring program in the second quarter of 2001, per agreement with the TCEQ, based upon the characterization being complete for this class of compounds.

Volatile Organic Compounds Results. There were no VOCs detected at or above the PQL in Ogallala Aquifer samples during 2002.

Semi-volatile Organic Compounds Results. One hundred thirty-one semi-volatile organic compounds were analyzed for in the Ogallala Aquifer during 2002. One compound was detected at or above its respective PQL, but was not confirmed.

Miscellaneous Factors Results. This category of analytes is made up of various water quality indicator analyses and the analysis of perchlorate. The water quality indicators are background constituents. They are expected to be detected in all wells. The analysis of water quality indicators is performed on all Ogallala Aquifer wells in order to give an indication of well problems, sampling problems, and potential contamination. The levels detected in 2002 in the Ogallala Aquifer are what are expected of these types of analyses.

Historical Comparisons-Perched Aquifer

Mean results for 1996 through 2002 are summarized in Table 4.4.4.2–3 for perched wells located within identified plumes.

Table 4.4.4.2–1. 2002 Summary Data for the Perched Aquifer

Analyte Type Code	CAS	Constituent	Number of samples	Number of detections[b]	Max (Mg/L)	Min (Mg/L)	Mean (Mg/L)	MCL (mg/L)
High Explosives								
	121-82-4	Cyclotrimethylenetrinitramine (RDX)	139	83	2.300000	0.000170	0.503102	0.002
	2691-41-0	HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	133	68	0.380000	0.000081	0.061428	0.002
	1946-51-0	4-amino-2,6-Dinitrotoluene	113	42	0.031100	0.000052	0.008441	—
	35572-78-2	2-amino-4,6-Dinitrotoluene	111	17	0.045000	0.000063	0.009463	—
	121-14-2	2,4-Dinitrotoluene	113	15	0.029600	0.000084	0.010922	—
	99-35-4	1,3,5-Trinitrobenzene	97	13	0.860000	0.000040	0.069529	—
	118-96-7	2,4,6-Trinitrotoluene	111	12	0.012700	0.000210	0.005406	—
	78-11-5	Pentaerythritol tetranitrate (PETN)	102	11	0.001400	0.000180	0.000567	—
	479-45-8	Tetryl	111	10	0.001100	0.000047	0.000423	—
	99-65-0	1,3-Dinitrobenzene	102	8	0.003600	0.000046	0.000704	—
	606-20-2	2,6-Dinitrotoluene	103	7	0.000790	0.000140	0.000366	—
	88-72-2	o-Nitrotoluene (2-nitrotoluene)	103	6	0.002100	0.000086	0.000633	—
	99-99-0	p-Nitrotoluene (4-nitrotoluene)	106	4	0.000500	0.000180	0.000320	—
Metals								
	7439-97-6	Magnesium	109	109	70.700000	9.600000	28.513211	—
	7439-98-7	Barium	103	103	0.544000	0.050800	0.238799	2.0
	7440-02-0	Vanadium	92	89	0.126000	0.005150	0.015528	0.26
	7440-22-4	Boron	88	88	1.600000	0.035000	0.386336	—

Table 4.4.4.2–1. 2002 Summary Data for the Perched Aquifer *(continued)*

Analyte Type Code	CAS	Constituent[a]	Number of samples	Number of detections[b]	Max (Mg/L)	Min (Mg/L)	Mean (Mg/L)	MCL (mg/L)
Metals *(continued)*								
	7440-28-0	Iron	80	68	32.900000	0.013800	3.016231	0.3
	7440-31-5	Chromium (III) (total chromium)	164	62	14.700000	0.000714	1.288827	0.1
	7440-36-0	Manganese	59	46	0.484000	0.001820	0.064117	0.05
	7440-38-2	Nickel and compounds	63	35	1.010000	0.003900	0.172872	
	7440-39-3	Zinc	50	27	1.000000	0.003180	0.062216	5.0
	7440-41-7	Aluminum	71	26	15.200000	0.058500	1.202119	0.05-0.2
	7440-42-8	Molybdenum	32	25	0.472000	0.011500	0.069264	
	7440-43-9	Copper	68	23	0.176000	0.001880	0.034502	1.3
	7440-47-3	Arsenic	74	8	0.023000	0.004620	0.011309	0.010
	7440-48-4	Selenium	88	8	0.007500	0.002600	0.005468	0.05
	7440-50-8	Thallium	58	7	0.006300	0.000260	0.001539	0.002
	7440-62-2	Cobalt	90	7	0.033900	0.004000	0.011689	—
	7440-66-6	Lead (inorganic)	39	3	0.011100	0.001100	0.004750	0.015
	7782-49-2	Cadmium	81	2	0.001500	0.001010	0.001255	0.005
Miscellaneous Factors								
	10-33-3	Total Dissolved Solids	107	107	630.000000	139.000000	329.822430	500
	14797-73-0	Perchlorate	108	11	0.300000	0.016400	0.112964	—
	14808-79-8	Sulfate	100	100	70.800003	5.800000	22.235600	250
	16887-00-6	Chloride	87	87	123.000000	4.180000	43.262299	250
	16984-48-8	Fluoride	102	102	2.400000	0.085000	0.897412	4.0
	57-12-5	Cyanide	90	2	0.010800	0.005350	0.008075	0.2
	C-012	TOC[c]	309	309	2.110000	0.233000	0.829288	

Table 4.4.4.2–1. 2002 Summary Data for the Perched Aquifer *(continued)*

Analyte Type Code	CAS	Constituent[a]	Number of samples	Number of detections[b]	Max (Mg/L)	Min (Mg/L)	Mean (Mg/L)	MCL (mg/L)
Semivolatile Organics								
	117-81-7	Bis (2-ethyl-hexyl) phthalate	14	9	0.002900	0.000860	0.002018	6.0
	123-91-1	1,4-Dioxane	13	1	0.041000	0.041000	0.041000	—
Volatile Organics								
	79-01-6	Trichloroethylene	94	23	0.046800	0.001100	0.010335	0.005
	67-64-1	Acetone	109	21	0.009500	0.003200	0.005519	—
	75-09-2	Methylene chloride	101	14	0.004100	0.000630	0.002326	—
	107-06-2	1,2-Dichloroethane	103	13	0.015800	0.001300	0.004931	0.005
	108-88-3	Toluene	99	9	0.001800	0.000210	0.000744	1.0
	74-83-9	Bromomethane	108	8	0.001800	0.001100	0.001337	—
	127-18-4	Tetrachloroethylene	108	4	0.014700	0.002500	0.006500	0.005
	156-59-2	cis-1,2-Dichloroethylene	106	4	0.004500	0.002300	0.003475	0.07
	67-66-3	Chloroform	105	4	0.081800	0.008300	0.029600	—
	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	108	4	0.057900	0.006500	0.021400	0.005
	75-69-4	Trichlorofluoromethane	109	3	0.003800	0.001300	0.002967	—
	108-90-7	Chlorobenzene	111	2	0.003900	0.003500	0.003700	0.1
	75-71-8	Dichlorodifluoromethane	111	2	0.001000	0.000990	0.000995	—
	56-23-5	Carbon tetrachloride	106	1	0.001200	0.001200	0.001200	0.005

"— " = No MCL
RRS 2 Res = Risk Reduction Standard 2- Residential value
[a] Only those analytes that had at least one detected result were reported.
[b] A 'detection' was considered to be any value that occurred at or above the laboratory's Practical Quantitation Limit (PQL).
[c] Each Total Organic Carbon sample has 4 distinct sample runs. All runs were taken into account for the calculation of the values in this table.
Source: DOE 1995d.

Table 4.4.4.2–2. 2002 Summary Data for Ogallala Aquifer

AnalyteType Code	CAS	Constituent[a]	Number of samples	Number of detections[b]	Max (Mg/L)	Min (Mg/L)	Mean (Mg/L)	MCL (mg/L)
High Explosives								
	121-82-4	Cyclotrimethylenetrinitramine (RDX)	62	1	0.000130	0.000130	0.000130	0.002
	88-72-2	o-Nitrotoluene (2-nitrotoluene)	62	3	0.002900	0.000120	0.001906	—
Metals								
	7429-90-5	Aluminum	65	23	12.000000	0.067099	1.834534	—
	7439-89-6	Iron	65	41	12.600000	0.058999	1.932953	0..3
	7439-92-1	Lead (inorganic)	65	5	0.011000	0.002220	0.005502	0.015
	7439-95-4	Magnesium	65	65	37.200000	11.500000	24.415385	—
	7439-96-5	Manganese	65	33	0.609000	0.006320	0.069776	0.05
	7439-98-7	Molybdenum	65	6	0.019900	0.011500	0.014167	—
	7440-02-0	Nickel and compounds	65	16	0.458000	0.005980	0.102105	—
	7440-22-4	Silver	65	2	0.036100	0.006610	0.021355	0.10
	7440-31-5	Tin	65	1	0.011700	0.011700	0.011700	—
	7440-38-2	Arsenic	65	12	0.017500	0.005110	0.008028	0.010
	7440-39-3	Barium	65	63	0.449000	0.020100	0.144606	2.0
	7440-41-7	Beryllium	65	2	0.000574	0.000276	0.000425	0.004
	7440-42-8	Boron	65	55	0.223000	0.082700	0.154751	—
	7440-47-3	Chromium (III) (total chromium)	65	21	0.270000	0.005170	0.030679	0.1
	7440-50-8	Copper	65	15	0.083800	0.005010	0.002362	1.0
	7440-61-1	Uranium	3	3	0.007200	0.005300	0.006167	0.30 μg/L
	7440-62-2	Vanadium	65	58	0.052000	0.005430	0.016804	0.26
	7440-66-6	Zinc	65	36	0.294000	0.005170	0.040518	5.0
	7782-49-2	Selenium	65	6	0.006570	0.005090	0.005798	5.0
	18540-29-9	Hexavalent Chromium	60	2	9.400000	0.024000	4.711999	0.1

Table 4.4.4.2–2. 2002 Summary Data for Ogallala Aquifer *(continued)*

AnalyteType Code	CAS	Constituent[a]	Number of samples	Number of detections[b]	Max (Mg/L)	Min (Mg/L)	Mean (Mg/L)	MCL (mg/L)
Miscellaneous								
	T-005	Alkalinity	55	55	248.0000	144.0000	201.2363	—
	57-12-5	Cyanide	55	1	0.005600	0.005600	0.005600	0.2
	16887-00-6	Chloride	55	48	57.50000	4.11990	11.59062	250
	16984-48-8	Fluoride	55	52	2.30999	0.14000	1.38230	4.0
	11-02-9	Hardness	55	55	284.0000	118.0000	189.2363	
	1-005	Nitrate/Nitrate as N	2	2	1.09000	1.07000	1.08000	10
	14797-55-8	Nitrate	54	54	6.52099	0.01700	1.35750	10
	14797-65-0	Nitrite	52	46	0.05200	0.00100	0.005826	1.0
	14808-79-8	Sulfate	55	53	40.09999	5.80000	17.96377	250
	10-33-3	Total Dissolved Solids	55	55	593.0000	192.0000	275.9636	500
	C-012	TOC[c]	176	148	1.30999	0.24500	0.58102	—
Volatile Organics								
		No Detections						
Semivolatile Organics								
	117-81-7	Bis (2-ethyl-hexyl) phthalate	34	1	0.021000	0.021000	0.021000	6.0

"— "= No MCL
RRS 2 Res = Risk Reduction Standard 2- Residential value
[a] Only those analytes that had at least one detected result were reported.
[b] A 'detection' was considered to be any value that occurred at or above the laboratory's Practical Quantitation Limit (PQL).
[c] Each Total Organic Carbon sample has 4 distinct sample runs. All runs were taken into account for the calculation of the values in this table.
Source: DOE 1995d.

Table 4.4.4.2–3. Mean Results for Select Perched Aquifer Investigation Wells at Pantex for 1996-2002

Locations	1996	1997	1998	1999	2000	2001	2002
Metals (Wells selected for their proximity to existing plumes)							
Chromium, in mg/L							
PTX06-1011	0.2135	NS	0.139	0.147	0.125	2.46	0.339
PTX06-1052	NW	NW	NW	NW	6.275	6.6	6.6
PTX08-1008	6.487	8.64	10.2	13.05	8.94	11.9	8.7
PTX08-1009	3.44	2.67	0.547	0.226	0.216	0.256	0.152
Chromium, hexavalent, in mg/L							
PTX06-1011	0.0965	0.12	0.06	NS	3.07	6.95	–
PTX06-1052	NW	NW	NW	NW	6.95	6.8	5.5
PTX08-1008	7.09	9.8	11.125	10	7.03	12	8.3
PTX08-1009	3.524	2.25	0.59	0.23	0.21	0.224	0.076
Manganese, in mg/L							
PTX06-1011	0.0054	NS	0.0025	0.0023	0.0016	0.212	0.0128
PTX06-1052	NW	NW	NW	NW	0.001	0.00065	–
PTX08-1008	0.0015	0.0012	0.0022	0.00309	0.0115	–	–
PTX08-1009	0.0014	–	0.0017	0.0052	NS	0.000852	–
Thallium, in mg/L							
PTX06-1011	0.0025	NS	–	–	–	0.000526	–
PTX06-1052	NW	NW	NW	NW	26.5	–	–
PTX08-1008	13	13	13	12	13	–	–
PTX08-1009	0.00355	–	–	–	–	–	–
Explosives (Wells selected for their proximity to existing plumes) HMX, in mg/L							
PTX06-1003	0.0195	0.00078	–	0.00795	–	–	–
PTX06-1005	0.343	0.32	0.356	0.27	0.606	0.418	0.380
PTX06-1014	1.57	0.25	0.0236	–	0.155	0.1345	0.161
PTX06-1038	NW	NW	0.585	0.212	0.139	0.1625	0.195
RDX, in mg/L							
PTX06-1003	0.047	0.0028	0.0244	0.0428	0.0428	0.00052	0.0017
PTX06-1005	0.74	0.93	0.643	0.846	1.34	1.05	1.1
PTX06-1014	12.36	3.7	0.5045	1.64	1.4	1.08	1.18
PTX06-1038	NW	NW	0.5	1.505	1.38	1.09	1.18
Volatile Organic Compounds (Wells selected for their proximity to existing plumes) TCE, in mg/L							
OW-WR-45	0.0083	0.00945	0.00675	0.01	0.0027	0.0028	0.012
PTX06-1010	0.01	0.0054	0.0076	0.0058	0.0072	0.0052	0.0063
PTX10-1013	0.0357	NS	0.0328	0.0258	0.037	0.0402	0.022
PTX10-1014	0.0245	NS	0.0197	0.0193	0.011	0.0112	0.0074
Contamination Indicators and Quality Parameters Chlorides, in mg/L							
PTX06-1003	74.125	–	70.29	67.1	NS	37.7	39.2
PTX06-1005	25.02	28.79	–	24.89	NS	31.4	41.6
PTX06-1014	39.72	40.59	42.4	34.2	35.89	33.55	37.8
PTX06-1038	NW	NW	36.06	34.54	NW	34	36.3

Table 4.4.4.2–3. Mean Results for Select Perched Aquifer Investigation Wells at Pantex for 1996-2002 *(continued)*

Locations	1996	1997	1998	1999	2000	2001	2002
Sulfates, in mg/L							
PTX06-1003	33.4	–	24	26.8	NS	19.9	19.1
PTX06-1005	28	34.2	NS	27.9	NS	23	27
PTX06-1014	16.1	22.4	13.8	13.9	13.4	13.45	13.9
PTX06-1038	NW	NW	29.7	30.1	NS	35.2	36.0
Total Organic Carbon, in mg/L							
PTX06-1003	13	1.09	3.006	1.29	NS	0.8899	–
PTX06-1005	51.44	3.04	3.1	4.64	NS	2.102	1.9
PTX06-1014	21.5	1.03	3.64	1.52	0.807	1.21	1.05
PTX06-1038	NW	NS	4.07	4.58	NS	1.55	1.15

[a] "–" indicates mean was less than detection limits.
[b] NS indicates not sampled or no result for that analyte.
[c] NW indicates new well, no samples prior to indicated sample.
Source: DOE 1995d.

4.4.5 Geology and Soils

4.4.5.1 Geology

Pantex is located on the Southern High Plains portion of the Great Plains Province. The topography is relatively flat and marked by thousands of playa lakes. The representative site being evaluated for the MPF is in the center of Pantex. The Panhandle region is characterized by a number of major structural and sedimentary basins separated by uplifts. These major structural elements, the result of tectonic events, have influenced subsequent tectonic processes. Pantex is located on the Amarillo Uplift, which, along with the Oldham-Harmon Trend, comprise a west-northwest trending uplifted area that separates the Andarko Basin to the northeast and the Palo Duro Basin to the southwest. Pantex is located at the southeastern edge of the Whittenburg Trough that separates the Amarillo Uplift from Bush and Bravo Domes to the west (Figure 4.4.5.1–1) (BWXT 2002a).

Geologic Conditions

This subsection describes the geologic conditions that could affect the stability of the ground and infrastructure at Pantex and includes potential volcanic activity, seismic activity (earthquakes), slope stability, surface subsidence, and soil liquefaction.

Volcanism

The closest Tertiary or Quaternary volcanism in the region surrounding Pantex is in New Mexico, over 161 km (100 mi) from the site (BWXT 2002a).

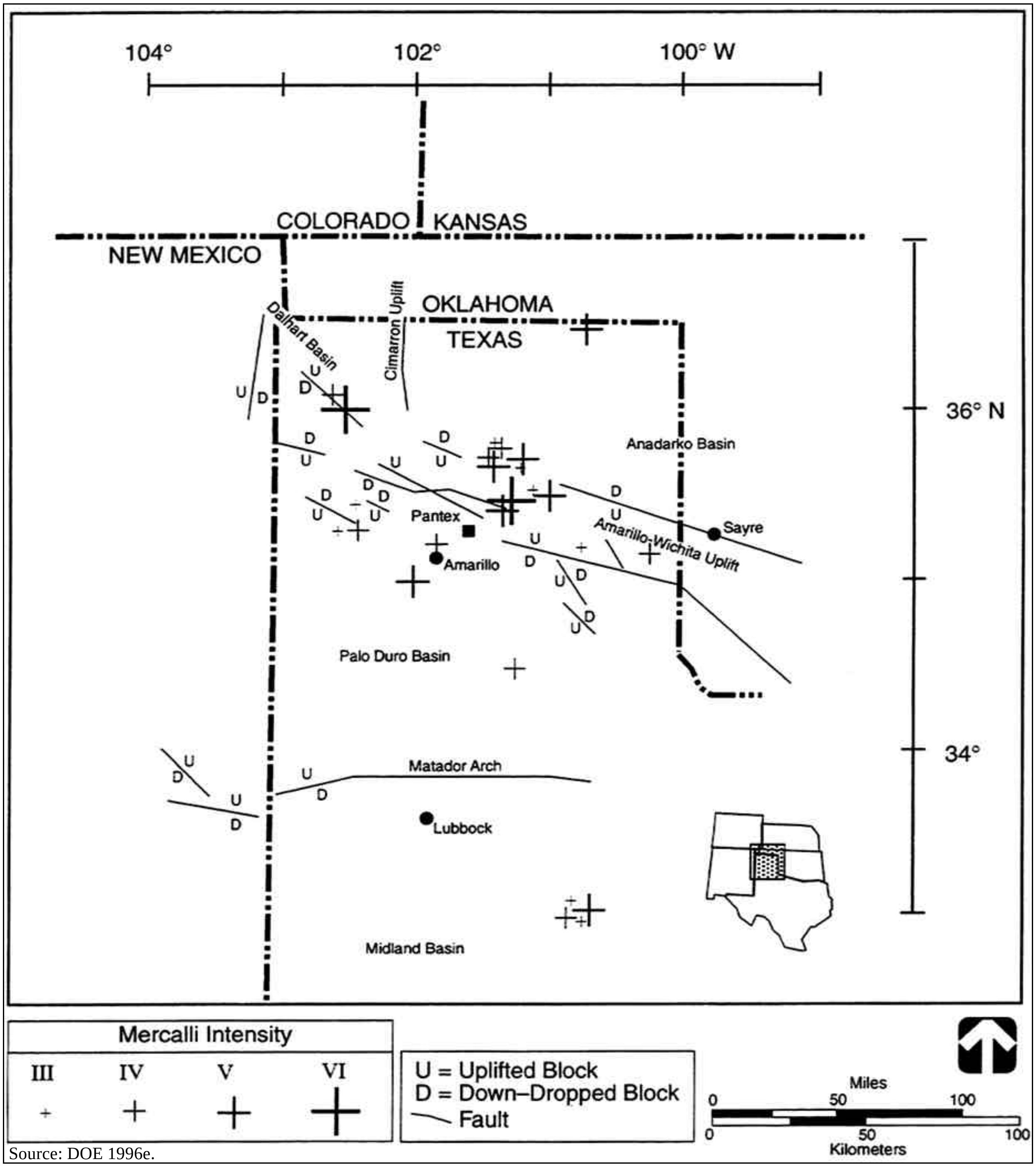


Figure 4.4.5.1–1. Earthquakes in the Texas Panhandle and Their Relation to Tectonic Features

Seismic Activity

No tectonic faulting younger than Late Permian is recognized at or near Pantex site. Three major subsurface faults and one minor surficial fault exist in the area as follows: (1) 249 km (155 mi) long, about 40 km (25 mi) north of site; (2) 69 km (43 mi) long, about 8 km (5 mi) south of site; (3) 64 km (40 mi) long, about 11 km (7 mi) north of site; and (4) the surficial fault is 6 km (4 mi) long, about 32 km (20 mi) northwest of site.

Although the Meers Fault in Oklahoma is about 241 km (150 mi) east of Pantex, it is often cited in tectonic discussions because it is on the southeastward extension of the Amarillo Uplift structure and has a Holocene scarp (a line of small cliffs or sharp rises produced by faulting) about 26 km (16 mi) in length with vertical displacements up to 5 m (16 ft). At least three episodes of movement on the Meers Fault are dated between 4,000 and 5,000 years ago using geomorphic evidence and preliminary radiometric dates, but no current microseismic activity seems associated with the fault (BWXT 2002a).

Approximately 25 earthquakes have been recorded in the Texas Panhandle. The largest earthquakes were the March 27, 1917, Panhandle event, about 24 km (15 mi) east of the site, and the July 30, 1925, event northeast of Amarillo, about 24 km (15 mi) northeast of Pantex. Both earthquakes had a maximum intensity of VI on the Modified Mercalli Scale, or 5.0 on the Richter Scale, with observed effects that include pictures falling off walls, furniture moving or overturning, and weak masonry cracks appearing (see Table 4.2.5.1–2). Most shocks in the Texas Panhandle are located along the Amarillo Uplift, although uncertainties in the calculated epicenters preclude identifying specific active faults.

In the Panhandle region, earthquakes with a Richter magnitude of 5.0 or greater are predicted to occur with a frequency on the order of four times in 100 years. At Pantex, it is assumed that the largest earthquake to be expected in the region can happen anywhere in the region including the site itself (BWXT 2002a). The potential for local or regional earthquakes with a magnitude great enough to damage structures at the site to the degree that hazardous materials would be released is extremely low. While seismic events have occurred in the region, the magnitudes have been low and infrequent (BWXT 2002a).

Slope Stability, Subsidence, and Soil Liquefaction

Slope stability is not an issue at Pantex because all structures are built on the essentially flat surfaces rather than on the gentle slopes of the playa basins. The soil classification definitions include a range of slopes for each particular soil type. In general, the surficial soil extends to depths of no more than 3 m (10 ft). The underlying Blackwater Draw Formation is the material on which larger structures are founded.

Liquefaction is not considered to be an issue at Pantex because the near-surface materials are not saturated (BWXT 2002a).

Salt dissolution, while an active and ongoing process in the Southern High Plains, poses no immediate threat to Pantex. The potential for salt dissolution to disrupt the surface at the site is extremely unlikely. Most active salt dissolution is concentrated near the eastern caprock (an overlying rock layer usually hard to penetrate) escarpment and to a lesser degree near the northern margin in the Canadian River Valley. It is important to note that salt dissolution is a geologically active process; however, it is a very slow process relative to human activities (DOE 1996d).

4.4.5.2 Soils

The primary surface deposits at Pantex are Pullman soils on the plains surface and Randall soils in the playas. The Pullman soils comprise the uppermost section of the Blackwater Draw Formation. This formation consists of a sequence of buried soil horizons with an upper unit of mostly silty clay loam and caliche that is approximately 3 m (10 ft) thick and a 10-24 m (33-79 ft) thick lower unit of silty sand with caliche (crust of calcium carbonate that forms on the stony soil of arid regions). Pantex contains several soil types that, according to the Natural Resources Conservation Service (NRCS), have been classified as prime farmland. Prime farmland, as defined in 7 CFR 657, contains the best combination of physical and chemical characteristics for producing crops. These soil types cover the majority of Pantex (DOE 1996d).

Soil Erosion

Soil erosion at Pantex is limited due to vegetation growth, relatively flat topography, and the internal drainage patters associated with the playas.

Mineral Resources

The Texas Panhandle is one of the major oil and gas producing areas in the country. There is a helium natural gas field known as the Cliffside Field located in Potter County, west of Pantex.

4.4.6 Biological Resources

4.4.6.1 Terrestrial Resources

Pantex is located on the Llano Estacado (staked plains) portion of the Southern Great Plains of Texas at an elevation of approximately 1,067 m (3,500 ft). The topography at Pantex is relatively flat, characterized by rolling, treeless, grassy plains, and numerous natural playa basins. The term "playa" is used to describe shallow lakes, mostly less than 1 km (0.6 mi) in diameter. The region is a semi-arid farming and ranching area. Pantex is surrounded by agricultural land, but several significant industrial facilities are also located nearby. Shortgrass prairie grasslands were the native vegetation until the prairie was converted to agricultural use for crops, grazing, or protective vegetative cover under the Conservation Reserve Program. The few remaining native grassland areas are heavily grazed by livestock. Such grazing has transformed much of the rangeland from the native blue grama-buffalo grass to shrubland (i.e., honey mesquite [*Prosopis glandulosa*]). Essentially all land at Pantex has been managed or disturbed to some degree. The following five basic habitat types have been identified: operational areas, grasslands, mowed areas, agricultural croplands, and playas. Approximately 229 plant species and numerous animal species are found in the Pantex area (Pantex 2001b).

Native vegetation is characterized as shortgrass prairie. 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*). Much of the native shortgrass prairie has been converted and used for agricultural purposes, primarily crop cultivation and cattle grazing. The current state of the altered shortgrass prairie at Pantex ranges from unvegetated, in the south-central region, to a variety of species elsewhere on the site (DOE 1996d).

The dominant vegetation on the uplands surrounding Playas 3, 5, and Pantex Lake is buffalo grass, while the uplands surrounding Playa 1 support buffalo grass, 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 buffalo grass, blue grama, and silver bluestem. Playa 4 uplands consist of buffalo grass 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 is dominated primarily by silver bluestem and rare individuals of yankee weed (*Eupatorium compositifolium*). The west-central region of Pantex has vegetative composition of predominantly kochia (*Kochia scoparia*) and pigweed (*Amaranthus* spp.), with lesser extents of buffalo grass, planted Siberian elm, and cottonwood (*Populus ocifero*) (DOE 1996d).

The Southern High Plains of Texas contain relatively little native undisturbed grassland. Playas are considered “islands” of wildlife habitat, providing many species with food, cover, and water. Wildlife surveys conducted at Pantex have characterized wildlife presence and use of the entire site, rather than focusing on each playa. Animal species found at Pantex include 7 species of amphibians, 43 species of birds, 19 species of mammals, and 8 species of reptiles. Grazing is permitted onsite while hunting is not allowed. Radiological surveys of beef cattle raised on or near Pantex have not been considered necessary based on the results of a study showing that routine operations do not pose a risk to the public from the consumption of these animals. The largest source of uranium in the cattle feed was from commercial mineral supplements typically fed to cattle in the area. 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 obtained similar conclusions (DOE 1996d).

The uplands of Pantex support a variety of invertebrates, reptiles, amphibians, birds, and mammals. The insect class is well represented with grasshoppers, beetles, true bugs, flies, bees, wasps, ants, moths, butterflies, and dragonflies. The most frequently occurring species of reptiles and amphibians include the Great Plains toad (*Bufo cognatus*), Woodhouses 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 1996d).

Some of the more common species of birds that have been observed at Pantex include the Western meadowlark (*Sturnella neglecta*), horned lark (*Eremophila alpestris*), mourning dove (*Zenaida macroura*), Bewicks wren (*Thryomanes bewickii*), mockingbird (*Mimus polyglottos*), house finch (*Carpodacus mexicanus*), common nighthawk (*Chordeiles minor*), greater roadrunner (*Geococcyx californianus*), killdeer (*Charadrius ociferous*), Swainsons hawk

(*Buteo swainsoni*), red-tailed hawk (*Buteo jamaicensis*), and turkey vulture (*Cathartes aura*) (DOE 1996d).

Representative mammals that occur at Pantex 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 1996d).

The 2002 revision of the *Integrated Plan for Playa Management at Pantex Plant* (BWXT 2002b) calls for adaptive management for species diversity that is consistent with the shortgrass prairie ecosystem of the Southern High Plains. Species diversity and supporting habitat have been changed by cultivation, intensive grazing, and invasion of honey mesquite (*Prosopis glandulosa*). Consequently, the importance of managed playas and shortgrass prairie has increased for wildlife and plant species. Thus preservation and management of remaining grassland is an important goal for biotic community protection. This management issue takes on special significance because few federally managed public lands occur on the Southern High Plains, an important part of the Central Flyway for migratory birds. In addition, threatened, endangered, and other rare species can be found in these habitats. Prescribed grazing is a primary tool for improving plant and animal biodiversity while vegetation and wildlife monitoring are important components of biotic community protection at Pantex. A rotational grazing system among Playa Management Units was developed in December 1999 (BWXT 2002b). This rotation is comprised of an intensive grazing treatment of 50-80 percent removal of biomass; a moderate grazing treatment of the standard Natural Resource Conservation Service 50 percent reduction rule; and a deferred grazing treatment. Prescribed burning may be cycled into this rotation within the next 5 years (Pantex 2002).

4.4.6.2 Wetlands

There are six playas on DOE-owned or leased land at Pantex: Playas 1, 2, and 3 are on the main Pantex site; Playas 4 and 5 are on land leased from Texas Tech University; and Pantex Lake is on a separate parcel of DOE-owned property, approximately 4 km (2.5 mi) northeast of the main portion of Pantex and would not be affected by the proposed project. (See Figure 4.4.4.1–1 for the locations of the playas and Pantex Lake on Pantex). Playas 1, 2, 3, and 4 and Pantex Lake are wetlands and are subject to compliance with 10 CFR 1022: EO-11990 “Protection of Wetlands” and EO-11988 “Floodplain Management.” Playa wetlands are important natural resources for two primary reasons: (1) water collected in the playas is a likely source of recharge to subsurface aquifers; and (2) playa wetlands provide valuable habitat and food for many wildlife species, including upland game birds, raptors, and waterfowl (Pantex 2001b).

Playa vegetation on the Southern High Plains varies from one playa to another and throughout the changing conditions of the seasons. When water is present within the basins for an extended period, playa vegetation is usually composed of emergent and submergent aquatic species; however, as available water subsides, the species shift to semi-aquatic or moist soil annuals. With little moisture present, playa vegetation is commonly made up of characteristic upland species. Because of the diversity among individual playas, a specific vegetative characterization is presented for each playa at Pantex.

Playa 1

This playa receives the continuous discharge from the WWTF. As such, it supports 19 obligate aquatic plant species, the highest number of any playa at Pantex. Like most wet playas, the dominant plants are emergent and submergent species. Cattail *(Typha anqustifolia)* and bulrush (*Scirpus* spp.) are present at Playa 1. Other notable obligate aquatic species present within the playa were pondweed (*Potamogeton nodosus*), arrowhead (*Sagittaria montevidensis*), spikerush (*Eleocharis macrostachya*), and smartweed. The facultative aquatic or semi-aquatic species found at Playa 1 include several species of smartweed (*Polygonum spp.*), slim aster (*Aster subulatus*), and western black willow (*Salix goodingii*). The uplands surrounding Playa 1 are typical High Plains grassland composed of buffalo grass, blue grama, and prickly pear.

Playa 2

The basin of this playa is dominated by several species of smartweed, primarily *Polygonum pensylvanicum*, *P. amphibium*, and *P. coccineum*. Other significant species within the basin included mallow (*Malvella leprosa*), ragweed (*Ambrosia grayii*), and sunflower (*Helianthus annuus*). One small association of cattails was also noted within the playa. The edge of the playa basin contains tumbleweed and frog fruit, while, slightly above the basin, the major plant species are wheatgrass and snow-on-the-mountain (*Euphorbia marginata*). The plant composition of the uplands surrounding Playa 2 is very similar to that of Playa 1.

Playa 3

This playa, adjacent to the Burning Ground, has a basin floral composition of primarily spikerush with little vervain (*Verbena bracteata*) and hairy water clover (*Marsilea vestita*). The edge of the basin is dominated by spikerush, woollyleaf bursage (*Ambrosia grayi*) and cocklebur (*Xanthium strumarium*), and the uplands surrounding Playa 3 have a species composition similar to Playas 1 and 2.

Playa 4

The low areas of this playa contain abundant spikerush and ragweed, with some hairy water clover and buffalo grass. 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, but with a greater coverage of buffalo grass.

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 wheatgrasss, but there is a transition into High Plains grassland dominated by buffalo grass and, to a lesser degree, three-awn and blue grama. In the past, Pantex Lake received discharge from site activities, but does not now.

4.4.6.3 Aquatic Resources

There are no federally designated Wild and Scenic Rivers onsite. No streams or rivers flow through Pantex. Major surface water in the vicinity includes the Canadian River, 27 km (17 mi) to the north, Sweetwater Creek and the Salt Fork of the Red River, respectively 80 km (50 mi) and 32 km (20 mi) to the east, and the Prairie Dog Fork of the Red River, 56 km (35 mi) to the south. The Canadian River flows into Lake Meredith about 40 km (25 mi) north of the plant. The only naturally occurring waterbodies onsite are the playas and very small, unnamed, intermittent channels and ditches that may feed stormwater into them.

Aquatic resources at Pantex are not extensive and are comprised of the perennial Playa 1. Since Playas 1 through 4 and Pantex Lake are considered wetlands, they are detailed in Section 4.4.6.2. Playa 1 is permanently inundated with water, receiving discharge from WWTF. However, the playas are frequently dry because of the high, naturally occurring evaporation rate combined with a rate of infiltration that normally exceeds the rate of inflow. Playas in the area of Pantex may be as large as 1,220 m (4,000 ft) in diameter and more than 9 m (30 ft) deep. Most of the playas are floored with a clay accumulation at the bottom that is lens shaped, being thickest in the middle and thinning out toward the edges. These clay floors may contain desiccation cracks up to 1.8 m (6 ft) deep when the floor is dry. The only surface waterway that flows throughout the year is the one that receives flow from the WWTF and discharges into Playa 1. The remaining channels and ditches contain flows only after storm events. The playas are considered by the State of Texas to be “waters of the state” and have been designated as jurisdictional wetlands (Pantex 2001b).

The aquatic regions of Playa 1 support over six genera of plants. The dominant vegetation is cattail, great bulrush *(Scirpus validus),* and three species of smartweed (*Polygonum* spp.). During surveys in 1992, 26 families of macroinvertebrates were collected from Pantex playas. Insects identified included 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. Vertebrate species recorded at Playa 1 include the Plains leopard frog (*Rana blairi*), the Woodhouses toad, and the upland chorus frog (*Pseudoacris triseriata feriarum*). The concrete ponds, representing another aquatic habitat at Pantex, 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 personnel resampled the earthen stock tank near Pantex Lake. Specimens of fathead minnows (*Pimephales promelus*) and one black bullhead (*Ictalurus melas*) were collected (DOE 1996d). Birds are the most conspicuous animal associated with the playas in terms of numbers, diversity, and biomass. Situated along the central flyway migratory route, the playas provide valuable habitat for migration, wintering, and nesting. The most common wintering ducks are mallards, northern pintails, green-winged teals, and American wigeons. Species known to breed in playas include the mallard, northern pintail, blue winged teal, cinnamon teal, northern bobwhite, western meadowlark, yellow-headed blackbird, red-winged blackbird, and ring-necked pheasant (Pantex 2001b).

4.4.6.4 Threatened and Endangered Species

Table 4.4.6.4–1 provides a list of Federal- and state-threatened and endangered species along with other species of special interest that occur or may occur within Carson County and/or Pantex. There is no critical habitat for any threatened or endangered species at Pantex. The bald eagle (*Haliaeetus leucocephalus*) is the only federally protected species known to inhabit Pantex for extended periods of time. Currently, it is listed as threatened by the USFWS. It winters in the high plains of Texas, usually from October through February or March (a 4- to 5-month period), and forages near waterbodies (playas), feeding on fish, waterfowl, and small mammals. The bald eagle is sighted yearly at Pantex and is considered a winter resident and a spring and fall migrant. Additional listed species that may occur on or around Pantex include 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 in recent years (BWXT 2002b, DOE 1996d).

Species that are federally proposed or candidates for listing as threatened or endangered do not receive legal protection under the *Endangered Species Act.* However, USFWS encourages the consideration of impacts to these species in project planning since their status can be changed to threatened or endangered in the foreseeable future. Two candidate species occur in Carson County with one present at Pantex. The candidate species are the black-tailed prairie dog (*Cynomys ludovicianus*), which is a Pantex resident, and the lesser prairie chicken (*Tympanuchus pallidicinctus*). No suitable habitat exists at Pantex for the lesser prairie chicken. The mountain plover (*Charadrius montanus*) is a federally proposed threatened species that has been sighted at Pantex in 2002 (BWXT 2002b, DOE 1996d).

Four special-status species may be found within the Pantex environs. The ferruginous hawk *(Buteo regalis)* is a common winter resident that feeds on prairie dogs and cottontail rabbits. The area west of Zone 4 West is a potential feeding location because of its prairie dog towns. Also associated with the prairie dog towns is the western burrowing owl *(Athene cunicularia hypugaea)*. Up to 10 pairs of western burrowing owls have been identified as nesting in the area just west of Zone 4 West. The Texas horned lizard (*Phrynosoma cornutum*) is a Pantex resident and has state-threatened status. The state also lists the white-faced ibis (*Plegadis chihi*), a spring and fall migrant and summer resident at Pantex, as threatened (BWXT 2002b, DOE 1996d).

There are no protected plant species known to occur at Pantex or within Carson County.

4.4.7 Cultural and Paleontological Resources

4.4.7.1 Cultural Resources

All undertakings at Pantex are conducted in compliance with relevant cultural resource Federal legislation, particularly Sections 110 and 106 of the NHPA, and DOE orders and policies that address cultural resource protection and management. A Programmatic Agreement has been implemented in consultation with the Texas SHPO and the Advisory Council on Historic

Table 4.4.6.4–1. Listed Federal- and State-Threatened and Endangered Species and Other Special Interest Species that Occur or May Occur within Carson County and Pantex, Texas

Species	Federal Classification	State Classification	Occurrence at Carson County/Pantex
Mammals			
American black bear *Ursus americanus*	Not Listed	Threatened	Transient in Carson County and Pantex
Black-footed Ferret *Mustela nigripes*	Endangered	Endangered	Extirpated in Texas
Black-tailed Prairie Dog *Cynomys ludovicianus*	Candidate	Rare but with no regulatory listing status	Carson County and present at Pantex
Cave Myotis Bat *Myotis velifer*	Not Listed	Rare but with no regulatory listing status	Carson County/No record from Pantex
Plains Spotted Skunk *Spilogale putorius interrupta*	Not Listed	Rare but with no regulatory listing status	Carson County/No record from Pantex
Swift Fox *Vulpes velox*	Removed from Candidate listing October 30, 2001	Rare but with no regulatory listing status	Carson County may occur at Pantex
Birds			
American Peregrine Falcon *Falco peregrinus anatum*	Delisted	Endangered	Carson County and Pantex
Arctic Peregrine Falcon *Falco peregrinus tundrius*	Delisted	Threatened	Carson County and Pantex
Baird's Sparrow *Ammodramus bairdii*	Not Listed	Rare but with no regulatory listing status	Carson County/No record from Pantex
Bald Eagle *Haliaeetus leucocephalus*	Threatened–Proposed for Delisting	Threatened	Winter Resident within Carson County and Pantex
Ferruginous Hawk *Buteo regalis*	Not Listed	Rare but with no regulatory listing status	Winter Resident within Carson County and Pantex
Interior Least Tern *Sterna antillarum athalassos*	Endangered	Endangered	Potential migrant within Carson County and Pantex
Lesser Prairie Chicken *Tympanuchus pallidicinctus*	Candidate	Rare but with no regulatory listing status	Carson County/Suitable Habitat at Pantex
Mountain Plover *Charadrius montanus*	Proposed Threatened	Rare but with no regulatory listing status	Carson County and Pantex
Snowy Plover *Charadrius alexandrinus*	Not Listed	Rare but with no regulatory listing status	Potential migrant within Carson County and Pantex
Western Burrowing Owl *Athene cunicularia hypugaea*	Not Listed	Rare but with no regulatory listing status	Resident within Carson County and Pantex
White Faced Ibis *Plegadis chihi*	Not Listed	Threatened	Summer resident within Carson County and Pantex
Whooping Crane *Grus americana*	Endangered	Endangered	Migrant within Carson County and Pantex
Reptiles			
Texas Garter Snake *Thamnophis sirtalis annectens*	Not Listed	Rare but with no regulatory listing status	Carson County/No suitable habitat at Pantex
Texas Horned Lizard *Phrynosoma cornutum*	Not Listed	Threatened	Carson County and Pantex Resident

Sources: Swepston 2002, TX P&W 2002, USFWS 2002.

Preservation to provide for more efficient and effective review of Pantex projects having the potential to impact historic properties. In addition, a draft Cultural Resource Management Plan was completed in September 2000 (DOE 2002e). The ROI for cultural resources is the entire Pantex Site.

Prehistoric Resources

Systematic archaeological inventories at Pantex have included approximately half of the facility acreage (DOE and Texas Tech University areas combined). Through these inventories, 57 prehistoric sites have been identified (DOE 1996d, DOE 2002e). Archaeological test excavations conducted at 23 of these sites suggest that a majority of the sites were occupied during the Late Archaic and Late Prehistoric periods (1000 B.C.-A.D. 1541). These sites are generally associated with local playas, located within 0.40 km (0.25 mi) of the playa margin or along distinct drainages into playa. However, some sites are located in the upper areas between playas. Sites consist mainly of lithic scatters with varying amounts of fire-cracked rock. DOE, in consultation with the Texas SHPO, has determined that of the 57 prehistoric sites identified, only 2 sites are potentially eligible for listing on the NRHP. The remaining 55 sites are determined to be ineligible for listing due to a lack of contextual integrity. DOE also has decided to protect 22 of the 55 ineligible sites because they are a unique grouping of Southern High Plains sites. The uniqueness is based on the sites' location near contiguous playas and the sites' research potential to illuminate prehistoric human use of the region's playas (DOE 1995c). This is the largest such grouping of sites currently under Federal protection.

Historic Resources

Historic resources located at Pantex include archaeological sites dating to pre-1942, World War II-era resources, and Cold War-era resources. Twelve pre-1942 Euro-American historic sites have been identified at Pantex. These sites include foundations of demolished buildings such as homes and agricultural support structures (e.g., barns, windmills), and surface scatters of metal, ceramic, and glass artifacts. DOE has determined, in consultation with the Texas SHPO, that these 12 sites lack integrity, and thus are not eligible for the NRHP (DOE 2002e).

The entire Pantex Site has been surveyed for World War II-era structures and foundations, and all such properties have been systematically recorded. These resources are part of the original Pantex Ordnance Plant, which was in operation from 1942-1945. Current discussions between DOE and the SHPO suggest that none of these properties are eligible due to a lack of integrity (DOE 2002e). A number of World War II-era original drawings and documents have been identified at Pantex and are now preserved in the environmentally controlled records storage area at the site.

From 1951-1991, Pantex had a Cold War mission centered around nuclear weapons, including fabrication of high explosives, assembly and disassembly, and repair and modification (DOE 1996d). A literature search was conducted that identified approximately 700 buildings and structures and a large inventory of related equipment and documents from this era. To assess these properties for significance, an oral history program has been established to record information from Pantex employees, a building survey is underway, and a draft historical context has been prepared and reviewed by the Texas SHPO. To date, all Cold War-era buildings have been surveyed on a preliminary basis, all design drawings have been reviewed, and approximately half of the buildings have been documented in a survey format. DOE has determined that 183 buildings are eligible for inclusion in the NRHP. Continuing consultations are being conducted between DOE and the SHPO regarding formal eligibility for World War II- and Cold War-era resources.

Native American Resources

To date, no known Native American traditional cultural properties, sacred sites, or mortuary remains have been identified at Pantex, and based on completed inventories, none are anticipated. A recently completed search of treaty records has indicated that no federally recognized Native American tribes have recognized title or treaty rights to Pantex land area (DOE 2002e). However, the U.S. Indian Claims Commission has found that the Kiowa, Comanche, and Apache Tribes of Oklahoma have legally recognized traditional interests in the Texas Panhandle (DOE 1996d).

Native American groups thought to have traditional interests in the Pantex area have been contacted regarding operations at Pantex. These tribes include the Comanche Tribe of Oklahoma, Kiowa Tribe of Oklahoma, 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 (DOE 1996c, DOE 1996d). The Jicarilla and Mescalero Apache have both stated that they have no concerns for the central Texas Panhandle. The Kiowa and Apache Tribes of Oklahoma have since been in further contact with the Pantex Site (BWXT 2002a).

Cultural Resources on the Reference Location

The reference location at Pantex has been surveyed to locate any cultural resources. No prehistoric or historic archaeological sites are located at the reference location. All of the World War II and Cold War-era properties are located south of the reference location.

4.4.7.2 Paleontological Resources

The surficial geology of the Pantex region consists of silts, clays, and sands of the Blackwater Draw Formation. In other areas of the High Plains, this formation contains Late Pleistocene vertebrate remains, including bison, camel, horse, mammoth, and mastodon, with occasional and significant evidence of their use by early North American populations. Evidence of woolly mammoths has been found north of Pantex near the Canadian River (DOE 1996c). However, no paleontological resources have been found on the Pantex Site.

4.4.8 Socioeconomics

Socioeconomic characteristics addressed at Pantex include employment, income, population, housing, and community services. These characteristics are analyzed for a four-county ROI consisting of Armstrong, Carson, Potter, and Randall Counties in Texas, where almost 96 percent of site employees reside (DOE 1996c), as shown in Table 4.4.8-1.

Table 4.4.8–1. Four-County ROI Where Pantex Employees Reside

County	Percent of Total
Armstrong	1
Carson	11
Potter	34
Randall	50
ROI Total	**96**

Source: DOE 1996c.

4.4.8.1 Employment and Income

The service sector employs the greatest number of workers in the ROI with more than 30 percent of the workforce. Other important sectors of employment include retail trade (18.8 percent); government (12.5 percent); and finance, insurance, and real estate (10.3 percent) (BEA 2002).

The labor force in the ROI increased 13.7 percent from 1990 to 2001, an average of 1.2 percent each year. In comparison, the State of Texas labor force increased at a greater rate, a total of 21.4 percent over the same time period. Total employment in the ROI increased at a faster pace than the labor force, a total of 15.8 percent. Unemployment fell from 4.9 percent in 1990 to 3.1 percent in 2001. In comparison, the Texas state-wide average unemployment fell from 6.3 percent in 1990 to 4.9 percent in 2001 (BLS 2002a).

In 2000, per capita income in the ROI ranged from a high of $29,207 in Carson County to a low of $19,465 in Armstrong County. The average per capita income in the ROI was approximately $24,520, compared to the Texas average of $27,752. Per capita income increased by almost 46 percent from 1990-2000, compared to a state-wide increase of 59 percent (BEA 2002).

4.4.8.2 Population and Housing

From 1990 to 2000, the ROI population grew from 196,111 to 226,522, an increase of 15.5 percent. This was a slower rate of growth than that of Texas, which grew at a rate of 22.8 percent during the same time period. Randall County had the highest rate of growth at 16.3 percent, while the population of Carson County decreased by 0.9 percent (Census 2002).

In 2000, the total number of housing units in the ROI was 91,594 with 85,272 occupied. There were 56,173 owner-occupied housing units and 29,099 occupied rental units. In 2000, the homeowner vacancy rate in the ROI ranged from a high of 3.5 percent in Carson County to a low of 1.4 percent in Randall County. The rental vacancy rate ranged from 12 percent in Armstrong County to 6.4 percent in Randall County. This is comparable to the State of Texas rates of 1.8 percent homeowner vacancy and 8.5 percent rental vacancy. The greatest number of housing units in the ROI is in Potter County with almost 49 percent of the total housing units. Randall County has more than 47 percent of the housing units in the ROI (Census 2002).

4.4.8.3 Community Services

There are a total of 9 school districts in the ROI serving over 40,000 students. The student-to-teacher ratio in these districts ranges from a high of 15.8 in the Canyon Independent School

District (ISD) in Randall County to a low of 9.7 in the Groom ISD in Carson County. The average student-to-teacher ratio in the ROI is 14.5 (NCES 2002).

The ROI is served by 6 hospitals with a capacity of over 1,300 beds, almost all of which are located in Amarillo (AHA 1995). There are approximately 470 doctors in the ROI, the majority of which are concentrated in Amarillo.

4.4.9 Radiation and Hazardous Chemical Environment

4.4.9.1 Radiation Exposure and Risk

An individual's radiation exposure in the vicinity of Pantex amounts to approximately 399 mrem/yr as shown in Table 4.4.9.1–1 and is comprised of natural background radiation from cosmic, terrestrial, and internal body sources; radiation from medical diagnostic and therapeutic practices; weapons test fallout; consumer and industrial products; and nuclear facilities. All radiation doses mentioned in this EIS are effective dose equivalents. Effective dose equivalents include the dose from internal deposition of radionuclides and the dose attributable to sources external to the body.

Table 4.4.9.1–1. Sources of Radiation Exposure to Individuals in the Pantex Vicinity Unrelated to Pantex Operations

Source	Radiation Dose (mrem/yr)
Natural Background Radiation	
Total external (cosmic and terrestrial)	95
Internal terrestrial and global cosmogenic	40[a]
Radon in homes (inhaled)	200[a]
Other Background Radiation[a]	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	less than 1
Air travel	1
Consumer and industrial products	10
Total	**399**

[a] An average for the United States.
Source: NCRP 1987.

Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population, in terms of person-rem, changes as the population size changes. Background radiation doses are unrelated to Pantex operations.

Releases of radionuclides to the environment from Pantex operations provide another source of radiation exposure to individuals in the vicinity of Pantex. Types and quantities of radionuclides released from Pantex operations in 2000 are listed in the *2000 Site Environmental Report for Pantex Plant* (Pantex 2001b).

The doses to the public resulting from these releases are presented in Table 4.4.9.1–2. The radionuclide emissions contributing the majority of the dose to the offsite MEI were tritium, thorium-232, uranium-234, and uranium-238. These doses fall within the radiological limits given in DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, and are much lower than those from background radiation.

Table 4.4.9.1–2. Radiation Doses to the Public From Normal Pantex Operations in 2000 (Total Effective Dose Equivalent)

Members of the Public	Atmospheric Releases		Liquid Releases		Total	
	Standard[a]	Actual	Standard[a]	Actual	Standard[a]	Actual
Offsite MEI (mrem)	10	1.61×10^{-4}	4	0	100	1.61×10^{-4}
Population within 80 km (person-rem)	None	1.59×10^{-3}	None	0	None	1.59×10^{-3}

[a] The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10-mrem/yr limit from airborne emissions is required by the *Clean Air Act* (40 CFR 61) and the 4-mrem/yr limit is required by the *Safe Drinking Water Act* (40 CFR 141). For this EIS, the 4-mrem/yr value is conservatively assumed to be the limit for the sum of doses from all liquid pathways. The total dose of 100 mrem/yr is the limit from all pathways combined. If the potential collective dose to the offsite population exceeds the 100 person-rem value, the contractor operating the facility would be required to notify DOE.

Source: Pantex 2001b.

Using a risk estimator of one latent cancer death per 2,000 person-rem to the public (see Appendix B), the fatal cancer risk to the offsite MEI due to radiological releases from Pantex operations is estimated to be 8.1×10^{-11} or 8.1 cancer deaths in a population of 100 billion. The estimated probability of this maximally exposed person dying of cancer at some point in the future from radiation exposure associated with 1 year of Pantex operations is less than one in 1 million (it takes several to many years from the time of radiation exposure for a cancer to potentially manifest itself).

According to the same risk estimator, 7.9×10^{-7} excess fatal cancers are projected in the population living within 80 km (50 mi) of Pantex from normal Pantex operations. To place this number in perspective, it may be compared with the number of fatal cancers expected in the same population from all causes. The mortality rate associated with cancer for the entire U.S. population is 0.2 percent per year. Based on this mortality rate, the number of fatal cancers expected during 1999 from all causes in the population of 292,877 living within 80 km (50 mi) of Pantex was 585. This expected number of fatal cancers is much higher than the 7.9×10^{-7} fatal cancers estimated from Pantex operations in 2000.

External radiation doses have been measured in areas of Pantex for comparison with offsite natural background radiation levels. Measurements taken in 2000 showed an average dose onsite of 72.2 mrem (Pantex 2001b).

Pantex workers receive the same dose as the general public from background radiation, but they also may receive an additional dose from working in facilities with nuclear materials. The average dose to the individual worker and the cumulative dose to all workers at Pantex from operations in 2001 are presented in Table 4.4.9.1–3. These doses fall within the radiological regulatory limits of 10 CFR 835. According to a risk estimator of one latent fatal cancer per 2,500 person-rem among workers (see Appendix B), the number of projected fatal cancers among Pantex workers from normal operations in 2001 is 0.017. The risk estimator for workers is lower than the estimator for the public because of the absence from the workforce of the more radiosensitive infant and child age groups.

Table 4.4.9.1–3. Radiation Doses to Workers From Normal Pantex Operations in 2001 (Total Effective Dose Equivalent)

Occupational Personnel	Standard	Actual
Average radiation worker dose (mrem)	5,000[a]	149
Collective radiation worker dose[b] (person-rem)	None	43.6

[a] DOE's goal is to maintain radiological exposure as low as is reasonably achievable. Therefore, DOE has recommended an administrative control level of 500 mrem/yr (DOE 1999e); the site must make reasonable attempts to maintain individual worker doses below this level.
[b] There were 293 workers with measurable doses in 2001.
Source: DOE 2001f.

4.4.9.2 Chemical Environment

The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (e.g., soil through direct contact or via the food pathway).

Workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. Pantex workers are also protected by adherence to OSHA and EPA occupational standards that limit atmospheric and drinking water concentrations of potentially hazardous chemicals.

Appropriate monitoring, which reflects the frequency and amounts of chemicals used in the operation processes, ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause or are likely to cause illness or physical harm.

Adverse health impacts to the public are minimized through administrative and design controls to decrease hazardous chemical releases to the environment and to achieve compliance with permit requirements. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at Pantex via inhalation of air containing hazardous chemicals released to the atmosphere by Pantex operations. Risks to public health from ingestion of contaminated drinking water or direct exposure are also potential pathways.

Nonradiological ambient air monitoring was conducted at a single location designated in TNRCC Hazardous Waste Permit HW-50284. The maximum measurement of hydrogen fluoride at this air monitoring site was 3.9 percent of the TNRCC Effects Screening Level (ESL) for hydrogen fluoride. The maximum measurement for any VOC was 87.5 percent of its ESL. This VOC (hexachlorobutadiene) was measured on a day when thermal treatment (burning) was not being conducted at the Burning Ground. The maximum concentration of respirable particulate matter measured at the site designated in HW-50284 was 78.9 percent of the NAAQS, 24-hour average concentration (150 $\mu g/m^3$).

4.4.10 Traffic and Transportation

4.4.10.1 Regional Transportation Infrastructure

Pantex is in the northern Texas panhandle approximately 27 km (17 mi) northeast of Amarillo, Texas. I-40 provides the main east-west route in the region. I-27 connects Amarillo with locations to the south as far as Lubbock, which is 199 km (124 mi) away. Truck shipments to Pantex from the east would arrive on I-40, exiting at FM 2373 (Figure 4.4.10.1–1). The shipping gate is off FM 2373.

4.4.10.2 Local Traffic Conditions

The area adjacent to Pantex is entirely agricultural, with an extremely low population density (8 persons per km^2 [3 persons per mi^2]). Local roads have more than adequate capacity to handle Pantex traffic, which originates in the Amarillo metropolitan area. Table 4.4.10.2–1 provides information on traffic on important roads.

Table 4.4.10.2–1. Traffic Conditions on Principal Access Roads to the Pantex Plant

Access Road	Annual Average Daily Traffic	Peak Hourly Traffic	Volume to Capacity Ratio	Level of Service[a]
U.S. 60 between FM 552 and the Pantex boundary	7,100	NA	NA	A-B
FM 683 adjacent to the plant	590	NA	NA	A-B
FM 2373 south of Pantex gate	2,200	NA	NA	A-B

NA = not available.
[a] Levels of Service:

A. Free flow of the traffic stream; users are unaffected by the presence of others.
B. Stable flow in which the freedom to select speed is unaffected, but the freedom to maneuver is slightly diminished.
C. Stable flow that marks the beginning of the range of flow in which the operation of individual users is significantly affected by interactions with the traffic stream.
D. High-density, stable flow in which speed and freedom to maneuver are severely restricted; small increases in traffic will generally cause operational problems.
E. Operating conditions at or near capacity level causing low but uniform speeds and extremely difficult maneuvering that is accomplished by forcing another vehicle to give way; small increases in flow or minor perturbations will cause breakdowns.
F. Defines forced or breakdown flow that occurs wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. This situation causes the formation of queues characterized by stop-and-go waves and extreme instability.

Source: Oeding 2002.

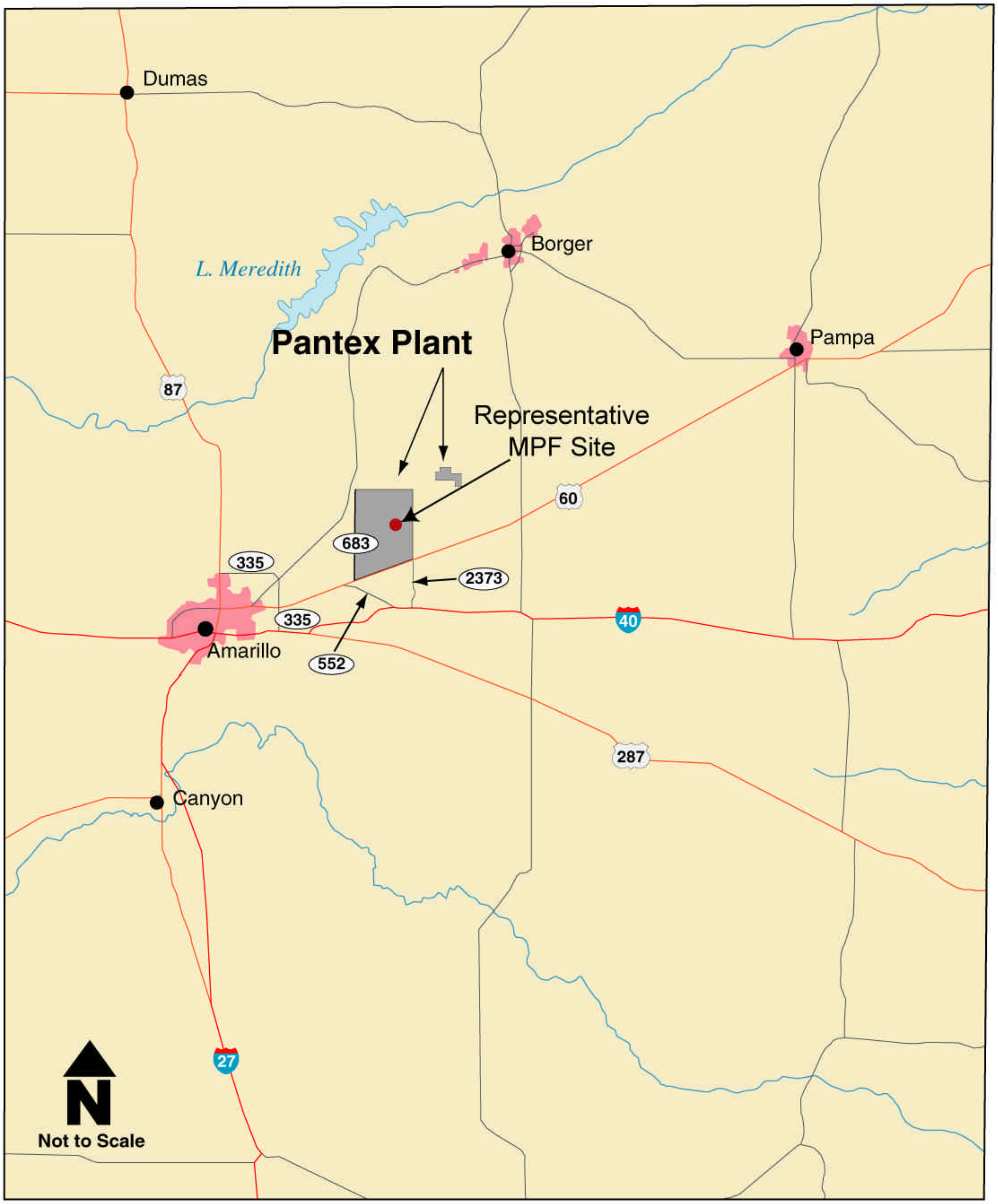


Figure 4.4.10.1–1. Highways in the Region of the Pantex Site

4.4.11 Waste Management

This section describes the DOE waste generation baseline that will be used to gauge the relative impact of MPF construction and operations on the overall waste generation at Pantex and on DOE's capability to manage such waste. Pantex manages LLW, mixed LLW, hazardous waste, and sanitary waste. TRU waste and mixed TRU waste are not normally generated and no high-level waste is generated at Pantex. Table 4.4.11–1 provides the routine waste generation rates at Pantex. Table 4.4.11–2 summarizes the waste management capabilities at Pantex.

Table 4.4.11–1. Annual Routine Waste Generation from Pantex Operations (m^3)

Waste Type	1996	1997	1998	1999	2000	2001
Transuranic	0	0	0	0	0	0
Low-level	135	65.6	55.1	91.8	93.9	52.4
Mixed	23.6	13.7	2.16	1.04	3.77	4.18
Hazardous[a]	190	128	153	121	122	140
Sanitary[b]	592	691	657	619	570	636

[a] Includes state-regulated waste. Hazardous waste reported in metric tons.
[b] From DOE 2002o (1996 data) and DOE's Central Internet Database (available at http://cid.em.doe.gov). Sanitary waste reported in metric tons.
Source: DOE 2002o.

4.4.11.1 Low-Level Radioactive Waste

Compactible solid LLW is processed at the LLW compactor and stored along with non-compactible materials for shipment to NTS, where most Pantex LLW is disposed of, or to a commercial vendor. Radioactively contaminated classified weapons components are sent to the classified LLW repository at NTS. Soil contaminated with depleted uranium has been disposed of at a commercial facility, and the possibility for disposal of other LLW at commercial facilities is being pursued where technically and economically advisable (DOE 1999h).

4.4.11.2 Mixed Low-Level Waste

Most Pantex mixed waste consists of paper products contaminated with solvents and low-level radionuclides, and inorganic debris (including metals) contaminated with low levels of radionuclides. Mixed waste is disposed of offsite. The majority of the mixed waste has been shipped to Envirocare of Utah. Small amounts are shipped to specialized treatment facilities, such as Diversified Scientific Services, Inc., in Tennessee.

Pantex treats mixed LLW onsite in three facilities: Building 11-9S, Building 16-18, and the Burning Ground. Both Building 11-9S and 16-18 are permitted for the treatment and processing of mixed LLW and hazardous waste in containers. The Burning Ground is permitted to treat explosives and explosive-contaminated waste by open burning. In some cases, a large volume reduction is attained by this treatment, and some wastes are rendered nonhazardous due to elimination of the reactivity hazard.

Table 4.4.11–2. Waste Management Facilities at Pantex

Facility/ Description	Capacity	Status	Applicable waste types				
			LLW	Mixed LLW	TRU Waste	Hazardous Waste	Nonhazardous Waste
Treatment Facility (m^3 per year)							
12-17—Evaporator for Tritiated Water	Campaign	Online	X				
12-19 East—Rotary Evaporator Vacuum Distillation Units	Campaign	Online					X
12-19 East—Fractional Distillation Unit	Campaign	Online					X
12-19 East—HE Precipitation Process	Campaign	Online					X
HWTPF—Waste Compacting	90	Online	X	X		X	X
HWTPF—Drum Crushing	208	Online	X	X		X	X
HWTPF—Wastewater Evaporation System	45	Online	X				X
HWTPF—Misc. Drum Operations (including neutralization and filtration)	Various[b]	Online	X	X		X	
HWTPF—Drum Rinsing System	45	Online				X	
HWTPF—Fluorescent Bulb Crusher	12	Online				X	
HWTPF—Scintillation Vial Crushing	90	Online	X				X
Burning Ground Thermal Processing Units	Variable[c]	Online		X		X	
Wastewater Treatment Facility	946,250	Online					X
Storage Facility (m^3)							
16-16 Building—Hazardous Waste Staging Facility	1,047	Online	X	X		X	X
Magazine 4-50	62	Online	X	X		X	X
Magazine 4-72	62	Online	X	X		X	X
Building 9-121	17	Online	X	X		X	X
Building 9-122	17	Online	X	X		X	X
Disposal Facility (m^3)							
Construction Debris Landfill (Zone 10)	21,208	Online	X				X

[a] Facility operates as needed when sufficient backlog has accumulated.
[b] Capacity varies with type of operation.
[c] Permit limitations are per burning event
Source: DOE 1999h, TNRCC 1996.

DOE decided to construct a Hazardous Waste Treatment and Processing Facility (HWTPF, Building 16-18) in its ROD for the *Final Environmental Impact Statement for the Continued Operation of Pantex and Associated Storage of Nuclear Weapon Components* (62 FR 3880; January 27, 1997). DOE completed construction and initiated operations of the HWTPF in FY2000 (DOE 2001a). Building 16-18 is assuming more of the treatment and processing as Building 11-9S is scheduled for closure. Operations currently consist of segregating and downgrading production line generated waste, destruction of classified and sensitive matter, evaporation of tritiated water, waste compaction, and segregation of scintillation vials into solid and liquid waste streams. There is also the capability to solidify liquids and to rinse drums for reuse, should the need arise.

4.4.11.3 Transuranic and Alpha Waste

Normal operations at Pantex do not generate TRU or alpha wastes, although there are procedures in place to manage TRU waste if it is generated. The small quantity of TRU waste (<1 m^3 [<35.3 ft^3]) that had been stored in Building 12-42 was moved to LANL pending disposal at WIPP.

4.4.11.4 Hazardous Waste

Hazardous wastes generated at Pantex include explosives-contaminated wastewater, spent organic solvents, and solids. Most hazardous waste generated at Pantex is shipped offsite for recycle, treatment, or disposal at commercial facilities. High explosives and high-explosive contaminated materials are burned under controlled conditions at the Burning Ground. Ash, debris, and residue resulting from this burning are transported offsite for disposal at a commercial RCRA-permitted facility. PCB waste is transported to offsite permitted facilities for treatment and disposal (DOE 1999h).

4.4.11.5 Sanitary Waste

The Texas Commission on Environmental Quality (TCEQ) requires solid waste to be characterized as Class 1, Class 2, or Class 3. The nonhazardous waste generated at Pantex falls under the Class 1 or Class 2 designation. Some solid waste (inert and insoluble materials like certain scrap metals, bricks, concrete, glass, dirt, and certain plastics and rubber items that are not readily degradable) are designated as Class 2 nonhazardous waste and are disposed of in the onsite landfill. The onsite landfill is approved for both Class 2 and Class 3 wastes. The remainder of the Class 2 nonhazardous waste generated at Pantex is sanitary waste such as cafeteria and lunchroom waste, paper towels, and office waste. Most of this waste is disposed offsite at permitted landfills (such as the City of Amarillo Landfill), although some goes to offsite commercial incinerators (DOE 1999h).

Class 1 nonhazardous waste (such as asbestos), although not hazardous by EPA’s RCRA definitions, is handled in much the same manner as hazardous waste and is sent to offsite treatment or disposal facilities. Medical waste is managed through a commercial vendor who picks up and transports the waste offsite (DOE 1999h).

4.4.11.6 Wastewater

Pantex's sanitary sewage and industrial wastewater are treated by Pantex WWTF and discharged to Playa 1. The treated effluent from the system either evaporates or infiltrates into the ground. The WWTF consists of a treatment lagoon and an irrigation storage pond. The treatment lagoon has a compacted clay liner and the storage pond has a synthetic liner. The treatment lagoon covers 97 ha (39 ac) and has a capacity of 41.58 million L (11 million gal). The irrigation storage pond is the same size and capacity. Construction of the new system was designed to allow Pantex to use treated effluent for irrigation purposes. In 2001, an application for a Texas Land Application Permit was filed with the TCEQ. This application has not been approved, thus Pantex continues to discharge to Playa 1. If the pending application is approved, Pantex will design and build an irrigation system to allow beneficial use of the treated effluent.

4.4.11.7 Pollution Prevention

The total waste (routine waste as well as environmental restoration and D&D waste) generated by Pantex was 906 m^3 (31,995 ft^3) in FY2001, accounting for 0.14 percent of DOE's overall waste generation. Waste streams are reviewed for beneficial use potential and recycled when this is determined to be a viable option (e.g., scrap metal). Implementing pollution prevention projects reduced the total amount of waste generated at Pantex in 2001 by approximately 10,600 m^3 (374,339 ft^3). Examples of Pantex pollution prevention projects completed in 2001 include the reduction of sanitary waste by 10,400 metric tons (11,400 tons) by recycling large quantities of asphalt and concrete. These activities included milling of pavement for reuse onsite (454 metric tons [500 tons]) and bulk removal of paving material for recycle by an offsite paving contractor (9,910 metric tons [10,900 tons]) (DOE 2002g).

Volume II, Appendix G, of the *Final Environmental Impact Statement for the Continued Operations of the Pantex Plant and Associated Storage at Nuclear Weapons Components* provides detailed information regarding pollution prevention and waste minimization at Pantex (DOE 1996d). Pantex established a Pollution Prevention and Waste Minimization Program to comply with the waste minimization requirements under RCRA. In 1996, the Pantex program received the White House Closing the Circle Award and the Vice Presidents Hammer Award for achievements in recycling and waste prevention (DOE 1996d).

4.4.11.8 Waste Management PEIS Records of Decision

A discussion of DOE's hazardous waste, LLW, mixed LLW, and TRU waste decisions based on the Waste Management PEIS is provided in Section 4.2.11.8. The Waste Management PEIS RODs affecting Pantex are shown in Table 4.4.11.8–1.

Table 4.4.11.8–1 Waste Management PEIS Records of Decision Affecting Pantex

Waste Type	Preferred Action
TRU waste	DOE has decided to store and prepare TRU waste onsite prior to disposal at WIPP. [a]
LLW	DOE has decided to treat Pantex's LLW onsite and to ship the waste to either the Hanford Site or NTS for disposal.[b]
Mixed LLW	DOE has decided to regionalize treatment of mixed LLW at the Hanford Site, INEEL, ORR, and SRS. DOE has decided to ship Pantex's mixed LLW to either the Hanford Site or NTS for disposal.[b]
Hazardous waste	DOE has decided to continue to use commercial facilities for treatment of Pantex's non-wastewater hazardous waste.[c]

[a] From the ROD for TRU waste (63 FR 3629) and the ROD for the WIPP Disposal Phase SEIS (63 FR 3624).
[b] From the ROD for LLW and mixed LLW (65 FR 10061).
[c] From the ROD for hazardous waste (63 FR 41810).