Chapter 2
SWEIS Baseline and Impact Analysis, 1996–2001

2.1 Resource Areas Not Evaluated in Detail

2.1.1 Visual Resources

Although the SWEIS does not discuss visual resources, the *Surplus Plutonium Disposition EIS*, in which the Pantex Plant was evaluated as a location for certain facilities, indicates that from the most sensitive vantage point for plant facilities at the intersection of Farm-to-Market 2373 and U.S. Route 60, the plant appears as a low cluster of buildings on the flat landscape. The most visible structures include a water tower (45 m [148 ft]) and the twin boiler house stacks (20 m [65 ft]). The meteorological tower on the northeast corner of the site is the tallest structure at 60 m (197 ft) and at a distance would appear as a pencil-thin structure. The operations areas are visible at night by the security lights (DOE 1999a:3-124).

Some of the projects proposed in the SWEIS for the period 1996–2006 and other proposed projects would include new structures. These facilities are expected to be of similar size and appearance to existing structures and would be located within areas that have a number of existing structures. Therefore, the new structures would be consistent with the existing visual character of the facilities. Several facilities would have new stacks of similar height to existing stacks and structures. The tallest new stack would be for the modified facility for the "35 Account Relocation" with a stack 16 m (53 ft) high, which is comparable to the existing boiler house stacks (Nava 2002a). Therefore, it is not expected that any of the proposed projects would change the visual impacts associated with the Pantex Plant.

2.1.2 Land Resources

Land resources are described in the SWEIS with respect to existing and projected uses of Pantex Plant site lands and their management as well as land uses within the site's region of influence (ROI).

Land Use. The Pantex Plant consists of 6,466 hectares (15,977 acres) of contiguous land, and 436 hectares (1,077 acres) of detached property known as Pantex Lake that is located approximately 4 km (2.5 mi) northeast of the main plant site. DOE owns approximately 3,683 hectares (9,100 acres) of the main plant site as well as the Pantex Lake property, and leases the remaining 2,347 hectares (5,800 acres) of the main plant site from TTU for use as a safety and buffer zone (DOE 1996a:1-1, 4-21; BWXT Pantex 2002c:2-4, 10-14). About 3,270 hectares (8,070 acres) of agricultural land within the combined main plant area and the Pantex Lake property are managed by TTU through a service agreement with DOE for farming and ranching use (BWXT Pantex 2002c:10-14). In April 1995, TTU was using approximately 2,596 hectares (6,421 acres) of DOE-owned land for agricultural purposes through the service agreement (DOE 1996a:4-21). During the summer of 2001, 1,545 hectares (3,817 acres) were used by TTU for cultivated crops and 602 hectares (1,487 acres) were used for rangeland (BWXT Pantex 2002c:2-4).

Approximately 809 hectares (2,000 acres) or about 22 percent of the main plant site land owned by DOE has been developed for industrial use. This figure excludes the Burning Ground and firing areas that encompass an additional 198 hectares (489 acres) (BWXT Pantex 2002c:2-4).

Farmland. As detailed in the SWEIS, a large portion of the Pantex Plant is used for grazing cattle and dryland crop production. Agricultural chemicals continue to be applied to crops in accordance with the

Land-Applied Chemical Use Plan for Pantex Plant. Pesticide use is reviewed and updated annually based on current issues and needs. The approved list of pesticides and herbicides is also published in each update of the Pantex Plant *Environmental Information Document* (EID). The 2002 EID includes seven products that were not listed in the SWEIS for the 1996–1997 growing season (BWXT Pantex 2002c:10-20).

Livestock Grazing. A large portion of the Pantex Plant is used for grazing cattle. Stocker calves, which are calves that have been weaned and turned out to pasture, are the most typical livestock operations on the site. Cattle are moved to different areas of the site according to management needs and availability of forage. Grazing is allowed on the uplands, Playa Management Units (PMUs), and Pantex Lake. Managed grazing is used to maintain biodiversity in the PMUs. In some areas, grazing is also used to reduce biomass, and thus fire hazard. A rotational grazing system for the PMUs was developed in December 1999, and consists of an intensive grazing treatment of 50 to 80 percent removal of biomass, a moderate grazing treatment of the standard Natural Resources Conservation Service 50 percent reduction rule, and a deferred grazing treatment. Prescribed burning may be cycled into this rotation in the future (Nava 2001a). The Texas Tech Research Farm and their cooperators follow cultural and conservation farming practices at the Pantex Plant. These practices are identified in the *Cropland and Rangeland Conservation Plan for Pantex Plant* (BWXT Pantex 2002d).

Future Land Use. Future land and facility use at the Pantex Plant will continue to be managed by DOE through the land use and facility planning process (DOE P 430.1, *Land and Facility Use Planning*, 1996) as further described in the SWEIS. In general, land use is expected to remain constant, with continued cooperation with TTU through the Service Agreement and leasing of TTU land for security and safety reasons (BWXT Pantex 2002c:10-32; Nava 2001a).

Land Use in the ROI. The SWEIS evaluated existing and projected future land use within 16-km (10-mi) and 80-km (50-mi) radii of the Pantex Plant. It was projected that approximately 2,429 hectares (6,000 acres) of new land would be developed in or near the Amarillo city limits to keep pace with the projected population increase (DOE 1996a). Current land uses within the 80-km (50-mi) radius of the site continue to be dominated by agriculture, with most urban-related uses concentrated in the Amarillo area (BWXT Pantex 2002c:10-1). No unpredicted changes in overall land use patterns have occurred since 1996.

The total projected land required for the six proposed projects evaluated in the SWEIS was estimated to be about 0.04 percent of the DOE-owned property on the site, with the resulting impacts determined to be negligible. As discussed in Section 1.3.3 of this SA, to date, only the HWTPF has been constructed; the capabilities of three of the new or modified facilities have been combined into a single, smaller facility; and the other two will be housed in existing space.

The impact of continued operations, including pit storage, on land resources was determined to be limited with little change in site land use expected (DOE 1996a:4-34). A review of documented land use conditions and site activities for the period 1996–2001 indicates that these are consistent with and bounded by those analyzed in the SWEIS.

2.1.3 Geology and Soils

The SWEIS describes the topographic and geologic setting, geomorphology, site stratigraphy, geologic hazards, and associated baseline soil and sediment quality of the Pantex Plant site and ROI. Also included is an impact analysis of the Proposed Action and alternatives considered in the SWEIS.

Topography and Stratigraphy. In descending order, the principal stratigraphic units include surficial deposits mainly comprising Pullman and Randall series soils, Blackwater Draw Formation, Ogallala Formation, and the Dockum Group (BWXT Pantex 2002c:3-1). The Ogallala Formation is of great importance to the site and region as a water source, is stratigraphically complex, and is the subject of ongoing surveillance.

Seismicity and Engineering Geology. The EID presents detailed descriptions of the regional seismicity of the Pantex Plant site, as well as of other geologic conditions (i.e., presence of capable faults, salt dissolution, and land subsidence) that may present a hazard to the site (BWXT Pantex 2002c). This information is fully consistent with that summarized in the SWEIS. The largest earthquakes that have occurred in the Texas Panhandle have produced peak Modified Mercalli Intensities of VI. Such an earthquake typically produces only slight damage to ordinary structures, and negligible damage to well-built or specially designed structures (DOE 1996a:4-43–4-45; BWXT Pantex 2002c:3-41–3-52). Therefore, local or regional seismic events are unlikely to cause major damage to site structures. Also, salt dissolution is not expected to pose any immediate threat to the Pantex Plant (BWXT Pantex 2002c:3-52)

Soil and Sediment Quality at Solid Waste Management Units. The SWEIS summarized the status of ER activities related to legacy soil and sediment contamination at identified solid waste management units (SWMUs). Initial RCRA Facility Investigations (RFIs) have been completed for all release site groupings. However, the Texas Commission on Environmental Quality (TCEQ), formerly the Texas Natural Resource Conservation Commission (TNRCC),[3] provided comments that required further investigation at the release site groupings. To better respond to TCEQ comments, the release site groupings were regrouped according to physical location and surface water drainage patterns. The new groupings, or Waste Management Groups, will be reported by major operational zones.

Current investigations have focused on defining extent of contamination that was identified in the original investigations. Additionally, some new constituents have been investigated, based on regulator comments and historical searches of Pantex Plant processes. The constituents added to the investigations include perchlorate and several experimental high explosives. However, investigations indicate that the concentration and extent of these compounds is limited in soils.

Investigations have also continued to define the presence or absence of radionuclides in areas previously suspected to contain radiological materials. Sampling of the landfills has indicated that radioactive materials have not been placed in the landfills. Investigations have identified depleted uranium at one burn pad at the Burning Ground and at Firing Site 5. Interim corrective measures were implemented to remove the depleted uranium to levels that meet Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements.

Preliminary investigations were also conducted at four active firing sites, based upon a request from the TCEQ. The investigation was conducted to determine whether the active sites present a threat to human health and the environment. The report concluded that the sites did not present an imminent threat to human health or the environment. Therefore, final investigations, cleanup, and closure of the sites could be deferred until the sites are no longer active. Additionally, a final RFI report was completed for the inactive Firing Sites 5, 6, and 15. The TCEQ approved closure of these firing sites to Risk Reduction

[3] Effective September 1, 2002, TNRCC became the Texas Commission on Environmental Quality, or TCEQ. This SA refers to the TCEQ throughout the document for consistency, including activities that occurred when the agency was called TNRCC. TNRCC has been retained only in the titles of TNRCC permits and documents.

Standard 2 (RRS 2), and deed recordations were prepared and entered into the Carson County records (Amos 2002).

Investigations have also focused on finding possible sources of volatile organic compounds (VOCs) and HE in groundwater. Soil gas plumes have been identified at the Burning Ground, Fire Training Area Burn Pits, and under portions of Zone 11. Based on the soil gas concentrations at the Fire Training Area Burn Pits, the Pantex Plant requested closure to TCEQ RRS 2 levels.

The soil gas plumes at Zone 11 and the Burning Ground are primarily limited to the soils above the perched aquifer layer beneath Pantex Plant. Measures were taken at the Burning Ground to prevent the downward migration of the soil gas plume to the Ogallala Aquifer, the main drinking water aquifer. A subsurface HE plume extending to the perched aquifer was identified at SWMU 122b in Zone 12. These areas will undergo the full corrective measure process, including a risk assessment and corrective measures study, to determine appropriate actions to prevent risk to human health or the environment.

Interim corrective measures have been performed at several units to reduce concentrations below RRS 2 levels and to protect human health and the environment. Soil interim corrective measures, including source removal (e.g., tanks), soil removal, soil covers, and composting, have been conducted at the following areas and units:

- Burning Ground
- Landfills
- Zone 12, including the Former Cooling Tower, Building 12-68 sump and soils, Building 12-43 equalization tank, and SWMU 122b
- Zone 11, including the Building 11-36 sump area and leaching bed, Building 11-44 equalization tank, former waste retention pond, trinitrotoluene (TNT) evaporation pit areas, and oleum tank area
- Zone 10 TNT evaporation pits
- Firing Sites
- Temporary Burning Ground (SWMU 53)
- Fire Training Area Burn Pits
- Various ditches within the plant.

Additionally, a soil vapor extraction system was installed at the Burning Ground to reduce concentrations of VOCs in the subsurface soil gas plume.

Investigations of all units are scheduled to be completed before May 2005 to meet the requirements of the Risk Reduction Rule. The full corrective measure process will be conducted for sites that will be closed to RRS 3 levels after approval of the RFI for all units. All corrective action units are expected to be closed or in remediation by 2008.

Soil and Sediment Quality and Surveillance Monitoring. The SWEIS summarizes the results of annual soil and sediment surveillance monitoring for 1994 and 1995. Soil surveillance monitoring was performed for 17 offsite and 31 onsite locations. Samples were collected and analyzed for radionuclides, metals, explosive compounds, and VOCs, with comparisons made to background locations. Uranium-238 concentrations at the firing sites were higher than concentrations of other radionuclides, similar to previous trends and attributable to depleted uranium use in explosives test firings that ceased in 1986. Overall, soil monitoring results for 1995 were within the observed ranges of concentrations for uncontaminated soil and comparable to historical results and those for control locations. Boron, manganese, zinc, high-melting explosive (HMX), and total xylene concentrations in the area of the Burning Ground were higher than those at control locations and the range for background soil. All observed concentrations were less than those considered indicative of environmental risk (DOE 1996a:4-66–4-68).

During 2000, soil was routinely sampled at 23 onsite locations representing the Burning Ground, firing sites, Zone 4 West, and playa sampling areas. Soil was also sampled at 25 offsite locations that represent the Pantex Plant vicinity to include control (background) sampling areas. Samples were analyzed for radionuclides, metals, explosives, and VOCs. Onsite soil monitoring results for 2000 were, with few exceptions, within the concentration ranges observed for uncontaminated local soil, and were generally consistent with both background concentrations and historical results. Measurable amounts of the explosive compounds HMX, research development explosive (RDX) and TNT were detected in soil samples from locations in and adjacent to the Burning Ground. Elevated concentrations of HMX (from 0.30 to 160 mg/kg) were found in the soil at three Burning Ground locations; trace concentrations (0.09 to 0.20 mg/kg) were detected in samples from two locations just outside the Burning Ground perimeter. RDX (0.14 and 0.16 mg/kg) and a trace concentration of TNT (0.24 mg/kg) were detected in the soil at one Burning Ground location. All of these compounds were detected at concentrations below their respective RRS2 levels, are consistent with those previously documented in the SWEIS, and are believed to originate from past operations (BWXT Pantex 2001d:9-1,9-3,9-9–9-19).

As discussed in Section 2.1.2, new facility construction under the Proposed Action was projected to permanently impact about 0.04 percent of the DOE-owned property on the site. Direct impacts on site geology and soils were determined to be negligible and limited primarily to temporary soil disturbance. Impacts on site geology and soils of continued operations including pit storage activities were determined to be minimal. A review of site activities for the period 1996–2001, including those related to the ER program, indicates that impacts on geology and soils continue to be bounded by those previously assessed in the SWEIS. The potential for site geologic and soil conditions, particularly earthquakes, to affect either existing or proposed plant facilities, as well as to cause an accidental release that could impact human health, was also evaluated in the SWEIS. In general, the maximum credible earthquake was determined to have a low frequency of occurrence and the extent of damage and the potential for such an event to cause an accidental release would be dependent on several factors (DOE 1996a:4-68, 4-69). Since the SWEIS was issued, a new seismic analysis for the Pantex Plant has been completed using the guidelines in DOE Standard 1023, *Natural Phenomena Hazards Assessment*. No new or previously unidentified geologic hazards or substantial increase in risk to site facilities from identified geologic hazards is indicated by the available data.

2.1.4 Acoustics (Noise)

The SWEIS indicates that traffic is the primary source of noise at the Pantex Plant boundary and at residences near roads. Average sound levels (energy equivalent sound levels) on the site are in the range 40 to 60 decibels A-weighted (dBA). (For comparison, aircraft overflights can produce maximum noise levels of 90 dBA.) The target range results in impulsive noise and higher noise levels near the range. HE detonations also result in impulse noise. Modeling of overpressures from the largest HE detonations at the Pantex Plant indicates that these detonations could be audible to distances of 5 to 10 km (3 to 6 mi). Except for airblast noise from HE detonation, noise levels at the site boundary from continued operations would be below the day/night average sound level guideline of 65 dBA for compatibility with residential land uses as defined by the Federal Aviation Administration and the Federal Interagency Committee on Urban Noise. The SWEIS concludes that noise impacts at nearby noise sensitive areas (residences) from the usual noise sources at the Pantex Plant are negligible (DOE 1996a:4-157–4-168).

Although there would be temporary increases in noise levels and traffic from construction of the facilities proposed in or since the SWEIS was issued, construction activities and operation of these facilities were not expected to cause sufficient change in noise levels to result in annoyance to the public. Similarly, the other construction activities proposed for this period would result in some temporary increase in noise levels and construction traffic, but these activities are expected to be similar to other construction activities at the Pantex Plant. Operation of these new or modified facilities is expected to result in minimal change in offsite noise impacts (DOE 1996a:4-168, 4-169).

2.1.5 Biotic Resources

Biotic resources considered in the SWEIS include terrestrial resources (vegetation and wildlife), aquatic resources, wetland resources, and protected (threatened and endangered) and sensitive species.

Terrestrial and Aquatic Resources and Species. Although much of the site's natural vegetation, and that of the Texas Panhandle in general, has been altered with the land converted for agricultural uses, the site continues to support natural grasses, including buffalo grass, along with a variety of terrestrial wildlife species (DOE 1996a). To manage for biodiversity, a plan for the revegetation of some formerly cultivated areas was implemented in 1996. Areas of formerly cultivated land, including land around Playas 1, 2, and 3, an area southeast of Playa 2, and fields within Zone 11, were planted with native grasses during the spring and summer of 1996. Several disturbed areas such as abandoned parking areas, well construction sites, denuded ditches, landfill covers, and roadsides were seeded with native grasses in 1999 and 2000 in an effort to minimize soil erosion. Areas reseeded in 1999 and 2000 were in poor to fair condition in 2000 because of poor soil moisture conditions during the growing season (BWXT Pantex 2001d:3-12, 3-13).

In addition to uplands, numerous natural playa basins on or adjacent to the site support an assemblage of wetland and upland flora, as well as a number of species drawn to these habitats including migratory waterfowl, amphibians, and reptiles. The SWEIS identified 40 plant, 12 mammal, 12 bird, 7 reptile, 6 amphibian, and 2 fish species as representative of the nonthreatened/nonendangered flora and fauna at the Pantex Plant. In 2000, at least 22 mammal species and 112 bird species, including 9 new bird species, were recorded at the Pantex Plant (BWXT Pantex 2001d:3-13).

Historical monitoring results of radionuclide levels in both onsite and offsite vegetation reported in the SWEIS indicate that uranium and tritium concentrations at the Pantex Plant were comparable with control site (background) concentrations. In 2000, native vegetation and selected crops from both onsite and offsite locations were sampled and analyzed for select radionuclides and inorganic fluoride by independent analytical laboratories. The onsite and offsite data were compared to those from the control locations and 3-year (1997–1999) mean values. The comparisons indicate no impacts from Pantex Plant operations in 2000 (BWXT Pantex 2001d:10-1, 10-3, 10-12). Radionuclide surveillance of fauna (i.e., prairie dogs), first initiated in 1995, is conducted semiannually at four onsite locations and one control location (BWXT Pantex 2002c:7-28). The 2000 results were consistent with those of previous years: very small concentrations of radionuclides that occur naturally in the soil and that are also generated by Pantex

Plant operations, have been found in the tissues of prairie dogs. This indicates that uptake of radionuclides from any source (including naturally occurring or plant activities) is minimal (BWXT Pantex 2003a:10-15).

Protected and Sensitive Species. The listing of Federal and state-listed wildlife species and other special status species in the *2000 Site Environmental Report for Pantex Plant* (BWXT Pantex 2001d) differs from that presented in the SWEIS. The SWEIS identifies 23 listed and candidate species and species of concern. Eight of these species are not included in the 2000 site listing, including three birds (loggerhead shrike, migrant loggerhead shrike, black tern); three bats (occult little brown myotis, Western small footed myotis, Yuma myotis); and two reptiles (smooth green snake and Texas garter snake). Seven of these species were formerly classified by the U.S. Fish and Wildlife Service (FWS) as Category 2 candidate species, a designation that was discontinued in 1995 (59 FR 58982). In addition, it has been determined that habitats for the smooth green snake and Texas garter snake do not occur at the Pantex Plant (Ray 2002a). Therefore, these species are no longer included on the Pantex Plant's list.

The black-tailed prairie dog and the snowy plover have been added to the site listing since the SWEIS was published. The black-tailed prairie dog was designated a Federal candidate species in February 2000 (65 FR 5476); surveys of the Pantex Plant site in 2000 estimated a population of 1,426 black-tailed prairie dogs (Ray 2002b). This is a considerably lower population than estimates made in 1997 (10,000) and 1998 (13,000) that were based on burrows, rather than actual counts of prairie dogs (BWXT Pantex 2001d:3-13). The snowy plover is a Federal species of concern and is known to occur on or near the Pantex Plant site (BWXT Pantex 2002c:7-58).

In addition, the listing status for several other species has changed from that reflected in the SWEIS. The bald eagle, a winter resident, is the only listed species to spend an extended period of time on the site (DOE 1996a:4-180; BWXT Pantex 2002c:7-49). Texas Parks and Wildlife has changed the status of the bald eagle from endangered to threatened to match its Federal status. Further, the FWS has proposed removing the bald eagle from the List of Endangered and Threatened Wildlife in the conterminous United States (64 FR 36454). The peregrine falcon is a migrant and has been observed on the site; both the American and Arctic subspecies occur in the region (BWXT Pantex 2002c:7-49). In 1999, the FWS removed the American peregrine falcon from the Federal list (it is still state-listed) and likewise delisted the Arctic peregrine falcon, which was listed under the similarity of appearance provision of the Endangered Species Act (64 FR 46542). For mammals, the swift fox was formerly a Federal candidate species but has since been removed from the list because currently available information indicates that threats to the species have been reduced to the point that its candidacy for listing is no longer supported (66 FR 54808). Despite research, including annual survey efforts, no substantiated evidence exists that suggests that the swift fox occurs at Pantex. The closest known populations are in Dallam and Sherman counties in the northwest Panhandle (BWXT Pantex 2002c:7-13). The only other identified status change is for the smooth green snake, which is now state-listed as a threatened species.

The SWEIS indicates that new facility construction planned in or adjacent to Zones 11 and 12 under the Proposed Action could result in the loss of some vegetation and less mobile animals (i.e., reptiles, small mammals). Because the construction would occur in previously disturbed areas and would affect less than 1 percent of the DOE-owned land at the site, potential impacts on biological resources were determined to be negligible (DOE 1996a:4-182). A biological assessment of the Pantex Plant completed in 1996 for the SWEIS addressed the impacts of continuing operations on listed species and species of concern that may occur in or migrate through the area. The assessment was approved in 1996, and the FWS concurred with the conclusion that continued Pantex Plant operations are not likely to adversely affect any federally listed threatened or endangered species (DOE 1996a:4-180, 4-181; BWXT Pantex 2001d:2-16, 3-12; 2002a:7-48).

A review of current biological resources survey information, species regulatory listings, and land use and habit management practices indicates no substantial changes since publication of the SWEIS. Furthermore, projected land disturbance for new project implementation for the period 1996-2001 has been less than forecasted in the SWEIS, and potential impacts on biological resources are fully bounded by those previously assessed in the SWEIS.

2.1.6 Socioeconomic Resources

The SWEIS addresses the population, housing, labor force, income, and public finance characteristics in the Pantex Plant region. The ROI for the SWEIS socioeconomic analysis includes the four counties that form a rectangle around the Pantex Plant: Armstrong, Carson, Potter, and Randall counties. At the time the SWEIS was issued, 96 percent of the Pantex Plant employees resided within these four counties. The SWEIS estimated that the population within the ROI was 209,762 in July 1995. Approximately 96 percent of the population in 1995 lived in the Amarillo metropolitan statistical area (MSA), which consists of Potter and Randall counties (DOE 1996a:4-193).

According to the SWEIS, there were more than 5,300 business establishments in the ROI. Services, retail, and wholesale businesses constituted 70 percent of the establishments, employed two-thirds of the employed persons, and accounted for a total annual payroll in excess of $800 million. Construction firms represented 7.8 percent of the businesses, but employed less than 5 percent of the workforce, with an annual payroll of $77 million. Nearly 10 percent of businesses were finance, insurance, and real estate firms, which employed about 5 percent of the workforce, and had a total annual payroll of $86 million. Farming and ranching contributed nearly $300 million to the economy of the ROI. Nearly 1,300 farms and ranches operated in the ROI, covering more than 86 percent of the total land in the four counties (DOE 1996a:4-200, 4-201). There were 200 manufacturing establishments in the ROI, comprising less than 4 percent of area businesses, yet employing 10,590 persons, over 15 percent of the workforce, with an annual payroll of $281 million. Activities at the Pantex Plant were included in the manufacturing category (DOE 1996a).

In 1995, the Pantex Plant employed 3,530 persons, 3,310 of which were Mason & Hanger-Silas Mason Company, Inc., and Battelle Memorial Institute employees; 75 were DOE Amarillo Area Office (now the Pantex Site Operations) employees; 130 were DOE Transportation Safeguards Division (TSD) employees; and 15 were employees of Sandia National Laboratories or other national laboratories. In addition to the 3,530 plant employees, approximately 250 employees associated with consultants, subcontractors, and oversight agencies worked at the plant, for a total of 3,800 onsite employees (DOE 1996a:4-205).

The SWEIS estimated that the 3,800 onsite workers would be sufficient for the continuation of operations at the 2,000-weapons-activity level per year. It was estimated that a total of 6,257 secondary jobs would be created at the 2,000-weapons-activity level throughout the ROI from regional spending by direct workers, as well as from procurement of equipment, materials, and supplies for the Pantex Plant. Therefore, it was estimated that a total of 10,057 jobs would be generated in the ROI as a result of the activities at the plant. Total annual earnings in the ROI as a result of the 2,000-weapons-activity level and pit storage operations were estimated to be approximately $398 million. Of this, $176 million is earnings generated through secondary employment in the ROI (DOE 1996a:4-207, 4-209).

Construction and associated secondary jobs generated by new facility and upgrade projects in the peak construction year were estimated at 1,227 workers. This amounts to an estimated increase of approximately 12 percent over the plant’s permanent workforce. However, this increase would provide only short-term benefits to the local economy. Because almost all construction workers can be locally hired, the benefits would generally accrue to the population in the ROI. Earnings in the ROI from facility construction and upgrade were estimated to temporarily increase to $437 million from $398 million generated by continued operations at the 2,000-weapons-activity level. Personal income would increase from $564 million to $620 million. After the construction and upgrade of new facilities is completed, operations of the facilities would not add significantly to the socioeconomic effects described for continued operations (DOE 1996a:4-210).

Since issuance of the SWEIS, the population in the ROI has increased approximately 8 percent, from 209,762 to 226,522 (BWXT Pantex 2002c:8-4), while the number of onsite workers has decreased approximately 9 percent. Table 2–1 shows the change in the number of onsite workers from 1995 to 2001. The current employment total of 3,425 consists of 2,998 management and operating contractor (currently BWXT Pantex) employees (9 percent decrease), 75 DOE Amarillo Area Office (now the Pantex Site Operations) employees (no change), 100 DOE TSD employees (23 percent decrease), 27 DOE national laboratory employees (80 percent increase), and 225 persons associated with outside contractors and oversight agencies (10 percent decrease) (BWXT Pantex 2002c:8-12).

Table 2–1. Change in Number of Onsite Workers

Onsite Workers	1995	2001	Percentage Change
Maintenance and operations contractor	3,310	2,998	-9
DOE Pantex Site Operations	75	75	0
DOE Transportation Safeguards Division	130	100	-23
DOE national laboratories	15	27	+80
Outside contractors and oversight agencies	250	225	-10
Total	3,780	3,425	-9

Total employment in the ROI for the fourth quarter of 2000 was 100,820 persons. Twenty-six percent of the workforce (25,816 persons) is employed in the service sector, while 12 percent (11,735 persons) is employed by manufacturing establishments. The finance, insurance, and real estate sector, and the construction sector each employs approximately 5 percent of the workforce. Only 1 percent of workers in the ROI is currently employed in the agriculture sector (BWXT Pantex 2002c:8-15). The Texas Workforce Commission projected the overall economy of the Panhandle to grow by 10 percent between 1998 and 2008 (BWXT Pantex 2002c:8-14).

Using direct expenditures and employment data associated with the Pantex Plant, and data provided by the Bureau of Economic Analysis of the U.S. Department of Commerce on the Amarillo MSA, the overall indirect effect of the Pantex Plant is estimated to be nearly $250 million in annual secondary employment earnings and almost 5,000 jobs (BWXT Pantex 2002c:8-16, 8-17). This estimate is close to, and within, the SWEIS estimate of 6,257 secondary jobs at the 2,000-weapons-activity level. This estimate includes all four counties of the SWEIS ROI (which includes the Amarillo MSA), and is lower than the SWEIS estimate mainly because there are fewer onsite workers than estimated in 1995.

2.1.7 Human Health

2.1.7.1 Radiological Impacts

The SWEIS provided 10-year worker dose estimates for the following major activities:

- Intrasite transportation and Zone 4 staging operations (61 person-rem)

- Pit repackaging from AL-R8 to AT-400A containers (300 person-rem)
- Weapons operations (330 person-rem)
- Intersite transportation (3.2 person-rem)

The total worker dose estimated in the SWEIS for the 1996–2006 timeframe is about 700 person-rem, or about 70 person-rem per year. Table 2–2 shows that annual doses between 1996 and 2000 varied from about 11 person-rem to about 36 person-rem, or roughly half the SWEIS estimate (BWXT Pantex 2001e). These lower doses could in part be attributed to repackaging pits in AL-R8 SI containers rather than the AT-400A containers assumed in the SWEIS. DOE evaluated repackaging pits in AL-R8 SI containers in a SA (DOE 1998). The SA concluded that while both the AL-R8 SI and AT-400A containers meet the necessary safety and storage design specifications, certain attributes of the AL-R8 SI container surpass those of the AT-400A container. In particular, the radiation dose assessment performed in the SA indicates that the total worker dose associated with repackaging and use of the container is lower than for the AT-400A. DOE determined, based on the SA, that use of the AL-R8 SI pit storage container is within the parameters of the SWEIS.

Table 2–2. Annual Worker Doses, 1994 to 2000

Year	Total Worker Dose (person-rem)	Maximum Individual Dose (rem)	Number Monitored	Number with Zero Dose	Percent with Zero Dose	Average Worker Dose (rem)
1994	28.817	0.662	2,978	2,649	89	0.010
1995	36.623	0.764	3,107	2,791	90	0.012
1996	27.624	0.712	3,209	2,852	89	0.008
1997	10.991	0.432	3,120	2,790	89	0.004
1998	14.836	0.700	2,800	2,494	89	0.006
1999	25.589	0.764	2,686	2,345	87	0.010
2000	34.180	0.975	2,766	2,494	90	0.012

Source: BWXT Pantex 2001e:Table 6.1–1.

The SWEIS estimates that the average person in the vicinity of the Pantex Plant receives a dose from plant operations of 4.98×10^{-7} mrem/yr. The annual site environmental reports include doses to the hypothetical maximally exposed (offsite) individual; and the collective population dose for persons residing in the vicinity of the plant, from which the dose to the average person can be calculated. Doses to the maximally exposed individual are a very small fraction of the 10 mrem/yr dose limit specified in 40 CFR 61. The doses to the maximally exposed individual as well as to the average person residing in the vicinity of the Pantex Plant have been lower than the SWEIS estimate each year since the SWEIS was issued (BPM&H 1997:Table 6.2; BPM&H 1998:Table 4.2; M&H 1999:Table 4.2; M&H 2000f:Table 4.3; BWXT Pantex 2001d:Table 4.3). For example, in calendar year 2001, the maximally exposed individual dose equivalent was 1.36×10^{-5} mrem/yr, while the population dose was 4.48×10^{-9} person-rem/yr. Since the estimated population within an 80-km (50-mi) radius of the Pantex Plant was 294,000 in 2001, the dose equivalent to the average person residing in the vicinity of the Pantex Plant was 1.52×10^{-11} mrem/yr (BWXT Pantex 2003:Table 4.3).

2.1.7.2 Chemical Impacts

This section summarizes the chemical impacts described in the SWEIS and then assesses the effect of changes that have occurred between 1996 and the present. The SWEIS describes the impacts of emissions in three areas: onsite exposures, offsite exposures, and carcinogens.

Onsite Exposures. The SWEIS presents maximum potential onsite ambient concentrations of pollutants, averaged over 30 minutes and 1 year, and compares them with workplace exposure limits established by the Occupational Safety and Health Administration (OSHA) and the American Conference of Government Industrial Hygienists. In all cases, the calculated airborne concentrations are well below the exposure limits.

Offsite Exposures. Under normal operations, various chemicals are released to the atmosphere. Table 4.14.1.2-1 of the SWEIS provides a listing of the calculated maximum concentrations of these chemicals at the plant fence line, and the ratios of these concentrations to TCEQ effects screening levels (ESLs).[4] All of the approximately 80 chemicals listed have ESL ratios that are less than unity. Table 4.14.1.2-2 of the SWEIS compares predicted reference concentrations to reference concentrations that are measures of the potential for non-carcinogenic effects. The hazard index for a specific chemical is the ratio of the predicted concentration to the fence line concentration. If this ratio is appreciably less than unity, no adverse human health effects are expected. If the hazard index is close to unity, some adverse health effects may occur, and if the hazard index is substantially greater than unity, severe health effects can result. In the case of the approximately 80 listed chemicals, the sum of the individual hazard indices is 0.0909, indicating that no adverse health effects are expected.

Carcinogens. Of the approximately 80 chemicals identified as present at the Pantex Plant, two are known human carcinogens (benzene and chromium); one is a probable human carcinogen based on limited human data (formaldehyde); four are probable human carcinogens, based on animal data (carbon tetrachloride, ethylene dichloride, lead, and methylene dichloride); and one is a “possible” human carcinogen (1,1,2-trichloroethane). Using risk factors established by EPA and the maximum fence line airborne concentrations averaged over a year, the SWEIS establishes a lifetime probability of 1.2×10^{-5} that a hypothetical individual at the site boundary would contract cancer.

A review of the chemical inventory at the Pantex Plant indicates that no chemicals have accumulated to levels appreciably greater than those listed in the SWEIS (Boyer 2002). As discussed, both the onsite and fence line concentrations estimated in the SWEIS are below any levels that could result in adverse health effects. Therefore, even if there were a large increase in the amount of any chemical or a number of chemicals, the risk of adverse health effects related to chemical exposure to either workers or offsite individuals would not be expected to increase.

[4] Effects screening levels are used to evaluate the potential for effects to occur as a result of concentrations of constituents in the air. They are not ambient air standards. If predicted or measured airborne levels of a constituent do not exceed the screening level, adverse health effects would not be expected to result. If ambient levels of constituents in air exceed the screening levels, it does not necessarily indicated a problem, but rather, triggers a more in-depth review.

2.1.7.3 Industrial Hazards

In 1993, the Secretary of Energy announced that regulation of worker health and safety at DOE contractor-operated facilities would gradually shift from DOE to OSHA. The SWEIS summarized certain OSHA recordable statistics to compare the performance of the Pantex Plant to national averages for the general, manufacturing, and chemical industries. These statistics are shown in Table 2–3, which is reproduced from the SWEIS. These statistics provide a good indication of the plant's performance with respect to common industrial hazards. The SWEIS states that this table demonstrates that Pantex Plant safety programs tend to be more effective than those in the general, manufacturing, and chemical industries, and that for both total recordable cases and lost workday cases, incidence rates are below industrial averages. The exception is for lost workdays, where the Pantex Plant exceeds chemical industry incidence rates (DOE 1996a:4-268–4-269). Table 2–4, taken from the *Safety Information Document* (BWXT Pantex 2001e), makes a similar comparison to Bureau of Labor Statistics data.

Table 2–3. Comparison of Incidence Rates for Pantex Plant and Industry, National Averages

Operation	Incidence Rate per 100 Full-Time Workers per Year		
	Total Recordable Cases	Lost Workday Cases	Lost Workdays
Pantex Plant	5.1	2.2	74.3
General industry	8.4	3.9	86.5
Manufacturing industry	12.7	5.6	121.5
Chemical industry	6.4	3.1	62.4

Source: DOE 1996a:Table 4.14.1.4-1.

Table 2–4. Pantex Plant Average Rates Compared with Bureau of Labor Statistics Average Rates, 1990–2000

Operation	Incidence Rate per 100 Full-Time Workers per Year		
	Total Recordable Cases	Lost Workday Cases	Lost Workdays
Pantex Plant (composite)	4.72	2.66	71.6
Bureau of Labor Statistics	7.1	3.3	75.2

Source: BWXT Pantex 2001e:Table 6.3.1-3.

Table 2–5 shows annual data for total recordable case rate, the lost workday case rate, and the lost workday rate from 1996 to 2001. As indicated in the table, the incidence rates for each of these OSHA statistical categories has declined during this period, and are less than the average industry and Bureau of Labor Statistics rates shown in Tables 2–3 and 2–4.

Table 2–5. Pantex Plant Injury Rate Composite Statistical Summary, 1996–2001

Injury Category	Incidence Rate per 100 Full-Time Workers per Year					
	1996	1997	1998	1999	2000	2001
Total recordable case rate	5.68	4.45	3.09	2.89	3.11	3.13
Lost workday case rate	4.12	2.86	2.09	1.86	1.78	1.98
Lost workday rate	120.7	71.9	62.8	44.0	32.9	55.9

Source: Abstracted from Table 6.3.1-2 of BWXT Pantex 2001e; Nester 2003b.

2.1.8 Transportation

Hazardous materials transported on and off the Pantex Plant site include nuclear explosives; nuclear components; HE components and materials; tritium; hazardous, radioactive, and mixed waste; and a variety of chemicals.

The transportation impact assessment was evaluated in the SWEIS for 500-, 1,000-, and 2,000-weapons-activity levels. The *Pantex Plant 10-Year Comprehensive Site Plan* (BWXT Pantex 2001b:4-3) indicates that between 570 and 976 weapons would be handled annually between 2001 and 2010, although actuals for 2001 and 2002 are 530 and 985, respectively (Nava 2002b, 2002c). These weapons workload estimates and actuals are well within the range covered by the SWEIS. In addition, the activities described in the *Pantex Plant 10-Year Comprehensive Site Plan* (handling of SNM, HE, and weapons components) are consistent with those described in the SWEIS.

The intersite transportation analysis encompasses current and projected operations. Three major transportation activities are analyzed in the SWEIS:

- Nuclear explosives were based on 10-year weapons activity; the number and content of shipments are classified.
- Pit shipments by safe, secure transport (SST); the number and content of shipments are classified.
- Tritium reservoirs transported by DC-9 aircraft; the number and content of shipments are classified.

HE and SNM are frequently transported on and off the site. Typical vehicles used to transport these materials include forklifts, SSTs, safeguards trailers (SGTs), flatbed trailers, hardened utility trailers, vans, trucks, pallet jacks, and tow motors. Intrazone transportation is carried out in enclosed ramps and corridors, while interzone transportation is carried out on paved roads (BWXT Pantex 2001e).

The DOE/TSD Coordination Section handles all nuclear explosives and nuclear component movements in and out of the Pantex Plant. The SWEIS provides a description of SSTs that would be used by TSD to ship nuclear materials to other sites. The TSD is phasing out the SSTs and replacing them with SGTs. The SGT was introduced to take advantage of improvements in sensor and computer technology to replace SSTs that were approaching end-of-life miles-on-axles status (BWXT Pantex 2001e:5-6).

The *Pantex Plant 10-Year Comprehensive Site Plan* (BWXT Pantex 2001b:4-2) uses the weapons workload from the SSM PEIS for the period up to 2007 (DOE 1996b), which is consistent with the workload considered in the SWEIS. Therefore, the transportation impacts are expected to remain consistent with those described in the SWEIS.

2.1.9 Environmental Justice

Executive Order 12898*, Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs Federal agencies to address the environmental justice impacts of their actions on minority and low-income populations. Since issuance of the SWEIS, the Council on Environmental Quality (CEQ) released *Environmental Justice Guidance Under the National Environmental Policy Act* that further describes how agencies should analyze environmental justice issues. Every Federal agency is required to analyze environmental effects, including human health, economic, and social effects, of Federal actions, including effects on minority and low-income populations, when such analysis is required by NEPA. The ROI for the SWEIS environmental justice analysis is an 80-km (50-mi) radius centered in the southwest corner of Zone 4. This ROI extends beyond the four-county socioeconomic ROI. In 1990, most minority and/or low-income persons were found to be residing in the Amarillo urbanized area (DOE 1996a:4-337).

According to the 1990 Census, there were 267,107 persons within the Pantex Plant ROI. Whites were nearly 81 percent of the population, Hispanics were the second largest group with 13 percent, and Blacks accounted for just over 4 percent. Native Americans, Asians, Pacific Islanders, and other racial groups totaled slightly more than 2 percent of the population within the ROI (DOE 1996a:4-337). Approximately 15 percent of the population in the ROI was below the poverty level. Minority and low-income populations in sufficient concentrations were found in 25 tracts in the northeast quadrant of the Amarillo urban area and in 10 rural block numbering areas (BNAs) within the ROI. The SWEIS concluded that the plant is surrounded by rural tracts of white majority populations, and minority and low-income populations are located either in the Amarillo urban area, approximately 27 km (17 mi) away, or in the outer fringes of the ROI (DOE 1996a:4-343).

The SWEIS estimated that at the 2,000-weapons-activity level, employment would remain at its 1995 level. With no change in employment, the environmental impacts on the general population as well as on the minority and low-income populations were estimated to be similar to those experienced at the time the SWEIS was issued. Outside of the Amarillo metropolitan area, most of the minority and low-income population is located in BNAs at the outer reaches of the ROI, more than 48 km (30 mi) from the Pantex Plant. The SWEIS concludes that the minority and low-income populations, therefore, are not expected to experience any disproportionately high or adverse human health, social, economic, or environmental effects from Pantex Plant operations (DOE 1996a:4-343).

The SWEIS estimated that beneficial economic impacts of the Pantex Plant would be concentrated in the Amarillo metropolitan area where almost all of the employees reside, and where most of the local expenditures for the Pantex Plant occur. Almost 20 percent of the employees at the Pantex Plant belonged to the minority population at the time the SWEIS was issued. This ratio is comparable to the minority population in the Amarillo metropolitan area, where approximately 21 percent of the population is minority. Employment at the Pantex Plant, therefore, benefits both the majority and minority populations proportionately (DOE 1996a:4-346).

The 2000 Census indicates that the population within the 80-km (50-mi) radius ROI is 295,837, an 11 percent increase since the 1990 Census (BWXT Pantex 2002c:8-11). The percentage of minority populations around the Pantex Plant, however, has not changed since issuance of the SWEIS. Data from the 2000 Census for the 14-county area (80-km [50-mi] radius) surrounding the Pantex Plant shows that both white and minority populations have remained approximately the same, at 79 and 21 percent of the total population, respectively, with Hispanics remaining the largest minority (BWXT Pantex 2002c:8-7). The percentage of persons living below the poverty level has also remained approximately the same, at 15.7 percent (BWXT Pantex 2002c:8-28). The plant continues to be surrounded by rural tracts of white majority populations, and minority and low-income populations continue to be located either in the Amarillo urban area or the outer fringes of the ROI (BWXT Pantex 2002c:8-27).

Employment levels at the Pantex Plant have decreased by approximately 10 percent since the SWEIS was issued (BWXT Pantex 2002c:8-12). With such a small change in employment, the environmental impacts on the general population as well as on the minority and low-income populations are approximately the same as those experienced at the time the SWEIS was issued. About two-thirds of the total population in the ROI continues to be located in the Amarillo metropolitan area, where the minority population has increased slightly from the time the SWEIS was issued to approximately 29 percent, and the percentage of persons living in poverty has remained the same, approximately 15 percent (BWXT Pantex 2002c:8-27). Outside of the Amarillo metropolitan area, most of the minority and low-income population continues to be located at the outer reaches of the ROI. Therefore, the minority and low-income populations have not experienced any disproportionately high or adverse human health, social, economic, or environmental effects from Pantex Plant construction and operations.

2.1.10 Regulatory Requirements

Major Federal environmental laws and regulations, Executive orders, and DOE orders were reviewed to identify new requirements applicable to Pantex since the SWEIS was issued. No major environmental statutes have been passed since that time. However, changes continue to be made to the environmental regulations, which implement the requirements of the various statutes.

This section identifies applicable environmental, health and safety Executive Orders and DOE regulations that are applicable to Pantex Plant operations, and briefly describes changes or additions since the SWEIS was issued. Requirements have been implemented as appropriate, but no new major programs or activities have been required to achieve compliance. These requirements are considered in environmental and safety reviews, and design requirements for proposed projects and activities.

2.1.10.1 Executive Orders

Since issuance of the SWEIS, a number of applicable Executive orders have been issued, while others have been totally or partially superceded. Therefore, the Executive orders applicable to the environment at the Pantex Plant are listed in Table 2–6. Since issuance of the SWEIS, Executive Orders 13101, 13123, and 13148, on *Greening the Government*, and Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* have been issued. These new orders are described briefly in the following paragraphs.

Executive Order 13101, *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition.* This order requires Federal agencies to incorporate waste prevention and recycling into daily operations, work to increase the market for recycled products, and comply with policies for acquisition and use of environmentally preferable products and services.

Executive Order 13123, *Greening the Government Through Efficient Energy Management.* This order sets goals for agencies for reducing greenhouse gas emissions from facility energy use, reducing energy consumption per gross square foot of facilities, reducing energy consumption per gross square foot or unit of production, expanding use of renewable energy, reducing the use of petroleum within facilities, reducing source energy use, and reducing water consumption and associated energy use.

Executive Order 13148, *Greening the Government Through Leadership in Environmental Management.* This order requires agencies to integrate environmental accountability into day-to-day decision-making and long-term planning processes. The order sets goals for implementing environmental management systems, environmental audits, reporting to the public of pollution releases, pollution prevention or reduction at the source, reducing toxic releases and transfers of toxic chemicals, reducing use of toxic chemicals and hazardous substances, reducing generation of hazardous and radioactive waste types, phasing out the use of Class I ozone-depleting substances, and promoting environmentally sound landscaping practices.

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks.* This order requires agencies to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and ensure that they address disproportionate risks to children.

Pollution prevention, recycling, and energy efficiency initiatives at the Pantex Plant that were started before the issuance of the *Greening the Government* Executive orders are consistent with these orders and continue to be consistent. To comply with Executive Order 13148, an environmental management system plan is currently under development for Pantex, with the goal of having a system that is compliant with ISO 14001 by 2005.

Table 2–6. Executive Orders Applicable to the Environment at the Pantex Plant

Order	Date
Water Resources	
Executive Order 11988, Floodplain Management	May 24, 1977
Executive Order 11990, Protection of Wetlands	May 24, 1977
Biotic Resources	
Executive Order 13112, Invasive Species	February 3, 1999
Waste Management, Pollution Prevention, and Conservation	
Executive Order 12088, Federal Compliance with Pollution Control Standards	October 13, 1978 (partially revoked)
Executive Order 13873, Federal Acquisition, Recycling, and Waste Prevention	October 20, 1993
Executive Order 13101, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition	September 14, 1998
Executive Order 13123, Greening the Government Through Efficient Energy Management	June 3, 1999
Executive Order 13148, Greening the Government Through Leadership in Environmental Management	April 21, 2000
Cultural Resources	
Executive Order 11593, Protection and Enhancement of the Cultural Environment	May 13, 1971
Executive Order 13007, Indian Sacred Sites	May 24, 1996
Emergency Response	
Executive Order 12580, Superfund Implementation	January 23, 1987
Executive Order 12656, Assignment of Emergency Preparedness Responsibilities	November 18, 1988
Other	
Executive Order 11514, Protection and Enhancement of Environmental Quality (as amended by Executive Order 11991)	March 5, 1970
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations	February 11, 1994
Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks	April 21, 1997

2.1.10.2 DOE Regulations and Orders

DOE regulations issued since the SWEIS include 10 CFR 830, "Nuclear Safety Management," and 10 CFR 835, "Occupational Radiation Protection." The requirements in 10 CFR 830 are applicable to DOE and contractor employees conducting activities that may affect the safety of DOE nuclear facilities. It establishes quality assurance and safety basis requirements. The 10 CFR 835 regulations establish radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the activities conducted by DOE and its contractors. Activities may include, but are not limited to, design, construction, or operation of facilities.

DOE Order 414.1A, *Quality Assurance*, was issued in 1999 (the 414.1 series replaced DOE Order 5700.6C). It sets forth requirements for DOE and contractors to establish an effective management system using performance requirements. DOE Order 435.1, *Radioactive Waste Management*, was issued in 1999, replacing DOE Order 5820.2A. It establishes requirements that DOE programs and contractors must follow in managing DOE radioactive waste (including mixed waste) to provide radiological protection related to DOE facilities, operations, and activities.

Since the SWEIS, many DOE orders have been reorganized and some orders have been canceled. The DOE regulations and orders applicable to the environment at the Pantex Plant are listed in Table 2–7.

Table 2–7. DOE Environmental, Safety, and Health Regulations and Orders

Number	Title
Regulations	
10 CFR 820	Procedural Rules for DOE Nuclear Activities
10 CFR 830	Nuclear Safety Management
10 CFR 835	Occupational Radiation Protection
10 CFR 1021	Compliance with the National Environmental Policy Act
Orders	
414.1A	Quality Assurance
435.1	Radioactive Waste Management
451.1B	National Environmental Policy Act Compliance Program
470.1	Safeguards and Security Program
1230.2	American Indian Tribal Government Policy
5400.1	General Environmental Protection Program
5400.5	Radiation Protection of the Public and the Environment
5480.19	Conduct of Operations Requirements for DOE Facilities
5480.4	Environmental Protection, Safety, and Health Protection Standards
5530.1A	Accident Response Group
5530.4	Aerial Measuring System
5632.1C	Protection and Control of Safeguards and Security Interests

2.2 Resource Areas Evaluated in Detail

2.2.1 Facilities and Infrastructure

2.2.1.1 Facilities

Major operations performed at the Pantex Plant include assembly and disassembly of nuclear weapons, repair and modification of weapons, production of HE components, research and development, staging (temporary storage) of nuclear weapons, packaging and shipping of weapons and components, and interim storage of pits. These activities are housed in 476 buildings and an additional 144 structures (temporary buildings, trailers, and containers). Zone 4 magazines (95 buildings) are used for staging nuclear weapons, explosives, and pits. The SWEIS identifies 213,200 m^2 (2,295,000 ft^2) of facilities used specifically for mission purposes.

In the period 1990–1996, 206 facility upgrades, repairs, and improvements to facilities and maintenance activities were initiated. With regular maintenance and upgrades, the facilities were expected to continue to serve the activities and missions of the plant (DOE 1996a:4-9–4-19). Since 1996, various upgrades, repairs, and improvements have been completed.

The SWEIS projected that an additional 15,900 m^2 (171,160 ft^2) of facilities would be constructed for proposed projects, resulting in a total of 229,100 m^2 (2,466,160 ft^2) analyzed. Only one of these projects, the HWTPF, was constructed during the period 1996–2001. This project resulted in about 2,650 m^2

(28,500 ft^2), a 1 percent increase in facility area. No other projects that were initiated during this period resulted in additional floor space.

2.2.1.2 Infrastructure

The Pantex Plant has 76 km (47 mi) of roads within the site boundaries. Access is provided to the site by Texas Farm-to-Market roads and a railroad spur from the railroad along the southern boundary of the TTU property (DOE 1996a:4-10–4-12). None of the projects constructed or initiated during the period 1996–2001 resulted in major changes in the roads or the use of the railroad. New facilities may result in some changes in traffic patterns on the site, and additional parking would be provided at new facilities as necessary.

The SWEIS describes the utilities at the Pantex Plant, including the steam, electric, natural gas, water, and wastewater systems. Steam is provided for operations and heating by the plant boiler house, which operates on natural gas. With regular maintenance and upgrades, the infrastructure of the plant was expected to adequately serve the activities and missions of the plant, including the proposed facility projects included in the SWEIS ROD. The system capacities and projected usage from the SWEIS for the period 1996–2006 are shown in Table 2–8.

Table 2–8. SWEIS Projected Utility Consumption and Capacities, 1996–2006

Utility	Operation Consumption[a]	Projected New Facility Increase in Consumption[b]	Total Projected Consumption 2006	System Capacity[c]	Percentage of Capacity
Steam, M kg/yr (M lb/yr)	181 (398)	1.1 (2.5)	182 (401)	596 (1,314)	31
Electricity, Megawatt-hour/yr	90,400	379	90,800	201,480	45
Natural gas, M m^3/yr (M ft^3/yr)	16.2 (573)	0.1 (2.4)	16.3 (575)	289 (10,220)	5.6
Water, M L/yr (M gal/yr)	1,011 (267)	0.66 (0.174)[d]	1,011 (267)	1,893 (500)	53
Wastewater treatment, M L/yr (M gal/yr)	647 (171)	3.44 (0.909)	651 (172)	829 (219)	79

[a] Consumption of all Pantex Plant operations based on 1993 rates plus 10 percent at 2,000-weapons-activity level.
[b] Increase in consumption from facilities proposed in the SWEIS, which would be built between 1996 and 2006.
[c] Based on fiscal year 1995 Pantex Plant Site Development Plan.
[d] In addition 3.4 M L/yr (0.9 M gal/yr) of industrial water would be used.
Key: M, million.
Source: DOE 1996a:4-15, 4-17.

Table 2–9 shows the minimum and maximum utility use from 1996 through 2002. Steam use remained relatively stable during this period while use of all other utilities decreased during that time, water use and wastewater generation substantially. As can be seen in this table, current usage for most utilities is approximately 25 to 40 percent of available capacity, with natural gas use less than 5 percent of capacity. Usage data for all utilities shows that current usage is below the SWEIS projected 2006 consumption shown in Table 2–8.

Table 2–9. Pantex Plant Utility Consumption, 1996–2002

Utility	Annual Consumption Range	Maximum/ Minimum Usage Year	System Capacity[a]	Percentage of Capacity
Steam, M kg/yr (M lb/yr)	178–180 (393–395)	1996/2002	596 (1,314)	29–30
Electricity, Megawatt-hour/yr	74,000–81,800	1996/2002	201,480	36–41
Natural gas, M m^3/yr (M ft^3/yr)	10.5–13.1 (371-465)	1997/2002	289 (10,220)	3.6–4.5
Water, M L/yr (M gal/yr)	481–663 (127–175)	1996/2001	1,893 (500)	25–35
Wastewater treatment, M L/yr (M gal/yr)	284– 458 (75–121)	1996/2002	829 (219)	34–55

[a] Based on fiscal year 1995 Pantex Plant Site Development Plan.

Key: M, million.

Source: DOE 1996a:4-15; Davis 2002; Johnson 2002a, 2002b; Barrera 2003; Nester 2003a.

2.2.2 Cultural Resources

The SWEIS addresses the prehistoric and historic cultural resources, World War II and Cold War Era structures, and paleontological resources at the Pantex Plant. The SWEIS states that a programmatic agreement to ensure compliance with Sections 106 and 110 of the National Historic Preservation Act of 1966 would be produced in consultation with the Texas State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (DOE 1996a:4-187). In October 1996, a programmatic agreement was developed that provides for more efficient and effective review of Pantex Plant projects having the potential to impact prehistoric, World War II era, or Cold War era properties that may be eligible for listing on the National Register of Historic Places (National Register) (DOE 1996c). A draft Cultural Resources Management Plan was completed in September 2000 (BWXT Pantex 2002c:12-1). The final Cultural Resources Management Plan is scheduled to be submitted to DOE by September 2003.

Surveys and inventories conducted at the Pantex Plant identified 57 prehistoric and 12 pre-1942 Euroamerican historic sites on Pantex Plant land, including TTU property leased to DOE. None of the sites appeared to be potentially eligible for inclusion on the National Register. A comprehensive survey of World War II historical structures constructed between 1942 and 1945 resulted in the identification of 29 standing structures and 82 foundations and partial structures. Cold War operations had not been surveyed at the time the SWEIS was issued, although the SWEIS did acknowledge the need for such a survey (DOE 1996a:4-185).

In 1996, routine monitoring of two prehistoric archeological sites revealed that erosion had exposed bison bones at site 41CZ66. Emergency excavation was performed because the bones could not be protected in-situ. After analysis of the bones by the TTU Museum in 1997, a traveling interpretive exhibit was developed with the bison remains as the focal point. This exhibit is shown on a 4-month rotation at Panhandle area museums (BWXT Pantex 2002c:12-4).

Since issuance of the SWEIS, the prehistoric and Euroamerican historical sites have been evaluated in consultation with the Texas SHPO. Based on this evaluation, DOE has determined that two prehistoric sites, 41CZ66 and 41CZ23, are potentially eligible for inclusion on the National Register. These two sites will be protected and monitored, but will not undergo the extensive testing that would be required for a final determination of eligibility. DOE decided to protect 22 additional prehistoric sites not potentially eligible for inclusion on the National Register. These are a grouping of Southern High Plains sites that is the largest such resource grouping under Federal protection. DOE also determined, in consultation with the Texas SHPO, that the 12 Euroamerican historical sites lack integrity and, therefore, are not eligible for inclusion on the National Register (BWXT Pantex 2002c:12-3, 12-4).

Preliminary discussions between DOE and the Texas SHPO suggest that none of the World War II properties have sufficient integrity to be eligible for listing on the National Register. However, a number of original World War II era drawings and documents have been identified and are now preserved in the Pantex Plant's environmentally controlled records storage area (BWXT Pantex 2002c:12-4, 12-5).

Subsequent to issuance of the SWEIS, a literature search was completed that identified approximately 700 buildings and structures and a large inventory of related equipment and documents from the Cold War era. In 1997, an oral history program was developed to capture previously undocumented information from Pantex Plant employees. At the end of fiscal year 1997, 21 oral histories had been collected, and a Cold War-era building survey had been initiated. To date, all Cold War era buildings have been surveyed on a preliminary basis, all design drawings have been reviewed, and about half of the buildings have been documented in a survey format. This effort culminated in the draft *Cold War Context Statement for the Pantex Plant* (Statement) (Mitchell 2001). In the transmittal letter to the Texas Historical Commission, DOE recommends that 183 buildings are eligible for inclusion on the National Register. DOE also indicated that specific DOE management recommendations for these buildings would be provided in a revised draft of the Cultural Resources Management Plan, scheduled for completion in fiscal year 2002 (Johnson 2001). In a February 2002 letter to the Pantex Site Operations, the Texas Historical Commission provided its review of DOE's draft Statement, indicating that there were no substantive suggestions for revisions (Ketter 2002). Continuing consultations are being conducted between DOE and the Texas SHPO regarding formal eligibility for World War II and Cold War era resources (BWXT Pantex 2002c:12-6).

To date, no Native American sites, traditional cultural properties, or mortuary remains have been discovered at the Pantex Plant, and based on completed survey and identification work, none are anticipated. However, should such items be discovered, they would be treated in accordance with the requirements of the Native American Graves Protection and Repatriation Act. Since issuance of the SWEIS, DOE completed a Native American treaty search to identify federally recognized Native American tribes that have treaty or traditional, cultural, or religious interests in preserving cultural or related natural resources at the Pantex Plant. This study concluded that there were no federally recognized Native American tribes with recognized title or treaty rights to Pantex Plant land area (BWXT Pantex 2002c:12-6, 12-7).

The SWEIS concluded that no impacts to cultural resources as a result of continued operations are anticipated. No surface remains or historical structures potentially eligible for the National Register were identified at the six new project sites evaluated in the SWEIS. The SWEIS did acknowledge that subsurface cultural resources may be discovered during construction, remodeling, or land-altering activities associated with proposed new facility construction and upgrades. If that were to occur, work would be stopped until an evaluation could be conducted to determine the significance of the resource. The Texas SHPO would be consulted and mitigation, documentation, and/or preservation measures would be conducted as necessary (DOE 1996a:4-188–4-190).

2.2.3 Water Resources

Surface and groundwater resources at the site and within the ROI are described in the SWEIS. The surface water discussion addresses surface water features and hydrologic characteristics, floodplains, baseline surface water quality, and surface water discharges and permits. Groundwater aspects considered include the hydrogeologic characteristics of aquifers and unsaturated materials, baseline groundwater quality, and groundwater rights and uses (DOE 1996a).

2.2.3.1 Surface Water

Hydrology and Floodplains. Six playas on or adjacent to the Pantex Plant site have natural water features that allow storm water runoff from the plant to flow to the playas. Playa 1 has received continuous discharges from the Pantex Plant Wastewater Treatment Facility (WWTF), with the only continuous flow occurring in the associated discharge outfall ditch. Playas 1, 2, and 4 have also received wastewater effluent and storm water via discharge points originating from plant operations. Playa 3 receives storm water runoff from the Burning Ground (BWXT Pantex 2002c:5-6, 5-8–5-11).

As detailed in the SWEIS, floodplains on the Pantex Plant were delineated by the Tulsa District of the U.S. Army Corps of Engineers. Floodplain boundaries were delineated for Playas 1 through 4, Pantex Lake, and Pratt Lake (located north of Pantex Plant). Within the main plant site, the only major facility lying within delineated floodplain boundaries is the WWTF, which is located within the 100-year floodplain of Playa 1 (DOE 1996a:4-75, 4-76).

Surface Water Discharges and Permits. At the time the SWEIS was issued, the Pantex Plant was authorized to discharge treated domestic (sanitary) sewage, treated industrial wastewater, and storm water to Playa 1; and treated industrial wastewater and storm water to Playas 2 and 4 under a National Pollutant Discharge Elimination System (NPDES) Permit issued by the EPA, and a Wastewater Discharge Permit issued by the TCEQ. The plant was also operating under the EPA-issued NPDES Storm Water Baseline Industrial General Permit and the General Permit for Storm Water Discharges Associated with Construction Activities (DOE 1996a:4-74–4-81).

Under the terms of the TNRCC Wastewater Discharge Permit, a study was initiated in 1996 to determine the feasibility of eliminating or minimizing wastewater discharge to playa lakes and open ditches, among other specific measures to be considered (DOE 1996a:4-82, 4-83). 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 November 1998, the DOE-Amarillo Area Office signed a Federal Facilities Compliance Agreement that specified an agreed-upon compliance schedule for corrective actions (BWXT Pantex 2001d:2-8), including upgrading the WWTF; eliminating discharges from several industrial outfalls to surface ditches; and implementing a number of operational, maintenance, and monitoring program modifications. In 1999, the effort to route all industrial wastewaters, including all internal outfalls that had discharged through ditches, to the sewer system and ultimately to the WWTF for treatment was completed (BWXT Pantex 2001d:8-5).

In September 2001, the TCEQ issued a Texas Pollutant Discharge Elimination System (TPDES) permit that combined the TNRCC and NPDES permits into a single permit (TNRCC 2001). (This combined permit resulted from Texas being delegated NPDES permitting authority by EPA in September 1998.) The new permit authorizes discharge of treated domestic and industrial effluent to the environment through Outfall 001 to Playa 1, and removed the internal and final storm water outfalls from the permit. Since issuance of the new TPDES permit, the storm water outfalls have been regulated only by the applicable TPDES Multi-Sector General Permit (MSGP) for Storm Water Discharges Associated with

Industrial Activity. Pantex filed for coverage under the new Texas MSGP in November 2001 (BWXT Pantex 2002c:5-9, 5-10).

In January 2001, the United States Supreme Court issued a decision that decisively limited the scope of the Clean Water Act (CWA) as it applies to the Pantex Plant. The Supreme Court held that isolated bodies of water like the playa lakes into which Pantex effluent and storm water discharges flow are not under the jurisdiction of the CWA. As a result, these discharges are no longer regulated by USEPA, but are now regulated by the state of Texas under applicable regulations. The wastewater discharge is regulated under the TPDES permit and the industrial storm water discharges are regulated by the TPDES MSGP. Regulation of storm water discharges related to construction activities is unsettled. The EPA general permit has expired and Texas has not yet issued its version of the general permit for storm water discharges from construction activities. When issued, the corresponding TCEQ regulations are expected to closely mirror the EPA NPDES General Permit for Storm Water Discharges Associated with Construction Activities (Chapman 2002).

Surface Water Quality Surveillance and Discharge Monitoring. Water quality surveillance monitoring is conducted at onsite playas, while storm water and effluent monitoring are conducted at discrete discharge points (outfalls) in accordance with the Pantex Plant discharge permits.

The SWEIS summarizes the results of surveillance and discharge compliance monitoring conducted at Playas 1 through 4, Pantex Lake, associated outfalls, and at an offsite control site (Bushland Playa) located 54 km (34 mi) west of the plant. Samples were collected and analyzed for a range of parameters including radionuclides, metals, HE compounds, polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs), VOCs, and others. Twenty locations were monitored in 2001 (McBride 2002). Surface water samples are compared to several different criteria, depending on the type of analyte. Radionuclides are compared to DOE Derived Concentration Guides (DCGs) and drinking water Maximum Contaminant Levels (MCLs). Metals are evaluated based on the Texas Inland Water Quality Parameters and permitted limits. Explosives are compared to limits defined in the Plant's TPDES permit. PCBs, SVOCs, VOCs, and pesticides are reviewed with regard to their specific detection limits. All analytes are compared to their historic levels.

Water quality surveillance monitoring has been gradually reduced since 1998 as sufficient baseline data has been collected to warrant such a reduction (BWXT Pantex 2002c:5-12). Monitoring results are reported annually in the site environmental reports. The most recent report published is for 2001. In 2001, sampling was routinely conducted at all outfalls where discharge occurred (6 of the 22 permitted internal and final outfalls); at 9 of the 24 storm water outfalls; and at Playas 1, 2, 3, and 4, and Pantex Lake (McBride 2002; Keck 2003). Monitoring results reported since the SWEIS was issued continue to support the premise that Pantex Plant operations have not had a detrimental effect on the quality of the playa waters (Nester 2002d).

The SWEIS projected an annual wastewater discharge of 647 million L (171 million gal) as an operational assumption for the 2,000-weapons-activity level (DOE 1996a:4-106). In 2001, discharges from the WWTF to Playa 1 totaled 297.4 million L (79 million gal). Discharges from the WWTF to Playa 1 have now declined for 6 consecutive years, from approximately 454 million L (120 million gal) in 1997 to 297 million L (79 million gal) in 2001 (McBride 2002; McBride 2003).

In 2001, sampling at the WWTF was conducted in accordance with the Pantex Plant's TPDES permit. Although there were exceedances for several parameters that were reported to the TCEQ as required by the TPDES permit, none represented a threat to human health or the environment. Storm water monitoring required by the MSGP in 2000 consisted entirely of quarterly visual monitoring at 9 of the 24 storm water outfalls. No abnormal conditions were documented (McBride 2002).

The SWEIS concludes that continued operations under the Proposed Action would not be expected to impact surface water quality or features. This was based on the assumption that any increase in wastewater discharge to onsite playas would be in accordance with permit discharge limitations. There were no foreseeable impacts to water resources from pit storage. Impacts to water resources from construction and operation of new facilities were projected to be limited to relatively small, net increases in water use and wastewater discharge associated with the HWTPF and Pit Reuse Facility (DOE 1996a:4-109, 4-110). Only the HWTPF has been constructed to date, and none of the modified projects are proposed for implementation before 2005. Overall, impacts on surface water resources continue to be within the range of impacts evaluated in the SWEIS.

2.2.3.2 Groundwater

Groundwater Hydrology. The Ogallala Aquifer is the principal aquifer and major source of water in the Pantex Plant vicinity and the surrounding ROI. Other hydrogeologic features occurring at the Pantex Plant and vicinity include perched aquifer(s), which form because of the presence of low-permeability materials that impede the downward migration of infiltrating water (DOE 1996a:4-83, 4-84).

Perched Aquifer. The perched aquifer beneath the Pantex Plant is discontinuous. Areas of perched water occur beneath Playa 3; the Old Sewage Treatment Plant; Playa 2; and Playa 1, Zones 11 and 12, extending to the southeast. The primary areas of interest within the perched aquifer occur beneath Playa 1, Zones 11 and 12, and the component of the flow system moving off the site to the east-southeast of Zone 12. The perched aquifer generally occurs at a depth of approximately 81 m (265 ft) below ground surface at the Pantex Plant. In 1997, hydraulic gradients were determined at a number of locations for the radial flow from Playa 1 and from the ditch east of Zone 12 to the down gradient extent of the perched aquifer. The calculated flow velocities are generally higher than those presented in the SWEIS with respect to groundwater flow through the perched aquifer zone, indicating the potential for greater groundwater movement. Several studies have been conducted to further identify and evaluate contaminant migration (Nava 2001b).

Ogallala Aquifer. In the plant vicinity, groundwater flows in the regional Ogallala Aquifer trend from the southwest to northeast (DOE 1996a:4-94). Based on data current through October 2000, the depth to groundwater in the regional Ogallala Aquifer ranges from about 105 m (344 ft) at the southern boundary of Pantex Plant to 151 m (496 ft) at the northern boundary (Nava 2001b). Compared with data in the SWEIS, the current data reflect a decline in the Ogallala water table elevation of up to 9 m (30 ft) beneath portions of the Pantex Plant. This is consistent with drawdown projections in the SWEIS and attests to the continued regional state of overdraft. Gradient calculations for the Ogallala Aquifer were also performed in 1997 along a number of flow path segments. The calculated flow velocities ranged from 0.018 to 3.2 m/day (0.06 to 10.6 ft/day) (Nava 2001b).

Groundwater Quality Surveillance Monitoring. As summarized in the SWEIS, both perched and Ogallala investigation and monitoring wells have been regularly sampled for over 10 years, and results have been reported in the annual site environmental reports since 1990. In 2001, the groundwater well network included a total of 125 wells. This network consisted of a total of 91 perched and 34 Ogallala wells (Stout 2002a). Most of these wells were drilled as part of the RFI conducted at the Pantex Plant. Specific wells at the Burning Ground are utilized as monitoring wells, as required by Pantex Plant's RCRA Part B Permit.

Investigation wells are sampled routinely to provide information for the final groundwater RFI. Permitted Burning Ground monitoring wells are sampled quarterly in accordance with the RCRA Part B Permit. Wells have been sampled for a number of constituents, including radionuclides, metals, HE compounds, PCBs, pesticides and herbicides, and VOCs. Results from sampling the perched wells indicate little change from the SWEIS. The results of the investigation efforts for the perched and Ogallala aquifers are described in the remainder of this section.

Perched Aquifer Characterization. Investigations through 2001 have indicated the presence of contamination in the perched aquifer below the Playa 1, Zones 11 and 12 area. Groundwater sampling results in the SWEIS indicate that the perched aquifer is contaminated with HE compounds, VOCs, and metals, the most predominant contaminants being RDX, TCE, chromium, and hexavalent chromium. As reported in the SWEIS, the most extensive contaminant plumes delineated have been associated with HE (particularly RDX). Chromium and hexavalent chromium were the most widespread metals identified, with chromium concentrations exceeding the RRS 2 in several perched aquifer wells centered around Zone 12 (DOE 1996a:4-96–4-104). Other HE and VOC compounds identified to a lesser extent include HMX, TNT, 2,4-dinitrotoluene, tetrachloroethylene, and 1,2-dichloroethane. A new inorganic contaminant, perchlorate, has also been identified.

Sampling data for the period 1998 to 2001 indicate that the areal extent of the RDX plume has progressed slightly to the south-southeast relative to the plume delineation provided in the SWEIS. The plume continues to encompass most of the eastern half of the Pantex Plant, the northeastern-most portion of TTU property, and is also present beneath private property to the east and southeast of the plant. RDX concentrations continue to exceed the RRS 2 residential groundwater concentration of 7.7 µg/L, with an observed maximum concentration of 2,650 µg/L (Nava 2002b). The average concentration of RDX, calculated from all detections to date from investigation and extraction wells, is 720 µg/L (Ford 2002; Stout 2002b).

Sampling data for the period 1999 to 2001 indicate a larger plume than originally found in the perched aquifer. This finding can be attributed to changes in sampling procedures in 1999 that were better able to detect low concentrations of VOCs. TCE persists in the perched aquifer above the RRS 2 residential groundwater concentration of 5 µg/L with an observed maximum concentration of 44 µg/L (Nava 2002b). The average concentration of TCE, calculated from all detections to date from investigation and extraction wells, is 8 µg/L (Ford 2002; Stout 2002b).

Relative to the RRS 2 residential groundwater concentration, total chromium and hexavalent chromium are the most widespread and have the highest concentrations of any regulated metals detected in the perched groundwater. Based on the most recent data, the extent of the chromium and hexavalent chromium plume is generally consistent with that presented in the SWEIS, but has been more clearly defined. The hexavalent chromium plume occurs within the chromium plume except in the east-southeast offsite area. Chromium and hexavalent chromium concentrations exceed the RRS 2 for residential groundwater of 100 µg/L, with an observed maximum concentration of 15,400 µg/L for chromium and 12,000 µg/L for hexavalent chromium in 2001 (Nava 2002b). The average concentrations of total chromium and hexavalent chromium, calculated from all detections to date from investigation and extraction wells, are 282 µg/L and 284 µg/L, respectively (Ford 2002; Stout 2002b).

The most notable change from the SWEIS is the inclusion of perchlorate sampling. Perchlorate use was limited to production of experimental HEs. Perchlorate was detected above the RRS 2 residential groundwater concentration at several locations in the perched aquifer in 2000. Plume mapping indicates a plume that is centered around the Zone 11 area.

A groundwater treatability study initiated in 1995 to remediate HE compounds, VOCs, and metals in the perched aquifer was expanded in 2001 as an Interim Stabilization Measure to mitigate the offsite migration of contaminants in the perched aquifer. The system now has a total of 49 extraction and 9 injection wells. Through April 2002, nearly 580 million L (153 million gal) have been treated.

Approximately 900 kg (2,000 lb) of HE compounds and more than 28 kg (62 lb) of hexavalent chromium have been removed from the perched groundwater (Clark 2002).

Ogallala Aquifer Surveillance. Investigations from 1995–2002 indicate that groundwater contamination attributable to the Pantex Plant is present only in the perched aquifer. In late 1999 and early 2000, positive detections of TCE, all from a single monitoring well, were confirmed in the Ogallala Aquifer at the Burning Ground located in the north-central portion of the site. The TCE detection triggered an extensive investigation to determine its source. Based on investigations, it was determined that the presence of TCE was due to the migration of a soil gas plume through the well casing material. The well was subsequently plugged to prevent further migration. No other detections of TCE or other soil gas VOCs have been confirmed at down gradient wells (Amos 2003).

Groundwater Use. Water from the perched zone is not used for industrial activities. Public consumption of water from the aquifer of interest (beneath Playa 1, Zones 11 and 12) does not occur. A discontinuous area of the perched aquifer at the northeast corner of the Pantex Plant is used by a single household (Stout 2002a).[5] The major groundwater source in the plant vicinity is the Ogallala Aquifer, which is used as a public water source by numerous municipalities and by industries in the High Plains. It is the potable water source for the Pantex Plant and for the City of Amarillo. Pantex Plant's well field is located in the northeast corner of the site, and the City of Amarillo's Carson County Well Field is located north and northeast of the plant's well field (DOE 1996a:4-104, 4-105; BWXT Pantex 2001d:1-10, 1-11).

The City of Amarillo produced approximately 24 billion L (6.2 billion gal) in 1995 from the Carson County Well Field (DOE 1996a:4-104). During 2001, the City of Amarillo produced nearly 26 billion L (6.9 billion gal) of drinkable water from this well field (Nava 2002b). As a bounding planning assumption in the SWEIS for the 2,000-weapons-activity level, annual groundwater use by the Pantex Plant was projected to be 1.01 billion L (0.267 billion gal) (DOE 1996a:4-106). Groundwater withdrawals from the Ogallala Aquifer by the Pantex Plant in 1995 totaled approximately 0.87 billion L (0.23 billion gal) (DOE 1996a:4-104), and in 2001, 0.49 billion L (0.13 billion gal), including use by TTU (Nava 2002b).

Overall, impacts on groundwater resources continue to be bounded by those projected in the SWEIS. The SWEIS concludes that the impact of continued operations under the Proposed Action on groundwater resources would be minimal. This is based on the assumption that activities taken to characterize groundwater contamination and to implement corrective actions would continue. Groundwater use under the 2,000-weapons-activity level was projected to remain within the site's available water supply capacity. There were no foreseeable impacts to water resources from pit storage. Impacts to water resources from construction and operation of new facilities were projected to be limited to relatively small, net increases in water use and wastewater discharge associated with the HWTPF and the Pit Reuse Facility (DOE 1996a:4-106–4–111). Only the HWTPF has been constructed to date, and none of the modified projects are proposed to be implemented before 2005.

There are two changes affecting the groundwater that are particularly noteworthy. Groundwater withdrawals in the ROI have increased since 1996, resulting in a continued decline in the regional water table of the Ogallala Aquifer. During the same period, 1996–2001, groundwater withdrawals by the Pantex Plant have declined by about 29 percent. Monitoring of the Ogallala Aquifer has been expanded

[5] Carbon filtration and a reverse osmosis system have been installed by Pantex Plant at the household to protect the occupants from the extremely low concentrations of organic compounds.

since 1999 and will be used to prepare a comprehensive groundwater RFI report for submittal to the TCEQ (Stout 2002a).

2.2.4 Air Quality

As discussed in the SWEIS, modeling results of concentrations for criteria and toxic pollutants using plant emissions for ongoing operations indicated that none of the National Ambient Air Quality Standards (NAAQS) would be exceeded at the Pantex Plant boundary. All of the toxic air pollutants were estimated to be below their respective ESLs at the plant boundary (DOE 1996a:4-124–4-135). Modeling performed during the period 1996-2001 indicated that no NAAQS or ESL was exceeded during that time. Similarly, based on projected emissions for continued operations during the period 2002–2006, concentrations at the Pantex Plant boundary are estimated to continue to remain within all NAAQSs and ESLs. Criteria pollutant emissions from continued operations at the Pantex Plant would contribute about 1 percent or less to the overall pollution burden in Carson and Potter counties, the two closest counties, and can be expected to have negligible impact on the regional air quality. Construction emissions from new facilities and facility upgrades during the period 1996–2006 were estimated to increase Pantex Plant emissions by 8 to 13 percent during the peak construction year. Air quality impacts resulting from construction of the new facilities would be negligible. Emissions from operating some of the proposed facilities evaluated in the SWEIS would be essentially unchanged from the existing facilities. Emissions from operating the new HWTPF and Pit Reuse Facility (now the SNMCRF) would be controlled by high-efficiency particulate air filters and activated charcoal canisters, or their equivalent. Air quality impacts from these facilities would be negligible (DOE 1996a:4-138–4-152).

Projects that were initiated during the period 1996–2001 would have resulted in some temporary air pollutant emissions during construction, and would be expected to have minimal emissions during operation. Demolition of approximately 930 m^2 (10,000 ft^2) of excess facilities in 2001 resulted in some temporary and short duration fugitive emissions and equipment exhaust emissions.

On January 29, 1998, the Pantex Plant submitted an Abbreviated Site Operating Permit Application to TCEQ. This application identified that the Pantex Plant had the potential to emit oxides of nitrogen and hazardous air pollutants in quantities that exceeded the criteria for a major source under 40 CFR 70, as implemented by the state of Texas at 30 TAC 122. In this application, the Pantex Plant also noted that it planned to establish federally enforceable limitations on its activities to reduce its potential to emit to below the major source criteria. On May 22, 2000, The Pantex Plant completed this process and submitted a notice to the TCEQ that it was withdrawing its application (Roulston 2002). Emissions data for 2001 reflect substantial reductions in the emissions of nitrogen oxides and carbon monoxide from levels shown in the SWEIS (BWXT Pantex 2002c:6-20, 6-21).

The Clean Air Act (CAA), as amended, requires that Federal actions conform to the host state's "State Implementation Plan" (SIP). A SIP provides for the implementation, maintenance, and enforcement of NAAQS for the six criteria pollutants, sulfur dioxide, particulate matter (PM_{10}) carbon monoxide, ozone, nitrogen dioxide, and lead. Conformance with the SIP is required to eliminate or reduce the severity and number of violations of NAAQS and to expedite the attainment of NAAQS. No department, agency, or instrumentality of the Federal government shall engage in or support in any way (i.e., provide financial assistance for, license or permit, or approve) any activity that does not conform to an applicable implementation plan. The final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (58 FR 63214) took effect on January 31, 1994. Pantex is within an area that is currently designated as attainment for criteria air pollutants. Therefore, the actions considered in the SWEIS and the other proposed actions considered in this SA are not affected by the provisions of the conformity rule.

2.2.5 Waste Management

The SWEIS describes the ongoing waste management practices relating to generation, storage, treatment, and disposal of waste at the Pantex Plant. Waste is primarily generated from ongoing assembly/dismantlement operations of nuclear weapons and HE production. Waste is also generated from support operations such as medical services, vehicle maintenance activities, general office work, construction activities, environmental monitoring, laboratory activities, and ER activities (DOE 1996a:4-229). LLW, LLMW, HW, and nonhazardous nonradioactive waste (NHW) are generated at the Pantex Plant. Other solid wastes include PCBs, asbestos, and medical wastes. Transuranic (TRU) and mixed TRU wastes are not normally generated at the Pantex Plant, and no high-level radioactive wastes have been or are expected to be generated. Three drums of TRU waste were generated in 1993 as a result of an incident during weapon dismantlement. At the time the SWEIS was issued, this waste was stored on the site in a monitored facility awaiting transfer to an offsite management facility (DOE 1996a:4-232).

Table 2–10 shows the annual waste generation from 1992 through 1995 for LLW, LLMW, HW, and NHW. As of September 1995, waste in inventory/storage included 474 m^3 (616 yd^3) of LLW, 147 m^3 (191 yd^3) of LLMW, 153 m^3 (199 yd^3) of HW, and 311 m^3 (404 yd^3) of NHW (DOE 1996a:4-233). LLW is stored on the site and shipped to the Nevada Test Site (NTS) for disposition, and is managed in accordance with the NTS Defense Waste Acceptance Criteria Certification and Transfer Requirement Program. LLMW is managed in accordance with the Agreed Order and *Site Treatment Plan–Compliance Plan*, State regulation 30 TAC 335, the RCRA Part B Permit, and 40 CFR 260–280. The LLMW is stored on the site and treated at the Burning Ground and in Building 11-9. At the time the SWEIS was issued, the HWTPF was planned to be used for treating and processing LLMW, LLW, and HW, and commercial LLMW treatment and disposal were also being pursued (DOE 1996a:4-233, 4-235, 4-236).

Table 2–10. SWEIS Waste Volume Generation, 1992–1995[a,b]

Waste Type	1992	1993	1994	1995
Low-level radioactive[c]	266 (346)	287 (373)	232 (302)	187 (241)
Low-level mixed	51 (67)	38 (50)	25 (33)	29 (38)
Hazardous	589 (770)	370 (484)	193 (252)	460 (598)
Nonhazardous	7,078 (9,201)	11,610 (15,093)	5,507 (7,159)	5,136 (6,677)
Total	7,984 (10,384)	12,305 (16,002)	5,957 (7,746)	5,810 (7,554)

[a] Waste volumes are reported in cubic meters (cubic yards).

[b] Conversion of different waste types from weight to volume were made using 0.72 kg/L (6 lb of waste per gal).

[c] Volumes include non-production waste.

Source: DOE 1996a:Table 4.13.1.2-1.

HW is managed in accordance with RCRA regulations, and is stored on the site, treated both on and off the site, and disposed of off the site. Commercial facilities are used for offsite treatment and disposal. NHW is accumulated and stored on the site and treated both on and off the site. Construction debris is disposed of in an onsite landfill. All other NHW is disposed of off the site by commercial contractors. NHW is managed in accordance with State regulation 30 TAC 335.4 (DOE 1996a:4-236, 4-238).

The SWEIS projects annual waste generation from 1997 to 2000 for the ER program and for the 2,000-weapons-activity level from 1997 to 2007. These estimates are shown in Tables 2–11 and 2–12, respectively.

Table 2–11. SWEIS Environmental Restoration Waste Projections, 1997–2000[a]

Waste Type	FY 1997	FY 1998	FY 1999	FY 2000[b]
Solid Waste, m^3 (yd^3)				
Low-level radioactive	237 (310)	0 (0)	0 (0)	0 (0)
Low-level mixed	0 (0)	0 (0)	0 (0)	0 (0)
Hazardous	765 (1,000)	7.6 (10)	0 (0)	0 (0)
Nonhazardous	8,659 (11,325)	772 (1,010)	0 (0)	0 (0)
Liquid Waste, L (gal)				
Low-level radioactive	0 (0)	0 (0)	0 (0)	0 (0)
Low-level mixed	0 (0)	0 (0)	0 (0)	0 (0)
Hazardous	749 (198)	3,039 (803)	16, 156 (4,268)	749 (198)
Nonhazardous	116,049 (30,757)	354,261 (96,492)	72,536 (19,162)	72,536 (19,162)
Total[c,d]	9,778 (12,711)	1,137 (1,478)	89 (116)	73 (95)

[a] Table includes a 10 percent margin to provide conservative estimates.

[b] Nonhazardous liquid waste and hazardous liquid waste would continue to be produced at this level beyond FY 2000.

[c] Assumes 1,000 L equals 1 m^3

[d] Totals (solid and liquid waste) are reported in cubic meters (cubic yards).

Source: DOE 1996a:Table 4.13.1.2-2.

Table 2–12. SWEIS Annual Waste Projections for Weapons-Related Activities (Excluding Environmental Restoration Waste), 1997–2007[a,b,c]

Waste Type	2,000 Weapons per Year
Low-level radioactive	249 (326)
Low-level mixed	183.2 (239.6)
Hazardous	191.6 (250.5)
Nonhazardous	1,315.6 (1,721)
Total	1,939.4 (2,239.1)

[a] Waste volumes are reported in cubic meters (cubic yards).

[b] Table excludes PCB, asbestos, and medical waste. Environmental restoration and wastewater discharge to playas and the Wastewater Treatment Facility are covered in Table 2–11 and Section 2.2.1.

[c] Table includes a 10 percent margin to provide conservative estimates.

Source: DOE 1996a:Table 4.13.1.2-3.

The SWEIS also estimates that pit storage activities would generate less than 1 m^3 (1.3 yd^3) each of LLW, LLMW, HW, and NHW annually, and indicates that the amount of waste generated would not affect waste management activities (DOE 1996a:4-240).

Various planned improvements for waste management operations were identified in the SWEIS, and the impacts of construction and operation of six new facilities were analyzed. Nonhazardous, nonradioactive debris generated by construction or modification of the new facilities would be disposed of in the onsite landfill; trash would be disposed of in the Amarillo landfill. The SWEIS concluded that generation of this waste would not affect Pantex Plant's waste management activities. Proposed new facilities, excluding the HWTPF, are expected to generate the same types and quantities of waste as the existing facilities they would replace, and therefore, their operational impacts would not change from current waste management practices. At the time of issuance of the SWEIS, the HWTPF was being designed to treat and process LLW, LLMW, and HW. The large-volume treatment process analyzed was predicted to increase the volume of waste by a factor of 1.45, depending on the actual process used (DOE 1996a:4-241).

The SWEIS concluded that waste management activities during the period 1997–2001 would result in only minimal impacts. If no offsite disposal were provided for the estimated generation of LLMW at the 2,000-weapons-activity level, the SWEIS predicted that additional waste storage capacity would be required in 2004. However, future offsite disposal would reduce LLMW inventories, and therefore, impacts to waste operations. If the Pantex Plant continues to ship LLW routinely throughout the year, no additional storage capacity would be required. Annual HW projections were equal to or below HW generated during 1992–1995. The SWEIS estimated that treatment and processing of LLMW, LLW, and HW at the HWTPF would begin in the year 2001. Depending on the treatment and processing techniques chosen, the volume of waste could either increase or decrease, which would affect the number of shipments to offsite facilities. However, minimal impacts were expected because historical capacities are greater than the expected generation rates. The SWEIS estimated minimal impacts to NHW management because the amount of NHW projected would be below historic generation rates. No additional waste management facilities or modification of existing waste management facilities were planned to support ER wastes; current facilities were planned to be used. Minimal impacts from projected ER wastes were expected because they represent less than 3.8 percent of waste generated from operations after 1999 (DOE 1996a:4-241, 4-242).

The Pantex Plant has an active pollution prevention program that includes using process information flows and pollution prevention opportunity assessments to determine cost-effective means for reducing or eliminating wastes. The Pantex Plant was recognized nationally as a recipient of the 1996 President's Closing the Circle Award, and was selected as the model facility among all Federal agencies because of its results-oriented waste reduction projects and its highly successful recycling programs (BWXT Pantex 2002c:14-2). The Pantex Plant also received National Pollution Prevention awards for the years 1997, 1998, and 1999. In 1997, awards were received for public outreach and partnership, integrated planning and design, and most improved large facility; in 1998 for zero generation/source reduction, return on investment, and the most improved large facility; and in 1999 for prevention, sowing the seeds of change, and being the model facility (Allen 2002).

As of September 2001, waste in storage included 83 m^3 (109 yd^3) of LLW, 4 m^3 (5 yd^3) of LLMW, 83 m^3 (109 yd^3) of HW, and 117 m^3 (153 yd^3) of NHW (BWXT Pantex 2002c:14-6). When compared to the estimates of waste in inventory provided in the SWEIS, all waste types in storage decreased by at least 46 percent.

Information from the *2000 Site Environmental Report* (BWXT Pantex 2001d) was used to determine waste generation at the Pantex Plant for the years 1997–2000. That report provides annual waste volumes (operations and ER combined) for each waste type. This information is provided in Table 2–13.

Table 2–13. Annual Waste Generation for Operations and Environmental Restoration Activities, 1997–2000[a]

Waste Type	1997	1998	1999	2000
Low-level radioactive	1,058.2 (1,384.1)	1,339.9 (1,752.6)	419.9 (549.2)	108.9 (142.4)
Low-level mixed	20.1 (26.3)	2.2 (2.9)	1.04 (1.36)	4.2 (5.5)
Hazardous	434.97 (568.94)	969.6 (1,268.2)	221.2 (289.3)	232.2 (303.7)
Nonhazardous	5,697 (7,452)	3,359 (4,394)	1,862 (2,435)	7,029 (9,194)
Total	7,210.27 (9,431.03)	5,670.7 (7,417.3)	2,504.14 (3,275.42)	7,374.3 (9,645.6)

[a] Waste volumes are reported in cubic meters (cubic yards)

Source: BWXT Pantex 2001d:Table 2.4.

The amount of operations and ER waste generated in 1997 (7,210 m^3 [9,431 yd^3]) was about 38 percent less than predicted in the SWEIS (11,717 m^3 [15,326 yd^3]). However, in 1998 and 2000, generation was much higher than estimated in the SWEIS. Generation in 1998 (5,671 m^3 [7,418 yd^3]) was 84 percent higher than originally estimated (3,076 m^3 [4,023 yd^3]), while the generation rate in 2000 (7,374 m^3 [9,645 yd^3]) was about 270 percent higher than estimated (2,012 m^3 [2,632 yd^3]). For 1999, the actual generation rate (2,504 m^3 [3,275 yd^3]) was only 23 percent higher than estimated (2,028 m^3 [2,653 yd^3]). The large increase from SWEIS estimates of LLW in 1997 and 1998 and of HW in 1998 is due to ER activities conducted during these years (Nava 2002a). The primary reason for the large increase in waste volume in 2000 was the generation of NHW from cleanup actions also associated with the ER program. In 2000, ER projects contributed 84.9 percent of the NHW (BWXT Pantex 2001d:2-11). The ER RCRA-permitted activities are all on schedule and in compliance with all permit requirements. All operable units are anticipated to have approved RFI reports by May 2005 (BWXT Pantex 2002c:15-4).

The Pantex Plant has been approved to ship four new LLW streams in addition to the nine approved when the SWEIS was issued. Approximately 20 additional potential LLW streams have been identified. The Pantex Plant has also complied with all requirements of the January 2001 NTS Waste Acceptance Criteria. In addition to disposing of LLW at NTS, Pantex is currently disposing of ER LLW at commercial facilities (BWXT Pantex 2002c:14-4, 14-5).

In November 2000, the Pantex Plant completed the last of 18 milestones for LLMW identified in the *Site Treatment Plan*. This substantially reduced, but did not eliminate, the inventory of LLMW at Pantex. An updated *Site Treatment Plan* identifying new milestones for LLMW streams remaining in inventory was prepared and submitted to the TCEQ in July 2001 (BWXT Pantex 2002c:14-8, 14-9).

The three drums of TRU waste generated in 1992 and stored on the site were shipped to Los Alamos National Laboratory in 1997 for interim storage pending final disposition at the Waste Isolation Pilot Plant. Because TRU waste is neither currently generated at the plant nor expected to be generated in the future, TRU waste management procedures have since been archived (BWXT Pantex 2002c:14-10).

Since the SWEIS was issued, a number of changes have occurred in waste management facilities and practices. The HWTPF (Building 16-18) was completed in 1999, began operation in 2001, and will be fully operational after post-start findings are addressed. Evaporation, stabilization, vial crushing, and sorting and segregation activities are currently being conducted (BWXT Pantex 2001a:3-54). In 2001, approximately 13,000 kg (29,000 lb) of waste were sorted and segregated; in 2002, 16,000 kg (35,000 lb). In 2001, approximately 64,000 kg (141,000 lb) of sensitive and classified matter, mostly paper, were destroyed; in 2002, 72,000 kg (159,000 lb) were destroyed. The HWTPF evaporated approximately 28,000 L (7,500 gal) of wastewater containing low levels of tritium (i.e., below drinking water standards) in 2001 and 9,800 L (2,600 gal) in 2002 (Garry 2003a). In 2002, 120 208-L (55-gal) drums of scintillation vials were crushed and segregated at the HWTPF (Garry 2003b).

The HWTPF as constructed differs somewhat from that described in the SWEIS. Design changes included the construction of a separate Liquid Processing Facility to process flammable liquids; elimination of forklift airlocks and overhead hoists from the main HWTPF; the handling of classified material; the elimination of a shipping dock at Building 16-18; and construction of a ramp connecting Building 16-18 and adjacent Building 16-16, the RCRA Hazardous Waste Staging Facility, for waste management. A SA prepared in January 2000 concluded that the environmental impact of these changes would be negligible (DOE 2000b:1).

The Burning Ground Upgrade, a major project at the Pantex Plant, included design and construction of a new open-air burner called the Flash Chamber. Completed in 1997 and fully operational in 1998, it replaces the previous burning pits and cages that had no provision for rainwater protection (BWXT Pantex 2002c:4-19; Nava 2002a). Building 11-9N, previously used for storage of HW, LLMW, and LLW, has been taken out of use due to deterioration of roof structural members, and is currently undergoing RCRA closure. All storage and operational activities were moved to Building 16-16, the Hazardous Waste Staging Facility, in 1997. Magazines 4-46 and 4-74 were previously permitted for the storage of HW, but have also undergone closure (BWXT Pantex 2002c:14-20, 14-21). Conex boxes are no longer used to store LLW and HW and have undergone RCRA closure (BWXT Pantex 2002c:14-22).

The review of current Pantex Plant waste management practices indicates that the inventory of all waste types has decreased by at least 46 percent since issuance of the SWEIS. The higher than estimated NHW generation can be attributed to ER activities. However, impacts to the site's waste management infrastructure resulting from this increased generation are negligible. NHW onsite storage and onsite and offsite disposal practices are adequate to manage this waste.

2.2.6 Facility Accident Scenarios

The SWEIS identifies 132 candidate accident scenarios, 11 of which were determined to be risk dominant (DOE 1996a:sec. D.3.2). Table 2–14 presents these accident scenarios and their radiological and chemical source terms, which bound the accident risks associated with operations at the Pantex Plant. This section evaluates changes to each bounding scenario in Table 2–14 since the SWEIS was issued, considering changes in operational activities; additions, modifications, or discontinuance of projects; and limits on radioactive, explosive or hazardous materials; and reviews each of the projects listed in Table 1–1 that have been implemented since the SWEIS was issued. Scenarios 3 and 8 are dominated by aircraft crashes. Aircraft crashes have been being evaluated under a separate study. That study has been summarized in the *Pantex Plant Site-wide Safety Analysis Report,* AB-SAR-314353. Therefore, these scenarios are not discussed in this SA.

Scenario 1, Explosive-Driven Plutonium Dispersal from an Internal Event. This scenario represents an accidental explosion that suspends respirable plutonium and causes its release to the atmosphere. The issues that determine whether this scenario remains bounding include consideration of whether there are buildings in which the allowable limits for radioactive materials have increased since the SWEIS was issued. Table B.1–1 of the *Safety Information Document* (BWXT Pantex 2001e) provides the limits for inventories of radioactive materials, by facility, as of October 2001. The radioactive materials listed are plutonium-239, uranium-238/depleted uranium, thorium-232, tritium, and uranium-235. There have been few changes since 1996 (Petraglia 2002a, 2002b). Most of the changes have reduced material limits, which would reduce risk. The limit for depleted uranium at some of the facilities has increased, but in no case to more than the 12,000-kg (26,455-lb) limit specified for numerous other facilities on the site. More importantly, releases of depleted uranium are not among the bounding scenarios.

There is one loading dock for which the plutonium-239 limits have increased, from 20 kg to 40 kg (Petraglia 2002a). However, loading dock scenarios are not among the candidate accident scenarios for determining the risk-dominant scenarios for the Pantex Plant listed in Table D.3.2-2 of the SWEIS. Another factor that qualitatively tends to reduce the risk associated with Scenario 1 is that, since 1996, a greater proportion of the weapons disassembly activities involves insensitive HE, which has a negligible probability of accidental initiation or transition from burning to detonation (Petraglia 2002b).

The SWEIS discusses the size of leak paths around doors and penetrations in considerable detail. The concern is that if there were an explosion causing plutonium to become airborne inside a cell, the amount of plutonium escaping from that cell is governed by the size of leak pathways. The SWEIS indicates that the area of some gaps between doors and frames exceed 271 cm^2 (42 $in.^2$). At the time the SWEIS was issued, designs had been developed to reduce the gaps to less than 32 cm^2 (5 $in.^2$) and modifications were funded for 1997.

Table 2–14. Risk-Dominant Accident Scenarios

Scenario	Description	Source Term
1	High-explosive explosion initiated during normal operation releases tritium and plutonium due to reservoir and pit failure	300[a] (270)[b] Ci of respirable plutonium and 3.0×10^5 (3.0×10^5) Ci of tritium
2	High-explosive explosion initiated during normal operation without accompanying radionuclide releases	No release of radionuclides or chemicals
3	High-explosive explosion initiated by seismic event or aircraft accident releases tritium and plutonium due to reservoir and pit failure	9.4×10^3 (4.0×10^3) Ci of respirable plutonium and 2.5×10^5 (2.5×10^5) Ci of tritium
4	High-explosive explosion initiated by seismic event or aircraft accident without accompanying radionuclide releases	No release of radionuclides or chemicals
5	Tritium release resulting from reservoir failure initiated during normal operation	1.8×10^5 Ci of tritium
6	Pit breach with plutonium release initiated during normal operations	1.8×10^{-5} Ci of plutonium
7	Tritium release from reservoir failures caused by a Building 12-42 South Vault fire initiated by a seismic event or aircraft accident	4.0×10^7 Ci of tritium
8	Pit breach with plutonium release caused by seismic event or aircraft accident followed by fire	50 Ci of plutonium
9	Tritium or plutonium release caused by seismic event or aircraft accident	0.012 Ci of plutonium and 3.0×10^5 Ci of tritium
10	Chlorine release due to failure of system piping and valves, or cylinder, caused by seismic event	408 kg (900 lb) of chlorine (the contents of six 150-lb cylinders)
11	Chlorine release due to failure of system piping and valves, or cylinder, initiated during normal operation	68 kg (150 lb) of chlorine (the contents of one 150-lb cylinder)

[a] Configuration 1, assuming that the cell leak area is 271 cm^2 (42 $in.^2$), Zone 4 storage configuration of 36 magazines with pits, 24 magazines with weapons.

[b] Configuration 2, assuming that the cell leak area is 32 cm^2 (5 $in.^2$), Zone 4 storage configuration of 60 magazines with pits.

Source: DOE 1996a:sec. 4.14.2.1, Tables D.3.2-2 and D.4.2.2-3.

The cells were renovated and new personnel doors were installed, which has effectively reduced the leak path area around the doors to approximately 32 cm^2 (5 $in.^2$) or less (Hedtke 2002). However, issues were subsequently identified regarding the grout in the piping penetrations and the area around the blast valve closure mechanisms. Therefore, current cell dispersal calculations include the grouted areas around penetrations (including the cross-sectional area of the penetration) and the small leak paths around blast valves as additional leak paths. The result is that it is necessary to consider approximately 271 cm^2 (42 $in.^2$) for leak paths when performing cell dispersal analysis. Since the SWEIS considers such scenarios, it remains bounding.

It is concluded that Scenario 1 still bounds the risk for internally initiated explosions that cause the release of plutonium.

Scenario 2, Accidental HE Detonation from an Internal Event. This scenario represents the accidental detonation of HE due to an internally initiated event, but without radioactive materials present. Many of the HE limits identified in Table B.3–1 of the *Safety Information Document* (BWXT Pantex 2001e) have been reduced since the SWEIS was issued. In addition, limits have now been established on the amount of insensitive HE for many of the magazines where previously there had been no limits (Petraglia 2002a).

Some buildings were not operational when the SWEIS was issued. However, the limits on the quantities of explosives in these buildings are within the range of limits at other buildings with similar operations.

Scenario 2 is treated qualitatively in the SWEIS, which states, "This scenario poses a risk to worker safety. There is a possibility of a fatal injury resulting directly from the HE explosion, not from radioactive exposure. Members of the public and non-involved workers are not at risk from this scenario." There is no reason to change this conclusion.

Scenario 4, Accidental HE Detonation from an External Event or Natural Phenomenon. This scenario represents the accidental detonation of HE, with no radioactive material present, due to a seismic event or an aircraft crash. The main initiator for this scenario is the seismic collapse of a HE development or manufacturing facility. The blast resulting from this explosion could fatally injure a worker in the vicinity. Members of the public and noninvolved workers are not at risk from this scenario. Similar to the discussion of Scenario 2, there is no reason to change this conclusion. Furthermore, new buildings are more robust with respect to natural phenomena than the ones they have replaced, which would tend to reduce the risk associated with this scenario.

Scenario 5, Tritium Reservoir Failure from an Internal Event. This scenario represents the release of tritium due to a reservoir failure during normal operations. Initiators for this scenario include an inadvertent squib valve actuation during weapons operations. The SWEIS assumes 2000 weapons assembly/disassembly operations per year. However, actual operations are less than 1,000 (BWXT Pantex 2001b:Table 4–1). Therefore, the SWEIS analysis remains bounding.

Scenario 6, Pit Breach from an Internal Event. This scenario represents a pit breach, with resultant plutonium release, from an internal event such as a pit drop or a forklift accident. The SWEIS indicates that this accident is dominated by handling accidents in cells, bays and special purpose buildings. The predicted risk of a person in the vicinity of the Pantex Plant developing a fatal cancer from this potential accident is 5.7×10^{-15} excess fatal cancers per year, which can be compared with the risk from all causes of 1.7×10^{-3} fatal cancers per year.

The *Pantex Plant 10-Year Comprehensive Site Plan* indicates that there will be 2,400 repackaging operations per year for the years 2002–2005 (BWXT Pantex 2001b:Table 4–1). The 1996 *Safety Information Document* discussion of this accident is based on 2,000 handling operations per year in cells and bays (BPM&H 1996:4-12). Assuming that the 2,400 repackaging operations are in addition to the 2,000 handling operations, the number of handling operations would be at most slightly more than double the number of units on which this accident is based. Doubling the risk of 5.7×10^{-15} cancers per year to 1.1×10^{-14} still represents a very small risk from this accident.

The SWEIS does not specifically present risk to facility workers or non-involved workers; it presents the expected consequences. For the facility worker, this accident would result in an exposure of no more than 7 rem, which corresponds to an upper bound increase in fatal cancer probability of 2.8×10^{-3}. For the non-involved worker, this accident would result in an exposure of no more than 4×10^{-3} rem, which corresponds to an upper bound increase in fatal cancer probability of 1.6×10^{-6} (DOE 1996a:4-286). Since the accident remains the same (breach of a single pit), these results remain unchanged.

Scenario 7, Multiple Tritium Reservoirs Failure from an External Event or Natural Phenomenon. This scenario represents the release of tritium from reservoir failures caused by a fire in the tritium storage vault. The fire could be initiated by a seismic event or an aircraft crash. The principal change since 1996 is that the old Building 12-42 South Vault has been closed and replaced by a new facility. The probability of failure of the new structure as a result of an earthquake is considerably smaller than that of the South Vault because it is designed to more stringent standards for natural hazards such as earthquakes. Therefore, the risk associated with this scenario is qualitatively judged to have decreased.

Scenario 9, Plutonium Dispersal from an External Event or Natural Phenomenon. This scenario is dominated by seismic events resulting in the structural failure of special purpose buildings containing nuclear explosives. In this context, the weakest special purpose facility, Building 12-41, has closed or will shortly close and be replaced by a new building that has been designed to more stringent seismic standards. Therefore, the risks associated with this scenario have decreased.

Scenarios 10 and 11, Chlorine Releases. The chlorine inventory at the Pantex Plant has not changed, so the risks associated with these scenarios remain the same as discussed in the SWEIS.

No new scenarios were identified that are appreciably different from the 11 scenarios discussed in this section. Changes in activities, facilities, or materials limits since the SWEIS was issued, including those described in Table 1–1, do not exceed any of the bounding accident scenarios. A qualitative review of the available information leads to the conclusion that there have been no changes associated with operations at the Pantex Plant that would more than minimally increase the accident risks arising from operations since the SWEIS was issued.