Site-Wide Proposed Plan

Pantex Plant – Amarillo, Texas

Pantex Mission Statement

Pantex Plant, a United States Department of Energy /National Nuclear Security Administration (USDOE/NNSA) facility, has a long-term mission to maintain the safety, security, and reliability of the nation's nuclear weapons stockpile. All work at Pantex is carried out under these overarching priorities: the security of weapons and information, the safety and health of workers and the public, and the protection of the environment.

B&W Pantex, the management and operating contractor at Pantex, maintains, builds, and retires nuclear weapons in support of our nation's nuclear deterrent. The Environmental Projects and Operations (EP&O) Division is responsible for the investigation and cleanup of the corrective action units at Pantex Plant. The mission of the EP&O Division is protecting people and the environment through responsible leadership, responsive cleanup actions, and innovative technology.

Additional information can be found at www.pantex.com.

National Nuclear Security Administration

USDOE-NNSA Pantex Site Office

B&W Pantex

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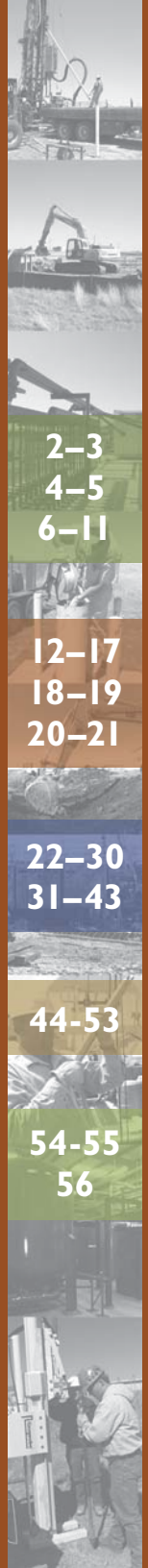


Proposed Actions for Final Remedy

Soils

1. Continue institutional controls at soil sites where restricted access and worker protective measures are already in place. Institutional controls may include using deed restrictions such as limiting land to industrial use, documenting risk information for workers, posting warning signs, and protecting groundwater by restricting use to minimize storm water recharge.
2. Finalize early actions for soils at the Burning Ground and ditches, which included placing additional soil cover on a disposal trench at the Burning Ground and maintaining ditch liners that protect workers from contact with contaminated soils and minimize further long-term migration of contaminants to perched groundwater.
3. Finalize early actions (covers and soil vapor extraction) taken at various landfills and at the Burning Ground at Pantex. These actions are considered as presumptive remedies (widely accepted remedies) to reduce the movement of contaminants to groundwater and to protect workers.

Perched Groundwater

4. Finalize early actions to remove and treat contaminated groundwater, control movement, establish flow-through treatment zones within the perched groundwater, monitor contaminant concentrations and movement, and control drilling and usage of the perched groundwater through institutional controls.

Protecting the Ogallala Aquifer

In addition to the proposed remedial actions for soils and perched groundwater, Pantex will expand the current Ogallala monitoring network to continue monitoring for indication of contaminant migration from perched groundwater. For continued protection of human health and the environment, Pantex will control drilling in areas to avoid cross-contamination from perched groundwater and restrict future drilling and water use in key areas at Pantex.

Purpose of the Proposed Plan

The purpose of this Proposed Plan is to present the public with an opportunity to provide feedback on the selection of preferred remedial actions to address contaminants in soil and groundwater at the United States Department of Energy/National Nuclear Security Administration (USDOE/NNSA) Pantex Plant near Amarillo, Texas.

Pantex Plant is located in the Texas Panhandle, 17 miles northeast of Amarillo.

As a result of historical operations at Pantex Plant and the World War II-era Pantex Ordnance Facility, contaminants in soil and perched groundwater, if left untreated, could potentially pose a health risk to onsite workers and offsite Plant neighbors. In addition, contaminants in soil and perched groundwater also have the potential to impact the Ogallala Aquifer beneath the Plant, which is protected by the Safe Drinking Water Act. Documents in the Administrative Record file provide detail about historical Plant operations.

This Proposed Plan describes the remedial action alternatives evaluated to protect human health and the environment, presents the preferred remedial action, and summarizes the information used to develop and select the preferred remedial action.

The Proposed Plan includes summaries of previous reports and key information used to select the remedial action. A list of these documents is provided inside the back cover of this Proposed Plan. Detailed information from key reports can be found in the Pantex Plant Public Reading Room at the Amarillo College Lynn Library and at the TCEQ Region 1 Office in Amarillo, Texas. Some of those reports are also available online at www.pantex.com. A map to the library is shown at the end of this document.

Major Environmental Statutes and Regulations

Pantex Plant is an active permitted hazardous waste facility subject to RCRA requirements. Following placement on the National Priorities List in 1994, Pantex Plant also became subject to CERCLA and National Oil and Hazardous Substances Pollution Contingency Plan requirements. Requirements for CERCLA and RCRA are addressed through an integrated approach overseen by EPA and TCEQ.

The following are Federal statutes and regulations discussed in this Proposed Plan:

- **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**: A federal statute that established a program to identify, evaluate, and remediate sites where hazardous substances may have been released into the environment (e.g. Superfund sites).
- **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**: The federal regulation that implements CERCLA. Among other things, the NCP establishes the overall approach for determining appropriate remedial actions at Superfund sites.
- **Resource Conservation and Recovery Act (RCRA)**: A federal statute that regulates permits for the treatment, storage, and disposal of hazardous wastes. The corrective action component to RCRA requires the cleanup of treatment, storage and disposal facilities after they are closed. The State of Texas has authority for implementing RCRA requirements.
- **Safe Drinking Water Act (SDWA)**: Federal legislation established to protect the quality of drinking water in the United States. The act focuses on all waters actually or potentially designated for use as drinking water, whether from surface or underground sources.

More information is available at:
http://www.epa.gov/epahome/laws.htm or
http//www.tceq.state.tx.us/remediation/rrr.html

This Proposed Plan is issued by the lead agency, USDOE/NNSA, in conjunction with the United States Environmental Protection Agency (EPA), as part of USDOE/NNSA's continuing public participation process and commitment to fulfill public participation requirements under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Section 300.430 (f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan.

USDOE/NNSA, with the agreement of the EPA, will select the final remedy only after the public comment period has ended and the comments received on the preferred remedial actions have been reviewed and considered. The preferred remedial action alternative may be modified, or a different alternative may be selected, based upon public comments. The public is encouraged to review and comment on all remedial action alternatives identified in the Proposed Plan during the public comment period. Detailed information on how the public can be involved in the alternative selection process is presented in the public participation process at the end of this summary.

Pantex Quarterly Groundwater Public Meeting hosted by the B&W Pantex Environmental Projects and Operations Division.

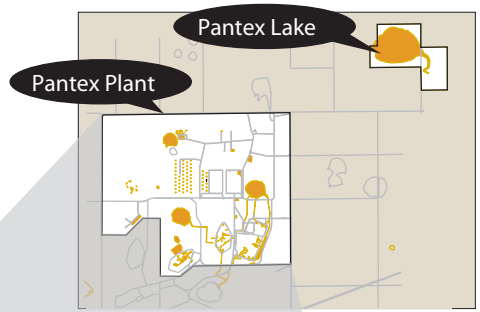
The U.S. Department of Energy/ National Nuclear Security Administration (USDOE/NNSA) is the lead agency for environmental cleanup at Pantex Plant. For additional information concerning the USDOE/NNSA's role in preparing this proposed plan, please contact:
Johnnie Guelker (806) 477-3183
JGuelker@pantex.doe.gov

The U.S. Environmental Protection Agency (EPA) is the lead regulatory agency providing oversight for the CERCLA cleanup at Pantex Plant. EPA will approve the final Proposed Plan and final remedy selection for the CERCLA cleanup at Pantex. For additional information concerning the EPA's role in preparing this Proposed Plan, please contact:
Camille Hueni (214) 665-2231
Hueni.Camille@epamail.epa.gov

The Texas Commission on Environmental Quality (TCEQ) is the lead regulatory agency providing oversight for the RCRA cleanup at Pantex Plant. TCEQ will review the Proposed Plan for concurrence and acceptance of the final remedy selection for the CERCLA cleanup at Pantex. Final approval of remedy selection for RCRA cleanup is provided with the Compliance Plan renewal process. For additional information concerning the TCEQ's role in preparing this proposed plan, please contact:
Fay Duke (512) 239-2443
FDuke@tceq.state.tx.us

Site Description

Pantex Plant is a 10,200-acre facility bounded on the north by Farm-to-Market Road 293, on the east by Farm-to-Market Road 2373, and on the west by Farm-to-Market Road 683. Pantex Plant leases approximately 5,900 acres south of the Plant from Texas Tech University for use as a safety and security buffer. The Texas Tech University Research Farm manages the buffer zone for a variety of agricultural uses. Pantex Plant consists of several functional areas, commonly referred to as numbered zones. The locations investigated for cleanup are pictured here, and brief descriptions of the major areas are included.

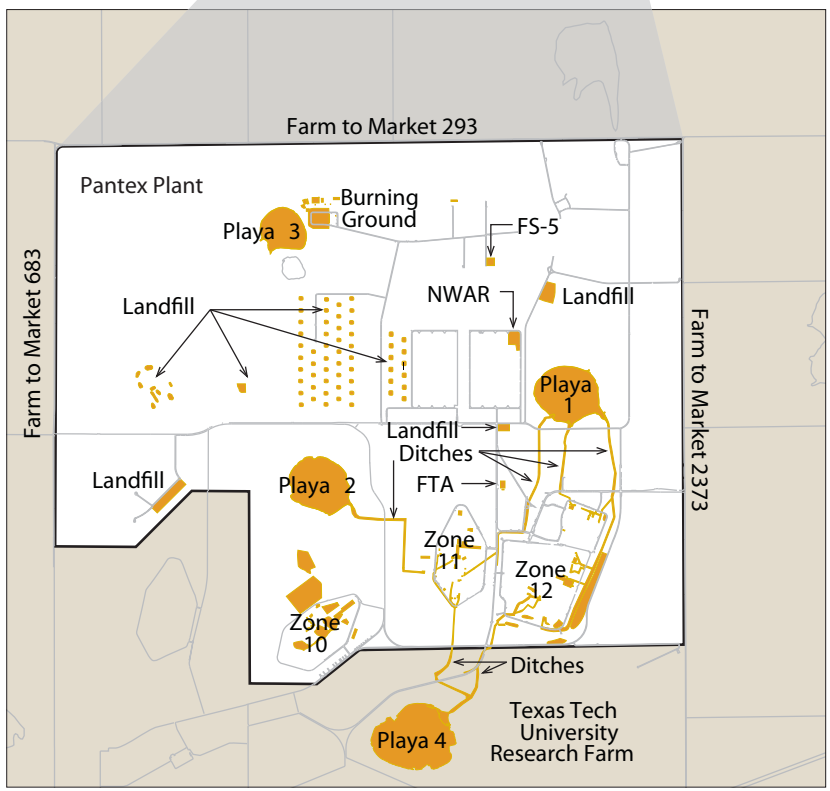


Zones 10, 11, and 12 are active operational areas. Facilities in these zones were originally built to manufacture conventional bombs during World War II. These zones currently contain both active and inactive areas. Since 1952, facilities in these zones have been reconstructed to serve as assembly/disassembly areas, staging areas, and support areas for other Plant functions.

Burning Ground is an active operational area. The facility was historically used for the disposal of high explosive waste and contaminated materials. Current use includes thermal treatment of high explosive-contaminated wastes.

Playa 3 is next to the Burning Ground. Playa 3 has not been used for industrial purposes, but receives storm water runoff from the Burning Ground. In the past, overflow from the solvent evaporation pit reached Playa 3.

Fire Training Area (FTA) was used for Pantex Fire Department training exercises; a portion of this area is still used by the fire department.



Ditches are located in various areas at Pantex Plant. Ditches are associated with the playa drainage basins. Like the playas, these ditches historically received treated and untreated industrial wastewater discharges.

Landfills are inactive units located in multiple areas at Pantex Plant. These landfills were used for general sanitary waste, construction debris, and demolition debris, including asbestos-containing materials and industrial wastes.

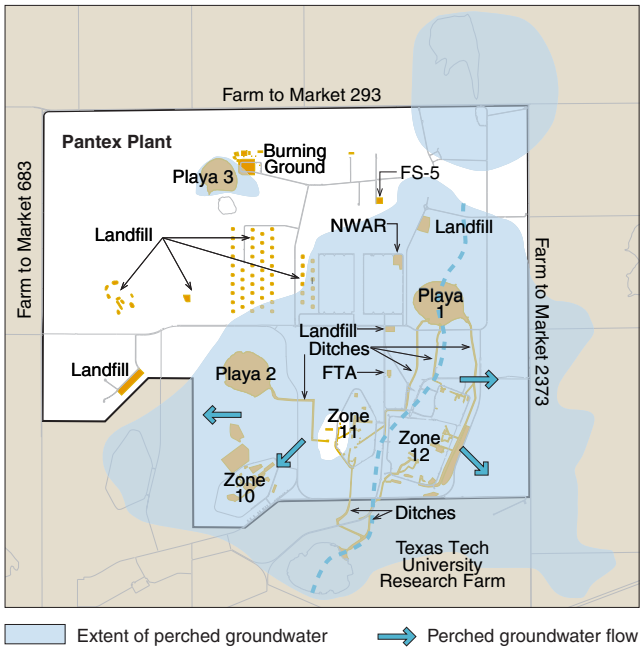
Firing Site 5 (FS-5) is an inactive area previously used for research and development testing of high explosives. Explosives were detonated at a surface test pad or in a gravel pit to test the firing of high explosives with parts made of depleted uranium and other metals.

Playas 1, 2, and 4 and Pantex Lake are four of five playas associated with Pantex Plant; Playa 1 and Playa 2 are within the boundaries of Pantex Plant, whereas Pantex Lake is 2.5 miles (4 km) northeast of the Plant boundary. Playa 4 is on Texas Tech property south of Pantex. Historically, these playas received treated and untreated industrial wastewater discharges.

Nuclear Weapons Accident Residue Storage Unit (NWAR) was a retrievable radioactive materials storage unit. Wastes stored at NWAR included radioactive debris from military aircraft accidents, residue from Pantex Plant Firing Site test shots, and low-level radioactive wastes from Pantex Plant production lines. By 1986, all wastes were removed and site decontamination was completed.

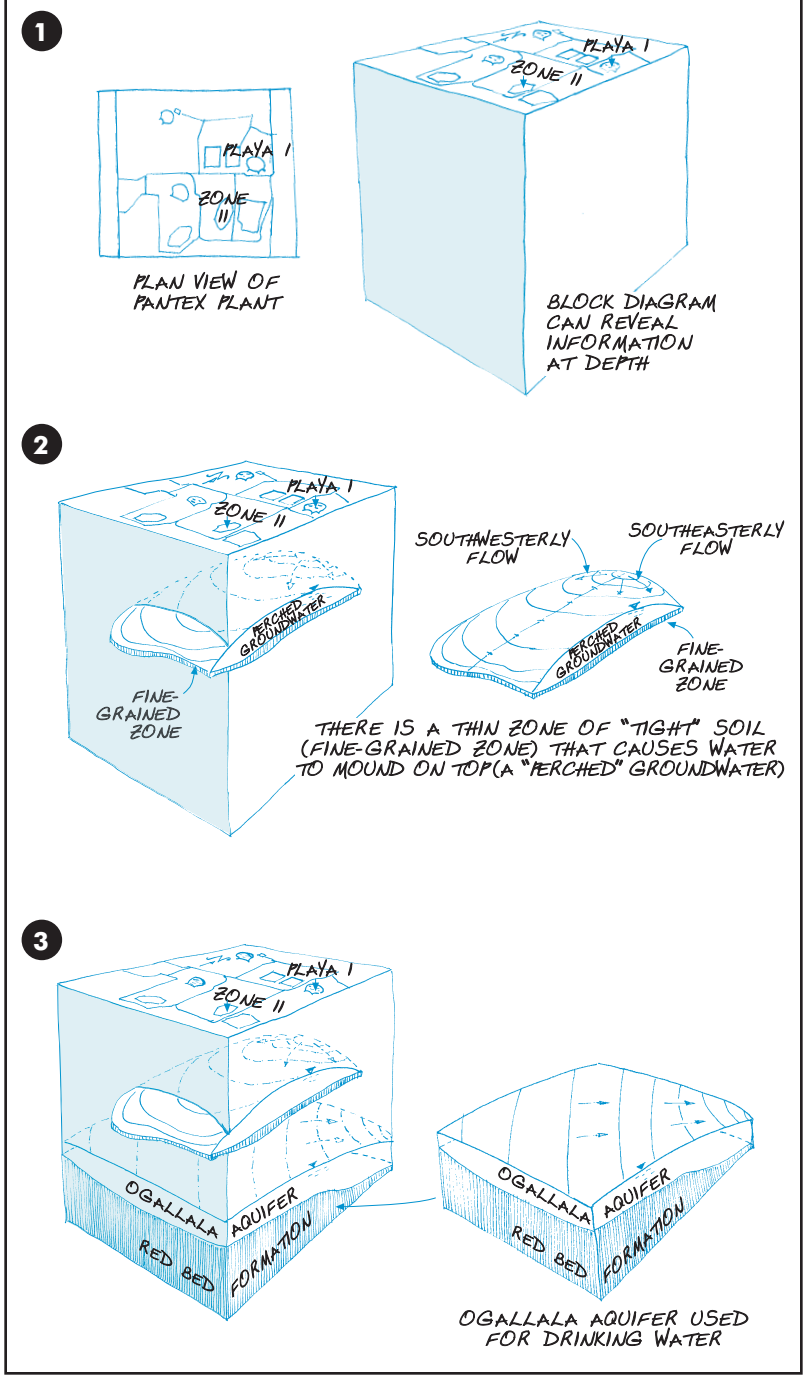
Groundwater at Pantex Plant

Two separate groundwater bodies are present under Pantex Plant at two different depths. The shallow groundwater body, called "perched groundwater," is created by water pooling on a thin zone of "tight" soil (fine-grained zone) at an average depth of about 276 feet below ground surface. This water body is rather thin (average thickness is about 7 feet) and the horizontal extent is limited. The deeper water body, called the Ogallala Aquifer, is limited in depth by what is referred to as the red bed formation. This formation slopes downward from south to north, so it is present at depths ranging from about 350 to 820 feet below the ground surface. The Ogallala Aquifer is extensive and significantly thicker (up to about 400 feet at the northern property boundary) than the perched groundwater. Vertical flow between perched groundwater and the Ogallala Aquifer is limited by the presence of the fine-grained zone. Downward movement of perched groundwater through the fine-grained zone to the Ogallala Aquifer varies from area to area. However, downward movement of perched groundwater generally increases toward the south and east near the edge of the perched groundwater.



Extent of perched groundwater at Pantex Plant.

Site Hydrogeologic Model for Pantex Plant



Cleanup Process

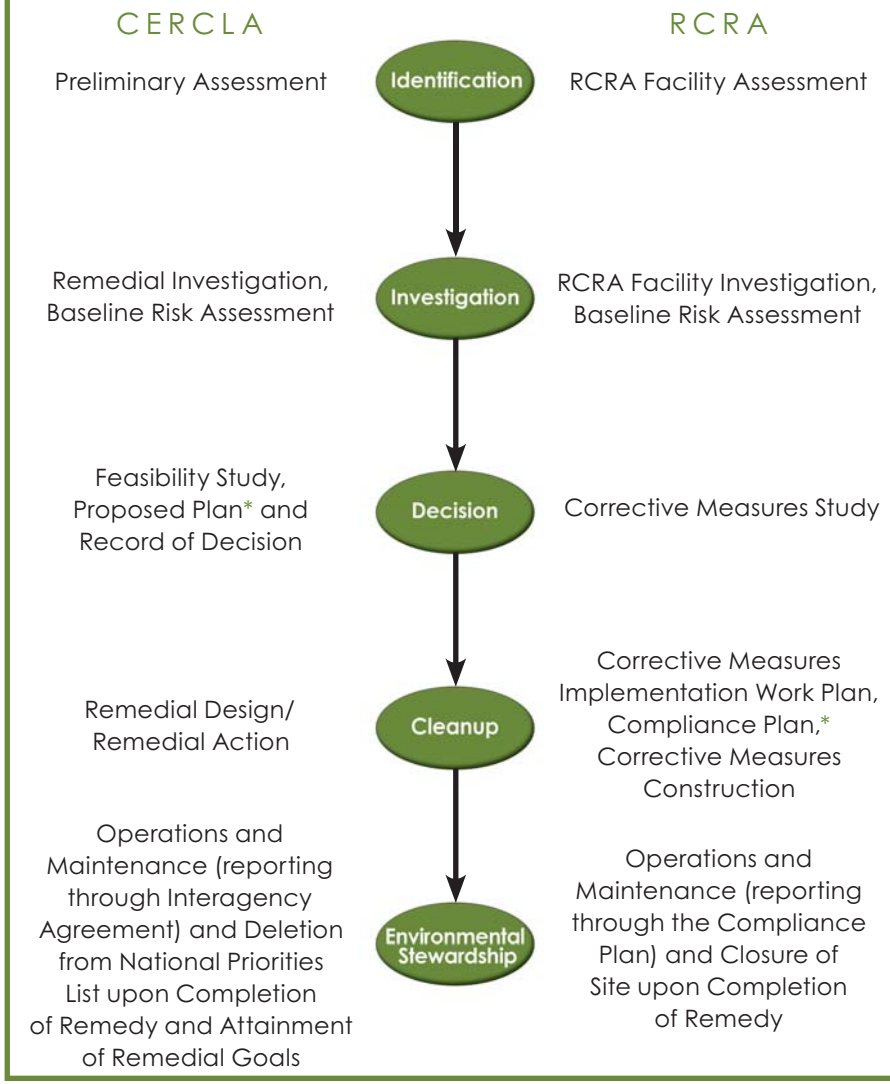
The integrated CERCLA/RCRA cleanup process is a phased approach that consists of the following steps:

- **Identification** of units where release of hazardous waste may have occurred.
- **Investigation** of potential contaminant releases in the units and determination of risks and potential cleanup options.
- **Decision** made by USDOE/NNSA, regulatory agencies, and the public on the preferred cleanup actions. The Proposed Plan is part of the CERCLA decision process. Once the final remedy is selected, a Record of Decision will be issued to document the final CERCLA cleanup remedy for Pantex. For RCRA, the remedy selected through CERCLA will be considered for acceptance, and the detailed remedy designs and monitoring network will be approved through the Compliance Plan Modification process in which public participation will also be solicited.
- **Cleanup** of units based on the Record of Decision and the detailed remedy designs.
- **Long-Term Environmental Stewardship** of the units to implement long-term actions such as institutional controls and to monitor the effectiveness of the actions.

Release units were identified for investigation under RCRA and CERCLA. The inactive release units are undergoing the full investigation and cleanup process to meet closure requirements established by EPA and TCEQ for the USDOE/NNSA Pantex Plant site. The identification and investigation phase of the cleanup process is complete for the inactive units. The currently active units will undergo the investigation and cleanup process when they are no longer actively used. The reports completed for the cleanup process are shown in the green box.

The CERCLA/RCRA cleanup process is similar, so the early investigation of the cleanup process followed RCRA regulations. The risk assessment, corrective measures study/feasibility study, and the final cleanup process integrates RCRA and CERCLA to ensure that final remedial actions meet both regulations.

Cleanup Process for Pantex



*Public participation stage as required for CERCLA or RCRA

CERCLA/RCRA Cleanup Process for Pantex

Pantex operates under a RCRA permit for waste treatment, storage or disposal (original issue in 1991). As a condition of the permit, Pantex investigated its facility to determine if pre-RCRA waste management practices posed a threat to human health or the environment. RCRA (overseen by TCEQ) provides for the investigation of chemical releases at Pantex. RCRA releases are investigated according to the State of Texas Risk Reduction Rule (online at www. tceq.state.tx.us/remediation/rrr.html). The Hazardous Waste Permit (HW-50284) and Compliance Plan (CP-50284) also provide requirements for the RCRA cleanup process at Pantex.

Pantex was added to the National Priorities List as a CERCLA site by EPA in 1994. CERCLA provides for the investigation of chemicals and radionuclides. Therefore a radiological investigation was also performed to supplement the chemical investigations conducted under RCRA. CERCLA regulations and guidance are used for investigation and cleanup at Pantex (online at www.epa.gov/superfund/index/htm). An Interagency Agreement (Federal Facilities Agreement) was recently developed between USDOE/NNSA, EPA, and TCEQ that outlines requirements, roles, and responsibilities for completion of the cleanup process under CERCLA.

Based on the investigations, if contaminants in soil or groundwater pose an unacceptable risk to people or the environment, the facility is required to plan and implement a cleanup program to reduce risk to people and the environment. Both RCRA and CERCLA provide a similar process to attain closure or deletion of the release sites.

Despite the similarities, two significant differences exist between CERCLA and RCRA in the cleanup process: (1) regulatory authority granted to EPA and TCEQ differs under each regulation, and (2) the timing and public participation and the remedy approval process differ. TCEQ and EPA both approve the remedy selection for chemicals; whereas only EPA approves the remedy selection for radionuclides. Under CERCLA, the remedy selection occurs with the Proposed Plan and the Record of Decision (ROD) which requires public participation in the selection. Under RCRA, the remedy selection is considered for acceptance by TCEQ after completion of the Corrective Measures Study/Feasibility Study (this study is used to develop the Proposed Plan), and final public participation and approval is received when the Compliance Plan Modification is developed that details the remedy selection, corrective measure design, and the monitoring network that will be used to evaluate the effectiveness of the remedy. Compliance Plan modification will likely occur after the Record of Decision.

Regulatory Documentation

The following cleanup phases and associated documents are complete or will be complete before final remedial actions are implemented at Pantex. All documents associated with the RCRA/CERCLA process can be reviewed from the Administrative Record file for Pantex. A listing of these documents is included in the additional reading material section inside the back cover.

Identification

- **RCRA Facility Assessment**: An assessment performed to identify areas where hazardous substances may have been released. These areas are then investigated under the correction action process.

Investigation

- **RCRA Facility Investigation**: Site characterization that determines the type and extent of contamination at Release/Corrective Action Units identified during the facility assessment.
- **Radiological Investigation** - Site characterization that determines the type and extent of radiological contamination at release areas.
- **Human Health Risk Assessment:** Determines the current and future risk posed to human health by the contaminants identified in the facility investigations.
- **Ecological Risk Assessment** : Determines the current and future risk posed to the environment (plants and animals) by the contaminants identified in the facility investigations.

Decision

- **Corrective Measure Study/Feasibility Study (CMS/FS):** A study that screens and evaluates remedial action alternatives to address contaminants that pose an unacceptable current or future risk to human health and the environment as identified in the risk assessment. The CMS/FS recommends the final cleanup actions for a site.
- **Proposed Plan**: A plan for site cleanup that proposes the preferred remedial actions and is available to the public for comment.
- **Record of Decision (ROD)**: A document that explains which cleanup alternative will be used at a Superfund site. It includes a summary of responses to comments on the Proposed Plan and a list of documents that were used to select the final remedy. Once the final ROD is issued, final remedial actions are implemented.

The Administrative Record includes all documents that support remedy decisions under both RCRA and CERCLA.

Community Involvement during the Cleanup Process

The Community Involvement Plan, originally developed in 1992, outlines the methods that facilitate two-way communication between the community surrounding Pantex Plant and the USDOE/NNSA Pantex Site Office and serves as a guideline for community involvement in site environmental activities. The Pantex Site Office uses the community involvement activities outlined in the plan to ensure that residents are continuously informed and provided opportunities to be involved. The current version, updated in 2007, can be found in the USDOE/NNSA Reading Room or online at www.pantex.com.

May 2007

PANTEX NEIGHBOR NEWSLETTER

Published by BWXT Pantex for the U.S. Department of Energy/National Nuclear Security Administration

EMS Goals for 2007

BWXT Pantex is committed to effective environmental management. The environment is considered when planning, designing and executing every Pantex activity and service. Pantex implemented an effective Environmental Management System (EMS) as part of the Plant's Integrated Safety Management System. The integrated systems promote consideration of personnel safety and environmental safety during hazards analysis processes prior to work activities.

Pantex will focus on the following items to further enhance the Plant's EMS:

- Water Conservation
- Energy Conservation – electricity and gasoline
- Waste Reduction
- Improving petroleum storage tanks

Find out more about Pantex's Environmental Management System at www.pantex.com/environment/index.shtml

The next quarterly Groundwater meeting will be at 4:00 p.m. at the Carson County Square House Museum in Panhandle June 4, 2007.

Public Meeting

The quarterly Groundwater Meeting hosted by the NNSA and the Texas Commission on Environmental Quality will be held June 4, 2007, at the Carson County Square House Museum in Panhandle, Texas. The meeting will start at 4 p.m.

All interested neighbors and stakeholders are invited to attend. This meeting will include an update on the status of environmental remediation projects at the Pantex Plant.

The Pantex Neighbor Newsletter is published quarterly to keep neighbors and stakeholders updated on current issues.

Comments? Call Erin Ritter, Public Information Coordinator at 477-5140.

In 2001, Pantex began co-hosting monthly public meetings with the TCEQ to discuss groundwater cleanup and other activities of the Environmental Restoration Project. Since 2003, groundwater public meetings have been held quarterly (March, June, September, and December) and focus on the status of accelerated cleanup and the remediation process.

In addition, Pantex publishes a quarterly *Neighbor Newsletter* that highlights the Environmental Restoration Project progress, among other environmental topics. Pantex also communicates important issues to the public through mailings, public meetings, workshops, poster sessions, community group presentations, pantex.com, and the news media.

A special meeting will be held for public involvement for this Proposed Plan. The detailed information for public involvement in the CERCLA remedy selection is provided at the end of this report.

A separate meeting will also take place in the future for the RCRA Compliance Plan Modification that includes the remedy selection, remedy design, and groundwater monitoring network. Public notices will be provided for public participation in that process.

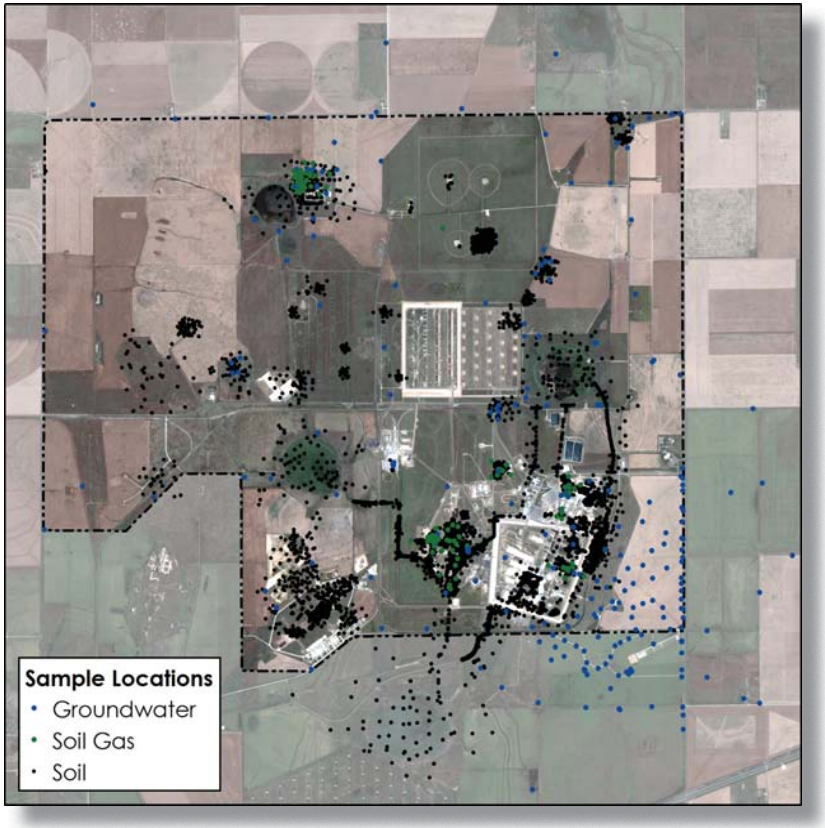
Recent Pantex Quarterly Groundwater Public Meeting hosted by the B&W Pantex Environmental Projects and Operations Division.

Site Investigation

Soil, soil gas, surface water, and groundwater samples were collected at Pantex Plant as part of multiple remedial investigations conducted at various areas across the site.

More than 18,000 soil samples and 500 soil gas samples were collected. More than 400 groundwater samples were obtained since 1999 from 31 wells completed in the Ogallala Aquifer. Additionally, more than 1,300 perched groundwater samples were collected from 116 wells at Pantex Plant since 1999. Based on the results of these investigations, soils, soil gas, and perched groundwater in different areas of the site were determined to be impacted by various contaminants.

Based on the information collected during the site investigation, interim cleanup activities and early remedial/corrective actions were conducted at Pantex Plant to immediately reduce the threat of exposure to Plant employees and neighbors and to minimize the potential for impacts to the Ogallala Aquifer. These early activities occurred before development of the Corrective Measures Study/Feasibility Study.



Site Cleanup

During the cleanup process, interim cleanup activities and early remedial actions were conducted at Pantex Plant to immediately reduce the threat of exposure to Plant employees and neighbors, to limit the migration of contaminant plumes in perched groundwater, and to minimize the potential for impacts to the Ogallala Aquifer. These early actions are allowed under CERCLA and RCRA. These early cleanup measures were also taken in accordance with the Hazardous Waste Permit and the Texas Risk Reduction Rule with the goal of achieving RCRA closure of units remediated to regulatory cleanup levels.

These interim activities occurred during the investigation and before development of the Corrective Measures Study/Feasibility Study. Activities implemented include:

- Soil removal
- Landfill covers
- Ditch lining
- Perched groundwater bioremediation
- Soil vapor extraction
- Extraction and treatment of perched groundwater.

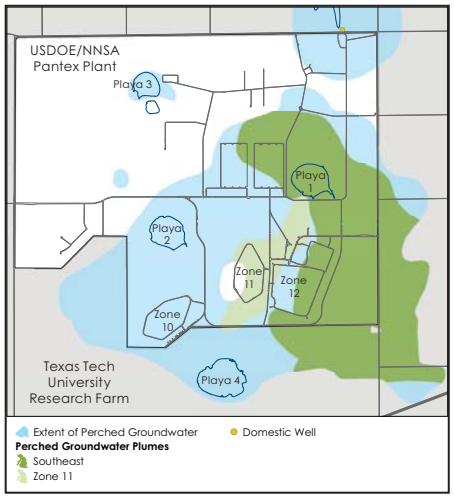
Excavation of ditch soils in Zone 11.

Current Conditions in Groundwater

Contaminants in perched groundwater at Pantex are a result of past industrial wastewater discharges to the ditches and playas and at a wash rack at the Burning Ground. Currently, only one domestic well is completed in perched groundwater. This well is north of Pantex Plant where the perched groundwater is clean.

Contaminants found offsite above regulatory levels (Safe Drinking Water Standards or RCRA drinking water standards for residential use) in perched groundwater at Pantex are associated with the manufacture of high explosives and include:

- High explosives, primarily RDX, and boron present offsite east and south of Pantex Plant.
- TCE (a volatile organic compound) and perchlorate present offsite south of Zone 11 and hexavalent chromium south of Zone 12 on Texas Tech University property.
- Perchlorate and TCE were found in a small disconnected plume beneath the Burning Ground. The concentrations in this plume were initially above regulatory standards but have since declined to safe levels.



Radionuclides have not been found above regulatory levels in groundwater.

Isolated detections of chemicals have occurred in the Ogallala Aquifer in recent years. Review of the data indicate there are no trends in the detections, meaning that there are no repeated detections in wells that would indicate the presence of a chemical plume. Pantex will continue to monitor the Ogallala Aquifer as part of the long-term stewardship program.

Current Conditions in Soils

Contaminants in soils at Pantex occur because of past waste management practices that released contaminants to soils.

Several groups of chemicals and some radionuclides have been detected in soils at Pantex. Many of these contaminants are bound to the upper soils because the clay-rich soils present at Pantex and dry climate conditions limit leaching or migration to deeper soils or groundwater.

During investigation, much of the upper soils were cleaned to levels that are safe for a worker that may work full-time in each area. Landfills that needed extra covers for protection of workers or for groundwater protection, had additional cover material added.

Soil gas plumes were also found in several areas where volatile organic compounds were released. Soil vapor extraction systems were placed in Zone 11 and the Burning Ground to address soil gas plumes in those areas.

Common Pantex Plant Contaminants

As a result of the historical operations that took place at Pantex Plant, the following are the most prevalent contaminants found at Pantex Plant:

- High explosive compounds (HEs): HEs are normally employed in mining, demolition, and military warheads. HEs were manufactured at Pantex for use in the final assembly of weapons. Many of the high explosives were previously released in wastewater streams to ditches and playas or were managed at the Burning Ground.
- Volatile organic compounds (VOCs): VOCs are organic chemicals that are commonly used as solvents, degreasers, paints, thinners and fuels. These substances were used during past operations at Pantex Plant. Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids and are typically found in soil gas plumes at Pantex.
- Metals: Metals are naturally occurring compounds that can become contaminants when they are present in levels above naturally occurring background. The most prevalent metals found at Pantex are chromium and hexavalent chromium that were used as corrosion inhibitors in boilers and cooling towers.
- Perchlorate: Perchlorates are the salts derived from perchloric acid. They occur both naturally and through manufacturing. They are also used as an oxidizer in rocket fuel and can be found in airbags, fireworks, and some fertilizers. Most perchlorate salts are soluble in water. Perchlorate was machined at Pantex for NASA in 1967 and has been found to a limited extent in soil at the Burning Ground and in perched groundwater.
- Polycyclic aromatic hydrocarbons (PAHs): PAHs are some of the most widespread organic pollutants at Pantex Plant because they are found in asphalt roofing materials, roads, and parking lots. They are primarily formed by incomplete combustion of carbon-containing fuels such as wood, coal, diesel, gasoline, or tobacco and are typically found in soils.
- Depleted uranium: Depleted uranium is what is left over when the most radioactive isotopes of uranium are removed. Depleted uranium contains greater than 99 percent uranium-238 (^{238}U) and is approximately 40 percent less radioactive than natural uranium of the same mass. Depleted uranium was used in some high explosive detonation tests at Pantex Plant resulting in soil contamination.

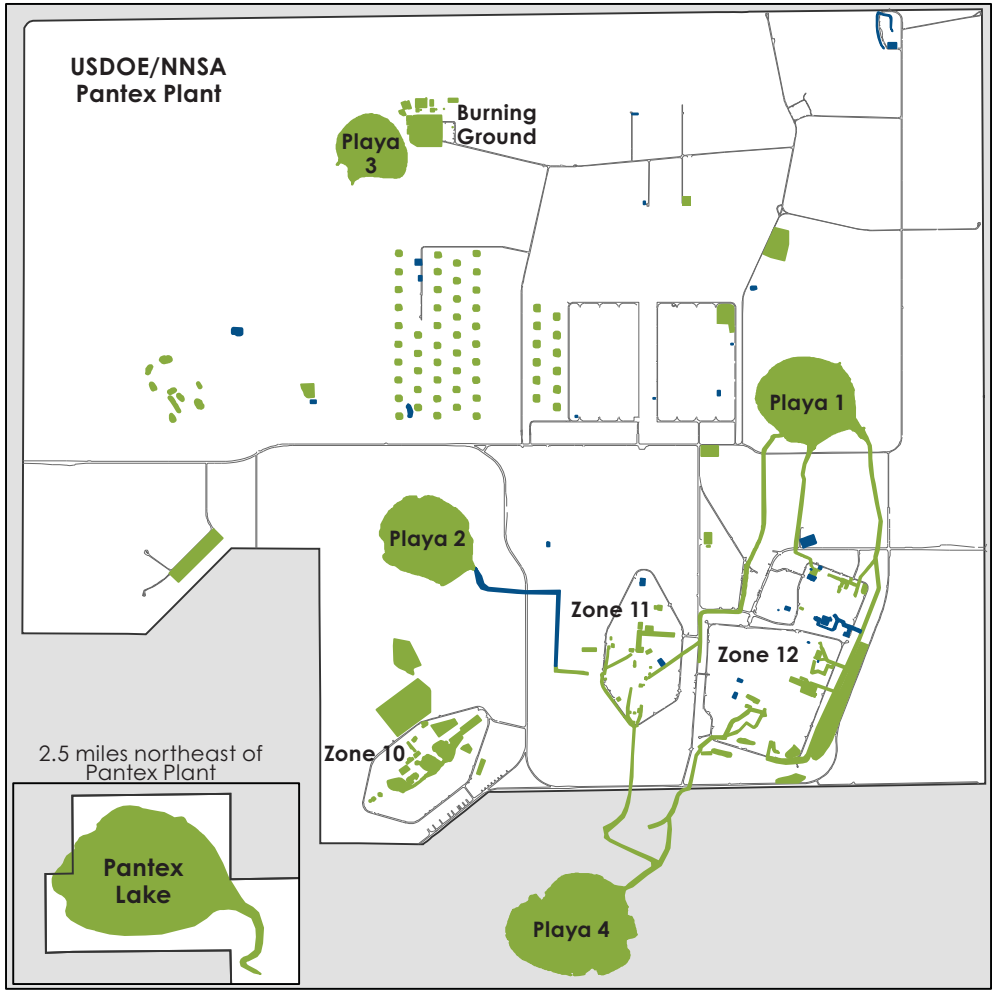
Release Unit Closure Status

Through the RCRA facility assessment, a total of 254 release units were initially identified at Pantex Plant because further investigation and cleanup may be warranted at the units. Inactive units were investigated and some units were closed early because either no contamination was found or the early cleanup actions met regulatory standards. The status of the units following investigations is as follows:

- 16 units are active facilities—investigation, cleanup, and closure are deferred until the unit is no longer active.
- 46 units were closed administratively—during initial investigation it was determined that no past releases occurred at these units.
- 57 units were investigated and closed to background concentrations or predetermined regulatory cleanup levels (CERCLA preliminary remediation goals or RCRA Risk Reduction Standard 1 or 2). Closure of these units is considered final and the units did not require a baseline human health risk assessment.
- 135 units required a baseline risk assessment (based on CERCLA or RCRA requirements) to determine current and future risks from soil and groundwater—these units will go through the full cleanup process.

The closure status of the 192 Pantex Plant release units that were investigated is depicted in the map to the right. The 57 release units depicted in blue are considered as no action release units because results of the investigation indicate that these units do not pose a threat to human health or the environment so require no further remedial action. The units depicted in green went through a baseline risk assessment and the results of the risk assessments are summarized in the next section.

A complete accounting of the no action release units is provided in the No Action Release Units Section of this document beginning on page 44.



Release Unit Closure Status

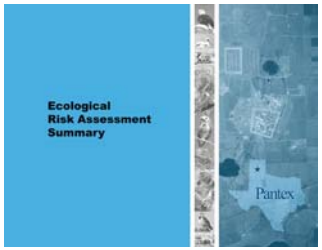
- Closure to Background or Regulatory Cleanup Level — Remedial Actions Final
- Closure Complete after Risk Assessment and Final Remedial Actions Completed

Summary of Site Risk

Ecological Risk Assessment

An Ecological Risk Assessment evaluated potential chemical and radiological impacts to plants and wildlife from soils, sediment, and surface water impacted by historical operations at Pantex Plant. The Ecological Risk Assessment concluded that risks to plants and wildlife at Pantex Plant are below regulatory thresholds, and no further remedial actions are required to address ecological concerns. The methods and results of the Ecological Risk Assessment are presented in the *Ecological Risk Assessment Summary*.

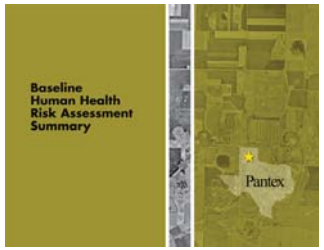
Additional details on the methods and results of the Ecological Risk Assessment are presented in the *Ecological Risk Assessment Summary* available in the Administrative Record File, USDOE/NNSA Reading Room, or online at www.pantex.com.



Human Health Risk Assessment

Human Health Risk Assessments evaluated potential radiological and chemical risks to onsite workers and neighbors that live near the Plant, based on how they could be exposed to impacted soil, soil gas, or groundwater. The risk assessment process at Pantex Plant identified key contaminants and media (for example, soil or groundwater) that require further remedial action because they pose a potential risk to human health.

Additional details on the methods and results of the Human Health Risk Assessment are presented in the *Baseline Human Health Risk Assessment Summary* available in the Administrative Record File or USDOE/NNSA Reading Room or online at www.pantex.com.



Human Health Risk Assessment Methods

The risk assessment methods include:

- Evaluation of data, consisting of measured concentrations of constituents in soil, soil gas, groundwater, and surface water
- Assessment of how people may be exposed to these constituents
- Assessment of how harmful, or toxic, a substance may be
- Calculation of risk.

Exposure Assessment

Pantex Plant is an industrial facility containing both active industrial areas and inactive areas, and future land use will remain industrial for the foreseeable future. Land use surrounding Pantex is primarily agricultural, with some ranching. Based on the known and anticipated future land use, three potentially exposed populations, or receptors, were considered in the risk assessment. Selection of these receptors was based on how they may come into contact with affected environmental media.

Onsite Industrial Worker: an employee who works outdoors and is assumed to have direct contact with constituents in surface soil by means of incidental ingestion, skin contact, and inhalation of vapors or dust.

Onsite Construction Worker: an employee or subcontractor who is assumed to have direct contact with constituents in surface and subsurface soil by means of incidental ingestion, skin contact, and inhalation of vapors or dust.

Offsite Resident Farmer: an individual living on a family farm in the immediate vicinity of Pantex Plant who is assumed to come into contact with constituents in groundwater by means of ingestion or inhalation while showering. This receptor may also be exposed to soil contaminants transported offsite by wind or by ingestion of agricultural products affected by contaminants.

Toxicity Assessment and Risk Calculation

In a toxicity assessment, data from animal and human studies are used to estimate how much of a substance it would take to cause some type of health effect. Using the toxicity information, potential risks to the workers and the farmer were calculated for two types of health effects—non-cancer and cancer.

Non-cancer risks were calculated by comparing an estimated dose a person would receive to a level that is considered safe by TCEQ and EPA. Cancer risks were calculated as the probability, or chance, that a person may develop cancer. TCEQ and EPA consider predicted cancer chances or rates to be safe when they are less than one in a million, which are lower than the general cancer rates of one case for every four people. If the predicted risks to workers and the farmer were higher than the levels EPA and TCEQ consider safe, then the unit was evaluated for remedial action in the Corrective Measures Study/Feasibility Study and presented in this Proposed Plan. Safe levels were considered for individual contaminants as well as combined effects from multiple contaminants. EPA regards the risk range of 1 in a million to 1 in 10,000 as safe for multiple contaminants.

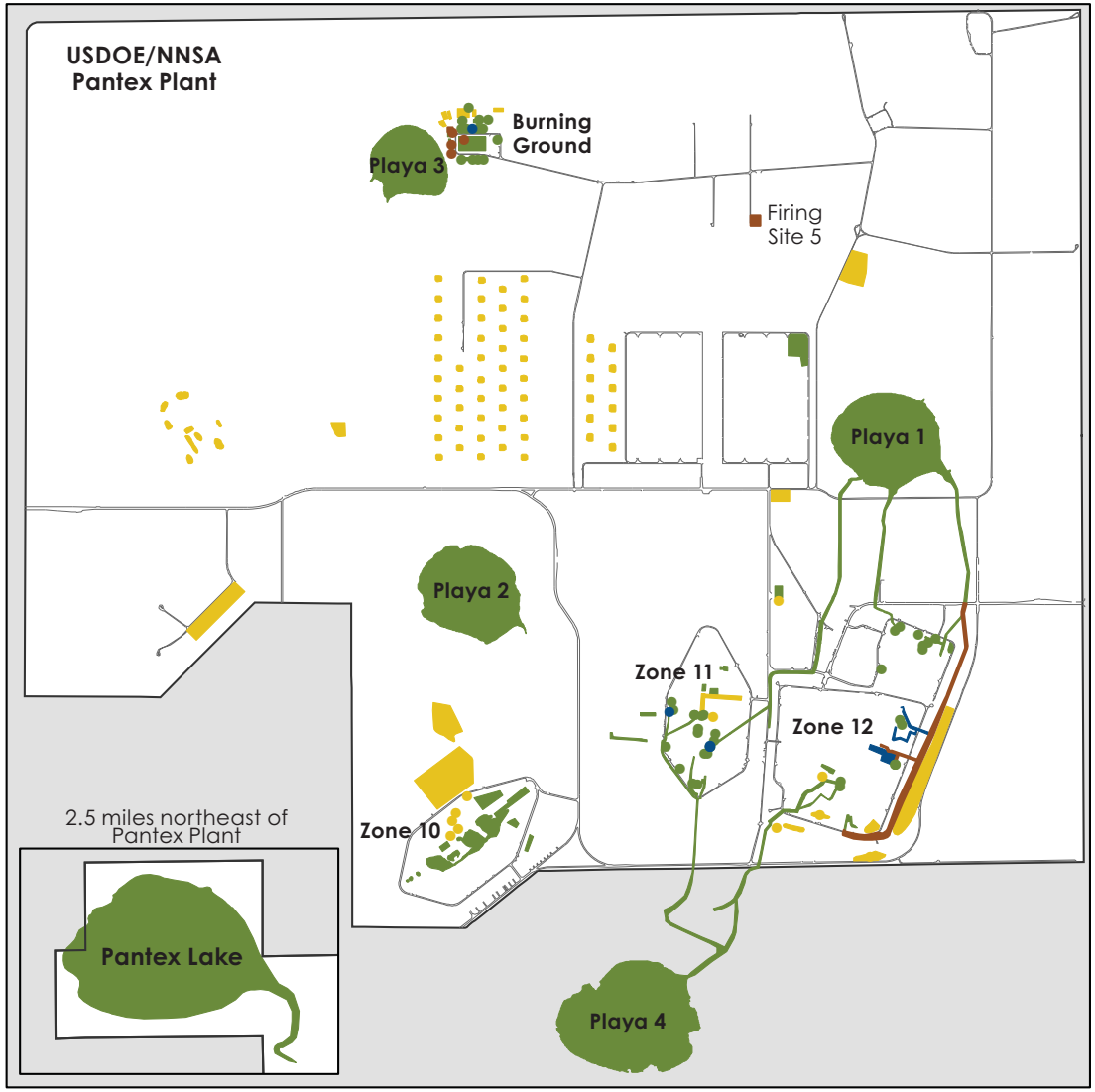
Human health risk results for the 135 release units evaluated indicate the following:

90 units were found to require no further remedial action because remaining contaminant concentrations do not pose unacceptable levels of risk to Pantex workers or neighbors. Early remedial actions, such as excavation of contaminated soil, were conducted at many of these units during the investigation to reduce risk to onsite workers. Many of these units were included in the risk assessment because of the potential to impact groundwater in the future; however, the risk assessment indicated that these sites do not pose a future risk. Because these units were not found to be a threat to human health or the environment, they were not evaluated for remedial actions in this Proposed Plan. They are included in the No Action Release Unit Section starting on page 44 of this document.

45 units required some type of remedial action to control or reduce risks to onsite workers or Plant neighbors. These units had early final remedial actions completed after the risk assessment (and prior to the Corrective Measures Study/Feasibility Study) or were evaluated for remedial action in this Proposed Plan.

- Following the risk assessment, early final remedial actions were completed for seven units and a portion of another unit to achieve cleanup objectives to reduce worker risk. Those eight areas are depicted as blue areas in the map to the right and are discussed on page 53. Only long-term monitoring and institutional controls will be required for these eight units.
- Remedial action alternatives for further cleanup or control were evaluated for the remaining 37 units where no early actions were taken after the risk assessment to reduce risk (depicted in gold and brown in the map to the right) and for perched groundwater. One of the units with early final actions also required further evaluation for remedial alternatives (at the Burning Ground). These units and associated risks are presented in the Remedial Action Alternatives Section in this Proposed Plan. For some of the units, such as the landfills, early remedies taken were evaluated to determine if further remedial action was necessary for protection of human health.

All 135 release units evaluated in the Human Health Risk Assessment will be managed as part of the long-term monitoring/stewardship program and will require institutional controls as specified under RCRA.



Release Units Assessed in the Human Health Risk Assessment

- Remedial Actions Evaluated in Proposed Plan
- Landfills
- Post-Risk Assessment Early Final Actions Completed
- Risk Assessment Determined No Further Corrective Action Required

Soil Risk

Through the evaluations in the risk assessment, release units with contaminated soil were determined to potentially affect human health by two pathways:

- Direct contact of soils by workers. Direct contact includes incidental ingestion of soil, skin contact, and inhalation of vapors or dust.
- Migration to groundwater that could be used as a drinking water source. Contaminants in soil have the potential to continue migrating to perched groundwater in areas that collect or pond storm water runoff.

The primary contaminants in soil that pose a direct contact risk to onsite workers are: chemical high explosives (RDX, TNT, HMX); PAHs; and radioisotopes of depleted uranium (^{238}U, ^{235}U). Of these, only high explosives are contaminants in perched groundwater. Depleted uranium isotopes have not been detected above background in perched groundwater. Depleted uranium is not expected to move from shallow soils to groundwater at Pantex because of its low solubility in water and dry climate conditions.

High explosive contamination is visible as a red discoloration in this soil excavated from Zone 12 in 1999.

Soil Units with a Direct Contact Risk to Onsite Workers

Onsite industrial workers are most likely to come into contact with the upper two feet of soil. Therefore, contaminants in the upper two feet of soil would need to be remediated to eliminate the risk to onsite industrial workers.

Onsite construction/excavation workers are likely to come into contact with soil to depths of fifteen feet beneath the surface. Therefore, contaminants in the upper fifteen feet of soil would need to be remediated to eliminate the risk to onsite construction/excavation workers.

Onsite workers could be exposed to contaminants when working at soil units where predicted risk is above safe levels, if no action is taken. To eliminate or reduce the threat of exposure to contaminants in soil encountered by onsite workers, remedial action alternatives were developed and evaluated for each of these units. These units are discussed and pictured on page 15.

Soil Units Requiring Groundwater Protection

Historically, treated and untreated industrial wastewater was discharged directly to drainage ditches. Water that entered the ditches from runoff or Pantex Plant discharges infiltrated the soil and moved downward (migrated) into perched groundwater. As a result of historical activities, a completed pathway to perched groundwater was identified for four soil units. These units contain contaminants that have, and may continue, to migrate from soil to perched groundwater at levels above drinking water standards. The units considered for remedial action for the migration to groundwater pathway are discussed and pictured in the map on page 15.

Groundwater monitoring data and modeling results from the human health risk assessments indicate that the maximum concentrations of contaminants from these units have already reached perched groundwater, and continuing impacts to perched groundwater are expected, but at concentrations that will decrease over time. The objective of remedial actions implemented at these soil units would be to reduce further migration of contaminants to the perched groundwater. Therefore, remedial action alternatives were developed and evaluated to determine the practicability and effectiveness of further reducing the downward movement of contaminants from these soil units to perched groundwater.

Soil Remedial Action Units

SWMU 25, 26, & 27: Burning Ground Explosive Burn Pads 11, 12, and 13

Burn pads were used to burn explosives and explosive-contaminated sludge. Contaminants in the top two feet of soil pose a direct contact risk to onsite industrial workers. The contaminant of concern at these units is the depleted uranium isotope ^{238}U.

SWMUs 14-24: Burning Ground Former Ash Disposal Trench

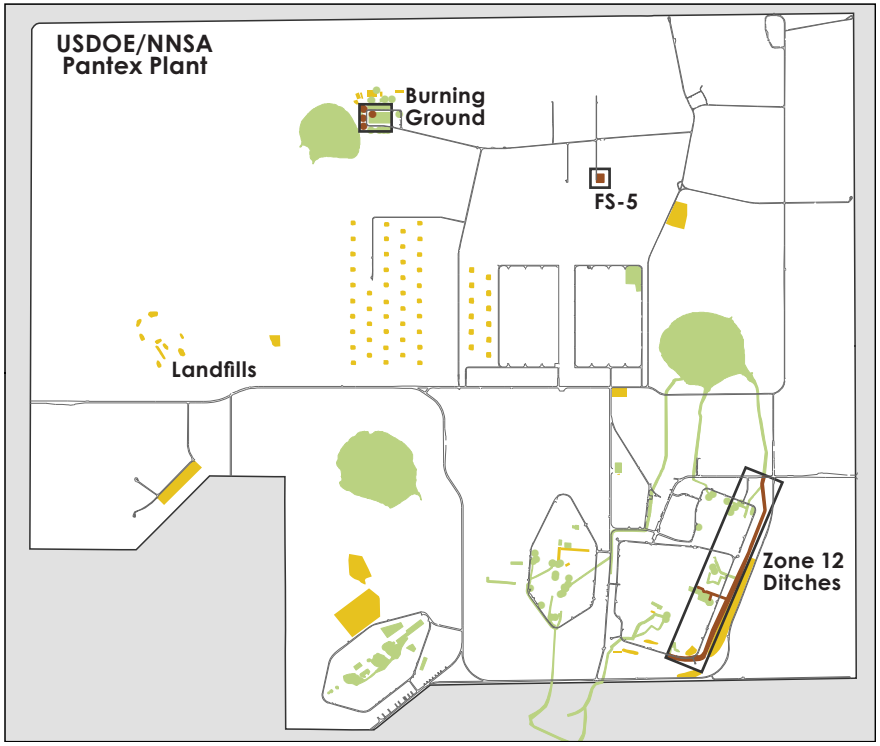
SWMUs 14-24 are eleven units in the Burning Ground that are associated with the trench between Burn Trays 8 and 10. These units were used to burn explosives and explosive contaminated sludge. Contaminants in the top fifteen feet of soil pose a direct contact risk to onsite industrial and construction/excavation workers. Contaminants would also have the potential to reach perched groundwater if low recharge was not maintained. The contaminants of concern at this unit are high explosives (RDX and TNT) and barium.

Landfills

Remedial action alternatives for 26 landfills, historically used for disposal of construction debris and other non-hazardous waste, were also evaluated in the Corrective Measure Study/Feasibility Study. Many of the landfills did not pose a risk to human health, but were evaluated to ensure they would continue to be protective of human health in the future. They were also evaluated for protection of groundwater.

SWMU 47: Burning Ground Solvent Evaporation Pit

Unlined pits were used for evaporation and thermal treatment of waste solvents contaminated with high explosives. Contaminants have the potential to reach perched groundwater. The contaminants of concern at this unit are volatile organic compounds (primarily toluene and trichloroethene).



SWMU 5/05: Drainage Ditch between Buildings 12-21 & 12-24

Drainage ditch in Zone 12 that received runoff from buildings containing film and x-ray developing and physical testing operations. Contaminants have the potential to reach perched groundwater and pose a direct contact risk to onsite industrial workers. The contaminants of concern at this unit are high explosives (RDX, TNT and HMX) and polycyclic aromatic hydrocarbons.

SWMU 70: Firing Site 5

Operated as a test facility for high explosives and explosive-containing components. Contaminants in the top two feet of soil pose a direct contact risk to onsite industrial workers. The contaminants of concern at this unit are the depleted uranium isotopes ^{238}U and ^{235}U.

SWMU 5/12a: Zone 12 Main Drainage Ditch

The main drainage ditch that received effluent directly from most of the Zone 12 ditches. Contaminants in the top fifteen feet of soil pose a direct contact risk to onsite industrial and construction/excavation workers. Contaminants also have the potential to reach perched groundwater. The contaminant of concern at this unit is the high explosive RDX.

SWMU 2: Building 12-43 Drainage Ditch

Drainage ditch in Zone 12 that received filtered effluent from a high explosive processing facility. Contaminants have the potential to reach perched groundwater and pose a direct contact risk to onsite industrial workers. The contaminants of concern at this unit are high explosives (RDX and HMX) and polycyclic aromatic hydrocarbons.

Contaminants of Concern (COCs)

These are contaminants that were identified in the risk assessment as posing unacceptable risk to an onsite worker or offsite resident. These COCs require evaluation for remedial actions.

Groundwater Risk

Contaminants were identified in perched groundwater at concentrations above drinking water standards. Currently, contaminated perched groundwater is not used for any purpose onsite or offsite, so no one is exposed to the contaminants. Because the perched groundwater meets the regulatory definitions for ability to yield enough water for domestic use and total dissolved solids are low, the perched groundwater must be considered for potential future use. Future exposure can be controlled in all USDOE/NNSA owned areas and through agreement with TTU. Without controls, perched groundwater beneath and surrounding Pantex Plant could be used as a potential water source and the perched groundwater may act as a source of contamination to the Ogallala Aquifer (the drinking water resource for the area), so affected groundwater must be remediated and controls provided to ensure protection of human health. However, if contaminants move from the perched groundwater to the Ogallala Aquifer in the future, people could potentially be exposed to drinking water that does not meet safe drinking water standards.

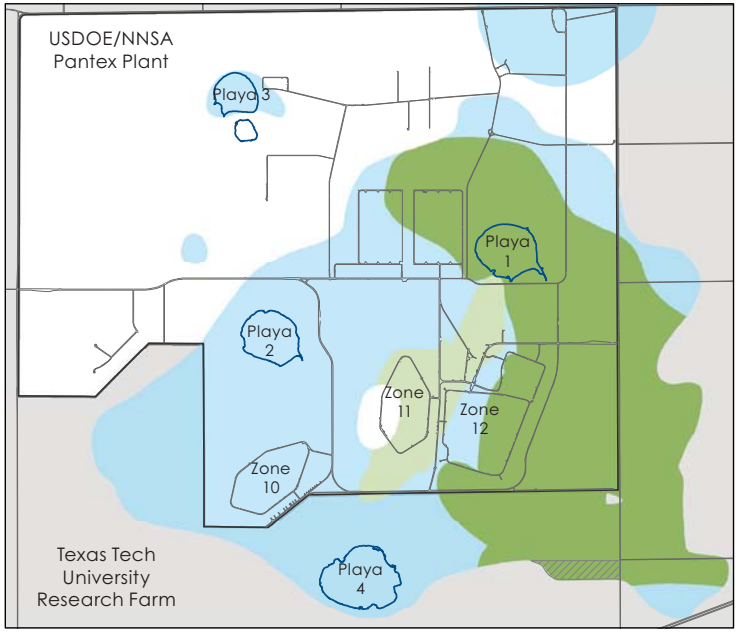
Perched Groundwater

As a result of historical operations, contaminants, including high explosives, volatile organic compounds, metals, and perchlorate, have migrated to perched groundwater above drinking water standards. The figure to the right shows a map of the extent of perched groundwater contamination (concentrations that exceed background). Two major areas, or plumes, of contaminants are found in perched groundwater. The major areas are the southeast plume (south and east of Zone 12) and the Zone 11 plume (beneath and south of Zone 11). Other areas of lower contaminant concentrations occur around Playa 1 and at the Burning Ground.

Historical operations that resulted in the contamination of perched groundwater no longer occur at Pantex Plant, and interim corrective measures, interim stabilization measures, and removal actions (collectively referred to as early actions) were implemented to prevent contaminated water from impacting the Ogallala Aquifer or other underlying aquifers. These early actions were also implemented to reduce the toxicity and volume of contaminants in perched groundwater.

The perched groundwater is a designated drinking water resource and is subject to drinking water standards under the Safe Drinking Water Act. Because concentrations of contaminants in the perched groundwater beneath Pantex property and offsite to the south and east currently exceed drinking water standards, the water is not safe for domestic use. Onsite use of perched groundwater is restricted by Pantex Plant. With the exception of one domestic supply well north of Pantex Plant, no public or private wells exist in the perched groundwater in the immediate vicinity of Pantex Plant. The one domestic well is not in an area impacted by historic operations.

In the absence of remediation, contaminants were predicted to migrate from perched groundwater to the Ogallala Aquifer in one area south of Pantex on Texas Tech University property. Remedial actions that reduce the concentration, volume, and movement of contaminants in perched groundwater are required to prevent these contaminants from adversely impacting the Ogallala Aquifer. Remedial actions may also include institutional controls to limit drilling and use of groundwater for immediate and continued protection of human health.



Extent of Perched Groundwater
Area Sensitive to Downward Migration

Perched Groundwater Plumes

Southeast

Zone 11

Contaminants of Concern in Perched Groundwater

Southeast Plume: *High Explosives* (2-Amino-4,6-dinitrotoluene, 4-Amino-2,6-dinitrotoluene, 1,3-Dinitrobenzene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, HMX, RDX, 1,3,5-Trinitrobenzene, TNT), *Volatile Organics* (1,2-Dichloroethane, TCE), *Metals* (Boron, Chromium, Hexavalent Chromium)

Zone 11 Plume: *High Explosives* (4-Amino-2,6-dinitrotoluene, 2,6-Dinitrotoluene, RDX, TNT), *Volatile Organics* (1,2-Dichloroethane, 1,4-Dioxane, Chloroform, PCE, TCE), Perchlorate

Removal Actions

CERCLA removal actions can be taken early to prevent or minimize damage to public health or the environment which could result from a release or threatened release of hazardous substances. These actions are similar to the RCRA interim stabilization/corrective measure actions already taken during the investigation phase.

EPA defines three kinds of removal actions based on the time available before a response action must be initiated:

- Emergency removal actions require a prompt response at the site.
- Time-critical removal actions are conducted when the lead agency (USDOE/NNSA) concludes that the action must begin within six months of release identification.
- Non-time-critical removal actions require a planning period that may extend for more than six months; during this planning period, the lead agency conducts an engineering evaluation/cost analysis (EE/CA) for the response action and seeks public comment on the response options.

Non-time-critical removal actions conducted for groundwater at Pantex include:

- Playa 1 Removal Action: Installation of a pump and treat system at Playa 1 designed to reduce the long-term potential for vertical movement of contaminated perched groundwater to the Ogallala Aquifer.
- *In situ* Bioremediation Removal Action: Installation of an *in situ* bioremediation system on the southeast edges of the contaminated perched groundwater that uses microorganisms to degrade high explosives and reduce chromium.

Documentation of these two non-time critical removal actions is available in the Administrative Record file.

Ogallala Aquifer

Groundwater data collected from the Ogallala Aquifer since 1999 show that the water is safe for use as drinking water, although infrequent detections of contaminants at low concentrations have occurred. No repeated detections that would indicate the presence of a contaminant plume in the Ogallala Aquifer have occurred. Based on these data, there are no current risks or imminent threats to human health, and no health concerns related to the detections.

The Ogallala Aquifer is a designated drinking water resource and is subject to drinking water standards under the Safe Drinking Water Act. Water from the Ogallala Aquifer currently meets all drinking water standards and is safe for use by Plant employees and neighbors; however, in the absence of remedial actions to stabilize and control migration, contaminated perched groundwater could potentially affect the underlying Ogallala Aquifer. Remedial action alternatives for perched groundwater were developed to continue to protect the Ogallala Aquifer as a drinking water resource.

Drilling a new extraction well near Playa 1, July 2007.

Basis for Action

It is USDOE/NNSA's current judgment that the Preferred Alternatives identified in this Proposed Plan, or the other active measures considered in the Proposed Plan, are necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Remedial Action Objectives

Remedial action or cleanup objectives are goals established to protect human health and the environment in accordance with 40 CFR §300.430(e)(2)(i). The following objectives were developed by USDOE/NNSA, EPA and TCEQ for remediation at Pantex Plant.

Soil Cleanup Objectives

- Reduce the direct contact risk to onsite industrial and construction/excavation workers through removal, treatment, or prevention of contact with contaminants in the soil; and,
- Reduce potential impact to perched groundwater and the Ogallala Aquifer through source control and stabilization measures in the deeper soils.

Loading of excavated soil into a rolloff container for disposal.

Groundwater Cleanup Objectives

- Reduce the risk of exposure to perched groundwater through contact prevention;
- Achieve cleanup standards for all contaminants in perched groundwater at the property boundary and/or areas sensitive to downward migration (areas where the fine-grained zone contains more sand or is thinner so that water can move through the fine-grained zone over a period of time - see page 16);
- Prevent growth of perched groundwater contaminant plumes; and,
- Prevent contaminants from exceeding drinking water standards in the Ogallala Aquifer.

Groundwater cleanup objectives were developed to address two separate groundwater issues: 1) restoration of perched groundwater to drinking water standards at the property boundary and/or areas sensitive to downward migration, and 2) protection of the Ogallala Aquifer. While remedial action alternatives address both objectives, protection of the Ogallala Aquifer is the primary goal of implementing remedial actions for groundwater at Pantex Plant.

Tankers of food grade amendment to be injected into perched groundwater to create an enhanced anaerobic bioremediation zone.

Achieving Remedial Action Objectives

Cleanup objectives for soil and groundwater can be met by a combination of the following:

- Reducing the concentrations of contaminants in soil and groundwater to levels at or below cleanup standards
- Reducing the saturated thickness of the perched groundwater to reduce future downward migration of contaminants to the Ogallala Aquifer
- Breaking the exposure pathway to eliminate exposure to the contaminated media.

Cleanup standards for soil and groundwater were determined using information about the expected use of the land (industrial use at Pantex), the highest beneficial use of the groundwater (drinking water in the surrounding area), and associated potential receptors (Pantex workers and surrounding neighbors).

Soil Cleanup Standards

Soil cleanup standards protective of onsite workers at Pantex Plant were developed for the expected industrial land use scenario. The cleanup standards for soil were developed in accordance with the Texas Administrative Code (30 TAC §335.563) Media Cleanup Requirements because they are considered as an applicable or relevant and appropriate requirement under CERCLA.

Cleanup Levels for Soil Units with Direct Contact Risks

Constituent	Cleanup Level (mg/kg)	
	Industrial Worker	Construction/ Excavation Worker
High Explosives		
RDX	26	512
TNT	71	87
Polycyclic Aromatic Hydrocarbons (PAHs)		
Benzo(a)anthracene	3.2	NE
Benzo(a)pyrene	0.32	NE
Benzo(b)fluoranthene	3.2	NE
Dibenz(a,h)anthracene	0.32	NE
Indeno(1,2,3-c,d)pyrene	3.2	NE
Radionuclides		
^{238}U	1.4	NE

NE - Not established, no unacceptable risk for these contaminants.

Understanding Concentrations

Concentrations of chemicals in soil are typically measured in units of mass of chemical (milligrams, mg) per mass of soil (kilograms, kg) and are written as mg/kg. A concentration of 1 mg/kg of a chemical in soil is equivalent to 1 part per million (ppm) because 1 kilogram = 1,000 grams = 1,000,000 milligrams.

In groundwater, chemical concentrations are expressed in units of mass of chemical (micrograms, µg) per volume of water (liters, L). A liter of water weighs 1,000 grams, and a microgram is 1/1,000,000th of a gram. Therefore, 1 µg/L is 1 part per billion (ppb) and represents a concentration of 1/1,000,000th of a gram of chemical dissolved in 1 kilogram of water.

To visualize these quantities, a single kernel of corn in a 45-foot tall, 16-foot diameter silo is one ppb. One thousand kernels of corn in the silo are one ppm.

Groundwater Cleanup Standards

Groundwater cleanup standards protective of Plant employees and neighbors were based on the highest beneficial use of groundwater as a drinking water source. The cleanup standards for groundwater are the maximum contaminant levels established by EPA. If a maximum contaminant level was not available for a constituent, a groundwater cleanup level was calculated in accordance with Texas regulations found in the Texas Administrative Code (30 TAC §335.563) to ensure that groundwater is safe for consumption. The State requirements were used because they are considered as an applicable or relevant and appropriate requirement under CERCLA.

Cleanup Levels for Perched Groundwater Constituents of Concern

Constituent	Cleanup Level (µg/L)
Metals	
Boron	7,300
Chromium (hexavalent)	100
Chromium (total)	100
Volatile Organic Compounds	
1,2-Dichloroethane	5.0
1,4-Dioxane	7.7
Chloroform	370
PCE	5.0
Trichloroethene	5.0
High Explosives	
2-Amino-4,6-dinitrotoluene	1.2
4-Amino-2,6-dinitrotoluene	1.2
1,3-Dinitrobenzene	3.7
2,4-Dinitrotoluene	1.0
2,6-Dinitrotoluene	1.0
HMX	360
RDX	7.7
1,3,5-Trinitrobenzene	220
TNT	3.6
Miscellaneous	
Perchlorate	26

Alternatives Evaluation Criteria

Remedial action alternatives developed to address release units with contaminants in soil and groundwater were evaluated in the Corrective Measure Study/Feasibility Study against the evaluation criteria required by CERCLA in the Code of Federal Regulations (40 CFR §300.430 (e)(9)(iii)) and RCRA in the Texas Administrative Code (30 TAC §335.561 –30 TAC §335.563). Three general types of criteria were used for evaluation:

- Threshold Criteria must be met for an alternative to be eligible for selection as a preferred remedial action.
- Balancing Criteria are used to compare remedial action alternatives.
- Modifying Criteria could change the outcome of selected remedial action alternatives based on feedback provided by the community and State.

Threshold Criteria and Balancing Criteria were evaluated in the Corrective Measure Study/Feasibility Study. The Modifying Criteria will be evaluated following the public comment period.

Threshold Criteria

The following two threshold criteria must be met for an alternative to be considered as a preferred alternative:

- **Overall Protection of Human Health and the Environment** addresses whether or not adequate protection of human health and the environment is provided during and after implementation of the remedial action.

- **Compliance with Applicable or Relevant and Appropriate Requirements** considers if a remedial action meets all federal, state and local laws and regulations.

The alternatives were ranked on their ability to meet the two essential threshold criteria using a "yes" or "no". Alternatives that did not meet both threshold criteria were not eligible to be the preferred alternative.

Preparing for injection of amendment to create a permeable treatment zone in perched groundwater.

Balancing Criteria

The following five balancing criteria are the primary factors that are taken into account when comparing the alternatives and choosing the preferred alternative:

- **Long-Term Reliability and Effectiveness** refers to the ability of the alternative to reliably protect human health and the environment over time once the remedial actions have been implemented.
- **Reduction of Toxicity, Mobility, or Volume of Waste** addresses the expected performance of treatment technologies in permanently and significantly reducing the toxicity, mobility, or volume of waste.

In the following sections, the alternatives evaluation for each release unit is summarized in a table. The table lists all alternatives evaluated, identifies if the alternative satisfies the threshold criteria, provides an evaluation of how well the alternative satisfies each of the balancing criteria, and shows the estimated net present cost of implementing the alternative.

Preferred Alternative shown in bold text

Sample Comparative Alternatives Analysis

	Threshold Criteria		Balancing Criteria						
							Cost		
List of Alternatives	Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume of Waste	Short-Term Effectiveness	Implementability	Capital	Total O&M	Total Cost
Alternative 1: No Action			Relative Ranking Scale				None		
Alternative 2	✓	✓	Least Effective				$< (Negligible)		
Alternative 3	✓	✓					$250k	$100k	$350k
Alternative 4	✓	✓	Most Effective				$1.9M	$600k	$2.5M

- **Short-Term Effectiveness** evaluates the potential to adversely affect human health and the environment during the time when remedial actions are taking place, and how quickly the alternative achieves cleanup objectives.
- **Implementability** refers to the technical and administrative difficulties for carrying out the alternative, including the availability of special materials or services, the need for regulatory approvals, and how hard it would be to construct and operate a particular remedial action at the site.
- **Cost** includes an estimate of the construction costs, the annual operations and maintenance (O&M) costs, and the total present worth of the alternative. Because Pantex Plant is an active facility with an ongoing mission, it was assumed that maintenance of soil covers, fencing, and other passive controls would occur as part of other routine activities so that annual maintenance costs will be negligible. Annual O&M costs for groundwater alternatives and other active remedies were included in the cost estimates.

With the exception of cost, alternatives are ranked on their ability to meet the remaining balancing criteria. The ranking system is discussed in more detail in the Corrective Measure Study/Feasibility Study. Cost is evaluated using the total present worth for each alternative to allow for a direct cost comparison.

Modifying Criteria

The two modifying criteria, Public Acceptance and State Acceptance, are evaluated after the public comment period. These two criteria involve consideration of State and public concerns that may modify the alternatives proposed for the site. Public Acceptance will be achieved through the public review of this proposed plan and response to public comments, which will be documented in a Responsiveness Summary as a part of the Record of Decision. State acceptance will be documented in the Record of Decision.

Remedial Action Alternatives Evaluated for Soil

This section identifies the remedial action alternatives that were evaluated to address contaminated soil and provides a summary of how well the alternatives achieve the threshold and balancing criteria.

Remedial Action Alternatives Evaluated for Soil Units

Alternative 1: No Action

No measures would be implemented to reduce or contain contamination in the soil units. The National Oil and Hazardous Substance Pollution Contingency Plan requires that "No Action" be included among the alternatives evaluated in the Corrective Measure Study/Feasibility Study as detailed in the Code of Federal Regulations (40 CFR §300 430(e)(6)) as a baseline for comparison to the other alternatives.

Evaluation against criteria:

- No Action is not protective of human health and the environment and does not comply with relevant local, state and federal laws and regulations. This alternative cannot be considered as a final remedy because it does not meet the threshold criteria.

Alternative 2: Institutional Controls

Institutional controls are part of long-term stewardship actions and are designed to help minimize the potential for human contact or migration of contaminants to groundwater. Controls may include land and natural resource restrictions, providing information to workers and the public, onsite control plans, deed restrictions, property purchase, posted warning signs, fences, barriers, or security personnel that limit unauthorized traffic in an area.

Evaluation against criteria:

- Institutional controls are protective of human health and the environment and comply with all relevant local, state and federal laws and regulations.
- Institutional controls are readily implementable, there is minimal additional short-term risk to workers because no active remediation occurs, and long-term effectiveness will be achieved because the site will be controlled by DOE for the foreseeable future.
- Institutional controls do not reduce toxicity, mobility, or volume of contaminants because no active remediation technologies will be implemented.
- Institutional controls are cost effective.

Alternative 3: Containment with Institutional Controls

Contamination in soil exceeding the cleanup standards would be left in its current location, but would be covered with either a soil cover or a synthetic liner depending on soil unit conditions. Soil units that only pose a direct contact risk to onsite workers would be covered with a soil cover to prevent exposure to contaminants. Soil units that function as channels or drainage ditches would be covered with a synthetic liner to minimize infiltration and prevent exposure to contaminants. Routine inspections and maintenance would be required to ensure the covers remain protective. Institutional controls as described in Alternative 2 would also be implemented under this alternative.

Evaluation against criteria:

- Containment is protective of human health and the environment and complies with all relevant local, state and federal laws and regulations.
- Containment is easily implementable since it is a widely used technology and minimal short-term risks to workers are involved. Soil covers and synthetic liners will continue to prevent direct contact to contaminants as long as they are properly maintained.
- Containment is more effective than institutional controls (Alternative 2) at reducing the toxicity, mobility, or volume of waste because covers and liners would mitigate the downward movement of contaminants by reducing the infiltration of water through the soil.
- Containment may or may not be cost-effective depending on the size of the impacted soil unit.

Disturbance of release units is prohibited without authorization. All units are clearly marked by signs such as the one shown here.

Remedial Technologies

The following remedial technologies were considered in the development of remedial action alternatives to treat the contaminated soils at Pantex Plant:

- **Soil cover/synthetic liner**: A cover/liner is the addition of one or more layers of soil and/or man-made materials (for example, clean soil or high density plastic) onto the land surface. Cover systems can be designed to reduce surface water infiltration, control gas and odor emissions, improve aesthetics, and provide a stable surface over waste. Typical cover systems for containment of contaminated soils include simple soil covers, asphalt/concrete covers, or other engineered covers.
- **Excavation**: Excavation involves digging up contaminated soil so that it can be treated and/or disposed at an onsite or offsite waste facility. The soil is excavated using conventional earth moving equipment such as backhoes or front-end loaders.
- ***In situ* ozone treatment**: Remedial process that injects ozone into soils to break down contaminants to products that are not harmful to human health or the environment. *In situ* technologies remediate contamination in place, that is, without requiring contaminated soil to be excavated or groundwater to be extracted for treatment.

Alternative 4: Removal and Offsite Disposal with Institutional Controls

Soil exceeding cleanup standards would be removed and disposed of at an offsite facility. Contaminated soil would be excavated to a depth of at least two feet where a direct contact risk to industrial workers exists or to a depth of at least fifteen feet where a direct contact risk to construction/excavation workers exists. Excavated soil would be characterized and safely transported to the appropriate offsite disposal facility and the soil unit would be backfilled with clean soil. Institutional controls as described in Alternative 2 would also be implemented under this alternative.

Evaluation against criteria:

- Removal is protective of human health and the environment and complies with all relevant local, state and federal laws and regulations.
- Removal achieves long-term effectiveness and reduces toxicity, mobility, or volume of waste by permanently removing contaminated soil from the unit.
- Because it takes additional effort to implement and presents a higher risk to workers during the excavation and transportation activities, removal does not address the short-term effectiveness criteria as well as institutional controls (Alternatives 2) and containment (Alternative 3).
- Costs for removal are dependent on the size of the impacted soil unit and the type of contaminants present. Cost can be prohibitive at some units due to type and depth of contamination.

Alternative 5: *In Situ* Ozone Treatment with Institutional Controls

This alternative is only applicable at soil units having contaminants deep in the soil (that is, units requiring groundwater protection measures). Alternative 5 involves drilling injection wells in the impacted subsurface soil and connecting the wells to an ozone generator. The goal would be to chemically degrade high explosives in the subsurface soil to prevent continued movement of contaminants to the perched groundwater. Institutional controls as described in Alternative 2 would also be implemented under this alternative.

Evaluation against criteria:

- *In situ* ozone is protective of human health and the environment and complies with all relevant local, state and federal laws and regulations.
- *In situ* ozone achieves long-term effectiveness and reduces toxicity, mobility, and volume of waste because the treatment results in the active destruction of contaminants.
- *In situ* ozone involves specialized technology which requires additional time and effort to construct and install. Construction activities present a greater risk to workers when compared to other alternatives.
- Cost for *in situ* ozone is generally higher than the other alternatives evaluated.

Newly installed landfill covers appear black in this June 2005 photo of the Burning Ground and Playa 3.

Preferred Remedial Action Alternatives for Soil Units

The following sections summarize how well each alternative meets the threshold and balancing criteria as applied to each soil unit. The preferred alternative and the rationale for choosing the preferred alternative for each soil unit is provided, based on the evaluation of the criteria. The evaluation is presented by type of risk: direct contact risk to workers or potential impact to groundwater. The following soil units will also be considered in developing the groundwater monitoring and long-term stewardship programs.

Soil Units with Direct Contact Risk to Workers

For these units, alternatives were evaluated to determine if additional remedial action is required to protect workers; therefore, not all alternatives were applicable or evaluated for each soil unit. For example, because a cover that effectively protects human health and the environment is already in place at the Former Ash Disposal Trench, soil removal and installation of a cover were not considered in the alternatives evaluated for this unit. Additionally, for these units, "No Action" was evaluated as "No Additional Action."

Burning Ground Former Ash Disposal Trench: Preferred Additional Remedial Action

The former ash disposal trench is between two former burn pads in the central portion of the Burning Ground. The central portion of the Burning Ground now contains burn trays, which are active permitted units. The Burning Ground has limited access, with fencing and a locked gate for entry.

The risk assessment determined that potential health risks to workers (industrial and construction) that could be present at the release area were above an acceptable risk range and would require cleanup or measures to control worker exposure to soils.

A soil cover, consisting of a synthetic liner with a soil overlay, was placed on the trench as an early remedial action before completion of the Corrective Measure Study/Feasibility Study. This soil cover was chosen as an early remedial action because of the limited options for reducing worker risk at this release area. Other options considered include soil removal, composting of soils, and *in situ* bioremediation. These options were unable to be implemented or the treatment would not be effective enough to achieve cleanup goals.

Because the soil cover is already in place and effectively prevents direct contact worker exposure, the alternative analysis in this Proposed Plan evaluates whether additional actions are necessary for the former ash disposal trench.

Final Preferred Remedial Action for the Burning Ground Former Ash Disposal Trench

- Finalize early remedial action—retain soil cover to prevent direct contact pathway for the worker. The cover will be inspected and maintained as part of the long-term environmental stewardship program.
- Institutional controls to prevent unauthorized access and limit worker activity (such as excavation).

Comparative Analysis of Additional Remedial Actions for the Burning Ground Former Ash Disposal Trench

Alternative	Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume of Waste	Short-Term Effectiveness	Implementability	Cost
Alternative 1: No Action			▮	▮	▮▮▮▮	▮▮▮▮	None
Alternative 2: Institutional Controls	✓	✓	▮▮	▮	▮▮▮▮	▮▮▮▮	$<

Based on the comparative analysis, the preferred additional remedial action alternative for the Burning Ground Former Ash Disposal Trench is Alternative 2: Institutional Controls. Alternative 2, with the soil cover already in place, meets the remedial action objectives and provides the best balance with respect to the evaluation criteria.

No action (Alternative 1) would not ensure land use is restricted. The soil cover that was installed as an early action reduces the direct contact risk to workers. Although this unit does not require groundwater protection, the soil cover also minimizes storm water infiltration that could cause contaminants to move downward. Institutional controls (Alternative 2) will prevent unauthorized access and ensure that the soil cover is undisturbed and continues to be fully protective of human health and the environment.

Firing Site 5 (SWMU 70): Preferred Additional Remedial Action

Firing Site 5 was used from 1953 until 1985 to test the behavior of simulated weapons components containing depleted uranium. In 1996 and 1997, Pantex conducted an interim corrective measure at Firing Site 5 that included excavation and offsite disposal of nearly 1,800 cubic yards of contaminated soil, decontamination and demolition of the facilities, and backfill of the area inside the berm with clean soil. Access to the Firing Sites, including Firing Site 5, is highly restricted. Because the former facilities were completely removed as part of the interim corrective measure, the area is not currently used and will not be used in the future.

Excavation of soil at FS-5 during the interim corrective measure, 1997.

After completion of the interim corrective measure, a risk assessment was performed in 1999 to determine whether the cleanup met acceptable risk criteria. Although results indicated the cleanup was effective in reducing risk to acceptable levels for an onsite worker and offsite resident farmer, the risk assessment was updated in 2007 to include newer risk assessment methods and toxicity information. Because of changes in toxicity information, the results of the 2007 risk assessment indicate risk is at unacceptable levels for a hypothetical full-time onsite worker exposed to depleted uranium remaining in soils at the unit. The remaining depleted uranium does not pose a risk to an offsite resident farmer that may live near Firing Site 5.

The interim corrective measure removed contaminated soil that presented the majority of the risk at Firing Site 5. The remaining contaminated soil is distributed across the entire area of the former firing site. The risk to current workers is acceptable because they are only present during mowing to control fire risk. Future worker exposure will continue to be controlled or managed, so the future risk to workers will remain low. Vegetative cover at the site minimizes wind blown dispersion for protection of workers and offsite residents.

Comparative Analysis of Additional Remedial Actions for SWMU 70 Surface Soil

Alternative	Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume of Waste	Short-Term Effectiveness	Implementability	Cost
Alternative 1: No Action			▮	▮	▮▮▮▮	▮▮▮▮	None
Alternative 2: Institutional Controls	✓	✓	▮▮▮	▮	▮▮▮	▮▮▮▮	$270k
Alternative 3: Soil Cover	✓	✓	▮▮▮▮	▮▮	▮▮▮	▮▮▮▮	$1.9M
Alternative 4: Removal and Offsite Disposal	✓	✓	▮▮▮▮	▮▮▮▮	▮▮	▮▮▮	$24M

Based on the comparative analysis, the preferred remedial action alternative for Firing Site 5 is Alternative 2: Institutional Controls. Because the area is not used and access is controlled, workers are currently protected from exposure to the remaining contamination in the soil. Since contamination hot spots were previously removed and remaining contamination is distributed more uniformly across the area, additional removal and offsite disposal of contaminated soil (Alternative 4) will not be as effective as previous actions. In addition, the excavation of large areas of the site and shipping of hundreds of truckloads of soil to the offsite disposal facility results in a greater risk of worker injuries during implementation of the alternative than the risk to onsite workers of leaving the contamination in place. Implementation of Alternative 4 is also cost prohibitive because the unit covers such a large area.

In comparison to institutional controls (Alternative 2), installing a soil cover with institutional controls (Alternative 3) only slightly reduces the risk to onsite workers and is more difficult and costly to implement. Continuing to implement institutional controls to limit access and control use effectively mitigates any remaining risks, and provides the best balance among the other alternatives with respect to the evaluation criteria.

Final Preferred Remedial Action for Firing Site 5

- Finalize early remedial action—soil removal and facility decontamination and demolition.
- Institutional controls to prevent unauthorized access, limit worker activity (such as excavation), and maintain or prevent disturbance of vegetative cover.

SWMUs 25, 26 and 27: Preferred Additional Remedial Action

SWMUs 25, 26, and 27 are inactive burn pads at the Burning Ground. The pads are located outside the current active permitted burn tray area in an area that is no longer used. Access to the Burning Ground is limited by fencing and a locked gate.

Removal and offsite disposal (Alternative 4) of the upper soils was conducted during the investigation at SWMU 27 because of the presence of depleted uranium in the upper soils. The early remedial action removed the majority of the risk at this unit. No early remedial actions were performed at SWMUs 25 and 26 because depleted uranium concentrations were much lower.

The human health risk assessment determined that risk to onsite workers was above acceptable risk levels for individual contaminants. The risk to potential onsite workers is acceptable when the area is controlled or managed to reduce worker exposure.

The comparative analysis looked at whether further remedial actions need to be performed for protection of workers.

Excavation of soil at the Burning Ground.

Comparative Analysis of Additional Remedial Actions for SWMUs 25, 26, & 27 Surface Soil

Alternative	Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume of Waste	Short-Term Effectiveness	Implementability	Cost
Alternative 1: No Action			▂	▂	▂▃▄▅	▂▃▄▅	None
Alternative 2: Institutional Controls	✓	✓	▂▃▄	▂	▂▃▄▅	▂▃▄▅	$<
Alternative 3: Soil Cover	✓	✓	▂▃▄▅	▂▃	▂▃▄▅	▂▃▄▅	$300k
Alternative 4: Removal and Offsite Disposal*	✓	✓	▂▃▄▅▆	▂▃▄▅▆	▂▃▄	▂▃▄▅	$680k

*Evaluation does not include SWMU 27

Based on the comparative analysis, the preferred alternative for SWMUs 25, 26, and 27 is Alternative 2: Institutional Controls.

Removal and offsite disposal (Alternative 4) provides the least amount of short-term effectiveness because there is a higher likelihood of worker injuries during implementation of the alternative, for a small amount of risk reduction to workers that infrequently enter the area. Installing a soil cover (Alternative 3) only slightly reduces the direct contact risk experienced by onsite workers and is more difficult and costly to implement. Implementing institutional controls presents the best balance of short-term effectiveness, overall protectiveness, and cost.

Final Preferred Remedial Action for SWMUs 25, 26, and 27

- Finalize early remedial action for removal of soils to reduce risk to workers that may be present.
- Institutional controls to limit worker activity at the old burn pads.

Soil Units with Direct Contact Risk to Workers and the Potential to Impact Groundwater

For these units, alternatives were evaluated to determine actions required to prevent movement of contaminants to groundwater and to protect workers. Alternatives were evaluated to determine if additional remedial action is required to protect groundwater because early remedial actions have been implemented; therefore, not all alternatives were applicable or evaluated for each soil unit.

SWMUs 2 and 5-05: Preferred Additional Remedial Action

SWMUs 2 and 5-05 are ditches that drain the east central portion of Zone 12 at a former industrial water treatment plant. These ditches are in a high security zone with limited access.

The human health risk assessment determined that the risk to onsite workers is unacceptable for contaminants present in the upper soils of the ditches. Deep soils in this area continue to contribute high explosives to perched groundwater because of past wastewater discharges to the ditches. Early remedial actions, soil liners, have been installed in this area to reduce infiltration of rain water and thereby minimize the continued leaching of high explosives from the soil beneath the ditch to the perched groundwater.

SWMU 5-05 after installation of the ditch liner.

The soil liners also reduce the risk to workers to acceptable levels by reducing exposure of workers to soils in the ditch. For the alternative analysis, these SWMUs are evaluated for additional actions required to determine the practicability and effectiveness of further reducing the downward movement of contaminants to perched groundwater.

Based on the comparative analysis, the preferred alternative for SWMU 2 and SWMU 5-05 is Alternative 2: Institutional Controls. No action (Alternative 1) would not ensure land use is restricted. *In situ* ozone treatment (Alternative 5) is difficult to implement because it requires specialized technology, has a high implementation cost, and achieves very little reduction in the mobility of contaminants

Comparative Analysis of Additional Remedial Actions for SWMUs 2 and 5-05

Alternative	Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume of Waste	Short-Term Effectiveness	Implementability	Cost
Alternative 1: No Action			▪	▪	▪▪▪▪	▪▪▪▪	None
Alternative 2: Institutional Controls	✓	✓	▪▪	▪	▪▪▪▪	▪▪▪▪	$<
Alternative 4: Removal and Offsite Disposal	Alternative 4 was not considered as an alternative because the contamination in the subsurface at SWMUs 2 and 5-05 is too deep to remove.						
Alternative 5: *In Situ* Ozone Treatment	✓	✓	▪▪▪	▪▪▪▪	▪▪▪	▪▪▪	$2.6M

in comparison to the liners already installed. The effectiveness of Alternative 5 is also not clear. Like the soil liners, *in situ* ozone treatment targets the soils at or near the ground surface. In the areas where liners have been installed, the downward movement of contaminants is still occurring in soils deeper than 200 feet.

Implementing institutional controls will ensure that the synthetic liners are properly maintained and will restrict site access and land use to control exposure risks. Thus, Alternative 2: Institutional Controls provides the best balance among the other alternatives with respect to the evaluation criteria.

Final Preferred Remedial Action for SWMUs 2 and 5-05

- Maintain ditch liners to reduce worker risk and to reduce movement of contaminants in soil to the perched groundwater.
- Institutional controls to limit worker activity and future use of the ditches for stormwater only.

SWMU 5-12a: Preferred Remedial Action

SWMU 5-12a is the drainage ditch along the eastern side of Zone 12 that carries stormwater runoff to Playa 1. Much of this ditch is enclosed in high security fencing and access is highly restricted so workers are almost never present in this area.

Soil removal has been implemented as an early remedial action at SWMU 5-12a. However, risk assessment results indicate that the upper soils may pose a risk to workers that could be present in the area, and contamination deep in the soils from past wastewater discharges to the ditches is predicted to continue impacting perched groundwater in the future. The alternative analysis was performed to determine if further corrective measures are necessary.

Based on the comparative analysis, the preferred remedial action alternative for SWMU 5-12a is Alternative 2: Institutional Controls.

Installing a synthetic liner with institutional controls (Alternative 3) would effectively break the direct contact risk pathway if workers are present. However, risk is only slightly elevated and soil concentrations are already near the cleanup goal. Evaluation of the liners installed at SWMUs 2 and 5-05 indicates a liner that minimizes infiltration of water at the ground surface may not effectively mitigate movement of contaminants at depth. Groundwater data collected at the source areas over time indicate that the continued release of contaminants from soil to the perched groundwater is not further degrading the water quality. Current perched groundwater concentrations at source areas are much lower than in areas outside the source. Therefore, the synthetic liner is only slightly more effective than institutional controls (Alternative 2) at reducing risk. Installing a synthetic liner is more difficult and costly to implement.

In situ ozone treatment with institutional controls (Alternative 5) is more effective at reducing toxicity, mobility or volume of waste, but requires specialized technology and has a high implementation cost at greater depths. Alternative 5 also achieves very little overall reduction in direct contact risk in comparison to institutional controls (Alternative 2). Institutional controls will effectively address the direct contact risk, and provide the best balance among the other alternatives with respect to the evaluation criteria.

Comparative Analysis for SWMU 5-12a

Alternative	Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume of Waste	Short-Term Effectiveness	Implementability	Cost
Alternative 1: No Action			▮	▮	▮▮▮▮▮	▮▮▮▮▮	None
Alternative 2: Institutional Controls	✓	✓	▮▮	▮	▮▮▮▮▮	▮▮▮▮▮	$<
Alternative 3: Synthetic Liner	✓	✓	▮▮	▮▮	▮▮	▮▮▮	$3.7M
Alternative 4: Removal and Offsite Disposal	Alternative 4 was not considered as an alternative because the contamination in the subsurface at 5-12a is too deep to remove using conventional excavation equipment.						
Alternative 5: *In Situ* Ozone Treatment	✓	✓	▮▮▮	▮▮▮▮	▮▮▮	▮▮▮	$11M

Final Preferred Remedial Action for SWMU 5-12a

- Finalize early actions that included removal of upper soils.
- Institutional controls to limit worker activity and future use of the ditches for stormwater only.

Soil Units with Presumptive Remedies

Under CERCLA, a presumptive remedy is a preferred technology that EPA believes, based upon its past experience, will be the most appropriate remedy for certain types of sites. Presumptive remedies reduce the time and cost of overall site cleanup by streamlining site investigation and selection of cleanup actions for particular sites.

The presumptive remedies implemented at Pantex Plant are soil vapor extraction (SVE) for soils contaminated with volatile organic compounds and containment for landfills.

Pantex Presumptive Remedies

Soil vapor extraction (SVE) is a process which physically removes contaminants from subsurface soil by inducing air flow. Flowing air strips volatile compounds from the soil solids and carries them to extraction wells through which they are collected and treated. SVE is a presumptive remedy for Superfund sites with volatile organic contaminated soil. (*Presumptive Remedies: Site Characterization and Technology Selection For CERCLA Sites With Volatile Organic Compounds In Soils*; http://www.epa.gov/superfund/policy/remedy/presump/finalpdf/scts.pdf)

Containment is achieved by placing a cover over designated materials to prevent exposure and to properly channel the drainage of water. Containment is the presumptive remedy for municipal and industrial waste landfills at Superfund sites. (*Presumptive Remedies for Municipal Landfill Sites*, http://www.epa.gov/superfund/policy/remedy/presump/clms.htm)

Installation of piping and manifold for a soil vapor extraction system at Pantex.

Solvent Evaporation Pit (SWMU 47): Preferred Remedial Action

The solvent evaporation pit was previously used for solvent disposal at the Burning Ground. This practice contributed volatile organic contamination to soils above the perched groundwater zone. In 2002, a soil vapor extraction and treatment system was constructed as an interim stabilization measure to address the volatile organic compounds detected at SWMU 47. Twenty-eight extraction wells were installed in the vicinity of SWMU 47 to extract and treat vaporized contaminants. Since it began operation, the Burning Ground soil vapor extraction system has removed and treated more than 12,700 pounds of solvents.

A detailed analysis of alternatives for SWMU 47 was not performed because soil vapor extraction is one of the presumptive remedies recognized by the EPA for volatile organic contamination in soil. The soil vapor extraction and treatment system was evaluated along with the "no action" alternative against the evaluation criteria in the Corrective Measure Study/Feasibility Study, and USDOE/NNSA determined that soil vapor extraction successfully meets the threshold and balancing criteria. The preferred alternative for SWMU 47 is to adopt soil vapor extraction as the final remedial action. After most of the solvents are removed from the soil, soil vapor extraction becomes much less effective. When this occurs, the system will be adapted to operate passively to complete the cleanup.

Final Preferred Remedial Action for SWMU 47

- Soil vapor extraction.
- Institutional controls to limit deep drilling in these areas.

Vegetative cover on Landfill 1.

Pantex Plant Landfills: Preferred Remedial Action

Landfills, found in many areas across Pantex, include construction debris (from demolition of buildings) and sanitary and industrial waste landfills from the former Pantex Ordnance Plant and from Pantex Plant. A cover has been installed on each landfill consistent with EPA's presumptive remedy for landfills, which is containment. Hotspot removal was also conducted at some landfills to supplement the effectiveness of containment. Containment was evaluated with the "no action" alternative against the evaluation criteria in the Corrective Measure Study/Feasibility Study, and USDOE/NNSA determined that containment successfully meets the threshold and balancing criteria. Containment meets the cleanup objectives for soil by effectively breaking exposure pathways and minimizing movement of water through the landfill debris; therefore, no further active remedial actions are necessary. The preferred alternative for the Pantex Plant landfills is to adopt the landfill covers as the final remedial actions.

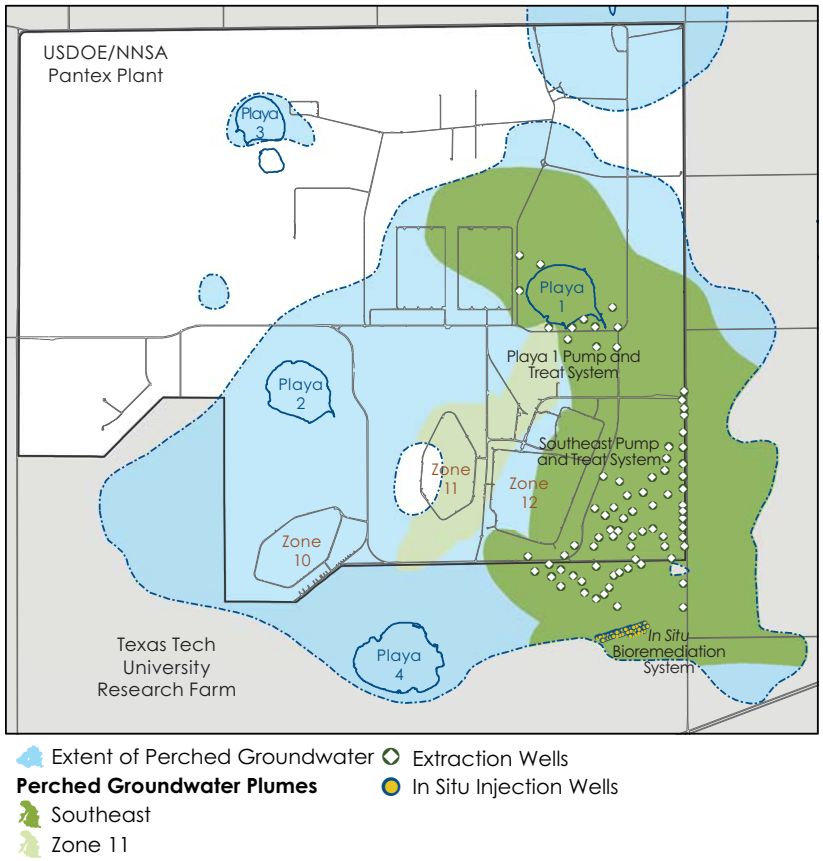
Final Preferred Remedial Action for Landfills

- Containment is the Preferred Remedial Action.
- Inspect and maintain covers to ensure effective water drainage away from the landfill.
- Institutional controls to limit worker activity and excavation in the landfill and to help protect the long-term integrity of the landfill covers.
- Manage uncertainties about landfill contents and leaching through long-term groundwater monitoring.

Remedial Action Alternatives Evaluated For Perched Groundwater

This section identifies the remedial action alternatives that were evaluated to address contaminants in perched groundwater and provides a summary of how well the alternatives achieve the threshold and balancing criteria. The preferred alternatives and the rationale used to select each preferred alternative is also provided.

Remedial action alternatives were evaluated for the two main plumes of contaminated perched groundwater shown in the figure: the southeast area and beneath Zone 11. The alternatives are evaluated separately for each of these plumes. The risk assessment results and CERCLA/RCRA regulations were used to help determine the areas that require remediation to prevent further plume expansion or downward movement to the Ogallala and to reduce risk in areas sensitive to vertical migration.



The risk assessment indicated that the use of contaminated perched groundwater would present health risks to onsite workers or to offsite residents if the water is used. Impacted perched groundwater is not used by Pantex and is controlled in onsite areas to prevent this risk. The risk assessment also indicated that perched groundwater, if left untreated, would likely impact the Ogallala Aquifer in an area south of Pantex on TTU property. In this area, water can move downward because the perching zone becomes thinner and more sandy. In other areas of the perched, groundwater moves downward through the perching zone very slowly allowing natural processes to reduce contaminant levels in perched groundwater before reaching the Ogallala Aquifer.

Interim corrective measures, interim stabilization measures, and removal actions (collectively referred to as early actions) have already been implemented to treat contaminants in perched groundwater, to stabilize the contaminant plume, and to ensure that the Ogallala Aquifer is protected as a drinking water source.

Early remedial actions for perched groundwater include:

- Installation of a pump and treat system in the more highly contaminated areas of the southeast perched groundwater where sufficient saturated thickness is available for pumping.
- Beneficial use of treated sanitary wastewater for irrigation and/or industrial use instead of discharge to Playa 1 to decrease the amount of water recharging the perched aquifer and to decrease the movement of perched groundwater and contamination to offsite areas.
- Installation of a second pump and treat system to decrease the mound of water beneath Playa 1 that pushes water to the south and southeast.
- Installation of an *in situ* bioremediation system south of Pantex on the TTU property to treat the thin saturated zones of the perched aquifer that are in an area sensitive to downward migration of groundwater.

The remedial action alternatives that were developed and evaluated in the Corrective Measure Study/Feasibility Study included making some or all of these early actions final.

Perched Groundwater Cleanup Considerations

Perched groundwater beneath Pantex is not a continuous large aquifer like the Ogallala Aquifer so cleaning up the perched groundwater presents some challenges. Considerations for cleanup include:

- The perched groundwater becomes very thin near the outer edges of the aquifer (to the east and south of Pantex). This prevents the use of pump and treat technologies in these areas.
- Perched groundwater has thicker saturated zones (more than 15 feet) that allow treatment using pump and treat technologies. However, this does not allow complete stabilization of all perched groundwater.
- Perched groundwater is deep (about 260 feet) and some areas of the fine-grained zone are thin making it difficult and unsafe to implement some technologies, such as horizontal drilling. If the technology could be implemented with precision at such depths, horizontal wells could provide much larger *in situ* treatment areas or greater pumping rates for extraction.
- Mounded water beneath Playa 1 continues to push perched groundwater away from the playa and towards offsite areas.
- *In situ* treatments are costly to implement and some technologies work more efficiently than others in the chemical and geologic conditions found in perched groundwater beneath Pantex.
  - » Pantex created an Innovative Technologies Remediation Demonstration (ITRD) Project Group that evaluated possible technologies for use in the final perched groundwater remedy. This group guided laboratory and field-scale pilot studies to determine the most reliable technologies that can reduce or stabilize contamination to meet cleanup requirements.
  - » The ITRD Project evaluated *in situ* treatment technologies including redox manipulation, enhanced anaerobic bioremediation, and chemical oxidation. Testing showed that some of these technologies do not effectively treat all contaminants found in perched groundwater. Other technologies work well, but are not cost effective for treating large areas because of the number of wells or number of amendment injections required.

Remedial Technologies and Actions Considered in the Perched Groundwater Alternatives Evaluation

The following remedial technologies or actions were considered in the development of remedial action alternatives to treat contaminated perched groundwater at Pantex Plant:

- **Institutional Controls:** Institutional controls are non-engineered tools, such as administrative and/or legal controls, that minimize the potential for human exposure to contaminants by limiting land or resource use. Examples of institutional controls include: land and natural resource use restrictions, groundwater drilling and well restrictions, deed restrictions, deed notices, property purchase, and education.
- **Monitored Natural Attenuation (MNA):** MNA is the reliance on natural processes to break down contaminants. Natural attenuation processes include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants.
- **Pump and Treat:** Remedial process that removes impacted groundwater from the aquifer and then treats it through a system designed to remove or reduce the contaminants to levels protective of human health and the environment.
- ***In Situ* Enhanced Anaerobic Bioremediation:** Remediation process that enhances the natural environment so that bacteria already present in the aquifer will degrade or break down organic contaminants. Organic contaminants turn into methane, carbon dioxide, and hydrogen gas, which do not pose a human health risk. This technology requires infrequent additions to maintain the enhanced environment.
- ***In Situ* Chemical Oxidation:** Remediation process that injects chemical additives into the aquifer to chemically react with the contaminants so that contaminants break down to products that do not pose a human health risk. Common oxidizing agents that are injected include ozone, hydrogen peroxide, sodium persulfate, and potassium permanganate. This technology requires multiple frequent additions to the aquifer to treat the groundwater as it moves through the aquifer.
- ***In Situ* Redox Manipulation:** Remediation process that injects chemical additives, such as sodium dithionite or calcium polysulfide, into the aquifer to set up a treatment zone to break down or immobilize a variety of contaminants as water moves through the treatment zone. This technology does not require multiple additions to the aquifer to be effective. Enhanced anaerobic bioremediation can also establish a redox manipulation treatment zone.
- **Dewatering the Perched Zone:** Removal of groundwater from the aquifer by pumping to decrease water levels. This action reduces the total volume of perched groundwater and can stabilize the movement of perched groundwater and dissolved contaminants. Although complete dewatering is not possible, natural attenuation processes will reduce contaminant levels in the remaining groundwater.

Alternatives Evaluated for Southeast Perched Groundwater

Early actions have already been implemented to treat the southeast perched groundwater and to ensure that the Ogallala Aquifer is protected as a drinking water source. The remedial action alternatives that were developed and evaluated in the Corrective Measure Study/Feasibility Study included making these early actions final. The alternatives are progressively evaluated to determine the most cost effective and practical methods that can be applied to achieve the remedial action objectives.

Alternative 1: No Action

Under this alternative, no measures would be implemented to reduce or contain contaminants in the southeast perched groundwater: all early actions would be discontinued and no additional measures would be taken to reduce movement of contaminants above drinking water standards. The current groundwater monitoring program would also be discontinued under this alternative. Pantex Plant would not restrict use of perched groundwater onsite or offsite. The National Oil and Hazardous Substance Pollution Contingency Plan requires that "no action" be included among the alternatives evaluated in the Corrective Measure Study/Feasibility Study, as detailed in the Code of Federal Regulations (40 CFR §300.430(e)(6)), as a baseline for comparison to the other alternatives.

Evaluation against criteria:

- No action is not protective of human health and the environment and does not comply with relevant local, state and federal laws and regulations. This alternative cannot be considered as a final remedy because it does not meet the threshold criteria.

Sampling technician measuring depth to water.

Alternative 2: Institutional Controls and Monitored Natural Attenuation

Alternative 2 is similar to the No Action alternative; however, under this alternative long-term groundwater monitoring will continue. This alternative relies on natural breakdown processes to reduce concentrations of contaminants. Additional monitoring wells in the perched groundwater would be added to the current network to better understand the movement and changes in concentrations of contaminants. Institutional controls would be used to prevent exposure and consumption of impacted perched groundwater.

Evaluation against criteria:

- Institutional controls are protective of human health because they restrict access to contaminated groundwater. However, since institutional controls would not actively treat contaminants in perched groundwater, this alternative does not comply with relevant local, state and federal laws and regulations. This alternative cannot be considered as a final remedy because it does not meet the threshold criteria.

Considerations for Alternatives 1 and 2

These alternatives do not meet remedial action objectives because:

- Neither alternative stabilizes the plume of contamination to prevent continued movement offsite.
- Monitored natural attenuation reduces contaminant levels at a very slow rate. Areas sensitive to vertical migration of perched groundwater may not be protected because contaminants may move to the Ogallala Aquifer before they have time to attenuate.
- Areas sensitive to vertical migration will not be protected in a shorter timeframe with either of these alternatives.
- Use of Alternative 1 will not control exposure to perched groundwater.

Alternative 3: Pump and Treat, Institutional Controls, and Monitored Natural Attenuation

Under Alternative 3 the current perched groundwater pump and treat system would remain in use to achieve remedial action objectives; however, no additional remedial actions would be undertaken to treat, contain, or remove southeast perched groundwater and all other early actions would be discontinued. Extracted groundwater would continue to be processed in the existing aboveground treatment plant to remove high explosives, volatile organic compounds, and metals. Natural contaminant breakdown processes are also considered in the evaluation of this alternative. This alternative uses institutional controls to limit exposure and consumption of impacted perched groundwater.

Evaluation against criteria:

- Pump and treat is protective of human health and the environment and complies with all relevant local, state and federal laws and regulations.
- Pump and treat successfully meets the short-term effectiveness and implementability criteria because the infrastructure has already been constructed.
- Pump and treat does not achieve long-term effectiveness and reduction in mobility, toxicity, or volume of waste criteria. The capability of the pump and treat technology to effectively stabilize by itself all of the contaminants of concern in perched groundwater is limited by site hydrogeologic conditions, such as low extraction well flow rates caused by limited saturated thickness of the aquifer. Therefore, Alternative 3 is not as effective as Alternatives 4 and 5 where more contamination is removed.
- Pump and treat capital costs ($3,200,000) and long-term operations and maintenance costs ($40,000,000) are lower than the other active remediation alternatives.

Alternative 3 Considerations

- The current pump and treat system cannot completely stabilize the perched groundwater plume.
  - » Because treated water would continue to be injected back into the perched with this option, dewatering of the perched would not occur and the driving force that causes the water to move would not be reduced. Thus, contaminated water would continue to move offsite.
- Pumping is not effective in the thin saturated zones of the perched aquifer, including sensitive areas where contaminated water can migrate downward. These areas would not be treated.
- Monitored natural attenuation reduces contaminant levels at a very slow rate. Areas sensitive to vertical migration of perched groundwater may not be protected because contaminants may move to the Ogallala Aquifer before they have time to attenuate.
- Areas sensitive to vertical migration would not be protected in a shorter timeframe.
- Human health would be protected because exposure to perched groundwater can be controlled.
- Monitored natural attenuation is effective in areas where much longer contaminant travel times to the Ogallala Aquifer were predicted in the risk assessment. Longer travel times allow time for natural breakdown to occur in areas east of Pantex.

Groundwater pump and treat system at Pantex.

Southeast Pump and Treat System Early Action

As an early action, a pump and treat system was installed in the more highly contaminated areas of the southeast perched groundwater where sufficient saturated thickness is available for pumping. This system includes 65 extraction wells to help prevent further plume migration to offsite areas. High explosives, volatile organic compounds, and metals are removed from the water using a combination of granular activated carbon, ion exchange, and other appropriate technologies. Treated water is used onsite for subsurface irrigation or is injected back into the perched groundwater.

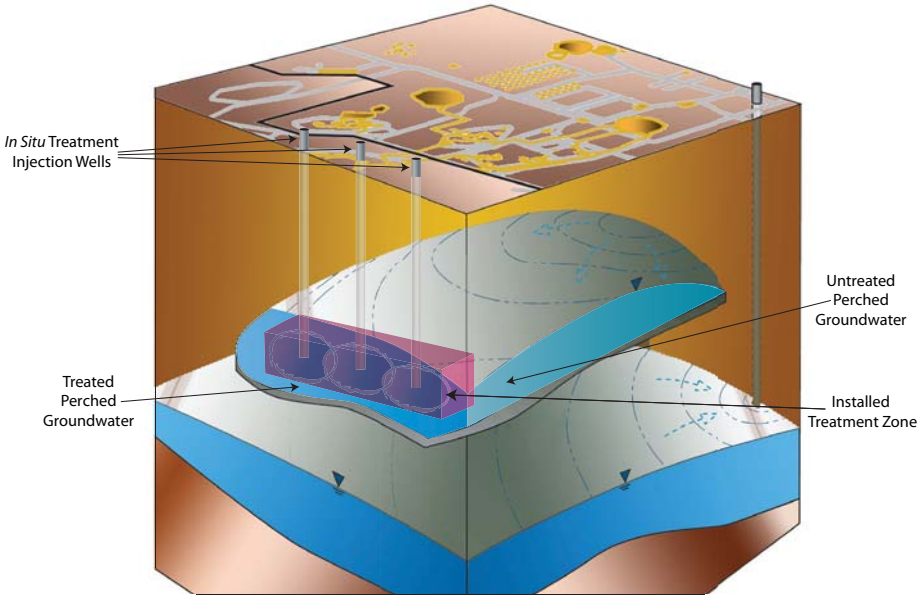
Alternative 4: Targeted *In Situ* Treatment, Institutional Controls, and Monitored Natural Attenuation

Alternative 4 provides for *in situ* treatment targeted at the southern and eastern areas of the southeast perched groundwater at Pantex Plant. All other early actions would be stopped. Several *in situ* remediation technologies are currently being investigated at Pantex Plant. These technologies include enhanced anaerobic bioremediation, *in situ* redox manipulation, and chemical oxidation. Natural contaminant breakdown processes are also considered in the evaluation of this alternative. This alternative uses institutional controls to limit exposure and consumption of impacted perched groundwater while the contaminants are treated *in situ* or breakdown naturally.

Evaluation against criteria:

- Targeted *in situ* treatment meets both threshold criteria because it is protective of human health and the environment and is compliant with all relevant local, state, and federal laws and regulations.
- *In situ* treatment successfully achieves long term effectiveness and reduction in toxicity, mobility, or volume of waste because it is the most effective at removing contaminants when compared to Alternatives 3 and 5.
- *In situ* treatment requires major construction, which increases short-term exposure risk to workers and is more difficult to implement.
- The capital cost of targeted *in situ* treatment is $45,000,000, which is much higher than the other alternatives because of the high number of wells required to treat the large area of perched groundwater. Operations and maintenance costs are also extremely high at $620,000,000.

Sampling technicians making repairs to a well.



Graphical representation of an installed permeable treatment zone in perched groundwater.

Alternative 4 Considerations

- *In situ* treatment would stabilize the plume only in the areas treated. The driving force that causes the water to move would not be reduced, so perched groundwater would continue to move offsite.
- Only limited areas can be treated with this technology because it is very expensive to implement with the use of vertical wells. Many injection wells are needed to create a continuous treatment zone, but the cost to drill each well is high because of the depth to perched groundwater at Pantex.
- Human health would be protected because exposure to perched groundwater can be controlled.
- Monitored natural attenuation is effective in areas where much longer contaminant travel times to the Ogallala Aquifer were predicted in the risk assessment. Longer travel times allow time for natural breakdown to occur in areas east of Pantex.

Alternative 5: Finalize Early Actions (Pump and Treat and *In Situ* Treatment) Institutional Controls, and Monitored Natural Attenuation

Early actions have already been implemented to reduce concentrations, control migration, or prevent exposure to impacted southeast perched groundwater. Alternative 5 leverages a combination of technologies, including the use of enhanced early actions, to address the remedial action objectives. The following early actions and enhancements were considered in Alternative 5:

- Continued use of the current pump and treat system in the southeastern portion of the perched aquifer. Changes or enhancements to the current pump and treat system include:
  - » Injection of treated groundwater into the perched zone will be eliminated or reduced to the extent practical to allow perched groundwater to be dewatered in the treatment area so that the groundwater can be better stabilized.
  - » Conveyance of treated water to a subsurface irrigation system or to an offsite disposal or beneficial reuse location to eliminate or reduce injection back into the perched zone.
- Extraction of groundwater near Playa 1 to decrease the mound of water created by recharge from past industrial and sanitary wastewater discharges to the playa. Extraction of water from this area will provide long-term stabilization of the southeast plume and reduce the total volume of perched groundwater.
- Targeted *in situ* treatment using enhanced anaerobic bioremediation along the southern edge of the perched groundwater to treat contaminants in areas sensitive to downward migration to the Ogallala Aquifer.

In addition to the early actions described above, Alternative 5 includes additional wells to monitor the effectiveness of contaminant degradation and institutional controls to prevent current and future exposure to perched groundwater contamination. Monitored natural attenuation would also be conducted as described in Alternatives 2 and 3.

Sampling treated water from the pump and treat system.

Injecting amendment into perched groundwater to create a permeable treatment zone.

Evaluation against criteria:

- Alternative 5 meets both threshold criteria because it is protective of human health and the environment and is compliant with all relevant local, state, and federal laws and regulations.
- Alternative 5 is successful in achieving long-term effectiveness and reduction in toxicity, mobility, or volume of waste because it is more effective at removing contaminants when compared to Alternative 3 and almost as effective as Alternative 4.
- Alternative 5 successfully meets the short-term effectiveness and implementability criteria because the major components of the infrastructure have already been constructed.
- The estimated capital costs to implement Alternative 5 are $25,000,000. Thirty year operations and maintenance costs are estimated to be $110,000,000.

Comparative Analysis of Southeast Perched Groundwater Alternatives

Alternative	Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume of Waste	Short-Term Effectiveness	Implementability	Cost		
							Capital	Total O&M	Total
Alternative 1: No Action							None		
Alternative 2: Institutional Controls and MNA	✓						$2.3M	$12M	$15M
Alternative 3: Pump and Treat, ICs, and MNA	✓	✓					$3.2M	$40M	$43M
Alternative 4: Targeted *In Situ* Treatment, ICs, and MNA	✓	✓					$45M	$620M	$665M
Alternative 5: Finalize Early Actions, Pump and Treat, *In Situ* Treatment, ICs, and MNA	✓	✓					$25M	$110M	$135M

ICs: Institutional Controls
MNA: Monitored Natural Attenuation

Costs of early actions taken after the risk assessments (15 new extraction wells, Playa 1 pump and treat system, and *in situ* bioremediation wells) are included in these estimates.

Alternative 5 Considerations

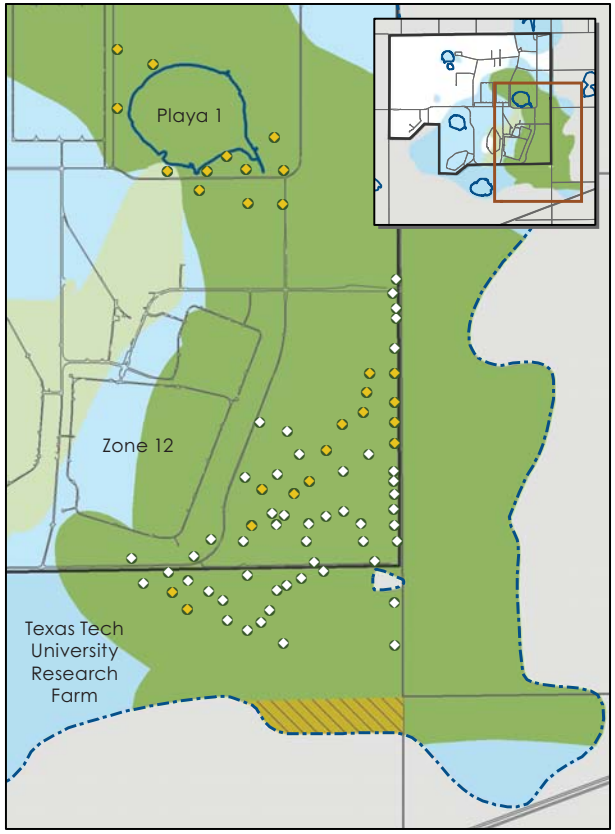
- The combination of dewatering in the southeast area and extraction of perched groundwater near Playa 1 can stabilize the southeast perched groundwater plume.
  - » This alternative includes monitoring of groundwater to ensure stabilization, as well as contingencies in case plume movement to the far southeast area of perched groundwater cannot be stabilized. Contingencies are discussed on page 43.
  - » Dewatering is expected to decrease water levels so that the saturated thickness is less than 10 feet throughout the treated area.
  - » Monitored natural attenuation will continue to remove contaminants remaining after groundwater extraction becomes ineffective. Attenuation to safe levels in perched groundwater is estimated to be on the order of two to three lifetimes.
- Thin saturated areas are treated using either monitored natural attenuation or *in situ* treatment methods.
  - » The areas most sensitive to downward migration are treated using *in situ* treatment technologies. These areas will be permanently treated to groundwater cleanup standards within approximately one year.
  - » Monitored natural attenuation is used in areas where much longer contaminant travel times to the Ogallala Aquifer were predicted in the risk assessment to allow sufficient time for natural attenuation to occur.
- Human health is protected because exposure to perched groundwater can be controlled.

PREFERRED ALTERNATIVE FOR SOUTHEAST PERCHED GROUNDWATER

Based on the comparative analysis of alternatives, the preferred remedial action alternative for southeast perched groundwater is Alternative 5: Finalize Early Actions, Pump and Treat, *In Situ* Treatment, Institutional Controls, and Monitored Natural Attenuation.

Alternative 5 meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the evaluation criteria. Alternative 4 may be able to more effectively reduce the toxicity of the contaminants, but it is impractical because of the extremely high cost to implement. The existing pump and treat system (Alternative 3) is slightly effective in stabilizing the perched groundwater plume, but is not sufficient to protect human health and the environment by itself because it is the least effective at removing contaminants from perched groundwater. Alternative 5 is the preferred alternative because it is the most cost-effective and practical alternative that will achieve substantive current and future protection of human health and the environment.

The figure to the right shows the areas of focus for perched groundwater remedial actions. The remedial action will be monitored and evaluated periodically to determine if contingency actions identified on page 43 will need to be implemented. If the analysis of data collected following remedial action implementation indicates the plume is not stable, contingency actions will be evaluated to determine the ones appropriate for improving the remedy.



Final Preferred Remedial Action for Southeast Perched Groundwater

- Continue extraction of perched groundwater in the southeast area and at Playa 1 to remove contaminants, dewater portions of the aquifer, and stabilize plume migration.
  - » Discontinue, to the extent possible, injection of treated water back into the perched zone.
- Continue enhanced *in situ* anaerobic bioremediation to establish permeable treatment zones in the perched groundwater south of Pantex to prevent downward movement of contaminants to the Ogallala Aquifer.
- Implement institutional controls to restrict groundwater drilling and use.
- Monitored natural attenuation in areas where engineered treatment technologies are more difficult and costly to implement and where contaminants are not expected to migrate to the Ogallala Aquifer for long periods of time, allowing time for monitored natural attenuation to reduce contamination.
- Monitor groundwater in the perched and Ogallala aquifers to verify plume stability, effectiveness of the treatments, and natural attenuation processes.
  - » Implement contingency actions if needed.

Zone 11 Perched Groundwater Cleanup Considerations

The same groundwater considerations discussed on page 32 also apply to Zone 11, with some exceptions as noted below.

- The plume of contaminated perched groundwater associated with Zone 11 is much smaller than the southeast plume as shown on page 31.
- Zone 11 perched groundwater contains fewer contaminants.
- The Zone 11 plume contains some contaminants that are not found in the southeast plume, so the same treatment options are not applicable.

These considerations require slightly different approaches to the alternatives considered for Zone 11.

Sampling technician connecting sample lines at the wellhead.

Alternatives Evaluated for Zone 11 Perched Groundwater

The remedial action alternatives for Zone 11 perched groundwater that were developed and evaluated against the threshold and balancing criteria are discussed in this section. The alternatives are progressively evaluated to determine the most cost effective and practical methods that can be applied to achieve the remedial action objectives.

Alternative 1: No Action

Under this alternative, no measures would be implemented to reduce or contain contamination in the Zone 11 perched groundwater. The current groundwater monitoring program would also be discontinued under this alternative. Pantex Plant would not restrict use of perched groundwater onsite or offsite. The National Oil and Hazardous Substance Pollution Contingency Plan requires that "no action" be included among the alternatives evaluated in the Corrective Measure Study/Feasibility Study, as detailed in the Code of Federal Regulations (40 CFR §300.430(e)(6)), as a baseline for comparison to the other alternatives.

Evaluation against criteria:

- No action is not protective of human health and the environment and does not comply with relevant local, state and federal laws and regulations. This alternative cannot be considered as a final remedy because it does not meet the threshold criteria.

Considerations for Alternative 1

This alternative does not meet remedial action objectives because:

- This alternative does not stabilize the plume of contamination and prevent continued offsite movement of contamination.
- Potential future use is not controlled so people could be exposed to the contamination.

Alternative 2: Institutional Controls and Monitored Natural Attenuation

Alternative 2 is similar to the No Action alternative; however, under this alternative long-term groundwater monitoring will continue. This alternative relies on natural contaminant breakdown to reduce contaminant concentrations. Additional monitoring wells in the perched groundwater would be added to the current network to better characterize the concentration and migration of constituents in the perched groundwater. Institutional controls would also be used to prevent onsite and offsite exposure pathways to impacted Zone 11 perched groundwater.

Evaluation against criteria:

- Institutional controls are protective of human health. However, since institutional controls would not actively treat contamination in the perched groundwater, this alternative does not comply with relevant local, state, and federal laws and regulations. This alternative cannot be considered as a final remedy because it does not meet the threshold criteria.

Geologist evaluating geophysical logs for a monitoring well.

Trenching for a conveyance line to carry water from a new extraction well to the treatment building.

Alternative 3: Pump and Treat, Institutional Controls and Monitored Natural Attenuation

This alternative uses institutional controls to limit exposure to Zone 11 perched groundwater contaminants. A perched groundwater pump and treat system for Zone 11 would be constructed and operated; however, no additional remedial actions would be undertaken to treat, contain, or remove perched groundwater at Zone 11 containing contaminants. An ex situ treatment system would be used to remove high explosives, volatile organic compounds, and perchlorate using granular activated carbon, ion exchange, and other appropriate technologies. Treated effluent would be discharged with the effluent from the southeast area pump and treat system or injected back into the perched zone for recirculation, depending on the selected design of the groundwater extraction system.

Evaluation against criteria:

- Pump and treat is protective of human health and the environment and complies with all relevant local, state and federal laws and regulations.
- Pump and treat successfully meets the short-term effectiveness and implementability criteria because the system is similar to the other pump and treat systems that have already been implemented at Pantex.
- Pump and treat may not achieve long-term effectiveness and reduction in mobility, toxicity, or volume of waste criteria because hydrogeologic conditions may limit the ability of a pump and treat system to effectively stabilize all of the constituents of concern in the plumes. Therefore, Alternative 3 may not provide long-term protection of human health and the environment.
- Pump and treat capital costs ($4,700,000) and long-term operations and maintenance costs ($26,000,000) are lower than the other active remediation alternatives.

Alternative 4: Targeted *In Situ* Treatment, Institutional Controls, and Monitored Natural Attenuation

In addition to the current institutional controls and monitoring program, this alternative provides for *in situ* treatment targeted to the south of Zone 11. *In situ* remediation technologies, including enhanced anaerobic bioremediation, *in situ* redox manipulation using either sodium dithionite or calcium polysulfide, and chemical oxidation using potassium permanganate, are currently being investigated at Pantex Plant. The one technology that has been demonstrated to be effective for high explosives, volatile organic compounds (including chlorinated solvents), and perchlorate is enhanced anaerobic bioremediation.

Evaluation against criteria:

- Targeted *in situ* treatment meets both threshold criteria because it is protective of human health and the environment and is compliant with all relevant local, state, and federal laws and regulations.
- *In situ* treatment successfully achieves long-term effectiveness and reduction in toxicity, mobility, or volume of waste because it is the most effective at removing contaminants when compared to Alternative 3.
- *In situ* treatment requires major construction, which increases short-term exposure risk to workers and is more difficult to implement.
- The capital cost of *in situ* treatment is $4,500,000, which is much higher than the other alternatives because of the treatment of a large area of perched groundwater. Operations and maintenance costs are also high at $31,000,000.

Sampling technicians preparing to video survey a well as part of the well maintenance program.

Considerations for Alternatives 2, 3, and 4

Alternative 2

- This alternative does not stabilize the plume of contamination nor does it prevent continued offsite movement of contaminants.
- Monitored natural attenuation reduces contaminant levels at a very slow rate. If contaminated groundwater from Zone 11 reached an area sensitive to vertical migration of perched groundwater, contaminants may move to the Ogallala Aquifer before they have time to attenuate.

Alternative 3

- A pump and treat system may not completely stabilize the perched groundwater plume.
- Pumping is not effective in the thin saturated zones of the perched aquifer, so these areas would not be treated.
- Areas sensitive to vertical migration may not be protected if the pump and treat system cannot stabilize plume movement.
- Human health is protected because exposure to perched groundwater can be controlled.

Alternative 4

- *In situ* treatment can stabilize the plume of contamination because the plume would be treated before moving offsite.
- This technology is well suited to the smaller plume of contamination in Zone 11. This technology can be implemented across the plume so that the plume is treated as it moves through the treatment zone.
- Human health is protected because exposure to perched groundwater can be controlled.
- Monitored natural attenuation is effective in areas where much longer contaminant travel times to the Ogallala Aquifer were predicted in the risk assessment.

PREFERRED ALTERNATIVE FOR ZONE 11 PERCHED GROUNDWATER

Based on the evaluation of alternatives in the Corrective Measure Study/Feasibility Study, the preferred remedial action alternative for Zone 11 perched groundwater is Alternative 4: Targeted *In Situ* Treatment. In this alternative, contaminated perched groundwater will naturally flow through a permeable treatment zone which will accelerate the breakdown of contaminants. Alternative 4 meets the threshold criteria and provides the best balance in achieving the evaluation criteria. Based on the hydrogeologic conditions beneath Zone 11, a pump and treat system (Alternative 3) may not effectively stabilize the perched groundwater plume or provide long-term protection of human health and the environment. Alternative 4 is the preferred alternative because it is the most effective and practicable alternative that will achieve substantive protection of human health and the environment in the short- and long-term.

The results of the comparative analysis for Zone 11 perched groundwater remedial action alternatives are summarized in the table to the right.

Comparative Analysis of Zone 11 Perched Groundwater Alternatives

Alternative	Protective of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume of Waste	Short-Term Effectiveness	Implementability	Cost		
							Capital	Total O&M	Total
Alternative 1: No Action							None		
Alternative 2: ICs and MNA	✓						$2.3M	$12M	$15M
Alternative 3: Pump and Treat, ICs, and MNA	✓	✓					$4.7M	$26M	$31M
Alternative 4: Targeted *In Situ* Treatment, ICs, and MNA	✓	✓					$4.5M	$31M	$35M

ICs: Institutional Controls
MNA: Monitored Natural Attenuation

Final Preferred Remedial Action for Zone 11 Perched Groundwater

- Targeted *in situ* treatment to reduce contaminants in perched groundwater to levels that are safe for human health and the environment.
- Institutional controls to restrict groundwater drilling and use.
- Monitored natural attenuation of contaminants after *in situ* treatment of the most highly contaminated portion of the plume has ended. Slower movement of perched groundwater to the Ogallala Aquifer near Zone 11 allows more time for natural breakdown to occur.
- Monitoring of perched and Ogallala groundwater to verify the effectiveness of the treatment and natural attenuation processes.

Summary of Preferred Alternatives

Based on information currently available, USDOE/NNSA believes the Preferred Alternatives in this Proposed Plan meet the threshold criteria and provide the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. USDOE/NNSA expects the Preferred Alternatives to satisfy the following statutory requirements of CERCLA §121(b): 1) be protective of human health and the environment; 2) comply with applicable or relevant and appropriate requirements (ARARs); 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element.

Contingency Actions

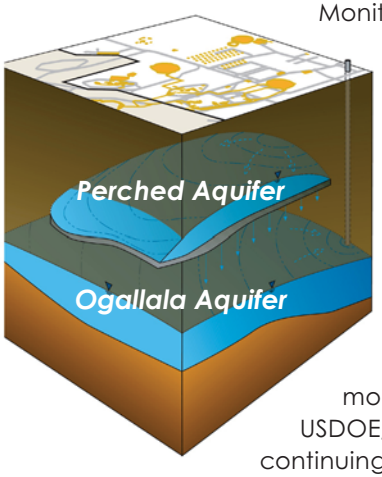
Monitoring is required to verify that remedial actions for perched groundwater are effective at meeting the remedial action objectives. The monitoring results will be evaluated periodically as part of the Compliance Plan and Interagency Agreement Progress Reports. If monitoring indicates that remedial actions taken pursuant to the Record of Decision are not effectively treating or stabilizing the perched groundwater plumes, then other actions may be implemented to enhance the chosen systems. Those actions can include the use of technologies previously described in this Plan and include:

- Use of *in situ* treatment to enhance other remedies in specific areas where monitoring and evaluation of results indicates further remedial action is required.
- Use or expansion of pump and treat systems where feasible to meet dewatering or treatment goals.
- Evaluation of the remedial action objectives to assess continued applicability and the need for change.

The public will continue to be involved in the future if contingency actions are considered for implementation.

Protection of the Ogallala Aquifer

The Ogallala Aquifer is the primary source of drinking and irrigation water in the region and for Pantex Plant. The early actions implemented to treat contaminants in perched groundwater also serve to protect the Ogallala Aquifer as a drinking water source.



Monitoring of groundwater in the Ogallala Aquifer is required to verify that remedial actions for perched groundwater are effective at protecting use of the Ogallala Aquifer. Pantex currently monitors the aquifer by regularly collecting samples from an extensive well network. This network will be improved for long-term monitoring of the aquifer. The number and location of wells will be determined during the remediation design phase and during modification of the Compliance Plan by USDOE/NNSA, EPA, and TCEQ. As part of the continuing public participation for RCRA and CERCLA, the monitoring network will be presented and discussed in a workshop for the public during the Pantex Compliance Plan modification process. The monitoring results will be reviewed at least semi-annually as part of the reporting requirements for RCRA and CERCLA and the effectiveness of the remedial actions chosen for the Record of Decision will also be reviewed every 5 years to ensure that the remedial action objectives are being achieved.

The long-term groundwater monitoring program also includes the development of contingency plans to define the process for determining and implementing future response actions for the Ogallala Aquifer in the event that contaminants in perched groundwater impact the Ogallala Aquifer. These response actions would be implemented to protect human health and address any confirmed impacts to the Ogallala Aquifer, should they occur.

Irrigation is the primary use of water from the Ogallala Aquifer in Texas (photo from USGS).

No Action Release Units

Units listed in this section are soil units that have been investigated and have been determined to pose no current or future threat to human health or the environment; therefore, they require no further remedial action. Units included in the human health risk assessments will require long-term stewardship such as institutional controls (for example, control of excavations and soil removal) and monitoring of groundwater in downgradient locations. Because no further remedial action is required at these units, other than institutional controls and groundwater monitoring for the Risk Reduction Standard 3 units, these units are considered as No Action Units.

The No Action Units are broken into different categories that correspond to the type of closure they received under RCRA rules that are implemented by the State of Texas:

- **Administrative Closures**
- **Closure to Background** (Risk Reduction Standard 1 under Texas regulations)
- **Closure to RCRA Cleanup Levels** (Risk Reduction Standard 2 under Texas regulations)
- **Closure with no further remedial action needed**, as determined through the human health and ecological risk assessments.

Each one of the above categories is detailed in the following pages, along with the list and map of release units for each category.

RCRA Closure Rules

The State of Texas has authority to regulate sites under RCRA. The Pantex Compliance Plan (CP-50284) contains the requirements for the investigation and cleanup of past hazardous waste units at Pantex. The Compliance Plan refers to State regulations (Texas Risk Reduction Rule) for the cleanup of the industrial solid waste units.

The Risk Reduction Rule is a set of regulations, found in 30 TAC §335 Subchapter S, that establish the requirements for closure or remediation of facilities or areas containing contaminants from industrial solid waste. This Rule provides three Risk Reduction Standards (RRS) for closure, described below.

Risk Reduction Standard 1: Closure/Remediation to Background

Under RRS 1, all waste and contaminated environmental media, such as soil or groundwater, must be remediated to background concentrations unaffected by waste management or industrial activities. No post-closure care is required for RRS 1 closure units.

Risk Reduction Standard 2: Closure/Remediation to Health-Based Standards and Criteria

Under RRS 2, all waste and contaminated environmental media must be remediated to health-based cleanup levels that provide appropriate protection for human health or the environment. RRS 2 cleanup levels are promulgated standards or are calculated according to the procedures specified in 30 TAC §335.555 using default land use and receptor assumptions. Closure under RRS 2 also requires an ecological evaluation. Once the requirements for cleanup are met for these units, no post-closure care is required. However, the contaminated area must be recorded in the county deed records.

Risk Reduction Standard 3: Closure/Remediation with Controls

This standard requires the remedy to achieve the highest degree of long-term effectiveness possible while considering cleanup objectives and costs. Cleanup levels are health-based, but may be derived using site-specific information for land use and potential receptors. Contaminants may be left in place if the risk posed by those contaminants does not exceed the target risk values provided in the rule. The use of institutional or engineering controls to attain regulatory compliance is also allowed.

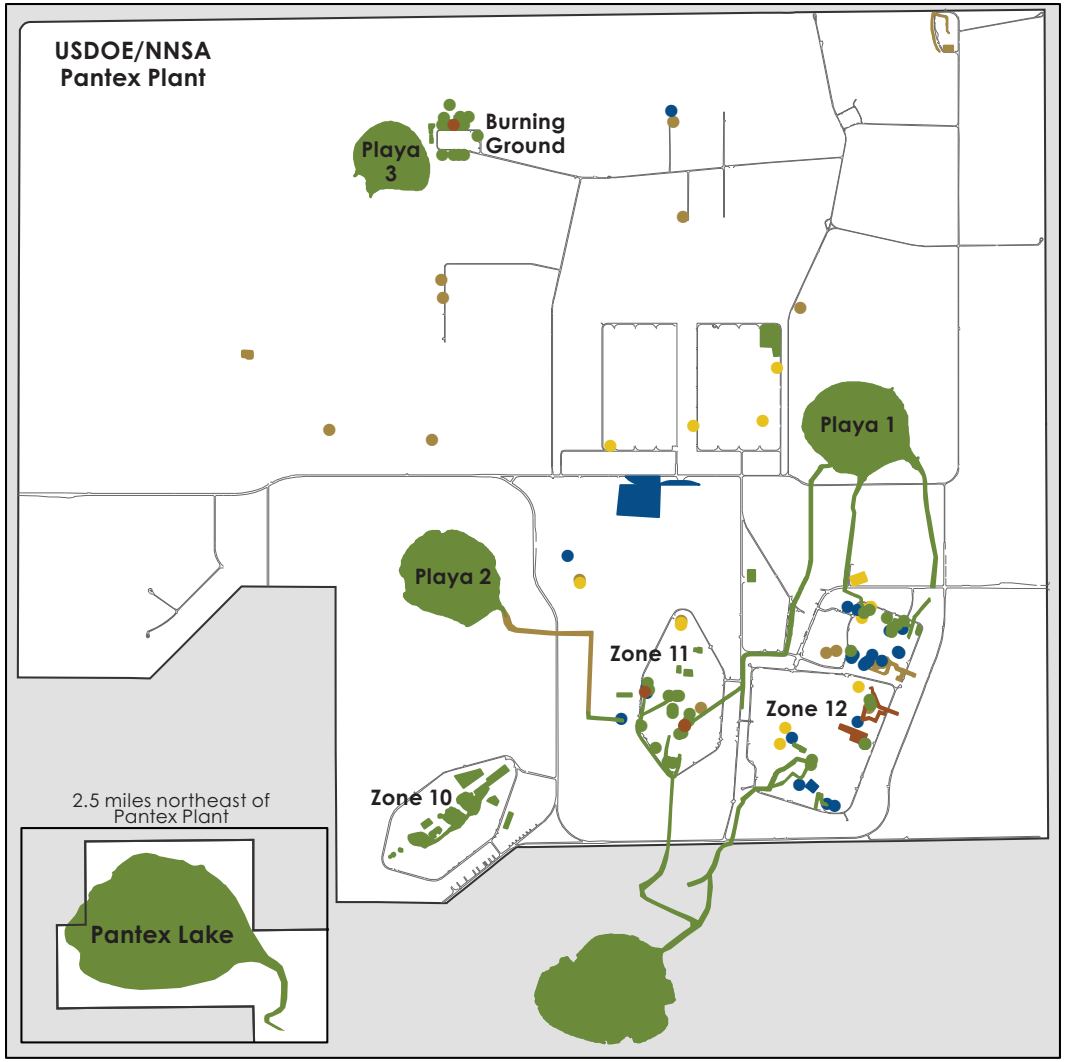
RRS 3 closure requires a Baseline Risk Assessment to evaluate potential adverse effects to human health or the environment in the absence of any action to control or mitigate the contamination. A Corrective Measure Study is also required to evaluate the abilities and effectiveness of remedial actions and to recommend the remedial action that best achieves the closure requirements of RRS 3. Following remediation, post-closure measures, such as institutional controls or continued monitoring, must be maintained and recorded in the county deed records.

No Action Units

As discussed on page 11, some of the release units identified at Pantex have already been approved for RCRA closure because these units meet RCRA requirements. The RCRA rules are applicable as cleanup standards under CERCLA, so these units are considered as "No Action" units under CERCLA (units that were closed administratively or to Risk Reduction Standard 1 or 2).

A human health and ecological risk assessment was performed for all Risk Reduction Standard 3 units (to satisfy both RCRA and CERCLA). Under the Risk Reduction Rule, some of the RRS 3 units will require some type of institutional controls and long-term groundwater monitoring for management of uncertainties related to migration of contaminants to groundwater. Because some post-closure care (institutional controls and groundwater monitoring) is already required under the Risk Reduction Rule, the units that were found to require no additional remedial action, based on the risk assessments, are included in the units requiring no action under CERCLA. Under CERCLA, these no action units do not require a full evaluation of alternatives, so are listed in this section with explanations for the no action listing.

The other units that required evaluation of additional action were discussed in the Remedial Action Alternatives Section, where the preferred remedy was presented for each of those units.



Administrative Closure
Closure to Background (Risk Reduction Standard 1)
Closure to RCRA Cleanup Levels (Risk Reduction Standard 2)

Closure Evaluation Through Risk Assessment

No Further Remedial Action Required
Early Final Actions Completed

Administrative Closure Units

These units were identified as potential release units during the initial RCRA Facility Assessment at Pantex. However, initial investigation of these units determined that no actual release to the environment had occurred, so these release units were administratively removed from the RCRA list of release units because no further investigation or cleanup was required for these units. Additionally, two units were administratively removed because the release unit was duplicated and investigated under another unit name.

These units are considered as No Action Units because there is no evidence of a release to the environment.

Zone 11

SWMU 59: Landfill East of Pad 11-13 (Duplicate of SVS 5)

SWMU 88: Building 11-41 Compressor Building Waste Accumulation

SWMU 111: Building 11-36 Solvent Tanks

SWMU 112: Building 11-36 Solvent Tanks

SWMU 114: Building 11-36 Scrubber System

SWMU 115: Building 11-36 Carbon Filter

SWMU 116: Building 11-36 Sludge Filters

SWMU 124: Building 11-50 Waste Water Treatment System

SWMU 129a: Building 11-44 High Explosives Contaminated Sludge Containers

SWMU 134: Building 11-29 Silver Recovery

Zone 12

SWMU 85: Building 12-16 MOCA Waste Accumulation Area

SWMU 89: Building 12-2 North Hall Waste Accumulation Area

SWMU 90: Building 12-9 Waste Accumulation Area

SWMU 91: Building 12-9 Solvent Storage Shed Waste Accumulation Area

SWMU 92: Building 12-9 (outside) Waste Accumulation Area

SWMU 93: Building 12-111 Paint Shop Waste Accumulation Area

SWMU 94: Building 12-R-13 (outside) Waste Accumulation Area

SWMU 95: Building 12-18 (outside) Waste Accumulation Area

SWMU 96: Building 12-21 Waste Accumulation Area

SWMU 98: Building 12-38 Solvent Storage

SWMU 99: Building 12-41 Waste Accumulation Area

SWMU 100: Building 12-42 Waste Accumulation Area

SWMU 101: Building 12-59 Waste Accumulation Area

SWMU 102: Building 12-68 Batch Master, Northeast Corner

SWMU 104: Building 12-82 Waste Accumulation Area

SWMU 105: Building 12-84 Waste Accumulation Area

SWMU 125: Building 12-43 High Explosives Contaminated Charcoal Boxes

SWMU 126: Miscellaneous High Explosives Contaminated Waste Dumpsters

SWMU 129b: Building 12-43 High Explosives Contaminated Sludge Containers

SWMU 131: Building 12-35 Portable Waste Oil Storage Tanks

SWMU 137: Building 12-41, Paint Shop Waste Water Tank

SWMU 138: Zone 12 Paint Shop Sandblaster Collection Cone

SWMU 141: Classified Waste Incinerator

Units in Miscellaneous Areas

SWMU 62: Landfill 11

SWMU 65: Landfill 14 (Duplicate of SVS 6)

SWMU 76: Firing Site 18

SWMU 77: Firing Site 23, Filter/Exhaust System

SWMU 83: Building 4-8, Container Storage Building, Asbestos Staging Area

SWMU 107: Building 16-5, Flammable Liquid Storage

SWMU 127: Miscellaneous Non-hazardous Waste Dumpsters

SWMU 128: Portable High Explosives Waste water Tanks

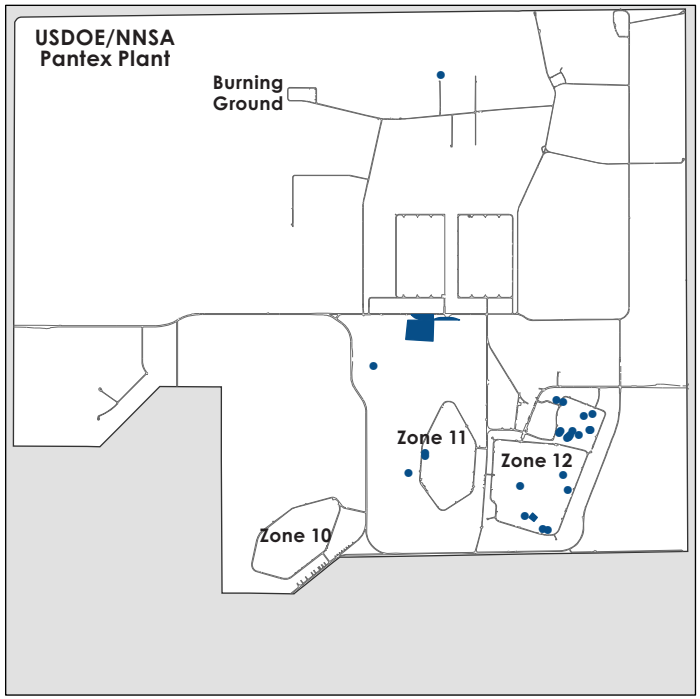
SWMU 132: Vacuum Guzzlers

SWMU 142: Miscellaneous Hood and Filter Systems, 24 Buildings

AOC 4: Site-Wide Asbestos Installation

AOC 9: Site-Wide Underground Storage Tanks

Unassigned: Unlined Landfill/Landfill 18 North of Firing Site 10



Administrative Closure

Note: portable units not depicted.

Common Acronyms and Terms

AOC: Area of Concern - any area having a probable release of a hazardous waste or hazardous constituent which is not from a SWMU and is determined by the TCEQ or EPA to pose a current or potential threat to human health or the environment. Investigation and cleanup at these units may be warranted.

Permitted Unit: These units were regulated under the Pantex Hazardous Waste Permit (HW-50284) and were closed using the Pantex cleanup process.

SVS: Supplemental Verification Site - any area having a possible release of a hazardous waste or hazardous constituent which is not from a SWMU. These units were added to the Hazardous Waste Permit (HW-50284) because investigation of the unit may be warranted.

SWMU: Solid Waste Management Unit - any identifiable unit where solid wastes have been placed at any time, regardless of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released. These units were identified for investigation and cleanup.

Other Acronyms in this Section

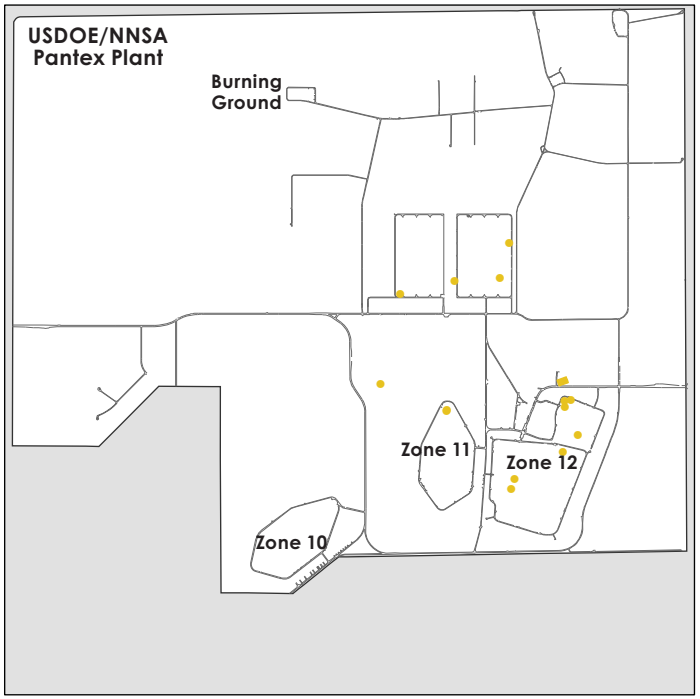
DDT: Common name for the chemical pesticide dichlorodiphenyltrichloroethane (pg. 48)

MOCA: Common name for the chemical 4,4'-Methylene-bis(2-chloroaniline) that is used to make polyurethane products that are a significant component of many common appliances. MOCA is widely used in such items as gear systems in modern office and home appliances, sporting goods, mouldings for motor vehicle body parts and military equipment. The compound is commonly used as a coating to set other glues, plastics and adhesives. Its main purpose is to act as a curing agent for other polyurethane and elastomer compounds (pg. 42).

Background (Risk Reduction Standard 1) Closure Units

These units were investigated and were found to be within background concentrations, as defined under the Texas Risk Reduction Rule. To establish background, Pantex sampled soils in nearby areas that were unaffected by industrial operations to determine the range of concentrations that normally occur in soils. The soil and groundwater backgrounds are documented in the *Risk Reduction Rule Guidance to the Pantex RFI* (BWXT Pantex, 2002). The following listed units have been approved for closure by TCEQ.

These units are considered as No Action Units under CERCLA because these units meet background criteria; thus, they do not impact the environment.



Closure to Background (Risk Reduction Standard 1)

Zone 11

SWMU 79a: 11-7A Pad Container (Permitted Unit 41)

SWMU 79b: 11-7B Pad Container (Permitted Unit 42)

SWMU 130: Portable Waste Solvent Tanks

Zone 12

SWMU 108: Building 12-68 Batch Master

AOC 6a: Building 12-35 Gasoline Leaks

Unassigned: Building 12-5B: Underground Storage Tank #7

Unassigned: Building 12-17E Underground Storage Tank #9

Unassigned: Underground Storage Tank #38 Building 12-98

Unassigned: Underground Storage Tank #39 North of Building 12-84A

Units in Miscellaneous Areas

SWMU 80 (4 Units): Zone 4 Container Storage Area Conexes 1, 2, 3, and 4 (Permitted Units 4, 5, 6, and 7)

SWMU 81: Magazine 4-19 Mixed Waste Storage

SWMU 133: Building 16-1 Underground Storage Tank #30 Waste Oil Tank

AOC 2: Main Electrical Substation (4-28)

AOC 6b: Building 16-1 Gasoline Leak

Permitted Units 8, 9, 10 & 11: Container Storage Area Conexes WM5, WM6, WM7, and WM8

Permitted Units 36, 37, 38, & 39: Buildings 11-9, 11-15a, 11-15b and 11-9 Tanks

Permitted Unit 40: Building 11-9 Storage

Permitted Units 46, 47, 48, 49 & 50: Container Storage Area Conexes WM1-A, WM1-B, WM3-A, WM5-A, & WM5-B

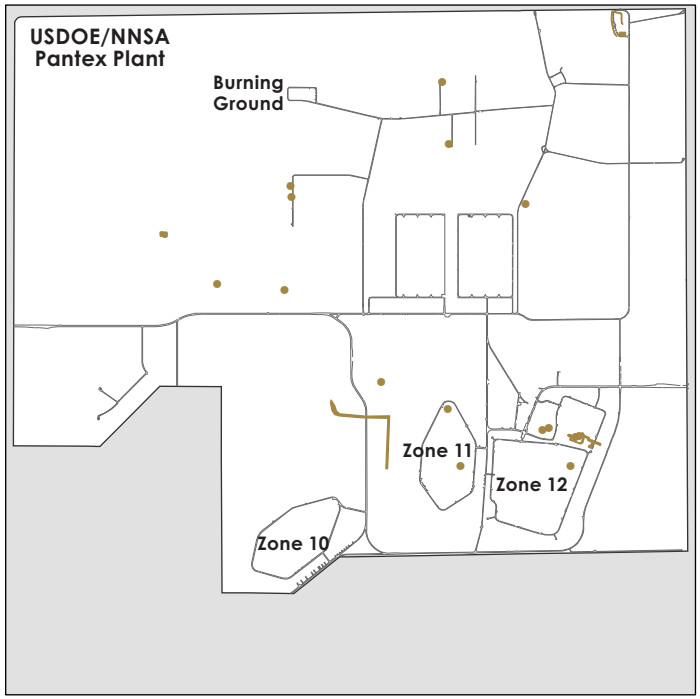
Permitted Unit 52: Igloo 4-46 Storage

Permitted Unit 54: Igloo 4-74 Storage

Units Closed to RCRA Risk Reduction Standard 2 Levels

These units were investigated and met or were cleaned up to meet prescribed RCRA concentrations, as defined under the Texas Risk Reduction Rule. Closure levels are documented in the *Risk Reduction Rule Guidance to the Pantex RFI*. These units have been approved for closure by the TCEQ and the contaminant characterization and cleanup information has been recorded in the Carson County deed records.

These units are No Action Units under CERCLA because these units require no further action for protection of human health or the environment.



Closure to RCRA Cleanup Levels (Risk Reduction Standard 2)

Zone 11

Unassigned SWMU: 11-14 Hypalon Pond and Waste Water Line

Permitted Unit 1: Container Storage 11-7 North Pad

Zone 12

SWMU 5-03a: Building 12-68 Drainage Ditches

SWMU 5-03b: Building 12-18 Drainage Ditches

SWMU 5-03c: Building 12-9 Drainage Ditches

SWMU 5-03d: Building 12-10 Drainage Ditches

SWMU 97: Building 12-34 Waste Accumulation Area

SWMU 109: Building 12-68 Concrete Sump

SWMU 110: Building 12-68 Electroplating Waste Retention Basin (Moat)

AOC 7b: Building 12-4 Sulfuric Acid Spill

Unassigned AOC: Building 12-1 Laundry Sump

Units in Miscellaneous Areas

SWMU 5-10: Drainage Ditches near the Old Sewage Treatment Plant

SWMU 5-14: Drainage Ditch from Zone 11 to Playa 2

SWMU 11: Firing Site 16 Surface Impoundment in Zone 5

SWMU 53: Temporary High Explosives Burning Ground

SWMU 63: Landfill 12

SWMU 71: Firing Site 6

SWMU 73: Firing Site 15

SWMU 106: Building 16-1 Waste Accumulation Site

SWMU 139: Firing Site 10 Photo Processing Leaching Bed

SWMU 140: Old Sewage Treatment Plant/Sludge Beds

SVS 1: Denuded Area near Playa 1

Unassigned SWMU: Firing Site 22 Container Gun Barrel

Unassigned: Dumpster Area near Firing Site 11

Risk Assessment Units That Require No Further Remedial Action

These units were evaluated in the human health and ecological risk assessments under CERCLA and RCRA regulations. Under RCRA, these units will be closed to Risk Reduction Standard 3. Many of these units were cleaned up during the investigation phase and met the RCRA Risk Reduction Standard 2 closure requirements for worker contact. However, the remaining soil contamination in these units had the potential to impact groundwater so these units were evaluated in the human health risk assessments to determine whether they pose a future threat to groundwater. The risk assessment used complex scientific models to determine the potential for future groundwater impact. Additionally, widely accepted risk assessment methods were also used to determine whether Plant workers or neighbors may be impacted by contaminants at these units. Risk assessment results indicate that these units do not pose a threat to human health or the environment, so no further remedial action is required. See the separate Human Health and Ecological Risk Assessment Summary Reports on the Pantex website (see back of report for more information) for more detailed risk information on all units evaluated in the risk assessments. Under the Risk Reduction Rule, some of these units will require post-closure care, such as institutional controls and long-term groundwater monitoring to address uncertainties related to migration of contaminants to groundwater.

These units are considered as No Action Units under CERCLA because these units require no additional remedial action based on the risk assessment results. Institutional controls and long-term groundwater monitoring will be conducted for these units.

Zone 10

SWMU 84: Building 10-9 Scrap, Salvage, and Storage Yard

SWMU 143a: Building 10-9 Former Waste Drum Storage Areas

SWMU 143b: Building 10 7 Former Waste Drum Storage Areas

SWMU 144: Building 10-13 Zone 10 TNT Settling Pit

SWMU 145: Building 10-17 Zone 10 TNT Settling Pit

SWMU 146: Building 10-26 Zone 10 TNT Settling Pit

AOC 3a: Former Boiler House Areas

AOC 14: Battery Storage Area (Building 12-18)

SVS 3 (SWMU 67): Carbon Black Burial Area near Building 10-7

Unassigned SWMU: Zone 10 Berms

Zone 11

SWMU 3: Building 11-44 Drainage Ditch

SWMU 5-08: Building 11-36 Drainage Ditch

SWMU 5-09a: Building 11-17 Drainage Ditch

SWMU 12: Drainage Ditch near Former 11-14 Pond

SWMU 13: Building 11-51 Former Solar Evaporation Pond

SWMU 86: Building 11-14 Solvent Storage Shed

SWMU 87: Building 11-20 Solvent Storage Shed

SWMU 119a: High Explosives Filters

SWMU 120a: Carbon Filters

SWMU 147: Building 11-13 TNT Settling Pit

SWMU 148: Building 11-17 TNT Settling Pits

SWMU 149: Building 11-26 TNT Settling Pit

SWMU 150: Building 11-12 TNT Settling Pit

AOC 1: Building 11-14A Transformer Leak

AOC 3b: Former Boiler House Areas

AOC 7a: Building 11-36 Sulfuric Acid Spills

AOC 8a: Pad 11-12 Solvent Leaks

AOC 8b: Pad 11-13 Solvent Leaks

AOC 8c: Building 11-17 Solvent Leaks

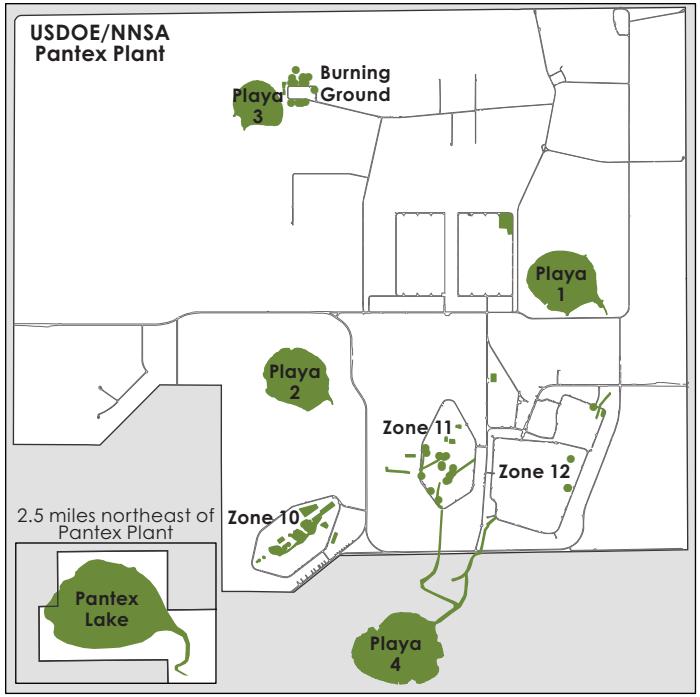
AOC 8d: Pad 11-22 Solvent Leaks

AOC 8e: Building 11-36 Solvent Leaks

SVS 2: Building 11-26 Parallel Depressions

Unassigned - Former 11-15 Pond

Unassigned: Former Leaching Bed North of Building 11-50 and West of Building 11-36



Closure Evaluation Through Risk Assessment

Zone 12

SWMU 5-02a: Building 12-51 Drainage Ditch

SWMU 5-02c: Building 12-110 Drainage Ditch

SWMU 119b: High Explosives Filters

SWMU 120b: Carbon Filters

SWMU 121: High Explosives Settling Tank

SWMU 123: Concrete Sump & Waste Water Treatment Unit

AOC 5: Electrical Equipment Bone Yard near Building 12-5

AOC 10a: Building 12-43A Pesticide Rinse Area

AOC 13a: Former Cooling Tower in Zone 12 (Pad)

AOC 13b: Former Cooling Tower in Zone 12 (Piping/Soil)

Burning Ground

SWMU 8: Playa 3

SWMU 45: Explosive Burn Cage

SWMU 46: Explosive Burn Cage

SWMU 48: Burning Ground Solvent Evaporation Pans

SWMU 49: Burning Ground Solvent Evaporation Pans

SWMU 50: Burning Ground Solvent Evaporation Pans

SWMU 51: Burning Ground Solvent Evaporation Pans

SWMU 52: Burn Racks and Flashing Pits

Unassigned: Demonstration Facilities

Units in Miscellaneous Areas

SWMU 4: Building 11-50 Drainage Ditch

SWMU 5-12b: Perimeter Drainage Ditch from Zone 12 to SWMU 5-14

SWMU 5-15a & b: Drainage Ditch to Playa 4

SWMU 6: Playa 1

SWMU 7: Playa 2

SWMU 9: Playa 4

SWMU 10: Pantex Lake

SWMU 82: Nuclear Weapon Accident Residue Storage

AOC 11: Fire Training Area Burn Pits

Risk Assessment Units That Require No Further Remedial Action

These units were evaluated in the human health and ecological risk assessments under CERCLA and RCRA regulations. Under RCRA, these units will be closed to Risk Reduction Standard 3. The results of the human health risk assessment indicated that the following units had contaminants of concern (contaminant concentrations exceeding acceptable criteria). However, these units did not require further remedial actions for one or more of the following reasons:

- Risk levels only slightly exceeded the acceptable criteria, so further work was not needed to manage or control risk.
- Contaminant concentrations were questionable because of problems with the laboratory analysis of a small amount of samples. Resampling and reanalysis of some of those samples indicated that the contaminant was not present.
- Some cleanup had occurred in the upper soils (upper 1 ft) and the remaining risk from contaminants at depth could be controlled through institutional controls to control excavation and worker practices.
- Some of the contaminants may be caused by the presence of asphalt (PAHs are a part of asphalt) or other man-made building materials that would be the source of the contamination. These types of risk are considered as background risks because they are present everywhere these types of constructed features are present.

Under the Risk Reduction Rule, these units will require post-closure care, such as institutional controls and long-term groundwater monitoring to address uncertainties related to migration of contaminants to groundwater. These units are considered as No Action Units under CERCLA because these units require no additional remedial action for protection of human health or the environment.

Zone 11

SWMU 5-09b: Building 11-20 Drainage Ditch

SWMU 5-11: Main Perimeter Ditch

Unassigned SWMU: Building 11-20 Evaporation Pit East of Bay 3

Unassigned SWMU: Building 11-20 Evaporation Pit South of Bay 11/West of Bay 6 Solvent Storage Shed

Zone 12

SWMU 5-01a: Building 12-5 Drainage Ditches

SWMU 5-01b: Building 12-5B Drainage Ditches

SWMU 5-02b: Building 12-67 Drainage Ditch

SWMU 5-04a: Building 12-19 Drainage Ditch

SWMU 5-06a: Building 12-44E Drainage Ditch

SWMU 5-06b: Building 12-81 Drainage Ditch

SWMU 5-07: Building 12-41 Drainage Ditch

SWMU 103: Building 12-81 Former Battery Storage Area

SWMU 135: Building 12-44E Leaching Bed

SWMU 136: Building 12-59 Subsurface Leaching Bed

AOC 7c: Building 12-64 Sulfuric Acid Spills

AOC 10b: Building 12-51 Pesticide Rinse Area

AOC 12: Building 12-5D Paint Shop/ Solvent Pit

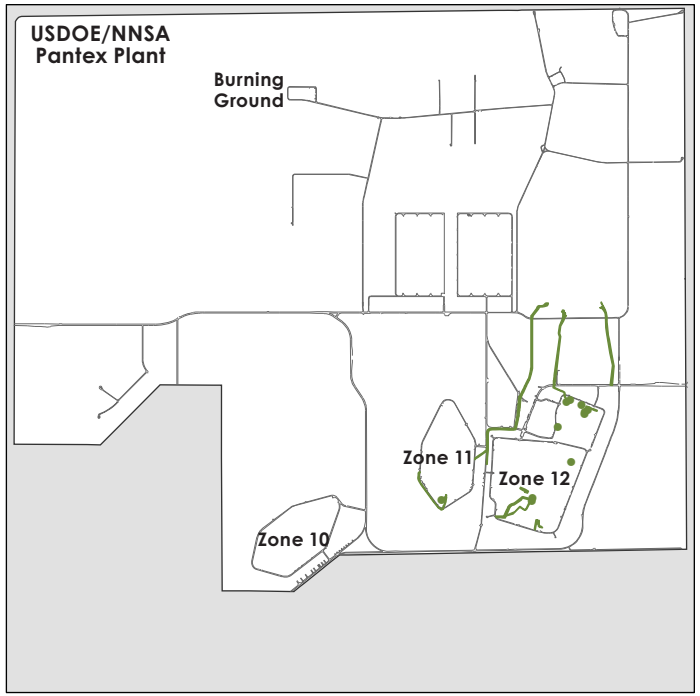
AOC 15: Building 12-35 DDT Release

Unassigned: SWMU Capacitor Bank Rupture

Unassigned: Concrete Sump (near Building 12-5B)

Units in Miscellaneous Areas

SWMU 5-13a, b, c: Drainage Ditch to Playa 1



Closure Evaluation Through Risk Assessment

Risk Assessment Units with Early Final Actions Completed

These units were evaluated in the human health and ecological risk assessments under CERCLA and RCRA regulations. Under RCRA, these units will be closed to Risk Reduction Standard 3. The results of the human health risk assessment determined that these units posed unacceptable risks to workers, if no remedial actions were taken. Based on the results of the risk assessments, early final remedial actions were implemented to immediately reduce the impact to workers. The results of these early remedial actions will be reported in the Interim Remedial Action/Corrective Measure Report to demonstrate compliance with the remedial action objectives. As with all Risk Reduction Standard 3 closures, institutional controls with long-term monitoring will be implemented at these sites.

These units are considered as No Action Units under CERCLA because these units were remediated following the risk assessment and no longer require additional remedial action for protection of human health or the environment. Institutional controls and long-term groundwater monitoring will be conducted for these units.

Zone 11

SWMU 113: Building 11-36 Overflow Collection System/Sump

SWMU 117: High Explosives Settling Tank

SWMU 118: Equalization Basin

Zone 12

SWMU 1: Building 12-17 Drainage Ditch

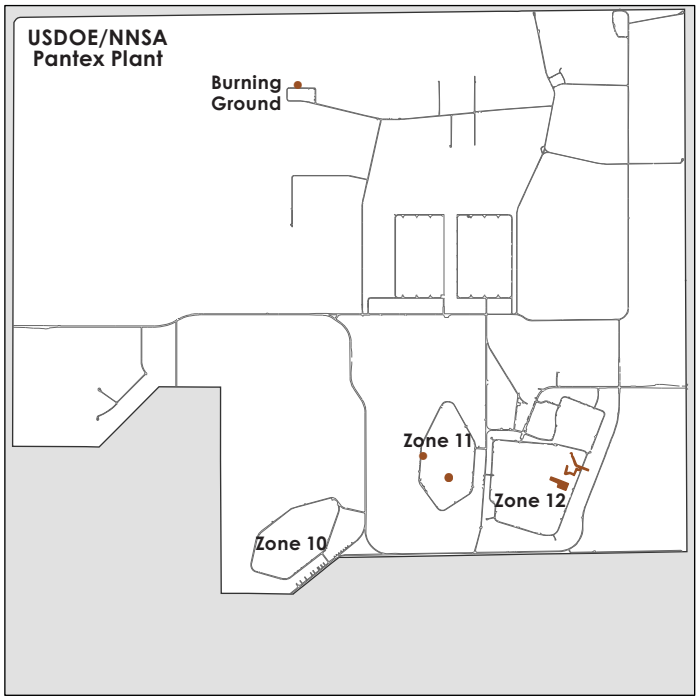
SWMU 5-04b: Building 12-73 Drainage Ditch

SWMU 122a: Equalization Basin

SWMU 122b: Building 12-24N & Building 12-43 Upland Soil

Burning Ground

Explosive Burn Pad 16 (part of SWMUs 14-27)



Early Final Actions Completed

USDOE/NNSA encourages community involvement to ensure that the preferred remedial action alternatives for soil and groundwater contaminants at Pantex Plant incorporate community needs and protect human health and the environment.

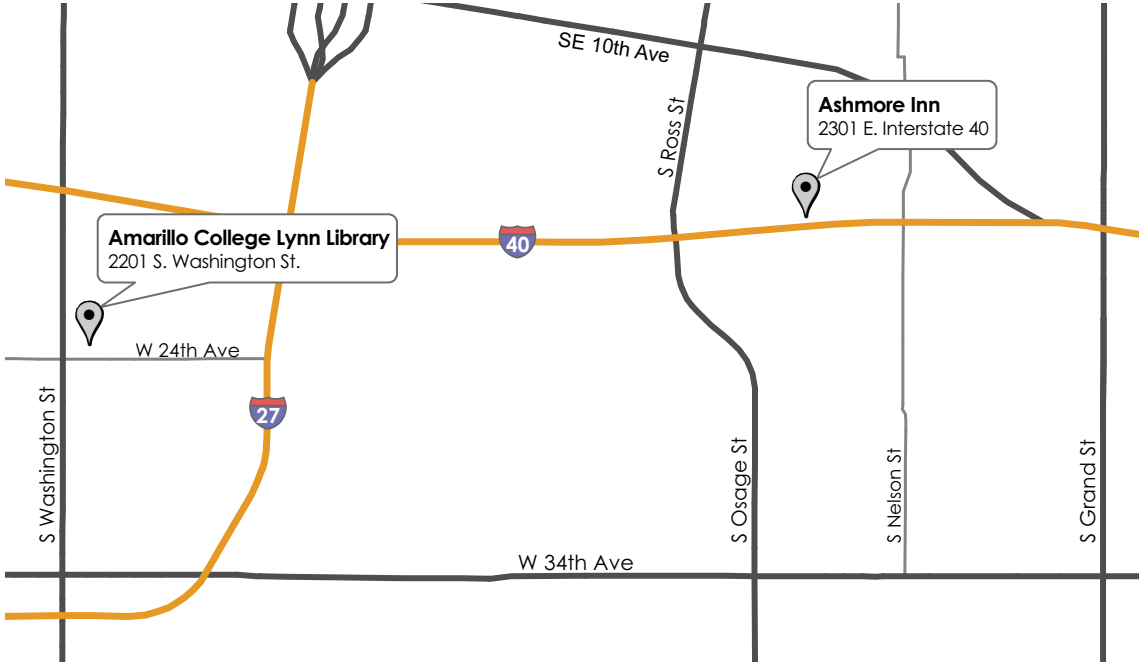
The alternatives proposed in this Plan may be modified, or different preferred remedial action alternatives may be selected, based upon public comments. The public is encouraged to review and comment on all alternatives described in the Proposed Plan and the rationale used to determine the preferred alternatives. Written comments on the Proposed Plan will be accepted through April 28, 2008.

Documents and reports used to develop the remedial action alternatives can be found in the Pantex Administrative Record:

USDOE/NNSA Pantex Plant
Highway 60 and F.M. 2373
Amarillo, Texas 79120
(806) 477-5140

Contact: Ms. Erin Ritter, B&W Pantex Public Information Coordinator
Hours: By appointment, Monday through Friday, 8:00 am to 4:00 pm

USDOE/NNSA maintains a reading room at the Amarillo College Lynn Library that allows the public easy access to unclassified documents concerning Pantex and other DOE facilities. Copies of final reports related to the environmental restoration program are available in the reading room. Some documents are also available on the internet at www.pantex.com/about/environment/erDocs/index.htm.



USDOE/NNSA will hold a public meeting on March 31, 2008 to explain the Proposed Plan and all of the alternatives presented. The meeting will begin with an open house and informal poster session with Pantex experts available to answer questions. The presentation will begin at 6:30 pm and will be followed by a formal opportunity for the public to provide verbal and written comments.

After considering public comments, USDOE/NNSA, EPA, and TCEQ will make final decisions on the remedial actions to be implemented at Pantex Plant. The final selection will be formalized in a document called the Record of Decision. A Responsiveness Summary that summarizes public comments and the responses to those comments will be included in the Record of Decision. USDOE/NNSA will continue to keep the public informed after selection and during implementation of the final remedial actions.

Dates to Remember

Public Comment Period:
March 17 to April 28, 2008

USDOE/NNSA will accept written comments on the Proposed Plan during the public comment period. Written comments should be addressed to:

Brenda Finley, Pantex Site Office
P.O. Box 30030, Amarillo, Texas 79120
E-mail: BFinley@pantex.doe.gov

Comments must be postmarked by April 28, 2008.

Public Meeting:
March 31, 2008

Ashmore Inn
2301 E. Interstate 40, Amarillo, Texas
(806) 374-0033

Open House/Informational Poster Session at 6:00 pm

Presentation Starting at 6:30 pm

Formal Comment Opportunity Starting at 7:30 pm

For more information, visit the USDOE/NNSA Reading Room at the following location:
Lynn Library Learning Center, Amarillo College
2201 S. Washington Street, Amarillo, Texas
(806) 371-5400
Normal Hours: Monday through Thursday, 7:30 am to 9:00 pm,
Friday, 7:30 am to 5:00 pm, and
Sunday, 2:00 pm to 6:00 pm

Information can also be obtained from:
Camille Hueni
Environmental Protection Agency Region 6
(214) 665-2231
Hueni.Camille@epamail.epa.gov

Fay Duke
Texas Commission on Environmental Quality
(512) 239-2443
FDuke@tceq.state.tx.us

Investigation Reports

BWXT Pantex, 2004. Final Pantex Plant Radiological Investigation Report. Pantex Plant, Amarillo, TX. January 2004.

BWXT Pantex, 2005. Sampling Results for Playa 3 Sub-basin (Playa 3a) and Ditches near FM 293. Pantex Plant, Amarillo, TX. December 2005.

Stoller, 2002. Burning Ground Waste Management Group, Final RCRA Facility Investigation Report. Pantex Plant, Amarillo, TX. March 2002.

Stoller, 2002. Final FTA RCRA Facility Investigation Report. Pantex Plant, Amarillo, TX.

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Stoller, 2003. Final RCRA Facility Investigation Report, Zone 11. Pantex Plant, Amarillo, TX. January 2003.

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Stoller, 2003. Final RCRA Facility Investigation Report, Ditches and Playas. Pantex Plant, Amarillo, TX. September 2003.

Stoller, 2004. Final Independent Sites RCRA Facility Investigation Report. Pantex Plant, Amarillo, TX. March 2004.

Stoller, 2004. Final Groundwater RCRA Facility Investigation Report. Pantex Plant, Amarillo, TX. March 2004.

Risk Assessment Reports

BWXT Pantex, 2004. Subsurface Modeling Report. Pantex Plant, Amarillo, TX. September 2003.

BWXT Pantex, 2006. Burning Ground Human Health Risk Assessment Report. Pantex Plant, Amarillo, TX. May 2006.

BWXT Pantex, 2006. Nuclear Weapons Accident Residue Storage Unit (NWAR) Human Health Risk Assessment Report. Pantex Plant, Amarillo, TX. August 2006.

BWXT Pantex/SAIC, 2006. Baseline Human Health Risk Assessment Report for Zone 10, 11, and 12, Fire Training Area, Ditches and Playas, Independent Sites, and Groundwater. Pantex Plant, Amarillo, TX. December 2006.

BWXT Pantex, 2007. Firing Site 5 Human Health Risk Assessment Report. Pantex Plant, Amarillo, TX. May 2007.

BWXT Pantex, 2007. Playa 4 Human Health Risk Assessment Report. Pantex Plant, Amarillo, TX. October 2007.

BWXT Pantex, 2007. Baseline Human Health Risk Assessment Summary. Pantex Plant, Amarillo, TX.

BWXT Pantex, 2007. Ecological Risk Assessment Summary. Pantex Plant, Amarillo, TX.

SAIC and BWXT Pantex, 2005. Site-Wide Ecological Risk Assessment Report. Pantex Plant, Amarillo, TX. February 2005, revised April 2006.

Decision Reports

BWXT Pantex, 2007. Corrective Measure Study/Feasibility Study. Pantex Plant, Amarillo, TX. September 2007.

BWXT Pantex/SAIC, 2007. Corrective Measures Study/Feasibility Study Modeling Report. Pantex Plant, Amarillo, TX. April 2007.

Regulatory Information

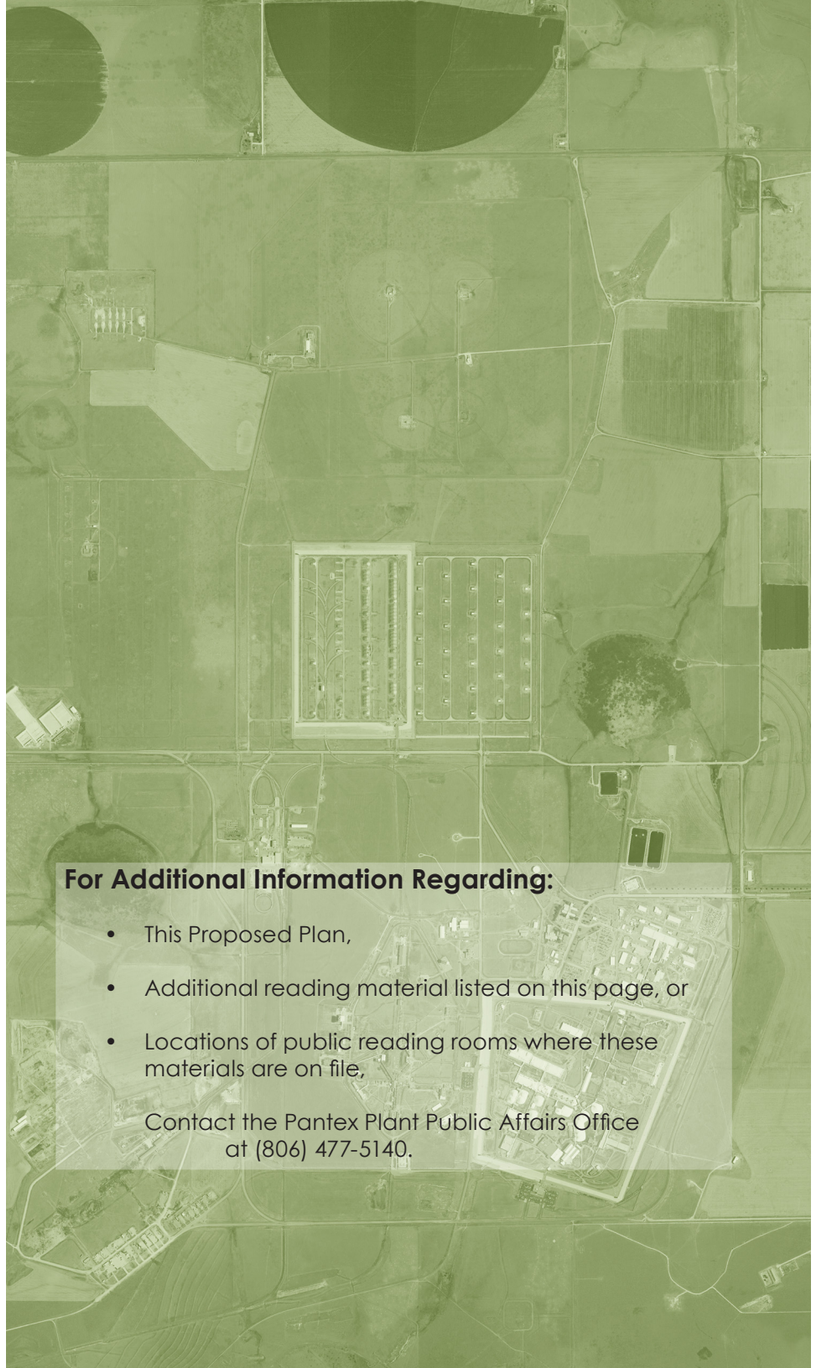
TCEQ, 1993. Risk Reduction Rule (30 TAC 335, Subchapter S). Located online at: www.tceq.state.tx.us/remediation/rrr.html.

TCEQ, 2008. Industrial and Hazardous Waste Corrective Action Program. Online at: www.tceq.state.tx.us/remediation/corrective_action/ihwca.html.

U.S. EPA, 2008. Superfund Information. Online at: www.epa.gov/superfund/index.htm.

U.S. EPA, 2008. Summary of the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund). Online at: www.epa.gov/lawsregs/laws/cercla.htm.

U.S. EPA, 2008. Summary of the Resource Conservation and Recovery Act. Online at: www.epa.gov/lawsregs/laws/rcra.htm.



For Additional Information Regarding:

- This Proposed Plan,
- Additional reading material listed on this page, or
- Locations of public reading rooms where these materials are on file,

Contact the Pantex Plant Public Affairs Office at (806) 477-5140.

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Acknowledgements

B&W Pantex

Dennis Huddleston, PMP, EP&O Division Manager
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Pantex Core Team

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