Ecological Risk Assessment Summary

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.

BWXT 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

BWXT Pantex

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Key Conclusions

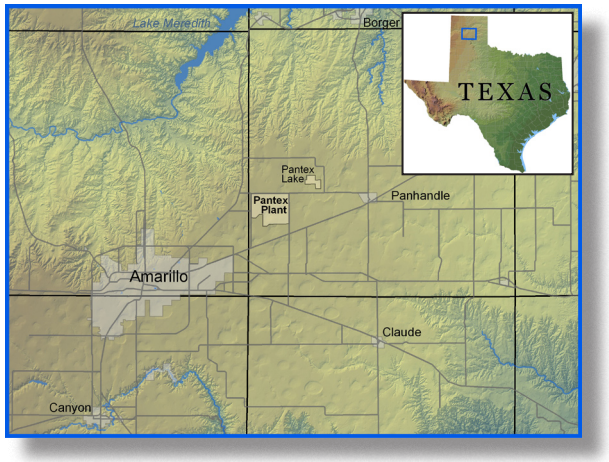
1. Cleanup actions already completed by the Environmental Projects and Operations Division and improvement of waste management practices protect plants and animals at Pantex.

2. Results of the ecological risk assessment indicate that current animal exposures to chemicals are below regulatory accepted levels or are similar to background and further cleanup is not required.

3. Future risks due to potential movement of chemicals to the playas are similar to current risk results and further cleanup is not required to protect plants and animals in the future.

4. Pantex will review the key assumptions of the ecological risk assessment every 5 years as part of the Long-Term Environmental Stewardship Program to ensure the continued protection of the environment.

This report summarizes the results of the ecological risk assessment (ERA) for Pantex Plant. Pantex Plant is in the Texas Panhandle, about 17 miles northeast of Amarillo. The Pantex Plant includes two pieces of property; the main property contains facilities to support the Plant mission and a separate piece of land that contains Pantex Lake. Pantex Lake was formerly used to collect treated wastewater discharges, but is now only used for agricultural purposes. Pantex was originally established in 1942 to build conventional weapons for World War II. The Pantex Ordnance Plant was deactivated in 1945 and sold to Texas Tech University. In 1951, Pantex was reclaimed by the Atomic Energy Commission to assemble nuclear weapons. Portions of the original Pantex Ordnance Facility to the south of Pantex Plant were retained by Texas Tech University for use as an agricultural research farm.



Pantex Plant is located in the Texas Panhandle, a relatively flat area punctuated by dramatic canyons and shallow depressions known as playa lakes.

Historical activities at Pantex caused the release of chemicals and radionuclides to soils in some areas of the Plant. Pantex has been investigating and cleaning up these areas, known as corrective action units, in agreement with state and federal regulations, the Pantex Hazardous Waste Permit, the Pantex Compliance Plan, and regulatory guidance.

Cleanup and Closure Process

The Texas Commission on Environmental Quality (TCEQ) and U.S. Environmental Protection Agency (EPA) oversee the investigation and cleanup of corrective action units at Pantex. The objective of the investigation is to determine where chemicals or radionuclides have been added to the environment and determine if it is necessary to clean up the chemicals and radionuclides to protect human health and the environment. After investigation, Pantex uses the information collected to determine if accepted regulatory levels are exceeded. If the area exceeds accepted regulatory levels, then Pantex cleans up the release area to meet the regulatory levels. Pantex has already completed some cleanup to meet human health standards. This ecological risk assessment is also performed as part of the process to determine if further cleanup is needed for the environment. After investigation and necessary cleanup, Pantex will request that the corrective action units be closed. Some of these corrective action units will then go into Long-Term Environmental Stewardship for areas that require special controls or continued monitoring to ensure that human health and the environment continue to be protected. The Compliance Plan for Pantex will be updated after final corrective measures for the Plant are agreed upon with the regulatory agencies and will include the requirements for monitoring and reporting of areas that will continue into Long-Term Environmental Stewardship.

What is an Ecological Risk Assessment?

An ecological risk assessment determines the likelihood that unacceptable ecological effects are occurring or may occur in the future. Ecological effects can only occur if:

1. The chemicals or radionuclides that have been found in soils and sediment may cause an unacceptable ecological effect, and;
2. The plants or animals contact the chemicals or radionuclides long enough and at high enough concentrations to cause an unacceptable ecological effect.

The TCEQ and the U.S. EPA have both published guidance for completing an ERA. The Texas guidance was primarily used to complete the ERA at Pantex because Texas is the lead regulatory agency for overseeing the investigation and cleanup at Pantex.

The ecological risk assessment at Pantex was completed to provide the following information:

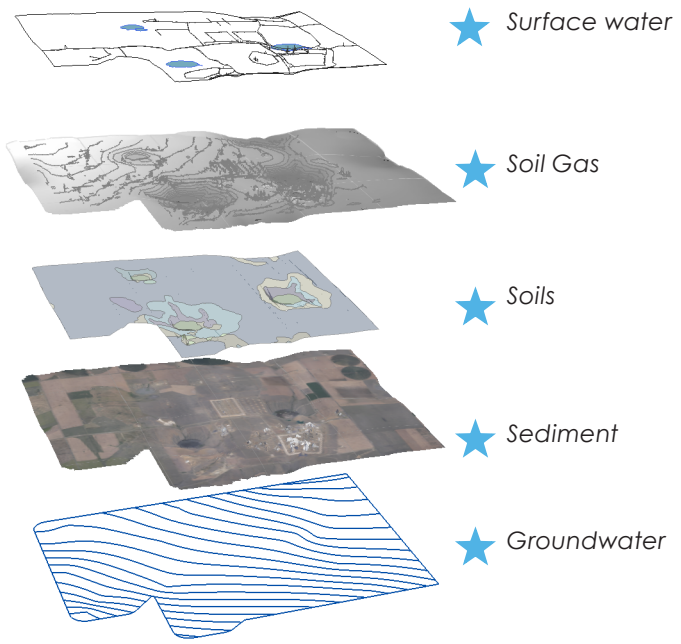
1. Determine whether current or future ecological risks are unacceptable because of chemicals and radionuclides found in the soils or sediments at Pantex.
2. Screen the corrective action units and chemicals of concern present at the units to identify those that might pose an ecological risk and to help focus any future efforts.
3. Develop protective ecological concentration levels, if unacceptable ecological risk is found.

The results of the ecological risk assessment are used to determine if further cleanup is necessary and to identify any long-term monitoring or controls that are required to protect the environment.

Site Investigation

During the numerous investigations at Pantex, soil, soil gas, sediment, surface water, and groundwater samples were collected at the corrective action units to determine if chemicals or radionuclides have affected the environment. Results of the investigations indicate that the following environmental media were affected by the release of chemicals or radionuclides:

Impacted media that have been investigated at the Pantex site include:



The ERA is an evaluation of the corrective action units that were investigated and determined to have chemicals or radionuclides added to the soils, sediment, or surface water.

Surface Water

Chemicals were found above human health screening criteria only at Playa 3. Because the surface water at the playas is important to wildlife at Pantex, surface water was considered for all of the playas in the ERA.

Soils

Chemicals were found in many of the corrective action units. The primary chemicals of potential concern include high explosives, polycyclic aromatic hydrocarbons, metals, and volatile and semi-volatile organic compounds. Radionuclides were identified at three release areas including the Burning Ground, Firing Site 5, and the Nuclear Weapon Accident Residue Storage Unit.

Sediments

Chemicals were found in the sediments at Playas 1, 2, and 3 and Pantex Lake and at Playa 4 on Texas Tech University land south of Pantex Plant. The primary chemicals of potential concern were similar to those found in soils. Treated and untreated industrial wastewater was formerly discharged to Playas 1, 2, and 4 and Pantex Lake through a series of ditches and contributed chemicals to the sediments. Playa 3 received runoff and possible overflows from former waste management pits at the Burning Ground.

Soil Gas

Chemicals that volatilize were found in soils at a few areas at Pantex Plant. The soil gas pathway was not assessed for animals because soil gas was only found in industrial areas that were excluded from the ecological risk assessment. Additionally, treatment systems to remove soil gas have been installed in two of these industrial areas.

Groundwater

Chemicals have been found in perched groundwater beneath portions of Pantex and extending offsite to the east and southeast. Because no wells or springs release affected perched groundwater to the surface, ecological receptors will not be exposed to perched groundwater. Perched groundwater is evaluated in the human health risk assessment.

Chemicals in Affected Soil and Sediment at Pantex

The primary chemicals that have been found in environmental media at Pantex include high explosives, poly-aromatic hydrocarbons, metals, and volatile and semi-volatile organic chemicals. Other chemicals have also been found but are either more limited in the number of areas found or occur in low concentrations. Those include PCBs from electrical transformer leaks, dioxins from areas where materials were burned, and pesticides where equipment was rinsed or pesticides were stored.

Most chemicals found at the corrective action units are from past discharges or waste management practices associated with the manufacture of high explosives at the former Pantex Ordnance Facility and Pantex Plant. Most high explosives dissolved in water naturally break down when exposed to sunlight, so high explosives are typically only found in dry areas (such as the grassland areas) where water does not pond, rather than in the playas.

What are High Explosives?

High explosives are chemicals such as TNT, RDX, and HMX that combust almost instantaneously when ignited by a spark, flame, or other impact.

This photo shows testing of high explosives at a Pantex firing Site.

Other organic chemicals include polycyclic aromatic hydrocarbons and volatile and semi-volatile organics. These organic chemicals are typically solvents that are used in the manufacturing process or for other industrial processes, such as at the vehicle maintenance facilities or in laboratories at Pantex. Volatile organics easily move downward in the soils and are often found as plumes of soil gas where the solvents have entered the soil, then evaporated to create a soil gas plume. Semi-volatile organics and polycyclic aromatic hydrocarbons do not easily move through soils because they attach to soil particles. Therefore, they usually are found in the upper soils where they were released.

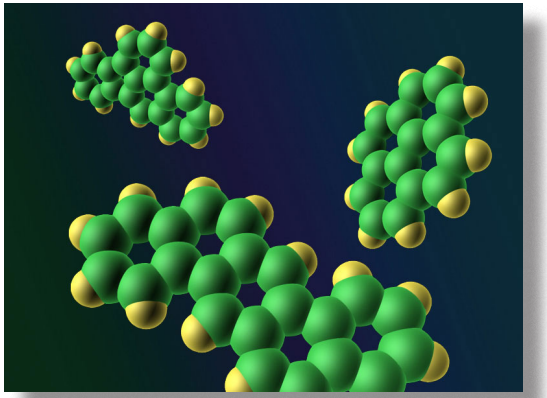


Illustration of a typical polycyclic aromatic hydrocarbon. Image from NASA.

Metals were also released in waste streams and as part of the management of wastes from industrial processes. Metals typically attach to soil particles and do not move through the soils easily. Because they are less mobile, metals are usually found in the upper soils where they were released. Both metals and semi-volatile organics can be transported to other areas when rainfall causes soil erosion.

What are Polycyclic Aromatic Hydrocarbons?

Polycyclic Aromatic Hydrocarbons (PAHs) are a group of chemicals that are formed during the incomplete burning of organic substances such as coal, wood, tobacco, or charbroiled meat. More than 100 different PAHs are known; these generally occur as complex mixtures in combustion products such as soot, rather than as single compounds. Most PAHs occur naturally and can be found in substances such as crude oil, coal, and creosote. A few PAHs are used in medicines and to make dyes, plastics, and pesticides; others are contained in asphalt used in road construction and roofing materials. They are found throughout the environment, either attached to dust particles in the air, dissolved in water, or as solids in soil or sediment.

Radionuclides in Affected Soils at Pantex

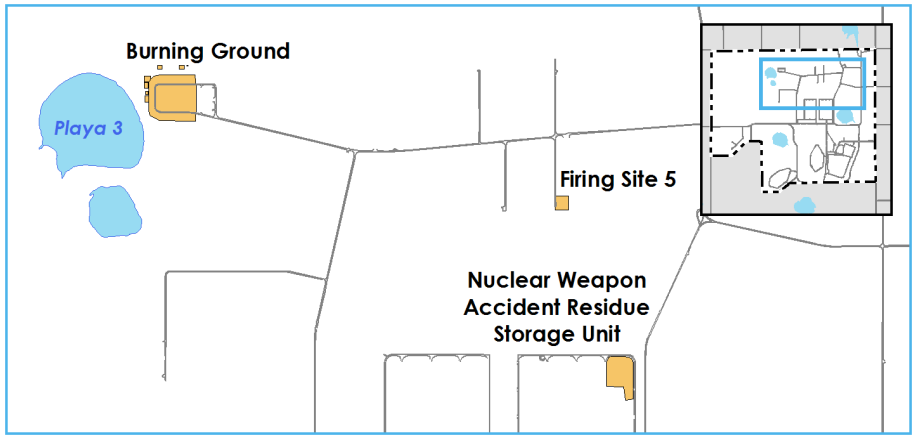
Pantex is the final assembly, disassembly, and maintenance facility for nuclear weapons; therefore, most weapon components are not developed or manufactured at Pantex. High explosives are the only weapon component to have been manufactured at Pantex. Because the nuclear components of the weapons were manufactured at other facilities, Pantex has few radiological concerns.

What is a Radionuclide?

A radionuclide is an atom with an unstable nucleus (for example, uranium-238 [^{238}U]). Radioactivity is the property of some materials to undergo spontaneous nuclear transformations, referred to as decay, that result in the formation of new elements (for example, ^{238}U decays into thorium-234 [^{234}Th]). Radionuclides occur naturally, but can also be artificially produced.

Pantex has three radiological areas of concern: the Burning Ground, Firing Site 5, and the Nuclear Weapon Accident Residue Storage Unit. Most of the radiological concerns are associated with the use of depleted uranium with some of the high explosive testing conducted at outdoor firing sites and from thermal treatment of waste materials at the former burn pads at the Burning Ground. Radiological constituents at the Nuclear Weapon Accident Residue Storage Unit are associated with the storage of soils from the firing sites and of plutonium. Plutonium was released at low levels to soils from a container of nuclear weapon accident residue material from military aircraft accidents that was stored at Pantex. Environmental cleanup has been completed at all three of the radiological areas of concern and was considered in the ERA for Pantex.

The ERA evaluated radionuclides detected in the three radiological areas for possible harmful effects to animals because of radioactive exposure. In addition, total uranium was also assessed for its properties as a metal to ensure that any harmful effects from the uranium metal would also be evaluated. The metallic properties of uranium were a focus of the ERA because of the known harmful effects to kidneys from exposure to uranium. Depleted uranium was detected at all three of the radiological areas of concern.



Pantex has three radiological areas of concern: Burning Ground, Firing Site 5, and the Nuclear Weapon Accident Residue Storage Unit.

What is Depleted Uranium?

Depleted uranium is what is left over when most of the other radioactive types of uranium are removed for the production of enriched uranium. 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. The amount of radiation emitted by depleted uranium is very low, and it does not significantly add to the background radiation that we encounter every day.

Site Description

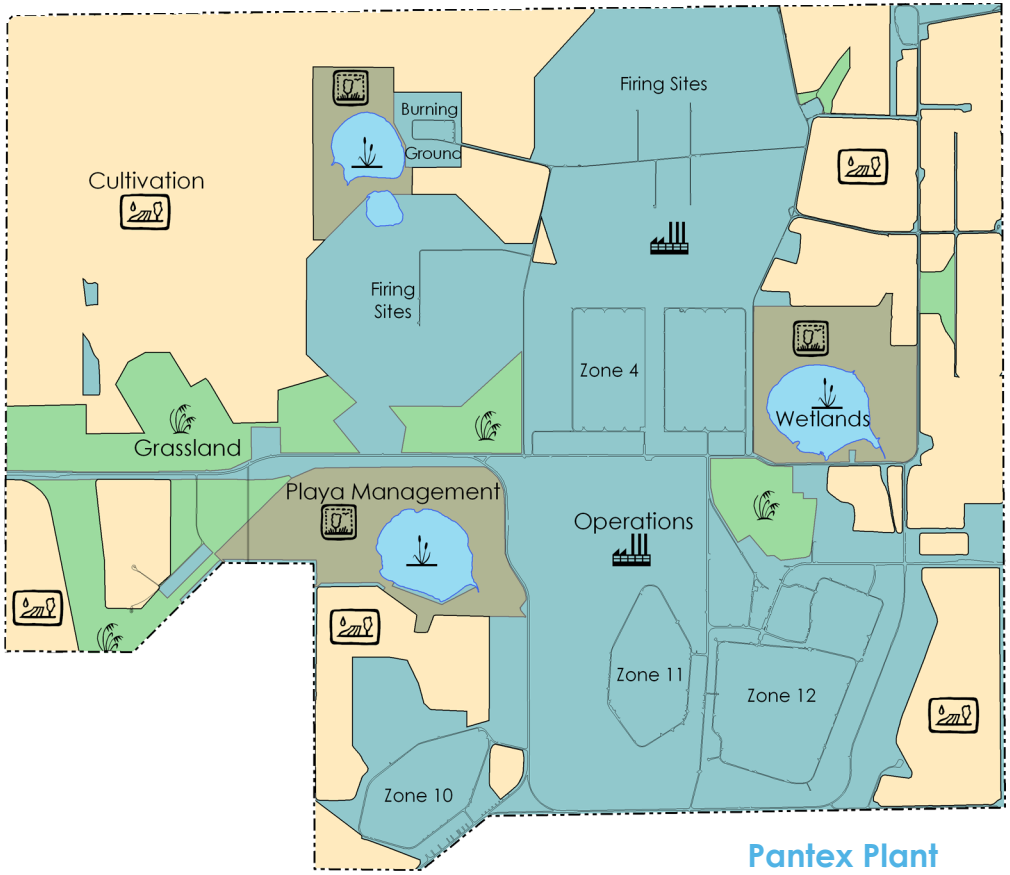
For the ecological risk assessment, the corrective action units were grouped by habitat type or industrial area. The habitat types at Pantex include grasslands, playa wetlands, and agricultural areas. Industrial areas cover large portions of Pantex with the surrounding areas used as safety and security buffers for the Pantex operations.

The industrial areas are where the Pantex mission is completed and contain buildings, roadways, parking areas, and small areas of mowed and maintained grasses. Many corrective action units are within the industrial areas at Pantex. Areas outside of the industrial areas are typically flat or gently rolling grassland areas. Some of the corrective action units are contained in the larger grassland areas. Each type of area is discussed below and depicted on the maps.

Industrial Areas

The corrective action units in the industrial areas are no longer in use, but may be encompassed by currently operational areas. The industrial areas at Pantex are divided into zones and many of the corrective action units are found in Zones 11 and 12. The security areas within the industrial areas include secure fencing, strong lighting at night, and areas devoid of vegetation for enhanced security. These areas are typically characterized by heavier industrial usage and are higher security zones.

Aerial photograph of Zone 12 at Pantex Plant.

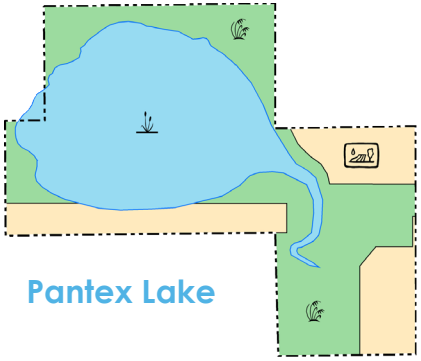


Pantex Plant

The corrective action units in Zones 11 and 12 include:

- Construction debris landfills from demolition of former buildings,
- Evaporation pits and ponds used to collect treated and untreated water,
- Storage areas for drums, batteries, equipment, and tanks,
- Release areas associated with the bomb loading lines from the Pantex Ordnance Facility, the paint shop, former vehicle maintenance area, and pesticide rinse areas;
- Wastewater treatment areas where industrial discharges were treated,
- Fire training area, and
- Ditches that carried storm water and industrial wastewater to the playas.

The Nuclear Weapon Accident Residue Storage Unit is enclosed in Zone 4 east, where very light industrial usage occurs. Portions of Zone 10 are still used operationally and corrective action units similar to those in Zones 11 and 12 are found in this area. The Burning Ground and Firing Sites are active areas that support current operations. These areas are in the outer grassland areas, outside main operational areas of the Plant.



Playas/Wetlands

Playa/wetland habitat corrective action units on the Pantex property (Playas 1, 2, and 3 and Pantex Lake) and Playa 4 on Texas Tech University property were investigated. Some organic chemicals and high explosives were formerly discharged in industrial wastewater streams directly to the ditches that led to Playas 1, 2, and 4 and Pantex Lake. Some, but not all, industrial discharges were treated prior to release. Playa 1 received larger amounts of industrial water discharge and consequently has higher levels of chemicals in comparison to the other playas. Pantex Lake and Playa 1 both received treated wastewater from the Plant. Treated wastewater from the Old Sewage Treatment Plant was discharged to Pantex Lake from the 1940's to the 1970's. In the 1970's, a new Wastewater Treatment Facility was built, and treated water was discharged to Playa 1.

Playa Management Units

Pantex manages Playas 1, 2, and 3 and the surrounding grasslands under a formal management plan. Only the playas are considered as Corrective Action Units; however, the playa management units are important as habitat for animals that will use the playas for food and water. The playa management units are described in more detail in the following Site Cleanup section.

Agricultural operations, such as milo harvest as shown in this photo, are conducted by the Texas Tech University Research Farm.

Cultivated Areas

Agricultural crops are grown in some areas of the Plant; however, the corrective action units are not farmed.

Grasslands

Grassland habitat corrective action units include construction debris landfills that contain the remains of old buildings that were demolished, sanitary waste landfills, release areas associated with the bomb loading lines from the Pantex Ordnance Facility, the Old Sewage Treatment Plant sludge beds and ditches, firing sites used to test high explosives, and the Burning Ground used for thermal treatment and subsequent burial of wastes. The firing sites (except for Firing Site 5) and the Burning Ground are still in use.

What is a Playa?

Playas are usually round depressions with clay bottoms that collect water during rainfalls but dry out during the hot or dry parts of the year. Rainfall is inconsistent in the High Plains area, and drought is a natural and common occurrence. The resulting wet-dry cycles produce highly diverse plant communities that are adapted to both wet and dry conditions. More than 300 species of plants are found in playas. The grasses found in playa watersheds are often taller than in surrounding areas, providing cover and forage for many birds and other wildlife species. Playas serve as stopovers for migratory species of birds during seasonal migration.

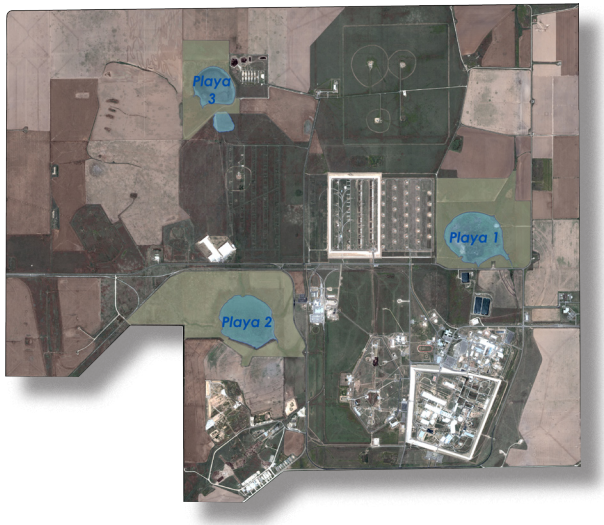
Site Cleanup

Many of the corrective action units have already undergone some type of cleanup action for protection of human health. Additionally, Pantex has changed waste management practices significantly over time. These actions have significantly improved the environment. The actions taken at Pantex include the following:

Excavation of ditch soils in Zone 11.

Soil Removal

Pantex has removed chemical hotspots in affected soils and backfilled with clean soil in many of the industrial areas (Zones 11 and 12), Zone 10, Burning Ground, Firing Site 5, landfills, and ditches. These excavations have removed affected soils that can be contacted by plants and animals and will also help prevent runoff of chemicals to other areas.



Playa Management Units for Playas 1, 2, and 3.

Wastewater Practices

In the 1980's Pantex started treating all industrial wastewaters prior to release to the ditches. In the 1990's Pantex reduced the release of treated industrial wastewater to the ditches by routing the discharge through the Wastewater Treatment Facility. By 1999, all discharges to the ditches were discontinued, reducing the amount of chemicals in the ditches and playas and the transport of chemicals in soils to the playas. These measures also help protect the playa wetlands and the plants and animals that use the playas.

Irrigation System

Pantex installed a subsurface irrigation system in the croplands at Pantex in 2005 to minimize discharge of the wastewaters from the Wastewater Treatment Facility to Playa 1. This measure reduced infiltration to perched groundwater and returned Playa 1 to its natural ecological condition.

Installation of a subsurface irrigation system near Playa 1.

Playa Management Units

Pantex developed management plans for Playas 1, 2, and 3 in 1995. The management plans are updated as needed to incorporate new management goals with the latest update completed in 2002. The goals of the management plans include cultural resource management and protection, erosion control, short grass prairie sustainability, and playa wetlands protection. A buffer area was established around each playa to filter runoff from agricultural and industrial operations, decrease sedimentation, and improve overall water quality in the playas. Within the buffer area of each playa and the playa itself, all cultivation practices were discontinued and the areas were reseeded. Managed grazing that meets the above objectives is included in the management plans. Pantex is currently working on a management plan for Pantex Lake that is similar to the management plans for Playas 1, 2 and 3.

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

Administrative Landfill Covers

Several landfills had up to three feet of new cover material added to reduce dust emissions, promote runoff of rainwater, and to eliminate chemicals from running off to the surrounding lands and the playas. These covers significantly improve the habitat for animals that use the surface soils.

Ditch Lining

Ditches are lined to reduce infiltration from natural runoff in the industrial zones. This also reduces runoff to the downstream ditches and the playas. These measures help protect the playa wetlands and the plants and animals that use the playas.

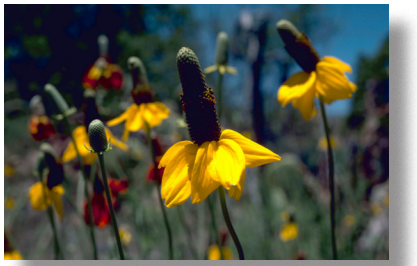
Installation of a ditch liner in Zone 12.

New grass takes the place of the Old Sewage Treatment Plant after demolition.

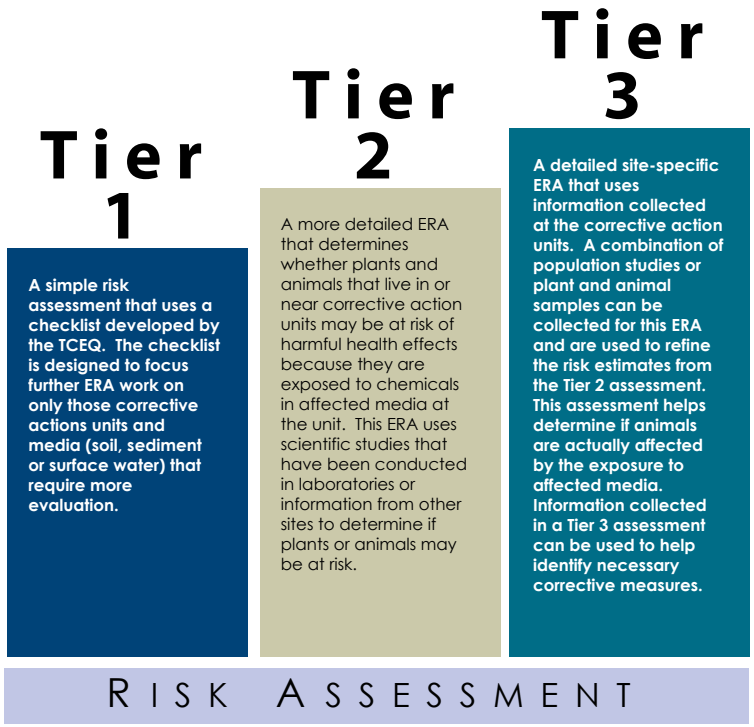
Other cleanup measures include the deactivation and decommissioning of facilities at Pantex, installation of soil vapor extraction systems in the Burning Ground and Zone 11 to remove soil gas, a perched groundwater pump and treat system to remove and treat affected water from the perched zone, and a bioremediation pilot system to treat soils that continue to affect the perched groundwater beneath Pantex. These measures are significant for protection of human health.

RISK ASSESSMENT METHODS

Pantex developed a work plan to describe the approach to evaluate risk to plants and animals that would contact chemicals or radionuclides in the corrective action units at Pantex. To ensure that the risk assessment approach would provide needed information for the state and federal agencies and the Natural Resource Trustees for Pantex, Pantex developed a Focus Team that met to discuss, develop, and approve the methods and approach for the ERA. The Focus Team members included risk assessors from the Texas Commission on Environmental Quality, U.S. Environmental Protection Agency, USDOE/NNSA, and BWXT Pantex. The Natural Resource Trustees for Pantex were also involved in the meetings and provided comments. The Final Work Plan Addendum (BWXT Pantex, 2004) documents the agreed approach and methods for conducting the ERA at Pantex.



Coneflowers.
Photo courtesy US Fish and Wildlife Service.



Ecological Risk Assessment: A multi-tiered approach

A tiered approach was used to evaluate the potential risk to plants and animals at Pantex. The tiered approach requires a more detailed evaluation with each tier, as needed. The ERA starts at a Tier 1 and can progress through a Tier 3 evaluation. The tiered evaluation is based on TCEQ guidance.

Pantex only used the Tier 1 and 2 evaluation, although some site-specific information had been previously collected at Pantex and was used in the final conclusions for the Tier 2 ERAs, as approved in the final Work Plan Addendum.

Natural Resource Trustees

Natural Resource Trustees act on the behalf of the public as Trustees of natural resources. Pantex has both state and federal Trustees. The Trustees that participated in the ERA at Pantex include the U.S. Fish and Wildlife, Texas Parks and Wildlife, Texas General Land Office, and the Texas Commission on Environmental Quality.

Trustees have information and technical expertise about the effects of chemicals and radionuclides on plants and animals, as well as the location of sensitive species and habitats. This expertise can help with determining whether plants and animals have been affected by chemicals or radionuclides that have been added to the environment. Trustees also review site information to determine if natural resources have been damaged so they can ensure that the environment is restored to its normal function.

Pantex included the Natural Resource Trustees at the planning stages of the ERA to ensure that Trustees had early access to information they needed to assess whether natural resources are damaged and require cleanup. The Trustees were involved in the development of the ERA Work Plan and reviewed all detailed ERAs (Tier 2) at Pantex. The Trustees and the TCEQ and EPA risk assessors approved the final ERA Work Plan for Pantex.

Tier 1 Risk Assessment

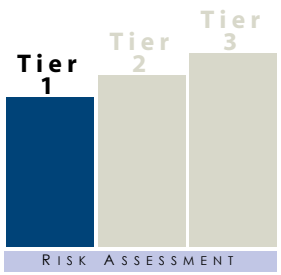
The Tier 1 Checklist is completed to help determine if further ERA work is needed. The completed checklist provides answers to the following basic questions:

Does the corrective action unit have chemicals or radionuclides added to soils or sediment and surface water at or near the unit?

Does the corrective action unit meet TCEQ criteria?

Does the affected area provide good habitat for plants and animals?

The criteria that allow exclusion of a corrective action unit from further evaluation are discussed in more detail below.



Tier 1 Checklists were developed by the TCEQ and must be completed for all corrective action units where chemicals or radionuclides have been found in environmental media such as soils, groundwater, sediments, or surface water. The checklist is designed to focus further ERA work on only those areas and media that require more evaluation. Some areas can be excluded from further evaluation if they meet the criteria in the checklist.

Have chemicals or radionuclides been added to the environment?

The investigations completed at Pantex determine whether chemicals and radionuclides have been added to the environment. All corrective action units that have chemicals or radionuclides below natural background levels do not require any further assessment because nothing has been added to the environment.

Does the unit meet TCEQ criteria?

For those units that have chemicals or radionuclides added to the environment, a Tier 1 Checklist is completed. Although some units have added chemicals or radionuclides to the environment, the corrective action unit can be excluded from a risk assessment if the following TCEQ criteria are met:

- ☐ The affected area is smaller than one acre and the affected area is not expected to spread to a size larger than one acre.
- ☐ The affected soils are below 5 feet.
- ☐ The affected area has some type of cover that will prevent animals from contacting the affected media and the cover keeps the affected area from spreading.

These exclusions are allowed because populations of animals and plants will not be in contact with the affected soils on a regular basis. Animal and plant populations will not be harmed by a small affected area and most animals and plants only contact the upper 1 to 3 feet of soil.

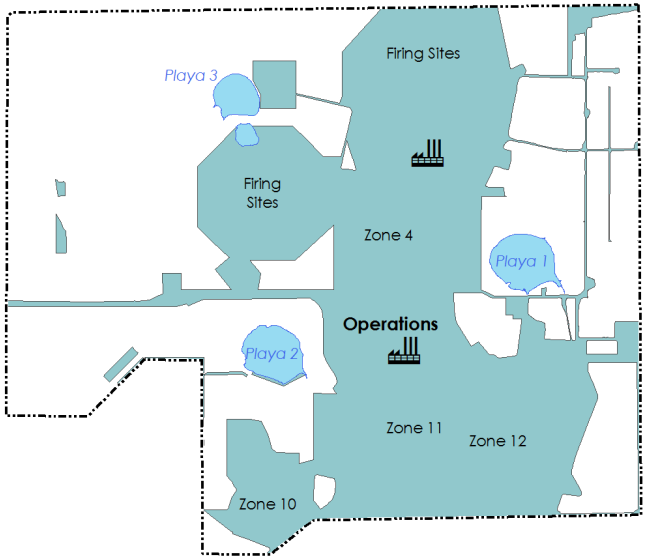
Does the affected area provide good habitat for plants and animals?

If the area is used for industrial purposes and contains buildings, roadways, or paved areas, then the area does not provide good habitat for plants and animals and can be excluded from an Ecological Risk Assessment. Areas that are monitored under the Pantex Plant Hazardous Waste Permit can also be excluded.

Tier 2 Risk Assessment

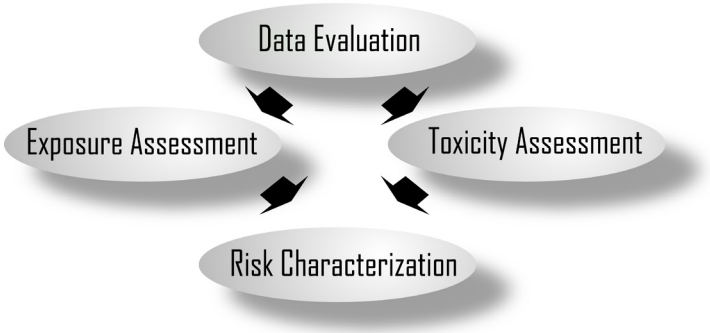
The Tier 1 Checklists focused the Tier 2 ERAs at Pantex to corrective action units outside of active industrial areas. Exceptions to this include landfills with new covers and two units that had affected areas smaller than one acre. The active industrial areas excluded for evaluation of current risk in a Tier 2 ERA include the units in Zone 11, Zone 12, active areas of Zone 10, and the active permitted portion of the Burning Ground. Because runoff from many of the corrective action units in industrial areas could potentially affect the ditches and playas, these units were included in a risk assessment for future risk at the playas.

The Tier 2 ERAs were focused on units in grassland and playa habitats outside of active operational areas. Tier 2 ERAs were completed separately for corrective action units in the grasslands and the playas. The playas were the focus of the Site-Wide ERA Report (BWXT Pantex, February 2005). The playas were chosen for the site-wide assessment because they provide the best habitat for plants and animals at Pantex. Animals would receive the greatest exposure in the playas because animals will be more attracted to the playas which are much larger than the corrective action units in the grasslands. Because all runoff moves to the playas, they also collect runoff from other corrective action units so plants and animals could be affected by the movement of chemicals or radionuclides in the future.



The areas outside of the playas were assessed separately and those Tier 2 ERAs are included in the RCRA Facility Investigation reports for the separate zones and corrective action unit groups at Pantex (see Additional Reading list at the back of this report). The Tier 2 ERA for the playas was included in the Site-Wide ERA Report.

Tier 2 ERA is a screening-level ERA that is completed to find out if plants and animals that live in and around the corrective action units may be at risk due to contact with chemicals or radionuclides that have been added to the environment. This ERA uses available scientific literature and assumptions that are designed to be conservative. This assessment looks at how much of a chemical or radionuclide a plant or animal will be exposed to and compares that exposure to acceptable toxicity criteria. This analysis produces a risk number. This risk number helps determine whether remediation may be required.



The general process for conducting a Tier 2 ERA includes four major steps: data evaluation, exposure assessment, toxicity assessment, and risk characterization.

Ecological Sampling

The investigations provided the results of sampling of soils, sediments, and surface water. Previous animal sampling had also been conducted for prairie dogs, salamanders, mice, and terrestrial invertebrates at the affected playas and grassland areas at Pantex. The same types of animals were also sampled at offsite reference playas that were not affected by Pantex or industrial activities. Reference areas included North Bush Farm Playa, Buffalo Lake National Wildlife Refuge, and the Texas Department of Criminal Justice Playa. Comparison of the measured concentrations of chemicals in the animal tissue is used to help determine whether chemicals in the environment may be affecting onsite animals.

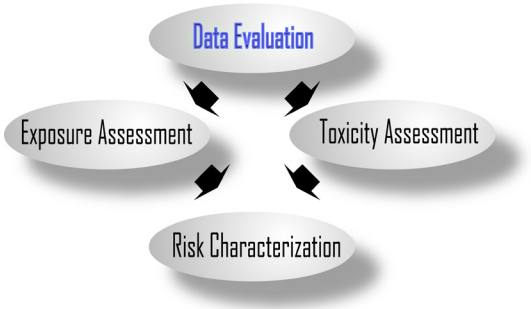
Population studies have also been conducted for benthic macroinvertebrates (such as mussels and crayfish) at the playas, mice, prairie dogs, and plants in the playas and grasslands. These population studies also help determine if the chemicals in the environment are affecting onsite animal and plant populations.

Additional information was also collected to help answer questions specific to the ERA. Because most animals only contact the upper 5 to 6 inches of sediments in wetland areas, sediment samples in the upper 6 inches of the soil column were collected in the playas and ditches. Surface water samples were collected right above sediment samples to determine how the affected sediments may be affecting surface water.

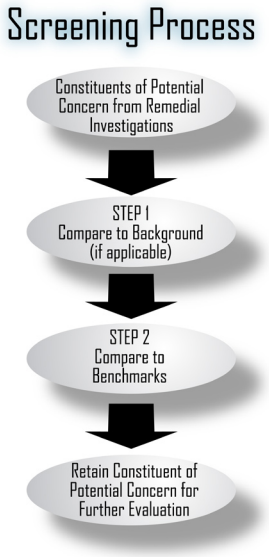
Salamander sampling in a playa near Pantex Plant.

Data Evaluation

This step involves evaluating all available data from the investigations and other ecological studies that have been conducted at Pantex to determine if enough data are available to determine whether plants and animals are at risk. Data collected during the investigation phase and during the ERA were used to evaluate risk to plants and animals.

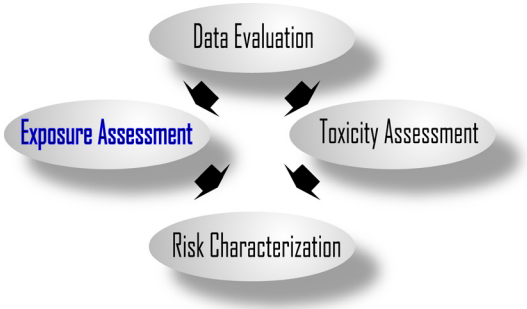


After collecting all data, the data are then screened against naturally occurring background concentrations for Pantex Plant and benchmarks provided by the TCEQ. Benchmarks are developed for groups of animals that can be exposed to affected soils, sediment, or water and are designed to be protective of all animals. Because they are protective of all animals, the benchmarks are conservative. TCEQ and EPA do not have radiological benchmarks for animals, so Pantex used ecological benchmarks developed by the USDOE for the radionuclides. This screening focuses the rest of the risk assessment only on those chemicals or radionuclides that have the potential to affect plants and animals. The results of the data screening indicated that only chemicals were required to be evaluated in the Tier 2 ERA because measured radiological activities were below background or ecological benchmarks.



Exposure Assessment

The exposure assessment is conducted to determine how animals or plants will be exposed to affected media and how much of the chemicals they will eat or drink as part of their food source. Many different plants and animals may live in a single habitat. Models of the two primary habitat types at Pantex, grassland and playa wetland, were developed to determine what animals may be exposed in each type of habitat.



Indicator Species

From the habitat model, indicator species are chosen to represent all animals with similar feeding habits in each type of habitat. For example, one bird is chosen to represent all birds that eat insects. The indicator species are chosen because they have the maximum exposure to affected soil, sediment, and surface water for animals with different feeding habits. Feeding habits of threatened and endangered species are also reviewed to ensure the indicator species are a good representation of species that require special protection. The chosen indicator species are fully evaluated through the Tier 2 ERA.

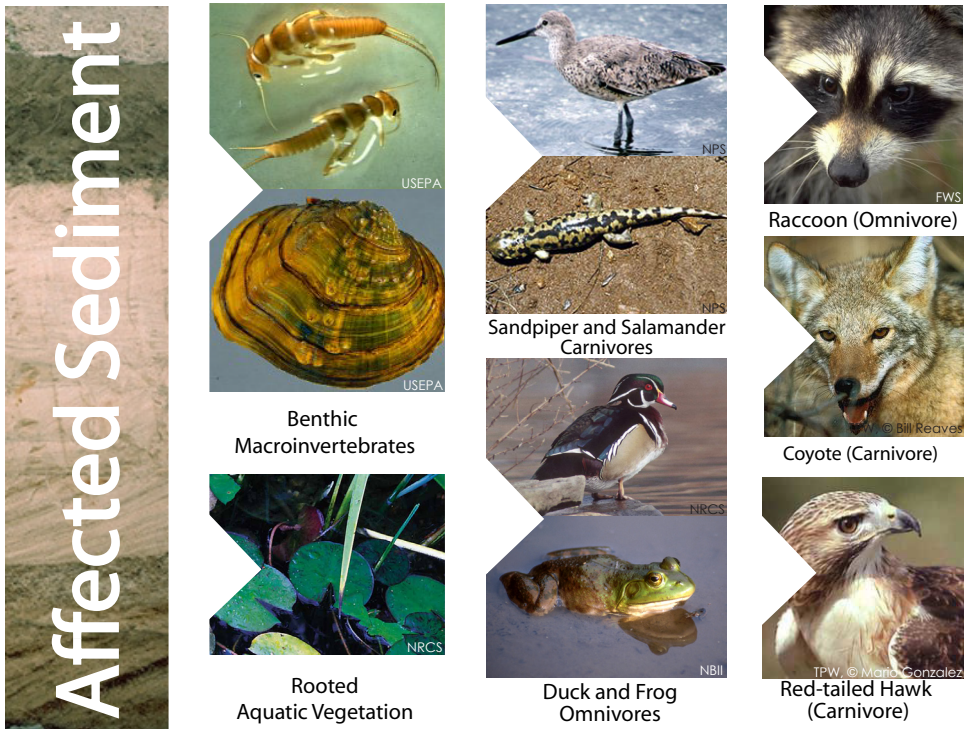
The playa wetland was evaluated both as a dry and a wet playa. For the dry playa evaluation, all of the grassland species were evaluated with the exception of the Texas horned lizard because their primary food source (ants) is not found in the bottom of the playas.

To determine risk to the indicator species, information was gathered to estimate what they eat, how much they eat on a daily basis, their average weight, and how large of an area in which they live and hunt. All of these factors are important to determine how much of the chemicals they will receive through food, soil, and water on a daily basis.

What is sediment?

Any particulate matter (for example, soil particles) that has been transported by water flow and is deposited as a layer of solid particles to form new soils on the bottom of a body of water (such as a playa).

Sediment transported by the Betsiboka River in Madagascar turns the ocean red in this photo taken from the Space Shuttle.



The wet playa wetland habitat model represents how indicator species are exposed to impacted media.

Photos courtesy US EPA, Natural Resources Conservation Service (NRCS), National Park Service (NPS), National Biological Information Infrastructure (NBII), Texas Parks and Wildlife Department (TPW), US Fish and Wildlife Service (FWS).

The grassland/dry playa habitat model represents how indicator species are exposed to impacted media.
Photos courtesy Alex Wild, National Park Service (NPS), Natural Resources Conservation Service (NRCS), Texas Parks and Wildlife (TPW), US Fish and Wildlife Service (FWS), and US Geological Survey (USGS).

Calculating Exposure

For the exposure assessment, the exposure to the affected soils, sediments, water, and food are calculated from sampling data collected during the investigation. Future exposure at the playas were calculated from estimated concentrations in sediment and water. The future concentrations were estimated using sediment fate and transport modeling (described on the next page).

Dose Calculation

All of the information gathered about the animals and the exposure point concentrations are combined into a dose equation to determine how much each indicator species will be exposed.

Example dose calculation for the mouse.

Example dose calculation for the hawk.

Other dose modeling would also have to be completed for the plants and invertebrates. Food chain dose modeling is completed for all indicator species and all chemicals so that a risk number can be calculated for each species and each chemical.

Modeling of Future Sediment and Surface Water Concentrations

A soil erosion model was used to estimate potential future chemical concentrations in playa sediments and surface water. This model estimates rainfall erosion from the overland flow of stormwater. Because the storm events causing erosion only happen a few times a year in the Texas Panhandle, the modeling considered a long time period of about 60 to 120 years of sediment accumulation. Information selected for use in the model was conservative so that estimates of potential future chemical concentrations would be higher than actually expected. The use of conservative assumptions accounts for uncertainty about future conditions.

The model does not account for natural processes that reduce chemical concentrations in sediments deposited in the playas such as:

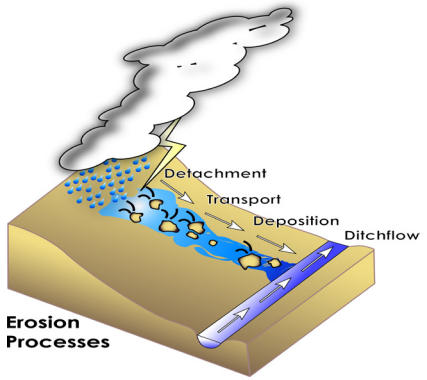
- The breakdown (or degradation) of chemicals to less harmful substances by sunlight or microorganisms (such as bacteria),
- Volatilization of chemicals to the atmosphere, or
- Movement of chemicals deeper into the ground.

In particular, high explosives dissolved in water are rapidly broken down, or degraded, by exposure to sunlight as evidenced by the very low concentrations of high explosives found in the playas despite the historical release of high explosive wastewater to the ditches and playas. In addition, high explosives do not tend to bond with soil particles, but readily move deeper into the ground.

Erosion and sediment transport were evaluated in the Ecological Risk Assessment using the Natural Resource Conservation Service's RUSLE2 soil erosion model and the EPA's Storm Water Management Model (SWMM). TCEQ guidance identifies the RUSLE2 model for estimating erosion of soils by overland flow. Because stormwater also moves through ditches at Pantex, rather than just as overland flow, SWMM was used to evaluate the amount of the sediment that settles out in the ditches that convey stormwater runoff to the playas. Modeling indicated that most sediment settles out in the playas, rather than the ditches. For this reason, future risks were evaluated at the playas.

Erosion and Deposition

The process of erosion involves the removal and transport of soil particles from the soil surface. The removal of soil particles from the soil surface, called detachment, occurs as raindrops hit the soil surface or as storm water flows over the soil surface. The process of detachment adds soil particles to the stormwater runoff. As soil particles are transported, they are deposited as sediment in other areas (such as in the playas). Detachment and deposition occur repeatedly as stormwater flows over the land surface. In areas affected by chemicals, chemicals are transported with the sediment and may be deposited in playas. A portion of the chemicals may also dissolve into the surface water.

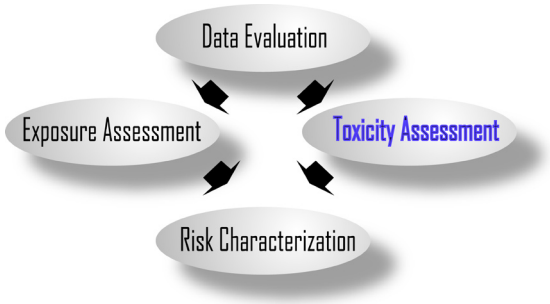


Erosion is controlled by four primary factors: climate, soil, topography, and land use. Climate factors such as the amount and intensity of rainfall affect how much soil is transported with heavier rainfall events causing more erosion. Different soil types detach or transport differently-clay soils do not easily detach, sands are easily detached but not easily transported because of the large particle size, and silts are easily detached and transported. Topography includes factors such as the length, shape, and steepness of soil slopes and affects the amount of sediment carried by the runoff. Land use includes vegetative cover, management practices such as crop rotation or conservation tillage, and supporting practices such as contouring or terracing that help reduce runoff and erosion. Site-specific factors for climate, soil, topography, and land use at Pantex were considered in the sediment transport modeling.

Example of erosion in an agricultural field.
Photo courtesy USDA Natural Resources Conservation Service.

Toxicity Assessment

In the toxicity assessment, information is gathered about how a chemical may affect plants and animals. Toxicity reference values represent a safe dose that an animal can receive and not have effects on growth, reproduction, or survival. Toxicity reference values are gathered from laboratory or field studies of the effects of chemicals on animals. These studies are conducted under conditions that may not be similar to Pantex, but are used for conservatism.



Toxicity Reference Values

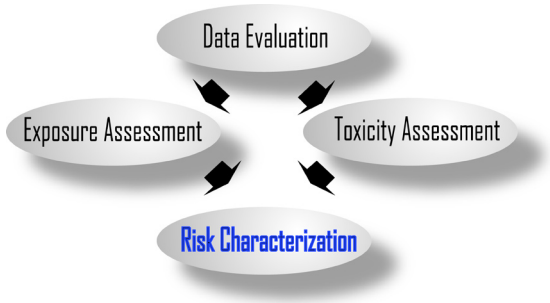
Toxicity reference values were chosen from studies that expose animals to different concentrations of chemicals and then record the effects of those exposures on the animal's growth, ability to reproduce, or ability to survive. These studies provide information about the dose of a chemical that does not affect animals (called a NOAEL - no observed adverse effect level) and the dose that shows that an animal's growth, ability to reproduce, or survive is affected (called a LOAEL - lowest observed adverse effect level).

Both the NOAEL and LOAEL toxicity reference values were used to characterize risk. TCEQ typically requires cleanup levels to be set between the NOAEL and LOAEL risk range, if risks are unacceptable. The NOAEL and LOAEL toxicity reference values were used as the criteria for determining unacceptable risks. If the predicted animal dose at Pantex was below either of the toxicity reference values, no cleanup was required for the corrective action unit because concentrations at the unit were within the acceptable cleanup range.

Risk Characterization

In the risk characterization phase, the exposure, or dose, of each indicator species to each chemical is compared to the toxicity reference value. If the dose that an animal receives from exposure to impacted Pantex soils is higher than the toxicity reference value, it may indicate a potential for risk. These calculations tend to be very conservative and are reviewed in an uncertainty analysis to determine how well they represent what is happening in the Pantex environment.

The uncertainty analysis looks at how naturally-occurring concentrations affect animals, whether similar conditions to Pantex were used in the tests to develop toxicity criteria, differences in the



tissue analysis of onsite and offsite animals, effects of pH and other soil factors on the chemical, whether hot spots of chemicals may affect receptors, and whether threatened and endangered species may be affected. The uncertainty analysis indicated that the predicted risks to animals were generally overestimated, rather than underestimated, so actual risks are expected to be lower than predicted risks.

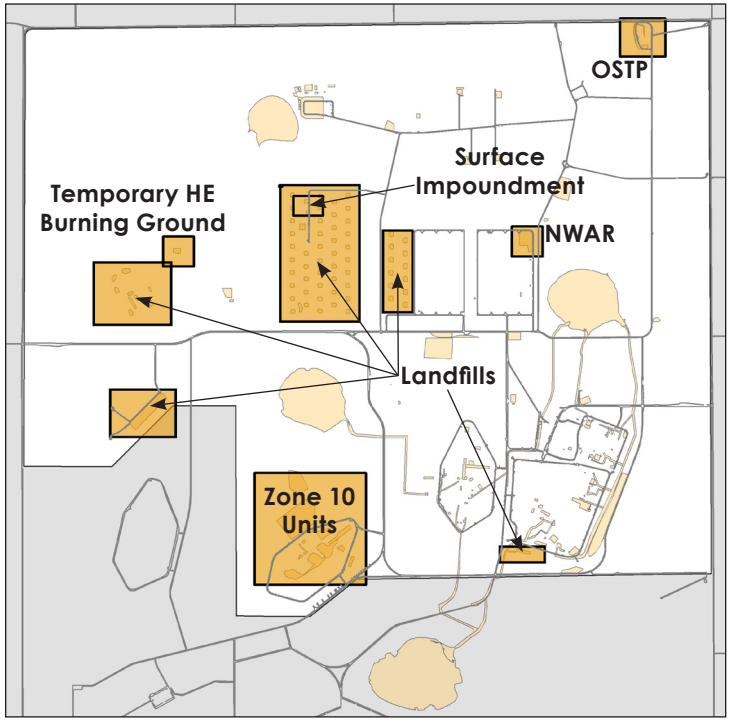
The endpoint of the risk assessment process is to determine if any of the chemical or radionuclide constituents pose an unacceptable risk to ecological receptors. After completing the risk characterization step, those constituents that pose unacceptable risk become constituents of concern (COCs) to be considered for corrective measures. TCEQ and EPA define the risks as being unacceptable if the dose from exposure to impacted soils at Pantex is higher than the toxicity reference value when considering all of the uncertainty in the predicted risks.

Grassland Habitat ERA

The grassland habitat Tier 2 ERA results are summarized here. The full Tier 2 ERAs are included in the separate RCRA Facility Investigation Reports listed in the additional reading material at the end of this report.

The **Zone 10 Corrective Action Units** are located in the inactive portions of Zone 10 and include three TNT settling pit areas, sanitary landfills, construction debris landfills, and the Zone 10 berms. The TNT settling pits and construction debris landfills to the north that contain the building debris are associated with the former Pantex Ordnance Plant. The sanitary and construction debris landfills on the north side of Zone 10 were used from the 1960's to the 1980's for construction debris and general Plant wastes. The Zone 10 berms are large earthen barricades that served as blast barriers for the former ordnance production facilities. Most of the berms have been removed as part of the removal of the former facilities; however, some of the berms were left in place because asbestos-containing tiles and building debris from the former ordnance facilities were found in the berms. During investigation, interim corrective actions in the form of soil and facility removal were completed in the Zone 10 area. Investigations indicate soils in various areas of Zone 10 have been impacted by metals, VOCs, SVOCs, high explosives, pesticides, PCBs, and herbicides.

Several of the **Landfills** across Pantex were assessed because these landfills have no additional cover that would prevent animal or plant contact with the impacted soils. The landfills are construction debris landfills that contain building debris from past facilities that have been removed from Pantex. Investigations of the landfills indicate soils have been impacted by metals, VOCs, SVOCs, and pesticides.



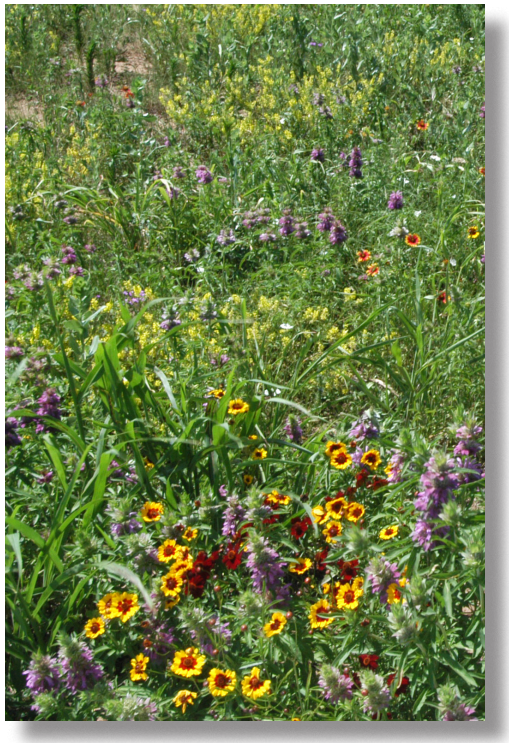
The **Surface Impoundment** facility contained a sump and a lined pond (surface impoundment) that received filtered cooling water and wash-down water from the development of high explosives. The sump, surface impoundment liner, associated piping, and surrounding soils were removed during investigation. Investigations indicate soils in this area have been impacted by high explosives and metals.

The **Old Sewage Treatment Plant (OSTP) Sludge Beds and Ditch** were originally constructed in 1942 to handle wastewater from the Pantex Ordnance Plant and the Amarillo Air Force Base and were used until the 1970's. Residual material from wastewater treatment (sludge) was taken to a sludge digester, then the solid residuals went to sludge drying beds. The ditch that surrounds the OSTP received excess treated wastewater and overflow from the sludge beds. During investigations, interim corrective actions in the form of soil and facility removal were completed. Investigations indicate soils have been impacted by metals, VOCs, and SVOCs.

The **Nuclear Weapon Accident Residue Storage Unit (NWAR)** was used as retrievable storage for containers of weapon accident residue from five military aircraft accidents, firing site soils containing depleted uranium, and low-level waste from Pantex Plant. All storage at this unit has been discontinued, and all wastes were removed and shipped offsite for disposal by 1986. Investigations were completed to confirm previous removal efforts were protective of human health and the environment. Results of the investigation indicate soils are impacted by metals and radionuclides.

The **Temporary High Explosive Burning Ground** was used for the uncontained burning of HE-contaminated waste when the dedicated Burning Ground was not available, from 1951 to 1954 and from 1959 to 1960. During investigations, soil removal and removal of facility material was completed. Investigations indicate soils have been impacted by high explosives, metals, PCBs, VOCs, and SVOCs.

Conclusions for Grassland Habitat ERAs



Wildflowers in bloom at Pantex Plant.

Plants and Macroinvertebrates

Risks above acceptable criteria for a few chemicals were predicted for these receptors. However, the toxicity criteria used for these species are very conservative and are based on studies that are not similar to the Pantex environment. TCEQ does not require development of cleanup goals for plants and macroinvertebrates unless there is unacceptable risk to wide-ranging species such as birds, lizards, mammals, or threatened and endangered species.

All other indicator species

Predicted risks were below acceptable criteria for these receptors. Hot spots of chemical constituents did not pose an unacceptable risk to these wider-ranging species and there were no unacceptable risks predicted for threatened and endangered species. Because the risk to these wider-ranging species is below acceptable levels, no constituents of concern were identified for the grassland habitat corrective action units and no cleanup goals were developed.

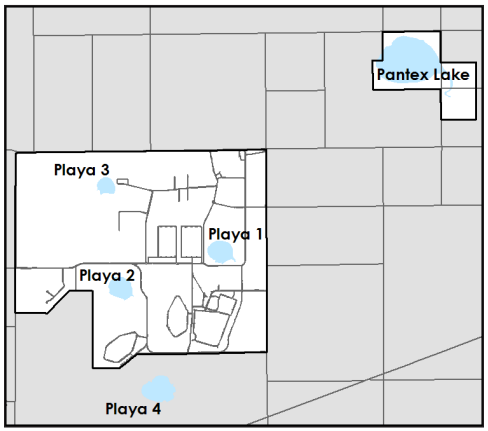
Photo courtesy Texas Parks and Wildlife Department © 2006, Bill Reaves.

Uncertainty Management

Pantex conducted an additional study of the roadside ditches near the OSTP area and a small playa basin south of Playa 3 to determine if possible runoff from impacted soils at nearby grassland habitat corrective action units have impacted those areas. The results of this study are documented in *Sampling Results for the Playa 3 Sub-basin and Ditches Near FM 293* (BWXT Pantex, 2005). The study concluded that the ditches along Farm-to-Market Road 293 have not been impacted by movement of chemicals from the OSTP area, and the Playa 3 sub-basin soil sample results are similar to background or have similar concentrations to those found in Playas 2 and 3, where little impact from past releases was found. Similar concentrations in soils also means that risks are similar, so potential risks at the Playa 3 sub-basin are similar to risks at Playas 2 and 3.

Photo courtesy USDA Natural Resources Conservation Service.

Current Playa Habitat ERA



The conclusions for current risks at the playa habitats are summarized here. Tier 2 ERAs for the playas and associated ditches are included in the Site-Wide ERA Report listed in the additional reading at the end of this summary. The Site-Wide ERA evaluated Playas 1, 2, 3, and 4 and Pantex Lake.

Playa 1 and Pantex Lake ERA

Playa 1 and Associated Ditches received treated and untreated historical industrial discharges from high explosive fabrication facilities in Zones 11 and 12 and treated wastewater from the Wastewater Treatment Facility. Industrial practices that released waters to this playa changed over time until routine discharges were discontinued in 2005 when a subsurface irrigation system was installed to minimize discharges to Playa 1.

Playa 1

Playa 1 contains approximately 79 acres of wetland and is now wet only in response to rainfall events because of the removal of discharges. Playa 1 is actively managed under the Pantex Plant Playa Management Plan, so it is not used for industrial purposes although managed grazing is allowed in the playa area on a limited basis. Results of the investigation of Playa 1 indicate sediments have been impacted by the more persistent chemicals, including metals, SVOCs, pesticides, and PCBs. These chemicals break down slowly or are trapped by soils and will not move downward in the environment. Isolated detections of high explosives were found in sediments of Playa 1.

Pantex Lake received treated wastewater from the Old Sewage Treatment Plant from 1942 to the 1970's, when the Old Sewage Treatment Plant was replaced with a newer facility. The Old Sewage Treatment Plant received wastewater from the former Pantex Ordnance Plant and Pantex Plant, and from the City of Amarillo and the former Amarillo Air Force Base from 1942 to 1965. Water was discharged to Pantex Lake through an underground pipeline that carried the water from the Old Sewage Treatment Plant to the playa bottom.

Pantex Lake

Pantex Lake contains approximately 337 acres of wetland and is now wet only in response to rainfall events. The land surrounding Pantex Lake is used to grow crops and much of the area is grazed, including the playa bottom. Pantex Lake is not formally managed under the Pantex Playa Management Plan, but has been managed by TTU. A small prairie dog community surrounds the playa to the north and east. Results of the investigation of Pantex Lake indicate sediments have been impacted by the more persistent chemicals that do not quickly break down or move downward in the environment, including metals, SVOCs, and pesticides. A few detections of VOCs were found at Pantex Lake.

Conclusions for Playa 1 and Pantex Lake

Plants and Macroinvertebrates

Risks above acceptable criteria for a few chemicals were predicted at Playa 1 and Pantex Lake. However, the toxicity criteria used for these species are very conservative and are based on studies that are not similar to the Pantex environment. TCEQ does not require development of cleanup goals for plants and macroinvertebrates unless there is unacceptable risk to wide-ranging animals such as birds, lizards, mammals, or threatened and endangered animals.

Dragonfly and frog fruit at Playa 1.

Pennsylvania smartweed and kildeer at Playa 1.

All other indicator species

Risks were below acceptable criteria for these animals. Site-specific animal data were used to help refine the final risk predictions for metals at Playa 1 and Pantex Lake. Tissue data for animals collected in onsite and offsite playas indicate that levels of metals in the tissues of onsite animals are similar to levels of metals in the tissues of animals found in offsite locations that are not affected by Pantex or other industrial activities. This is because the playa soils trap metals and limit the amount of metals that can transfer to plants or water where the animals will be exposed. Because the risk to these wider-ranging animals is below acceptable levels, no constituents of concern were identified for Playa 1 or Pantex Lake, and no cleanup goals were developed.

Playas 2, 3, and 4 ERA

Playa 2 and Associated Ditches received treated and untreated industrial discharges from a portion of Zone 11. Discharges from facilities in this portion of Zone 11 were much less than those sent to Playa 1 because most of the water from the high explosive facility in Zone 11 was routed to a treatment facility that released wastewater to ditches leading to Playa 1. Wastewater practices changed over time until all discharges to the ditches were discontinued in 1999.

Playa 2

Playa 2 contains about 74 acres of wetland habitat and is wet only in response to rainfall events. Some of the areas around Playa 2 are farmed, and managed grazing is allowed in Playa 2. Playa 2 is also actively managed under the Pantex Playa Management Plan. An extensive prairie dog community surrounds Playa 2 to the west, north, and east. Results of the investigation of Playa 2 indicate sediments have been impacted by persistent chemicals, including metals and SVOCs. A single detection of a VOC was found at Playa 2.

Playa 3 receives stormwater runoff from the Burning Ground and surrounding agricultural lands. Playa 3 was investigated for impacts because of potential runoff from solvent evaporation pits and burn pads that were formerly used in the adjacent Burning Ground.

Playa 3

Playa 3 and its small sub-basin to the south contain about 54 acres of wetland habitat. These two playa basins are connected when enough water is present. Playa 3 is surrounded by agricultural land on three sides with the Burning Ground adjacent to the east. Playa 3 is actively managed under the Pantex Playa Management Plan, and managed grazing is allowed under this plan. A small prairie dog community surrounds Playa 3. Results of the investigation indicate Playa 3 has been impacted by low levels of metals, pesticides, SVOCs, and VOCs. A single detection of one high explosive was found at Playa 3.

Playa 4

Playa 4 and Associated Ditches are located on Texas Tech University (TTU) property south of Pantex and formerly received treated and untreated industrial discharges from the southern portions of Zones 11 and 12. Discharges to Playa 4 were much less than those sent to Playa 1 because no high explosive fabrication facilities were located in those areas. Wastewater practices changed over time until all discharges to the ditches were discontinued in 1999.

Playa 4 contains about 113 acres of wetland habitat and is only wet in response to rainfall events. Playa 4 is grazed and the surrounding agricultural area is managed by TTU. An extensive prairie dog community surrounds Playa 4. Results of the investigation indicate Playa 4 is impacted by low levels of metals, pesticides, SVOCs, and VOCs.

Conclusions for Playas 2, 3, and 4

Plants and Macroinvertebrates

Risks above acceptable criteria for a few chemicals were predicted at these playas. However, the toxicity criteria used for these species are very conservative and are based on studies that are not similar to the Pantex environment. TCEQ does not require development of cleanup goals for plants and macroinvertebrates unless there is unacceptable risk to wide-ranging animals such as birds, lizards, mammals, or threatened and endangered animals.

Prairie rattlesnake at Pantex.

Jackrabbit near Playa 3; burrowing owl with young near Playa 2.

All other indicator species

Risks were below acceptable criteria for these animals. Because the predicted risk to these wider-ranging animals is below acceptable levels, no constituents of concern were identified for Playas 2, 3, and 4 and no cleanup goals were developed.

Uncertainty Management

Results from the study on the Playa 3 sub-basin indicated that measured concentrations were similar to the concentrations at Playas 2 or 3. Because the concentrations are similar, risks would also be similar. For this reason, no constituents of concern were identified for the Playa 3 sub-basin, and no cleanup goals were developed.

Future Playa Habitat ERA

Future risks were evaluated through use of sediment fate and transport modeling. All corrective action units that were investigated and found to have soils impacted by releases of chemicals were used in the evaluation of future risks at the playas because runoff from the units could impact the playas in the future. The sediment fate and transport modeling predicted future concentrations in sediments at the playas. Those predicted concentrations were compared to current measured concentrations in the playas to determine if chemical concentrations, as well as risks, could potentially increase or decrease in the future.

Future risks were evaluated for Playas 1, 2, 3, and 4. A small playa basin south of Playa 3 was also evaluated because runoff from the surrounding lands could impact this playa sub-basin. Pantex Lake does not receive runoff from Pantex Plant areas where the corrective action units are found, so it was not evaluated for future risk.

For each playa, runoff from the entire playa basin was evaluated to determine future sediment concentrations in the playa bottom. Because large areas outside of the playa bottoms contain soils that have not been impacted by past operations at Pantex, these background areas were also considered when evaluating future impacts to the playas.

Playa 1 Drainage Basin

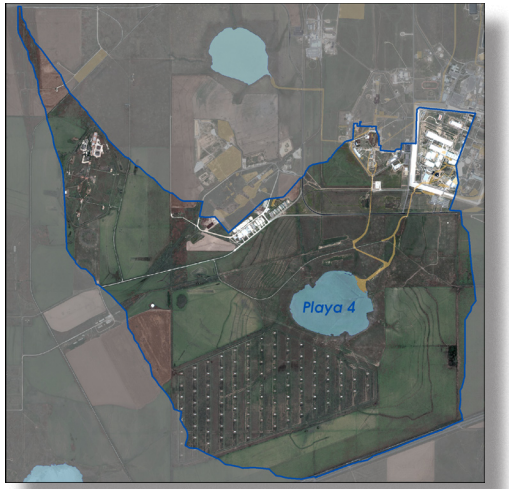
Playa 1 receives stormwater runoff from its surrounding basin, including many of the industrial areas at Pantex. The drainage basin for Playa 1 covers 2,430 acres. Approximately 7% of the basin contains impacted areas (highlighted in orange) that could contribute chemicals to the playa basin.

Playa 2 Drainage Basin

Playa 2 receives storm-water runoff from the west-central portion of Zone 11, the landfills north of Zone 10, and its surrounding playa basin. The drainage basin for Playa 2 covers 2,280 acres. Approximately 3% of the basin contains impacted areas that could contribute chemicals to the playa basin.

Playa 3 Drainage Basin

Playa 3 receives stormwater runoff from the Burning Ground and surrounding agricultural lands. A second smaller sub-basin just south of Playa 3 was also investigated as part of the future risk evaluation. The two playa basins are only connected when enough water is present in the playas. For this reason, each playa basin was assessed separately. The Playa 3 sub-basin receives runoff from surrounding agricultural lands and the Firing Sites to the south. The Playa 3 drainage basin covers approximately 980 acres. Approximately 6% of the basin contains impacted areas that could contribute chemicals to the playa basin. The Playa 3 sub-basin covers approximately 210 acres. Less than 1% of the basin contains impacted areas that could contribute chemicals to the playa basin.



Playa 4 Drainage Basin

Playa 4 receives stormwater runoff from the southern portion of Zones 10, 11, and 12, surrounding agricultural fields on TTU property, and from Department of Defense corrective action units on TTU property. The Playa 4 drainage basin covers 3,160 acres. Approximately 2% of the basin contains impacted areas from Pantex Plant that could contribute chemicals to the playa basin.

Results and Conclusions

Over 100 chemicals found in soils at the corrective action units outside of the playas were evaluated to determine if they could move to the playas and affect plants or animals in the future. Based on results of the sediment modeling, future concentrations of chemicals in playa sediments and surface water are expected to be similar to or lower than current concentrations. Therefore, future risks for plants and animals are expected to be similar to or lower than current risks.

Concentrations of a few high explosives and PAHs were predicted to increase because the model did not account for natural breakdown that can occur in the environment. All other chemical concentrations were predicted to decrease or be similar to natural background levels in the environment.

Because risks from current measured concentrations in the playas are within acceptable levels, future risks are also expected to be similar. For this reason, no constituents of concern were identified for corrective action units that may contribute chemicals to the playas, and no cleanup goals were developed.

Future Conclusions for High Explosives

Historically, chemicals in the ditches and playas at Pantex Plant originated from industrial wastewaters that were discharged directly to the ditches. In fact, Playa 1 was known as "Red Lake" among Pantex workers because dissolved high explosives gave the water a red or pink color. The direct discharge of untreated wastewater to the ditches was discontinued in the 1980's, and the ditches are currently used only for stormwater drainage. As a result, the only potential source of chemicals is stormwater runoff from surface soils that have been impacted by chemicals. The potential for contamination from this source is much less than from the historical industrial discharges. In addition, the worst areas of impacted surface soils have been removed, greatly reducing potential chemical concentrations in runoff.

High explosives dissolved in water naturally break down when exposed to sunlight. So the small amount of high explosives that are predicted to slowly move to the playas during rainfall events are expected to naturally break down. This prediction is supported by sediment data collected in the playas that indicate very little or no high explosives are now present in the sediments at the playas even though large amounts of high explosives were released in past industrial wastewater discharges. Analysis of surface water data collected in the playas since 1992 also indicate that low-level detections of high explosives are only occasionally seen in Playas 1 and 3.

CONCLUSIONS

As part of the corrective action process for Pantex Plant, ecological risk assessments were conducted to identify constituents of concern that would need to be evaluated for a corrective measure. The risk assessments are based on data collected from numerous remedial investigations and during the ecological risk assessment. These data were used to evaluate impacts from chemicals and radionuclides in soil, sediment, and surface water. Fate and transport modeling was conducted to evaluate whether constituents migrating from corrective action units to the playas would affect future plant and animal populations. The risk assessment conclusions are as follows:

Wildflowers at Pantex Plant.

1 Results of the ecological risk assessment indicate that current animal exposures to chemicals or radionuclides are below regulatory accepted levels or are similar to background and further cleanup is not required.

2 Future risks due to potential movement of chemicals from other corrective action units to the playas are similar to current risk results and further cleanup is not required to protect plants and animals in the future.

3 Cleanup actions already completed by the Environmental Projects and Operations Division and improvement of past waste management practices at Pantex have protected plants and animals at Pantex.

Based on the results of the ecological risk assessment, no unacceptable risks were identified, and further evaluation in a Tier 3 ERA or corrective action is not necessary. Corrective action units that require a human health risk assessment were included in separate risk assessment reports and are also summarized in a separate report.

NEXT STEPS

All ecological risk assessments have been completed for the corrective action units at Pantex and submitted to regulatory agencies for review and approval. The TCEQ has approved the Pantex ERA. Pantex is awaiting the final EPA concurrence with the TCEQ approval.

The final ecological risk assessment status of each corrective action unit is provided in the detailed results of the *Site-Wide ERA Report*. The information presented in the *Site-Wide ERA Report* will be used in future 5-year reviews of site-specific assumptions used in the ERA. The 5-year review process is conducted in accordance with the Pantex Plant Compliance Plan (CP-50284). These reviews will be done to ensure that basic assumptions affecting risk decisions are still in place (for example, areas excluded from the ERA as operational are still operational or that grazing is still conducted in the same manner). If assumptions have changed, a review will be conducted to determine if those changes will affect the predicted risks to the ecological communities.

Additional Reading Material

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

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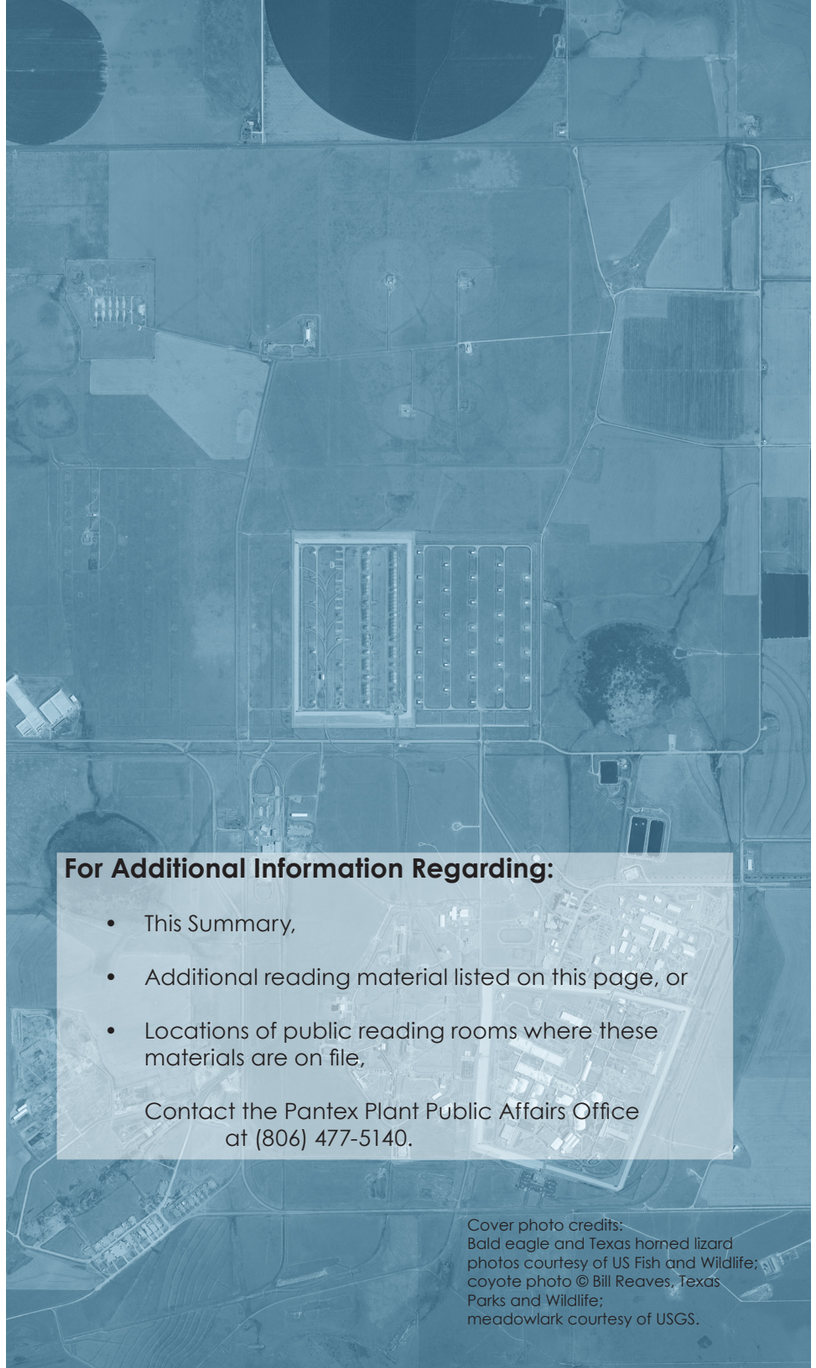
TCEQ, 2001. Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas. Located on the web at: www.tceq.state.tx.us/remediation/eco/eco.html. December 2001. Updated January 2006.

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

U.S. EPA. National Center for Environmental Assessment. Ecological Risk Assessment web page located at: cfpub.epa.gov/ncea/cfm/ecologic.cfm



For Additional Information Regarding:

- This Summary,
- 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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Glossary

Aquatic biota	A community of algae, plants, and animals that make up an aquatic ecosystem such as in a playa or lake.
Benthic macroinvertebrate	An animal without a backbone (for example, worm or insect) that lives in or on the sediments in a body of water.
Drainage basin	An area of land that drains to a river system or playa. Drainage basins are also known as watersheds.
Erosion	The removal and transport of soil particles from the soil surface by rainfall or wind.
Exposure	Contact by a receptor through eating, drinking, or skin contact with media that may be impacted by constituents.
Food chain	A group of plants and animals linked to each other through predator-prey relationships.
Habitat	The area or environment where an organism or ecological community normally lives.
Macroinvertebrates	Organisms that do not have a backbone and are large enough to be seen with the naked eye (for example: spiders and insects).
PAH	Polyaromatic hydrocarbons generally occur as mixtures. They are found in the environment because of their presence in asphalt, tar, creosote, and in some dyes, plastics, and pesticides.
Playa	Natural depressions that are typically round that capture runoff from the surrounding grasslands in the Texas Panhandle. The playas are dry during most portions of the year.
Population	A group of animals or plants of the same species that live in an area. For example: Texas horned lizard population of the Texas Panhandle.
Sediment	Particles (such as soil) that have been transported by water and deposited as a layer of solid particles to form new soils on the bottom of a body of water (such as a playa).
Wetland	An area that is regularly wet and is capable of supporting vegetation typically adapted for life in wet conditions. Wetlands are critical to sustaining many species of wildlife.

Acryonyms

EPA	Environmental Protection Agency
ERA	Ecological risk assessment
TCEQ	Texas Commission on Environmental Quality
VOC	Volatile organic compound
SVOC	Semi-volatile organic compound
PCB	Polychlorinated biphenyl

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