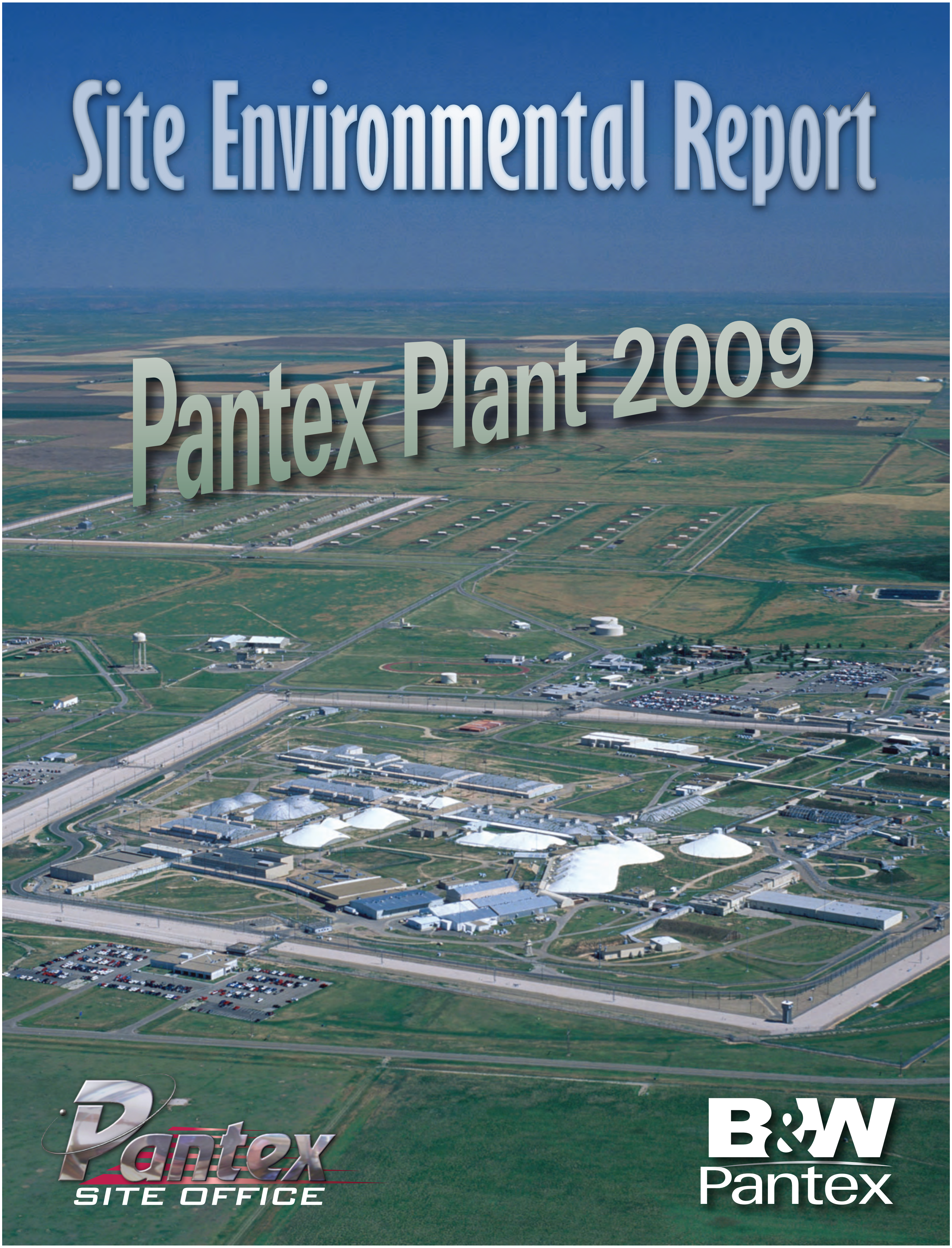
Site Environmental Report

Pantex Plant 2009



Pantex
SITE OFFICE

B&W
Pantex

Site Environmental Report Pantex Plant 2009

September 2010

Work Performed Under Contract No. DE-AC04-00AL66620

Prepared for

U.S. Department of Energy/National Nuclear Security Administration

Pantex Site Office

Prepared by

Environmental Stewardship Department,

Waste Operations Department,

and The Projects Division

Pantex Plant Babcock & Wilcox Technical Services Pantex, LLC (B&W Pantex) Amarillo, Texas 79120-0020

www.pantex.com

This page left blank intentionally.

Help Us Make This Site Environmental Report More Useful for You!

We want this summary to be easy to read and useful. To help continue this effort, please take a few minutes to let us know if this annual report meets your needs. Then tear out this page and mail or fax it to: Julie Chavarria, B&W Pantex/9-059,
P.O. Box 30020, Amarillo, TX 79120-0200.
Phone: (806) 477-6533; Fax: (806) 477-3119.

1. How do you use the information in this summary?

To become more familiar with Pantex Plant monitoring
To help me make a decision about moving to the Texas Panhandle
To send to others outside the Texas Panhandle
To prepare for public meetings
Other (please explain).

2. What parts of the summary do you use?

Pantex Plant overview/mission
Site management
Environmental compliance
Environmental monitoring
Quality assurance
Regulatory oversight
Current issues and actions.

3. Does this guide contain

Enough detail? Too much detail? Too little detail?

Comments:

4. If you could change this guide to make it more readable and useful to you, what would you change?

What is your affiliation? Please circle.

Pantex contractor	DOE
State agency	Federal agency
Public interest group	Member of the public
Member of Native American Nation	Local government
University	Industry.

Other Comments?

Thank you!

Annual Site Environmental Report for Pantex Plant

Julie Chavarria
B&W Pantex/9-059
P.O. Box 30020
Amarillo, TX 79120-0200

Acknowledgements

This report was prepared primarily by the staffs of the Environmental Programs of Babcock & Wilcox Technical Services Pantex, LLC (B&W Pantex). The Environmental Stewardship Department is managed by Jeffrey R Flowers, the Projects Division is managed by Dennis E. Huddleston, Jr., and the Waste Operations' manager is Deborah R. Franklin.

Report preparation was managed by Julie A. Chavarria. Editorial support was provided by Robert K. Roulston, Vo Tudman, H. Wayne Hardin, William R. Wyatt, and Martin R. Amos. Graphics support was provided by Barry W. Guidry and Keith D. Holeman.

The following authors provided information for the chapters for this year's report:

William R. Allen, Jr.
Anthony T. Biggs
Brent M. Bowen
Julie A. Chavarria
Ramon Coronado, Jr.
Boyd E. Deaver
Jeffrey R. Flowers
Laura I. Fox
David W. Griffis
H. Wayne Hardin
Shawn A. Hess
T. Michelle Jarrett
H.F. (Fred) Johnson
J. Michael Keck
D. David McBride
Kevin D. Morris
Barbara A. Nester
Robert H. Pankratz
Christopher A. Puroff
James D. Ray
Monty G. Schoenhals
Raj O. Sheth
Priscilla J. Thompson

The results presented in this report are from samples collected by the Projects Division's Sampling and Analysis Department. Many other staff members in the environmental departments worked on validating data, conducting quality checks, and in making the data available electronically.

The *2009 Site Environmental Report for Pantex Plant* was reviewed for classification and security issues; it was determined to be Unclassified.

This page was intentionally left blank.

Table of Contents

Chapter 5 - Air Monitoring

Chapter 6 - Groundwater Monitoring

Chapter 7 - Drinking Water

Chapter 8 - Wastewater

Chapter 9 - Surface Water

Chapter 10 - Soil

Chapter 11 - Fauna

Chapter 12 - Flora

Chapter 13 - Quality Assurance

FIGURES

TABLES

.

CHEMICALS AND UNITS OF MEASURE

aCi	attocurie
Ag	silver
As	arsenic
Ba	barium
Be	beryllium
Bq	Becquerel
°C	degrees Celsius
Ca	calcium
Cd	cadmium
cfm	cubic feet per minute
Ci	Curie
cm	centimeter
CO	carbon monoxide
Cr	chromium
Cu	copper
cu yd	cubic yard
DMSO	dimethyl sulfoxide
dps	disintegrations per second
E ±n	exponential (E) is10±n where n is some number (see Helpful Information on inside back cover)
°F	degrees Fahrenheit
Fe	iron
ft	foot/feet
ft/sec	feet per second
ft^2	square foot
ft^3	cubic feet
g or gm	gram
g/dL	grams per deciliter
gal	gallon
gpm	gallons per minute
Hg	mercury
hr	hour
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
in	inch(es)
K_2O	potassium oxide
kg	kilogram
km	kilometer
kW	kilowatt
L	liter(s)
lb	pound
m	meter
m/s	meters per second
m^2	square meter
m^3	cubic meter (approx. 1.308 cubic yards)
Ma	million years ago
Mcf	thousand cubic feet
MEK	methyl ethyl ketone
MeV	Megavolt (a.k.a. Million electron volts)
mg/dL	milligrams per deciliter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mi	mile
mi^2	square mile
min	minute
Mn	manganese
mph	miles per hour
mps	meters per second
mrem/hr	millirem per hour
mSv	millisievert
µCi	microcurie
µCi/ml	microcuries per milliliter
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
µL	microliter
µmho/cm	micromhos per centimeter
µR	microroentgen
NO_2	nitrogen dioxide
O_3	ozone
Pb	lead
PCBs	polychlorinated biphenyls
pCi/g	picocuries per gram
pCi/mL	picocuries per milliliter
PETN	Pentaerythrithol tetranitrate
PM_{10}	particulate matter with a mean aerodynamic diameter ≤10 micrometers
ppb	parts per billion
ppm	parts per million
psf	pounds per square foot
psi	pounds per square inch
R	Roentgen
rem	Roentgen equivalent man

RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine	TCE	trichloroethylene/ethene
		Ti	titanium
scfm	standard cubic ft per minute	TNB	trinitrobenzene
		TNT	trinitrotoluene
sec	second	TPY	tons per year
SO_2	sulfur dioxide	yr	year
SU	standard units	Zn	zinc
Sv	Sievert	μ	micro (1.0×10^{-6})

ABBREVIATIONS AND ACRONYMS

AEC	Atomic Energy Commission
AQMR	Air Quality Management Requirement
ARPA	Archaeological Resource Protection Act
B&W Pantex	Babcock & Wilcox Technical Services Pantex, LLC
BCG	Biota Concentration Guide
BOD	Biochemical Oxygen Demand
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMS/FS	Corrective Measures Study/Feasibility Study
COC	Chain of Custody
COD	Chemical Oxygen Demand
COPC	Contaminant of Potential Concern
CP	Compliance Plan
CRM	Cultural Resource Management
CWA	Clean Water Act
CY	Calendar Year
DBP	Disinfectant By-Product
DCG	Derived Concentration Guide
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
DOECAP	DOE Consolidated Audit Program
DQO	Data Quality Objective
EID	Environmental Information Document
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ERA	Ecological Risk Assessment
ESA	Endangered Species Act
FEC	Federal Electronics Challenge
FGZ	Fine-Grained Zone
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FM	Farm-to-Market Road
FY	Fiscal year (October 1 - September 30)
GAC	Granular Activated Carbon
gpd	gallons per day
GPS	Global Positioning Satellite
GWMSC	Groundwater Medium Specific Concentration
GWPS	Groundwater Protection Standard
HAP	Hazardous Air Pollutant
HE	High Explosives
HEPA	High-Efficiency Particulate Air
HHRA	Human Health Risk Assessment
HVAC	Heating-ventilation-air conditioning
IAG	Interagency Agreement
ITRD	Innovative Treatment Remediation Demonstration
ISB	In-situ Bioremediation
ISM	Interim Stabilization Measure
ISMS	Integrated Safety Management System
ISO	International Standards Organization
IWQP	Inland Water Quality Parameter
LAQR	Laboratory Quality Assurance Program
LTM	Long-Term Monitoring
MAPEP	Mixed Analyte Performance Evaluation Program
Max	Maximum
MCL	Maximum Contaminant Level
MDA	Minimum Detectable Activity
MDL	Method Detection Limit

Min	Minimum
MIOX	Mixed-Oxide
MSDS	Material Safety Data Sheet
MSGP	Multi-Sector General Permit
N/A	Not Applicable
NS	No Sample
NAGPRA	Native American Graves Protection and Repatriation Act
NAPL	Non-Aqueous Phase Liquid
NCRP	National Council on Radiation Protection and Measurements
ND	Not Detected
NELAC	National Environmental Laboratory Accreditation Conference
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NNSA	National Nuclear Security Administration
No.	Number
NPS	National Park Service
NRF	NEPA Review Form
ODS	Ozone Depleting Substance
P1PTS	Playa 1 Pump and Treat System
P2	Pollution Prevention
PA/CRMP	Programmatic Agreement/ Cultural Resources Management Plan
PCB	Polychlorinated Biphenyl
PE	Performance Evaluation
PGWCD	Panhandle Groundwater Conservation District
PID	Photo Ionization
PIDAS	DetectorPerimeter Intrusion Detection and Surveillance
PMU	Playa Management Unit
ppm	parts per million
PPOA	Pollution Prevention Opportunity Assessment
PQL	Practical Quantitation Limit
PRCM	Pantex Radiation Control Manual
PTE	Potential to Emit
PXSO	Pantex Site Office
QA	Quality Assurance
QC	Quality Control
Qtr	Quarter
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RFIR	RCRA Facility Investigation Report
ROD	Record of Decision
RRS	Risk Reduction Standard
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SEPTS	Southwest Pump and Treat System
SHPO	State Historic Preservation Office
SOW	Statement of Work
Std Dev	Standard Deviation
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TDSHS	Texas Department of State Health Services
TLD	Thermoluminescent Dosimeter
TPDES	Texas Pollutant Discharge Elimination System
TRI	Toxic Chemical Release Inventory
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
TTRF	Texas Tech Research Farm
UIC	Underground Injection Control
USACE	U.S. Army Corps of Engineers
VEE	Visual Emission Evaluations
VOC	Volatile Organic Compound
WMG	Waste Management Group
WWTF	Wastewater Treatment Facility

GLOSSARY

Activity - The rate of disintegration or transformation of radioactive material, generally expressed in units of Curies (Ci). The official SI unit is the Becquerel (Bq). One Bq (one disintegration or transformation per second) is equivalent to 2.7×10^{-11} Ci.

ALARA - An acronym and phrase, "As Low As Reasonably Achievable," used to describe an approach to radiation exposures and emission control or management whereby the exposures and resulting doses to the public are maintained as far below the specified limits as economic, technical, and practical considerations will permit. ALARA is not a dose limit.

Alpha particle - Type of particulate radiation (identical to the nucleus of the helium atom) consisting of two protons and two neutrons.

Ammonium nitrate - A colorless crystalline salt ($N_2H_4O_3$) used in explosives, fertilizers, and veterinary medicine.

Anion - A negatively charged ion that migrates to an anode, as in electrolysis.

ANSI - American National Standards Institute, a voluntary standards organization; Administrator, U.S. Technical Advisory Group to the International Standards Organization (ISO).

Aquifer - Rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.

Archeology - The scientific discipline responsible for recovering, analyzing, interpreting, and explaining the unwritten portion of the prehistoric and historic past.

Archival - Relating to, contained in, or constituting archives, which are places where generally unpublished public records or historical documents are preserved.

Artifact - Any object manufactured or modified by human beings.

Asbestos - Group of naturally occurring minerals that separate into fibers. The asbestos family includes actinolite, anthophyllite, chrysotile, crocidolite, and tremolite.

Assembly - The process of putting together a nuclear weapon or nuclear weapon component. This process takes place at Pantex Plant.

Background or control samples - Samples obtained from a background sampling location for comparison with samples obtained at or near Pantex. Background or control samples are not expected to be affected by Pantex operations. The U.S. Department of Agriculture Research Station and the Texas Agrilife Bush Research Farm at Bushland, Texas, have often been used as a control or background location.

Background radiation - Ionizing radiation in the natural environment, including cosmic rays and radiation from the naturally radioactive elements, both outside and inside the bodies of humans and animals.

Becquerel (Bq) – The *Système International d'Unités* (SI units) unit of radioactivity is the becquerel, defined as one nuclear disintegration per second; therefore, one Curie (Ci) is equivalent to 3.7×10^{10} Bq.

Best Management Practices - Practices that are not required by law, regulation, or permit, but are designed to help ensure that Pantex Plant produces the highest quality services and products.

Beta particle - Type of particulate radiation emitted from the nucleus of an atom that has a mass and charge equal in magnitude to that of the electron.

Biomass - Literally, "living weight," refers to mass having its origin as living organisms.

Biome - Recognizable community units formed by the interaction of regional climate, regional biota, and substrate, e.g., the same biome units generally can be found on different continents at the same latitudes with approximately the same weather conditions and where topography is similar. Biomes are the largest land community units recognized.

Biota - Living organisms.

Biota Concentration Guide – The limiting concentration of a radionuclide in soil, sediment, or water that would not cause dose limits for protection of aquatic and terrestrial biota to be exceeded. An analogue to the Derived Concentration Guide (DCG) used for human exposure.

Blackwater Draw Formation - Quaternary formation consisting primarily of pedogenically modified eolian sands and silts interbedded with numerous caliche layers. The Blackwater Draw Formation overlies the Tertiary Ogallala Formation at Pantex.

Burning Ground - The Pantex Plant location where thermal processing (burning) of high explosives (HE) is conducted.

Calibration - The adjustment of a measurement system and the determination of its accuracy using known sources and instrument measurements. Adjustment of flow, temperature, humidity, or pressure gauges and the determination of system accuracy should be conducted using standard operating procedures and sources that are traceable to the National Institute of Standards and Technology.

Cation – A positively charged ion that in an electrolyte moves toward a negative electrode.

Cell - (1) This is the smallest unit capable of independent functioning. (2) A structure at Pantex in which certain nuclear explosive assembly or disassembly operations are conducted.

Central flyway - A major migratory route used by large numbers of migrating birds in fall and spring that crosses the central portion of North America from Canada to Mexico.

Centripetal drainage - The flow of water in a basin toward a central drain or sink, such as a pond or lake.

Code of Federal Regulations (CFR) - Final federal regulations in force: published in codified form.

Composite samples – Samples that contain a certain number of subsamples.

Council on Environmental Quality (CEQ) - Created, in the Executive Office of the President, by the National Environmental Policy Act (NEPA), such that its members are exceptionally well qualified to analyze and interpret environmental trends and information of all kinds; to appraise programs and activities of the Federal Government in the light of the policy set forth in Title I of NEPA; to be conscious of and responsive to the scientific, economic, social, aesthetic, and cultural needs and interests of the Nation; and to formulate and recommend national policies to promote the improvement of the quality of the environment.

Cultural Resources - Districts, sites, structures, and objects and evidence of some importance to a culture, a subculture, or a community for scientific, traditional, religious, and other reasons. These resources and relevant environmental data are important for describing and reconstructing past lifeways, for interpreting human behavior, and for predicting future courses of cultural development.

Depleted uranium - Uranium for which the content of the isotope of uranium-235 is smaller than the 0.7 percent; the level found in naturally occurring uranium (and thus generally synonymous with the isotope uranium-238).

Derived Concentration Guide - The concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (for example, ingestion of water or breathing the air) would result in an effective dose equivalent of 100 mrem, (0.1 rem or 1 mSv). Values for these concentrations are listed for each of the indicated exposure modes in Chapter III of DOE Order 5400.5 by radionuclide.

Dismantlement - The disassembly of a nuclear weapon no longer required by the DOD. This process takes place at Pantex Plant.

Dockum Group - Triassic sedimentary rocks that underlie the Ogallala Formation at Pantex Plant. The Dockum Group rocks consist of shale, clayey siltstone, and sandstone.

Dose - The quantity of ionizing radiation received. Often used in the sense of exposure dose (a measure of the total amount of ionization that the radiation could produce in air, measured in roentgens [R]). This should be distinguished from the absorbed dose (measured in rads) that represents the energy absorbed from the radiation per gram of any material. Furthermore, dose equivalent (or biological dose), given in rem, is a term used to express the amount of effective radiation when modifying factors such as quality factors have been considered. It is therefore a measure of the biological damage to living tissue from the radiation exposure.

Duplicate sample - A sample that is taken at the same location and the same site; it may be taken simultaneously or consecutively. This sample may be collected for the purpose of evaluating the performance of a measurement system or of the homogeneity of a sample population; i.e., to determine whether the sample results are representative or an anomaly. The duplicates are supposed to be similar in terms of the population sampled.

Ecosystem - Living organisms and their nonliving (abiotic) environment functioning together as a community.

Effective Dose Equivalent (EDE) - The sum of the products of the exposures to individual organs and tissues and appropriate weighting factors representing the risk relative to that for an equal dose to the whole body.

Effects Screening Levels (ESL) - Guideline concentrations established by TCEQ to evaluate the potential impacts of air pollutant emissions including acute and chronic health effects, odor nuisance potential, vegetation effects or corrosion effects. ESLs are set to provide a margin of safety below levels at which adverse effects are reported in scientific literature. This margin of safety is added to protect sensitive sub-populations, such as children, the elderly, and persons with pre-existing illnesses.

Effluent - A fluid discharged into the environment; an outflow of waste. Its monitoring is conducted at the point of release.

Emission - A substance discharged to the air.

Emissions standards - Legally enforceable limits on the quantities and/or kinds of air contaminants that can be emitted into the atmosphere.

Encephalitis - Inflammation of the brain (specifically western equine and eastern equine). In the U.S., this is an acute, often fatal, viral disease of the central nervous system that is transmitted to humans by mosquitoes (arthropods) after a blood meal from infected horses or mules.

Environmental Monitoring - Sample collection and analysis of environmental media, i.e., air, water, soil, foodstuff, and biota for the purpose of assessing effects of operations at that site on the local environment. It consists of effluent monitoring and environmental surveillance.

Environmental Protection Agency (EPA) - Federal agency created to protect the nation's water, land, and air from pollution or environmental damage.

Environmental Restoration (ER) Program - Program at Pantex responsible for investigation and remediation of Solid Waste Management Units.

Environmental Surveillance - The collection and analysis of samples, or direct measurements of air, water, soil, foodstuff, and other media for the purpose of determining compliance with applicable standards and permit requirements, assessing radiation exposures of members of the public, and assessing the effects, if any, on the local environment.

Ephemeral - Lasting only a short period of time. Used in this document to describe water bodies that often do not have water year round. Typically, these water bodies have water following the wet seasons and then are dry during the dry seasons.

Evapotranspiration - The sum of evaporation, the process by which water passes from the liquid to the vapor state, and transpiration, the process by which plants give off water vapor through their leaves.

Fauna - Animal life, or animals as a whole, especially those that are characteristic of a region.

Fecal coliform bacteria - Simple organisms associated with the intestine of warm-blooded animals that are commonly used to indicate the presence of fecal material and the potential presence of organisms capable of causing human disease.

Flora - Plant life or plants as a whole, especially those that are characteristic of a region.

Gamma ray (gamma radiation) – High-energy, short wavelength electromagnetic radiation (a packet of energy) emitted from the nucleus. (Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission.) Gamma rays are very penetrating and can be stopped or shielded against by dense materials such as lead or uranium. Gamma rays are similar to X-rays, but are usually more energetic.

Grab sample - A single sample, collected at one time and place.

Hantavirus Pulmonary Syndrome - The hantavirus is found in saliva, urine, or feces of various rodent species and is transmitted to humans by inhalation. It causes rapidly progressive pulmonary symptoms that result in serious illness. Human-to-human transmission has not been demonstrated.

Hazardous material - A material, including a hazardous substance, as defined by 49 CFR 171.8 that poses a risk to health, safety, and property when handled or transported.

Hazardous waste - Defined by 40 CFR Part 261, as any material that a) is a solid waste, and b) is a listed hazardous waste (Subpart D), or c) exhibits any of the characteristics of ignitibility, corrosivity, reactivity or toxicity (Subpart C).

Hemoglobin - A protein found in red blood cells that transports oxygen.

Herpesvirus - Any virus belonging to the family Herpesviridae. It is basically a wildlife disease, and offers possible implications to research on human viruses.

Herbicide - A substance (usually chemical) used to destroy undesirable plants.

Herpetofauna - Reptiles (snakes, turtles, lizards, etc.) and amphibians (frogs, toads, salamanders).

High explosives (HE) - Any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, shock, or other suitable initiation stimulus undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases that exert pressure in the surrounding medium.

Histopathology - The science or study of dealing with the structure of abnormal or diseased tissue; examination of the tissue changes that accompany a disease.

Historic - Of, relating to, or existing in times postdating the development of written records. Historic cultural resources are all evidences of human occupations that date to recorded periods in history. Historic resources also may be considered to be archeological resources when archeological work is involved in their identification and interpretation.

Industrial solid waste - Solid waste resulting from or incidental to any process of industry or manufacturing, or mining or agricultural operations.

Infrastructure - The basic services, facilities and equipment needed for the functioning and growth of an area.

Insecticide - A substance used to destroy undesirable insects.

Interim Stabilization Measure (ISM) - Action taken to control or abate threats to human health and/or the environment from releases and/or to prevent or minimize the further spread of contamination while long-term remedies are pursued.

International System of Units - An internationally accepted coherent system of physical units, derived from the Meter, Kilogram, Second, Ampere (MKSA) system, using the meter, kilogram, second, ampere, kelvin, mole, and candela as the basic units (SI units) of the fundamental quantities length, mass, time, electric current, temperature, and luminous intensity. Abbr.: SI from the French – "Système Internationale d'Unités."

Invertebrate - Animals characterized by not having a backbone or spinal column, including a wide variety of organisms such as insects, spiders, worms, clams, crayfish, etc.

Isotope - Any of two or more species of atoms of a chemical element with the same atomic number and position in the periodic table and nearly identical chemical behavior but with different numbers of neutrons in their nuclei, and thus differing atomic mass number and different physical properties.

Lacustrine - Pertaining to, produced by, or inhabiting a lake or lakes.

Lagomorph - Any of the various gnawing mammals in the order Lagomorpha, including rabbits, hares, and pikas.

Less than 55-gallon Hazardous Waste Accumulation Sites - Temporary hazardous or mixed waste accumulation points located at or near the point of generation to collect no more than a total of 55 gallons of hazardous waste or no more than 1 quart of acutely hazardous waste. This area must be under the control of the operator of the process generating the waste.

Less than 90-Day Hazardous Waste Accumulation Sites - These are temporary accumulation areas used to collect hazardous wastes for 90 days or less before transfer to an interim status or permitted hazardous waste processing or storage facility.

Llano Estacado - Spanish for "staked plains," used to refer to the Southern High Plains.

Low-level radioactive waste - Waste containing radioactivity not classified as high-level, transuranic waste, spent nuclear fuel, or special by-product material.

Mammal - Animals in the class Mammalia that are distinguished by having self-regulating body temperature, hair, and in females, milk-producing mammary glands to feed their young.

Matrix spike duplicates - Used to evaluate the precision of a specific analysis.

Maximum Contaminant Levels (MCLs) - The maximum permissible level of a contaminant in water that is delivered to the free flowing outlet of the ultimate user of a public water system. MCLs are enforceable standards.

Method Detection Limit - A measure of instrument sensitivity using solutions that have been subjected to all sample preparation steps for the method.

Metric System - See International System of Units.

Mitigation - The alleviation of adverse impacts on resources by avoidance through project redesign or project relocation.

Mixed waste - Waste containing both radionuclides as defined by the Atomic Energy Act, and hazardous constituents as defined by 42 USC 6901 et seq. and 40 CFR 261.

Mortuary remains - Human physical remains and associated artifacts that exist in prehistoric and historic temporal contexts.

National Ambient Air Quality Standards (NAAQS) - Standards developed, under the authority of the Clean Air Act by the Environmental Protection Agency, to protect the quality of the air we breathe. Standards are set for six pollutants: sulfur dioxide, particulate matter with a mean aerodynamic diameter of 10 microns or less, carbon monoxide, ozone, nitrogen dioxide, and lead.

National Environmental Policy Act (NEPA) - Federal statute promulgated under 40 CFR part 1500 through 1508; requires Federal facility actions be evaluated for environmental impacts, usually in the form of Environmental Impact Statements or Environmental Assessments.

National Pollutant Discharge Elimination System (NPDES) - U.S. Federal Regulation (40 CFR, Parts 122 and 125) that requires permits for the discharge of pollutants from any point source into the waters of the United States.

National Register of Historic Places - A national list of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture.

Native American - A tribe, people, or culture that is indigenous to the United States.

Necropsy - Autopsy, postmortem examination.

Nuclear weapon - Any weapon with a nuclear device designed specifically to produce a large release of energy (nuclear explosion) from the fission and/or fusion of atomic nuclei.

Off-Normal Event - Abnormal or unplanned events or conditions that adversely affect, potentially affect, or are indicative of degradation in, the safety, security, environmental or health protection performance or operation of a facility.

Offsite - Outside the Pantex Plant site boundary.

Onsite - Within the Pantex Plant site boundary.

Ogallala Formation - Tertiary formation consisting of gravel, sand, silt, and clay. This is the principal geologic unit in the High Plains Aquifer. Comprises the Ogallala Aquifer in the Panhandle of Texas, the primary source of groundwater in the region. The top of the Ogallala Formation in large areas of Texas and New Mexico consists of a resistant caliche layer. The Ogallala Formation at Pantex overlies the Triassic Dockum Group strata and underlies the Quaternary Blackwater Draw Formation.

Outfall - The outlet of a body of water. In the surface water permitting program, the term outfall refers to the effluent monitoring location identified by the permit. An outfall may be "internal" (associated with a building) or "final" (the last monitoring point at Pantex.)

Perched aquifer - Groundwater separated from the underlying main body of ground water, or aquifer, by unsaturated rock.

Permian - The last period of the Paleozoic era (after the Pennsylvanian) thought to have covered the span of time between 280 and 225 million years ago (Ma); also, the corresponding system of rocks. It is named after the province of Perm, Russia, where rocks of this age were first studied.

Plague - An acute infection caused by the bacterium *Yersinia pestis*. It is transmitted from rodent to humans by the bite of an infected flea. It is less commonly transmitted by direct contact with infected animals or airborne droplets. This disease is also manifested by an acute onset of fever followed by shock, multiple organ failure, and death; caught early, it is treatable with antibiotics.

Playa - A natural depression acting as a detention basin receiving surface runoff within a watershed area; an ephemeral lake.

Plume - An elongated pattern of contaminated air or water originating at a point source, such as a smoke stack or a hazardous waste disposal site.

Plutonium - A heavy, radioactive, manmade metallic element with atomic number 94. Its most important isotope is fissile plutonium-239, which is produced by neutron irradiation of uranium-238. The nuclei of all atoms of this isotope contain 94 protons and 145 neutrons.

Pollution prevention – The process of reducing and/or eliminating the generation of waste materials through source reduction, process modification, and recycling/reuse to minimize environmental or health hazards associated with hazardous wastes, pollutants or contaminants.

Potable - Suitable for drinking.

Potentially interested parties - Under the National Historic Preservation Act (NHPA), organizations that have requested to be informed of Federal actions at a particular site.

Practical Quantitation Limit (PQL) - The Final Risk Reduction Rule Guidance is used to identify the quantifiable limit of detection for sampled constituents at Pantex. This limit is defined as Practical Quantitation Limit. A PQL is the lowest level that can be accurately and reproducibly quantified.

Prehistoric - Of, relating to, or existing in times antedating written history. Prehistoric cultural resources are those that antedate written records of the human cultures that produced them.

Process knowledge - Used to characterize a waste stream when it is difficult to sample because of physical form, the waste is too heterogeneous to be characterized by one set of samples, or the sampling and analysis of the waste stream results in unacceptable risks of radiation exposure.

Programmatic Agreement - The document outlining specific plans for the management of cultural resources at Pantex Plant before the long-term Cultural Resource Management Plan was implemented. The parties to the agreement were the U.S. Department of Energy, the President's Advisory Council on Historic Preservation, and the Texas State Historic Preservation Office.

Pseudorabies - A highly contagious disease affecting cattle, horses, dogs, swine, and other mammalian species, caused by porcupine herpes virus 1, which has its reservoir in swine. In species other than swine, pseudorabies is highly fatal.

Pullman soil series - Silty clay loams; soils found in the interplaya areas at Pantex Plant.

Quaternary - The second period of the Cenozoic era, following the Tertiary; also, the corresponding system of rocks. It began two to three Ma and extends to the present. It consists of two epochs, the Pleistocene and the Holocene.

Rabies - A rapidly fatal disease of the central nervous system that may be transmitted to any warm-blooded animal. The disease starts with a fever, headache, muscle aches, nausea, and vomiting. It progresses to agitation, confusion, combativeness, increased salivation and decreased swallowing, followed by coma and death. It is transmitted to humans by the bite of an infected dog, cat, skunk, wolf, fox, raccoon, or bat.

Radiation (nuclear) – Particles (alpha, beta, neutrons) or photons (gamma) emitted from the nucleus of an unstable (radioactive) atom as a result of radioactive decay. It does not include non-ionizing radiation, such as microwaves or visible, infrared or ultraviolet light.

Radioactive - The state of emitting radiation in the form of waves (rays) or particles.

Radioactivity – The spontaneous emission of radiation, generally alpha or beta particles, often accompanied by gamma rays, from the nucleus of an unstable isotope.

Randall soil series - Clay soils present in the playa bottoms at Pantex Plant.

Raptor - Birds of prey including various species of hawks, falcons, eagles, vultures, and owls.

Replicate analysis - A repeated operation occurring within an analytical procedure, e.g., two or more analyses for the same constituent in an extract of a single sample. *Replicate environmental samples* measure the overall precision of the sampling or analytical methods, while *replicate analyses* are identical analyses carried out on the same sample multiple times. They measure analytical laboratory precision only.

Resource Conservation and Recovery Act (RCRA) - Federal statute which governs current and planned hazardous waste management activities.

Risk Reduction Rules - 30 TAC 335 Subchapter S, outline three risk reduction levels to be considered relative to the corrective measures (DOE, 2002).

> ***Risk Reduction Standard 1*** ≡ Closure/remediation to background levels by removing or decontaminating all waste, waste residues, leachate, and contaminated media to levels unaffected by waste management activities.
>
> ***Risk Reduction Standard 2*** ≡ Closure/remediation to health-based standards and criteria by removing, containing, or decontaminating all waste, waste residues, leachate, and contaminated media to meet standards and criteria such that any substantial present and future

threats to human health and the environment are very low.

Risk Reduction Standard **3** ≡ Closure/remediation with controls, which entails removal, containment, or decontamination of waste, waste residues, leachate, and contaminated media to such levels and in such a manner that any substantial present or future threats to human health and the environment are reduced to an acceptable level, based on use.

Sanitization - The irreversible modification or destruction of a component or part of a component of a nuclear weapon, device, trainer or test assembly, as necessary, to prevent revealing classified or otherwise controlled information, as required by the Atomic Energy Act of 1954, as amended.

Saturated zone - The zone in which the voids in the rock or soil are filled with water at a pressure greater than atmospheric. The water table is the top of the saturated zone in an unconfined aquifer.

Sedimentation - The process of deposition of sediment, especially by mechanical means from a state of suspension in air or water.

Seismic - Pertaining to any earth vibration, especially an earthquake.

Sievert (Sv) – The *Système International d'Unités* (SI units) unit of equivalent dose. One sievert is equivalent to 100 rem.

Site - A geographic entity comprising leased or owned land, buildings, and other structures required to perform program activities.

Site (archeological) - Any area or location occupied as a residence or used by humans for a sufficient length of time to leave physical remains or traces of occupancy. The sites are extremely variable in size and may range from a single hunting camp to an extensive land surface with evidence of numerous settlements and activities. The site(s) may consist of secondarily deposited archeological remains.

Slug test - An aquifer test made either by pouring a small instantaneous charge of water into a well or by withdrawing a slug of water from the well. The rate of recovery of the water table to equilibrium conditions is monitored as the stress is applied to the aquifer. Information from slug tests can be used to estimate the hydraulic conductivity of the aquifer.

Solid Waste Management Unit (SWMU) - Any unit from which hazardous constituents may migrate, as defined by RCRA. A designated area that is, or is suspected to be, the source of a release of hazardous material into the environment that will require investigation and/or corrective action.

Split - One larger sample is split into "equal" parts. The goal of a split sample is to evaluate analytical accuracy. If a sample is split into two parts: one may go to the contractor, one to the regulator; or the two parts may go to two different labs for comparison purposes, or one may be sent to a laboratory for analysis; the second one held for later confirmatory analysis, or in case the first one is lost/broken.

Standard deviation - The absolute difference between one of a set of numbers and their means. It is a statistic used as a measure of dispersion in a distribution, the square root of the arithmetic average of the squares of the deviations from the mean.

Storm water - A precipitation event that leads to an accumulation of water; it includes storm water runoff, snowmelt runoff, surface runoff, and drainage.

Surface water - Water that is open to the atmosphere and subject to surface runoff. Surface water includes storm water.

Tertiary - The first period of the Cenozoic era (after the Cretaceous of the Mesozoic era and before the Quaternary) thought to have covered the span of time between 65 and 2 Ma; also, the corresponding system of rocks.

Texas Commission on Environmental Quality (TCEQ) - The state agency responsible for the environmental quality of Texas. TCEQ has the lead regulatory role for RCRA-regulated waste generated at Pantex Plant.

Thermoluminescent Dosimeter (TLD) - A device containing crystalline materials that, when struck by radiation, contain more energy than in their normal state. At the end of the measurement period, heat is used to anneal the crystals and free the energy, which emerges as a light pulse. The pulse is then mathematically converted to the dose received by the TLD Correction factors in the conversion equation adjusted for various filters, TLD crystal elements and incident radiation. The device can either be carried by a radiation worker, or, as used in this document, placed at a specific location to measure the cumulative radiation dose.

Thorium - A radioactive metallic element that occurs combined in minerals and is usually associated with rare earth elements (Th, Atomic # = 90).

Toxic Substances Control Act (TSCA) - Federal statute that establishes requirements for identifying and controlling toxic chemical hazards to human health and the environment.

Tracer - A labeled element used to trace the course of a chemical or biological process.

Transuranic waste (TRU) - Waste, without regard to source or form, that is contaminated with alpha-emitting radionuclides of atomic number greater than 92 (uranium) and with half-lives greater than 20 years in concentrations greater than 100 nanocuries per gram.

Triassic - The first period of the Mesozoic era (after the Permian of the Paleozoic era, and before the Jurassic) thought to have covered the span of time between 225 and 190 Ma; also, the corresponding system of rocks.

Trihalomethanes - One of the families of organic compounds (methane derivatives) in which three of the four hydrogen atoms in methane are substituted by a halogen atom in the molecular structure.

2,4,6-trinitrotoluene (TNT) - A flammable toxic compound ($C_7H_5N_3O_6$) obtained by nitrating toluene and used as a high explosive and in chemical synthesis.

Trip blanks - Provided for each shipping container to be analyzed for VOCs. Analytical results from trip blanks are used to evaluate whether there was any contamination of the sample bottle during shipment from the manufacturer, storage of the bottles, during shipment to the laboratories, or during analysis at the laboratory.

Tritium - A radioactive isotope of hydrogen with one proton and two neutrons in its nucleus. It is chemically identical to natural hydrogen and reacts with other substances and is absorbed into the body in the same manner. Elemental tritium incorporates readily with water to form tritiated water (HTO) or oxidized tritium. When this tritiated water is present in the gaseous state in the atmosphere, it is referred to as tritiated water vapor. Tritium decays by beta emission with a radioactive half-life of about 12.5 years.

Tularemia - A disease caused by *Francisella tularensis* and transmitted to humans by rodents through the bite of a deer fly, *Chrysops discalis*, and other bloodsucking insects; it can also be acquired directly through the bite of an infected animal or through handling of an infected animal carcass.

Uranium - A silvery, heavy, radioactive, polyvalent metallic element that is found especially in pitchblende and uraninite and exists naturally as a mixture of three isotopes of mass number 234, 235, and 238 in the proportions of 0.006 percent, 0.71 percent, and 99.28 percent, respectively (U, Atomic Number = 92).

Vadose zone - Also called the unsaturated zone, the zone between the land surface and the water table. The pore spaces in the vadose zone contain water at less than atmospheric pressure, as well as air and other gases. Saturated bodies, such as perched aquifers, may exist in the vadose zone.

Volatile organic compounds (VOCs) - Organic compounds capable of being readily vaporized at normal temperatures and pressures. Examples are benzene, toluene, and carbon tetrachloride.

Waste generator - Any individual or group of individuals that generate radioactive, mixed, hazardous, or other types of wastes at Pantex Plant.

Waste minimization - Refers to a practice that reduces the environmental or health hazards associated with hazardous wastes, pollutants, or contaminants after generation.

Waste Tracking System Database - Computerized log maintained by the Waste Operations Department.

Watershed – A ridge of high land dividing two areas that are drained by different river systems. It can also be the region draining into a river, river system, or body of water.

Weapon component - A part specifically designed for use in a weapon. These parts require sanitization prior to disposal.

Weir - A fence or enclosure set in a waterway to raise the water level or to gauge or divert its flow.

Wetlands - Land or areas exhibiting hydric soil concentrations saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions.

Executive Summary

The U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA), oversees the operation of Pantex Plant through the Pantex Site Office (PXSO). Babcock & Wilcox Technical Services Pantex, LLC (B&W Pantex) manages the environmental aspects of its operations systematically, in a manner consistent with Integrated Safety Management.

The Purpose of the Report

The *2009 Site Environmental Report for Pantex Plant* summarizes the efforts, data, and status of B&W Pantex's environmental protection, compliance, and monitoring programs for calendar year 2009. This report is prepared in accordance with DOE Order 231.1A, *Environment, Safety and Health Reporting* (DOE, 2004), and DOE Order 5400.5, *Radiation Protection of the Public and Environment* (DOE, 1993). These orders and DOE Order 450.1A, *Environmental Protection Program* (DOE, 2008), outline the requirements for environmental protection programs at DOE facilities to ensure that programs fully comply with applicable federal, state, and local environmental laws and regulations, executive orders, and DOE policies.

Environmental Management and Monitoring

Pantex Plant has a comprehensive environmental program. The environmental policies (pp. xxx-xxxi) define the program that contains components of environmental management including, but not limited to, regulatory compliance, pollution prevention, and environmental monitoring. The Pantex Plant's Environmental Management System (EMS) has been upgraded to meet the requirements of DOE Orders, including full assimilation into the Integrated Safety Management System. B&W Pantex completed the system upgrade ahead of the DOE due date of December 2005.

The purpose of the environmental monitoring component of the Plant's EMS is to provide indicators of potential impact to human health and the environment and to demonstrate compliance with applicable regulatory limits. The environmental monitoring program monitors air, groundwater, drinking water, surface water, wastewater, soil, vegetation, and fauna. B&W Pantex also operates a meteorological monitoring program that supports several of the requirements. Samples for 2009 were routinely collected at diverse locations, and 23,257 analyses were performed for substances including explosives, metals, organic chemicals, inorganic chemicals, radionuclides, and water quality indicators.

Data from the monitoring program obtained in past years are summarized in previous annual site environmental reports, which are available in the reserve library at Amarillo College, in Amarillo, Texas. The monitoring data, as well as the annual site environmental reports since 1996, have been made available electronically on the Pantex worldwide website at http://www.pantex.com.

In 2009, the calculated annual radiation dose from releases to the atmosphere from Plant operations was 2.86 x 10^{-7} mrem (2.86 x 10^{-9} mSv) for a hypothetical, maximally exposed member of the public. (See footnote 3 in Chapter 4 of this document.) This annual dose continues to be several orders of magnitude below the U.S. Environmental Protection Agency's (EPA's) standard for the air pathway of 10 mrem per year above background. The radiological monitoring results in 2009 were consistent with those of previous years. The background radiation dose measured at control locations (excluding radon) was attributed to naturally occurring terrestrial and cosmic radiation, and averaged 100 mrem for the year 2009. This is consistent with historical data. No unplanned radionuclide releases occurred at Pantex Plant in 2009. Ambient air monitoring results for 2009 were generally similar to those from previous years. All results were below the applicable DOE Derived Concentration Guide (DCG).

As in past years, monitoring results of perched groundwater beneath the Zone 12 operations area and beneath the safety and security buffer property to the south and southeast provide evidence of nonradiological contamination. Primary contaminants in perched groundwater beneath the Zone 12 operations area are explosives, metals, and organic solvents. The primary contaminant in perched groundwater beneath the safety and security buffer property to the south and southeast is explosives. Constituents detected in the Ogallala Aquifer were either one-time detections (i.e., not reproduced upon confirmation sampling) or attributable to sediments in the groundwater.

Pantex monitors drinking water for organic chemicals, inorganic chemicals, metals, water quality parameters, radionuclides, residual disinfectants, and miscellaneous constituents. Results from routine drinking water sampling in 2009 confirmed that the drinking water system at Pantex Plant met all applicable regulatory requirements.

Permit-required sampling of wastewater and storm water and environmental surveillance sampling of surface water was conducted for both radiological and nonradiological constituents. Sampling at the Wastewater Treatment Facility (WWTF) was conducted at outfalls in accordance with Texas Water Quality Permit No. WQ0002296000 and Texas Land Application Permit No. WQ0004397000, each issued by the Texas Commission on Environmental Quality (TCEQ). Results of permit-required sampling were reported monthly, quarterly, and annually to the TCEQ.

Surface water monitoring is generally dependent on precipitation or discharge events, since samples can only be collected when flow occurs. Storm water runoff involving industrial activities at Pantex Plant is sampled in accordance with the TCEQ issued Texas Pollutant Discharge Elimination System Multi-Sector General Permit No. TXR0P506 (MSGP) for storm water. Results of sampling at the surface water outfalls and playas (when samples could be collected) were normal and consistent with past monitoring results.

Soil samples were collected and analyzed for radionuclides, metals, explosives, semi-volatile, and volatile organic compounds (VOCs). Onsite soil monitoring results for 2009 were, with few exceptions, within the concentration ranges observed for uncontaminated local soil and were comparable to both historical results and to those for the control locations. Samples in most cases indicate that concentrations observed were naturally occurring and at background levels.

Flora and fauna monitoring results indicated that there were no detrimental impacts from Plant operations in 2009. The final section of this report describes the quality assurance program. Quality assurance is incorporated into all aspects of the B&W Pantex environmental program and includes performance checks, rigorous quality control checks, and intensive data management.

Environmental Remediation

Historical waste management practices at the Plant resulted in impacts to onsite soil and perched groundwater. High explosives, solvents, and metals were found in the soil in the main operational areas and the Burning Ground at the Plant, and in the perched groundwater beneath Pantex. Data collected in 2009 indicate that the main drinking water aquifer remains unaffected by natural migration of contaminants from soil and perched groundwater.

Pantex has completed investigation and soil cleanup of all solid waste management units, with the exception of units that remain in an active status. A Record of Decision was issued in September 2008 that described the final remedial actions for all investigated units. Most remedial actions were in place before 2009; however, Pantex achieved the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) construction complete milestone for all remedial actions in 2009. In addition Pantex also completed the following milestones to transition to long-term stewardship:

- Implementation and operation of Remedial Actions.
- Approval and implementation of long-term groundwater monitoring network.
- Submittal of application to include final remedies into the Pantex Compliance Plan No. 50284 issued by the TCEQ.

As part of the transition to long-term stewardship, Pantex operated and maintained the groundwater remediation systems, monitored the systems to determine effectiveness of the remedy, and maintained the soil remedies.

The pump and treat systems operated near or above performance goals established for the systems. In addition, declining water levels have already been observed around the pump and treat systems. Monitoring of the in-situ bioremediation (ISB) systems demonstrated that a treatment zone has been established to reduce contaminant concentrations. One ISB system that has been operating since early 2008 demonstrated that contamination was already being reduced at two close down-gradient wells. Although Pantex is in its first year of final remediation, the results of the groundwater systems indicate that they are effectively treating and containing contamination in the perched aquifer as designed. The systems will continue to be monitored to determine the effectiveness of the remedy and to determine if changes to the systems will be required over time to ensure the continued success of remedial actions.

Soil remedies were also inspected and maintained during 2009. Missing signs, holes in landfills, and burrowing animals were noted and corrected in soil units. The soil vapor extraction (SVE) system was put back on-line last year after Pantex completed a study evaluating the potential for transition to an enhanced attenuation process. The SVE system was restarted in September 2009 and will continue to operate until approval is received to move to the new process.

Regulatory Compliance and Permitting

During 2009, the Plant had no exceedances of permit limits of either Texas Water Quality Permit No. WQ0002296000, which regulates wastewater discharges to an onsite playa lake, or Texas Land Application Permit No. WQ0004397000, which regulates disposal of treated wastewater through a subsurface irrigation system. The TCEQ acted upon Pantex's request for a renewal and major modification of its wastewater discharge permit by issuing Permit No. WQ0002296000 solely under the authority of the Texas Water Code.

On July 7-9, 2009, the TCEQ conducted a Resource Conservation and Recovery Act (RCRA) inspection at Pantex, to determine compliance with the Plant's Hazardous Waste Permit No. HW-50284. Approximately 60 waste management units were inspected; no violations or areas of concern were identified by the TCEQ. The results of the inspection represent 15 consecutive years with no violations or areas of concern noted for the management of waste.

The TCEQ conducted a Comprehensive Compliance Evaluation Investigation of Pantex Plant's Drinking Water System on September 30, 2009. The system was determined to be operating satisfactorily and no violations or areas of concern were identified. The inspector noted that the B&W Pantex program is particularly strong in the areas of water quality monitoring and data evaluation. On December 17, 2009, the TCEQ notified Pantex that its Public Water System had achieved a "Superior Rating." Organizations receiving the Superior Public Drinking Water System Award are recognized for their overall excellence in all aspects of operating a public water system (PWS). To be recognized, a PWS must go above and beyond the minimum standards in protecting public health and ensuring reliable operation.

On May 5, 2009, the TCEQ issued Air Quality Permit 84802, which replaced Air Quality Permits 18379, 21233, the Texas Clean Air Act Provisions in Permit HW-50284 and several Permits-by-Rule. Permit 84802 is a Flexible Air Permit that includes an aggregate hourly and annual maximum emission rate for all emission points included in the Permit. It will give the Plant much more latitude in dealing with its air emissions.

Pantex Plant continues to qualify for a reduction in oversight inspections from the State of Texas. During 2009, the TCEQ extended program incentives to Pantex for having qualified as a Gold level member of the voluntary "Clean Texas" program. Pantex would normally expect major annual environmental inspections for Wastewater, and Air Compliance. In 2009, the TCEQ performed an Air Compliance investigation (no violations identified) but exempted the Pantex Plant from the 2009 Wastewater Permit Inspection. The RCRA inspection is not available as an exemption incentive for Pantex.

Pollution Prevention

In November 1999, the Secretary of Energy updated the waste reduction goals and established FY 2005 as the year that the new goals were to be met. By the end of 2005, B&W Pantex met and exceeded the Secretary's goals for low level radioactive, low level mixed, and hazardous waste. Routine sanitary waste was reduced by 21.2 percent from FY 1993 levels. This successful reduction was primarily the result of increasing the percentage of waste paper that was disintegrated and recycled. B&W Pantex is aggressively seeking cost-effective means of recycling more of the sanitary waste streams.

To continue the success achieved through the pollution prevention (P2) leadership goals that expired in 2005, DOE has established performance-based P2 and Sustainable Environmental Stewardship goals that are to be demonstrated by DOE sites through the integration of P2 into environmental management systems pursuant to DOE 450.1A (DOE, 2008).

These goals have been incorporated into the P2 and EMS programs at Pantex. These programs have been effectively used to identify specific site-wide environmental goals associated with prevention of pollution and minimization of waste.

During 2009, NNSA recognized Pantex Plant's groundwater management strategy with a Pollution Prevention Award for initiatives associated with implementation of its EMS. These initiatives not only reduced the amount of water pumped from the Ogallala Aquifer but also the electricity required for water harvest and treatment.

****

Please complete the questionnaire following the title page of this report to give us your comments or request information.

****

The DOE, through PXSO, is supportive of the Plant's Environmental Policy. Below is the B&W Pantex Environmental Policy.

B&W Pantex Environmental Policy

As part of the B&W Pantex Strategic Plan, we have an environmental policy to protect and conserve the natural environment within which we perform the Plant mission. This policy is the basis for our Environmental Management System (EMS). The EMS is a significant component of the Pantex Integrated Safety Management System that holds superior the goal of protecting our employees, the community, and the environment. Important areas of focus within the EMS are environmental compliance, waste management, energy conservation, pollution prevention, and environmental remediation.

This policy is a concise declaration of how we, B&W Pantex employees, will conduct work. The policy should be incorporated into each individual's personal commitment to protect the environment while accomplishing the Pantex mission.

B&W Pantex's Environmental Policy

<u>To Excel In:</u>

Implementing appropriate controls and actions to minimize environmental impacts caused by our activities, products, and services;

Continual improvement of our protection of the environment in Plant processes, including pollution prevention;

Strict compliance with relevant regulations and requirements;

Setting and reviewing environmental objectives and targets;

Communication of this policy to all employees; and

Availability of the policy to the public.

Approved: *John G. Meyer,* General Manager, B&W Pantex, 5/12/08

The following is the Pantex Site Office Environmental Policy Statement.

U. S. Department of Energy
National Nuclear Security Administration

PANTEX SITE OFFICE POLICY

PXSO-08-1

SUBJECT: Protection of Plant Employees, the Public, and the Environment

Policy Statement: The Pantex Site Office is committed to ensuring that all work at the Pantex Plant is performed in a manner that ensures the protection of employees, the public, and the environment. In order to achieve this objective, I expect:

- **Zero tolerance of ES&H violations. None of the Pantex Plant production goals is so important that established environment, safety, or health standards should ever be compromised.**
- **Line management emphasis on the implementation of the Integrated Safety Management tenets of define the scope of work, identify the hazards, implement appropriate controls and perform work safely.**
- **The development of specific ES&H objectives to implement this policy.**
- **Employee participation in all aspects of work planning, performance, and feedback.**
- **Clear contract accountability and performance objectives for ES&H compliance.**
- **Continuous improvement in all phases of ES&H performance.**

9/17/08

Steve C. Erhart Date
Manager
Pantex Site Office

This page was intentionally left blank.

Introduction

The Pantex Plant site, consisting of 7,001 hectares (17,503 acres), is located 27 kilometers (17 miles) northeast of Amarillo, Texas, in Carson County. The Plant was a World War II munitions factory and was converted to a nuclear weapons assembly facility in 1951. Today, it is the nation's only assembly /disassembly facility supporting the nuclear weapons arsenal. Included within this chapter are brief discussions of the Plant location, history and mission, and facility description, followed by the climate, geology, hydrology, seismology, land use, and population of the area around Pantex Plant.

1.1 Site Location and Environmental Setting

The Pantex Plant site is located in Carson County in the Texas Panhandle, north of U.S. Highway 60. The Plant is located 27 km (17 mi)[1] northeast of downtown Amarillo (Figure 1.1). It is centered on an approximately 7,001 hectare (17,503 acre) site. The Pantex Plant site consists of land owned and leased by the U.S. Department of Energy (DOE). The DOE owns 4,681 hectares (11,703 acres), including 3,683 hectares (9,100 acres) in the main Plant area, 610 hectares (1,526 acres) in four tracts purchased in the latter part of 2008 (east of FM 2373 near the main Plant area), and 436 hectares (1,077 acres) at Pantex Lake, which is located approximately 4 km (2.5 mi) northeast of the main Plant area. Although Pantex Plant proposes to develop the Pantex Renewable Energy Project (PREP) on the newly acquired land east of FM 2373, no government industrial operations are conducted at the Pantex Lake property. In addition, 2,347 hectares (5,800 acres) of land south of the main Plant area are leased from Texas Tech University for a safety and security buffer zone (Pantex Plant, 1998).

Pantex Plant is located on the Llano Estacado (staked plains) portion of the Great Plains at an elevation of approximately 1,067 m (3,500 ft). The topography at Pantex Plant is relatively flat, characterized by rolling grassy plains and numerous natural playa basins. The term "playa" is used to describe shallow lakes, mostly less than 1 km (0.6 mi) in diameter. The region is a semi-arid farming and ranching area. Pantex Plant is surrounded by agricultural land, but several industrial facilities are located nearby.

1.2 Facility History and Mission

Pantex Plant is a government-owned, contractor-operated facility. DOE oversees the operation of Pantex Plant through the Pantex Site Office. By year-end 2009, approximately 4,000 people were employed at the Plant. Mason & Hanger Corporation (MHC) was the operating contractor of the Pantex Plant from 1956 through May 1999 when it became a subsidiary of Day & Zimmermann, Inc. (D&Z). MHC (D&Z) was replaced as operating contractor by BWXT Pantex, LLC (BWXT Pantex), on February 1, 2001. BWXT Pantex combined elements of BWX Technologies, Honeywell, and Bechtel. Effective in January 2008, the name of the company was officially changed to Babcock & Wilcox Technical Services Pantex, LLC (B&W Pantex).

From 1942 to 1945, the U.S. Army used the Pantex Ordnance Plant for loading conventional ammunition shells and bombs. In 1951, the Atomic Energy Commission (AEC) arranged to begin rehabilitating portions of the original Plant and constructing new facilities for nuclear weapons operations. In 1974, the Energy Research and Development Administration (ERDA) replaced the AEC and took responsibility for the operation of Pantex Plant, and in 1977, the ERDA was replaced by the DOE. In 2000, the DOE enfolded the National Nuclear Security Administration (NNSA) into its structure.

[1] This report will generally use the convention of identifying a unit of measure in Système Internationale (abbreviated SI) units and providing the "English unit" equivalent in parentheses [for example as "X kilometers (Y miles)]." Because radiological measurements are compared to several limits that are generally specified using "English units," the convention is reversed for those measurements [for example "X μCi/mL (Y Bq/m^3)]."

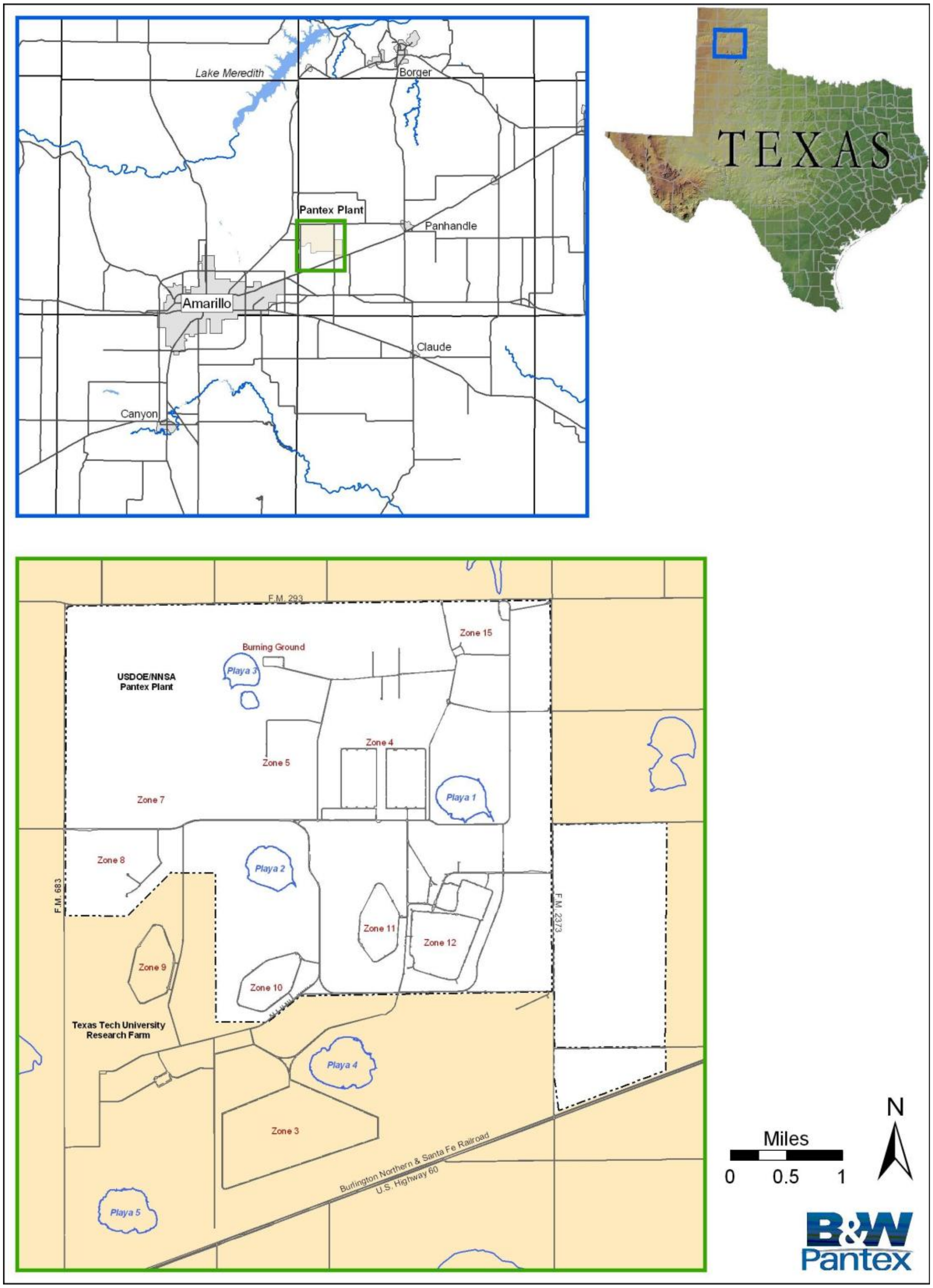


FIGURE 1.1 — *Pantex Plant Site Location*

Pantex Plant's primary mission is to:

- **Assemble** nuclear weapons for the nation's stockpile.
- **Disassemble** nuclear weapons being retired from the stockpile.
- **Evaluate, repair, and retrofit** nuclear weapons in the stockpile.
- **Provide interim storage** for plutonium pits.
- **Develop, fabricate, and test** chemical explosives and explosive components for nuclear weapons and to support DOE initiatives.

Weapons assembly, disassembly, maintenance, and evaluation activities involve short-term handling (but not processing) of encapsulated tritium, uranium, and plutonium, as well as a variety of nonradioactive hazardous or toxic chemicals. In addition, environmental restoration of the facility is an integral part of the DOE environmental management's mission to clean up its sites.

1.3 Facility Description

The Plant is composed of several functional areas, commonly referred to as numbered zones (Figure 1.2). Overall, there are more than 400 buildings at the Plant. Many of these areas are grouped into large functional zones, four of which remain active. Included within the zones are a weapons assembly/disassembly area, a weapons staging area, an area for experimental explosives development, a drinking water treatment plant, a sanitary wastewater treatment facility, and vehicle maintenance and administrative areas. Other functional areas include a utilities area for steam and compressed air, an explosives test-firing facility, a Burning Ground for thermally processing (i.e., burning or flashing) explosive materials, and landfills. One functional area is currently used only for storage.

The weapons assembly/disassembly area covers approximately 80 hectares (200 acres) and contains more than 100 buildings. Nuclear components, parts received from other DOE plants, chemical explosive components, and metal parts fabricated at Pantex Plant can be assembled into nuclear weapons in this zone. Nuclear weapons are also disassembled there.

One zone is used for general warehousing and temporary holding (or staging) of weapons and weapon components awaiting movement to another area for modification, repair, or disassembly; for shipment to other DOE facilities for reworking; for shipment to a facility for sanitization; or for shipment to the military. The warehouse area is also used for interim storage of plutonium components from disassembly operations.

The explosives development area consists of facilities for synthesizing, formulating, and characterizing experimental explosives.

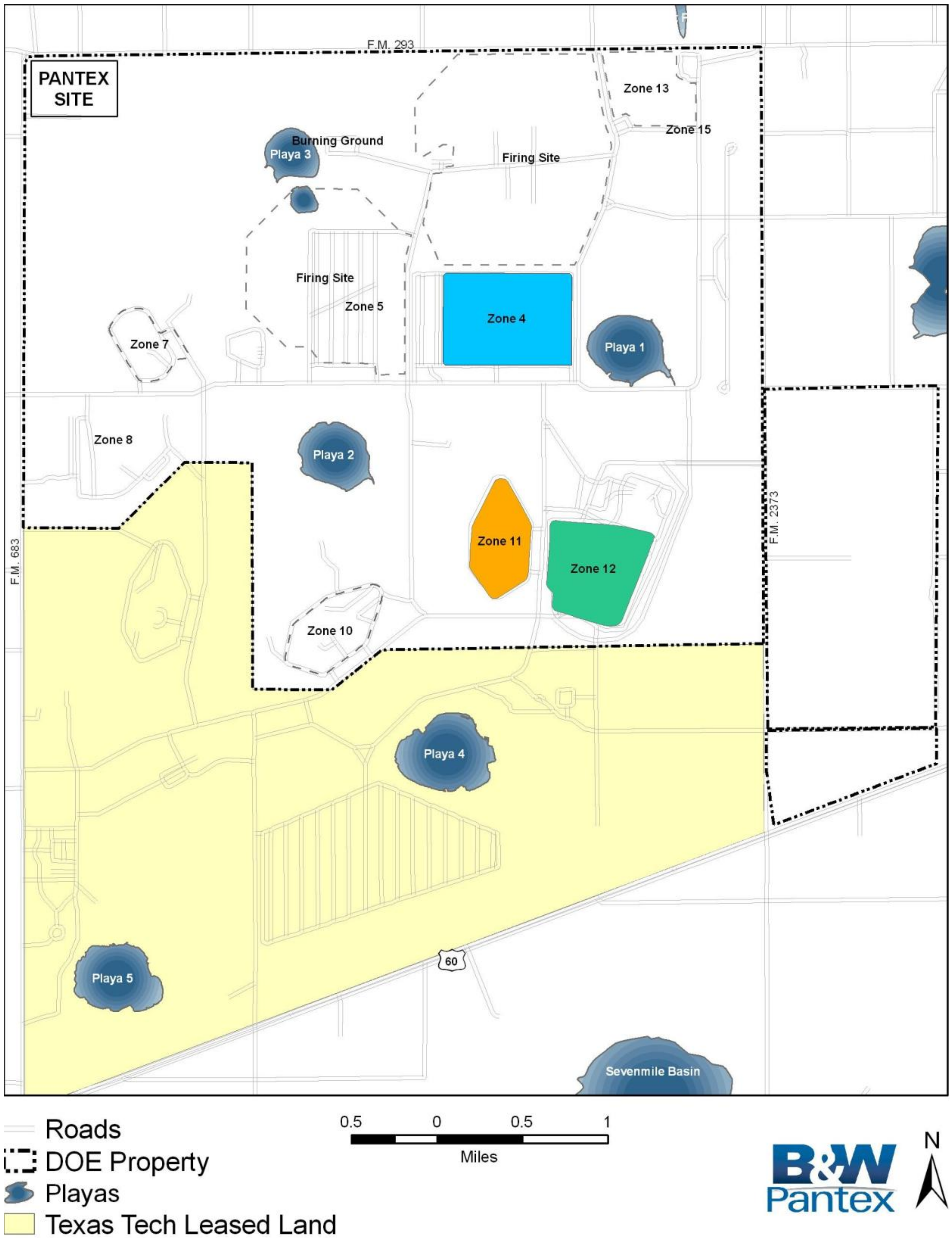


FIGURE 1.2 — *Principal Features of the Pantex Plant Site*

The drinking water treatment facility consists of production wells, chlorination/pumping facilities, storage tanks, and associated distribution lines. This facility also supplies non-potable water to the high-pressure fire protection system. The utilities area includes a steam generation facility (boiler house) and a central air compressor facility.

Wastewater generated at Pantex Plant is routed through a sewer system to a wastewater treatment facility. On October 6, 2003, the Texas Commission on Environmental Quality (TCEQ) issued B&W Pantex a Texas Land Application Permit that authorizes beneficial reuse of the wastewater for the purpose of agricultural irrigation via a subsurface fluid distribution system. Construction of the subsurface fluid distribution system was completed prior to the end of 2004. Treated effluent from the wastewater treatment facility and from the perched aquifer pump and treat system are currently discharged to this subsurface irrigation system. B&W Pantex is also authorized to discharge wastewater to an onsite playa lake pursuant to a Texas Water Quality Permit issued by the TCEQ on June 24, 2008. The TCEQ issued this renewal under the provisions of Chapter 26 of the Texas Water Code.

The explosives test-firing facility (commonly called “firing sites”) includes several test-shot stands and small-quantity, test-firing chambers for measuring detonation properties of explosive components. The firing sites also include supporting facilities for setting up test-shots, interpreting the results, and sanitizing some components. The Burning Ground is used for processing explosives, explosive components, and explosives-contaminated materials and waste by means of controlled open burning and flashing.

The land disposal area, north of Zone 10, is divided into two landfill sites, one of which currently receives nonhazardous solid wastes, primarily construction debris, and one that receives nonhazardous solid waste management unit debris. Before 1989, the Plant's domestic solid waste was sent to an onsite sanitary landfill for disposal. Since then, this waste has been processed to remove recyclable materials and the nonrecyclable material is sent to an offsite landfill. Practices preclude disposal of hazardous materials in onsite landfills; therefore, hazardous materials are transported offsite for disposal in accordance with applicable regulations.

The newly acquired land east of FM 2373 has not been assigned a formal zone designation. However, meteorological towers and proposed wind turbines for the generation of electrical power will be installed during the completion of the proposed PREP in the near future.

1.4 Climatological Data

The area’s climate is classified as semi-arid and is characterized by hot summers and relatively cold winters, with large variations in daily temperature extremes, low relative humidity, and irregularly spaced rainfall of moderate amounts. Three-fourths of the average precipitation falls from April through September, generally occurring with thunderstorm activity. The average annual snowfall is 17.9 inches (Department of Commerce [DOCa]). Snow usually melts within a few days after it falls. Heavier snowfalls of l0 inches or more, usually with near blizzard conditions, average once every 5 years and last 2 to 3 days.

The Amarillo area is subject to extreme and rapid temperature changes, especially during the fall and winter months when cold fronts from the northern Rocky Mountain and Plains states sweep across the area. Temperature drops of 50 to 60 degrees (F) within a 12-hour period are not uncommon. Temperature drops of 40 degrees have occurred within a few minutes.

Humidity averages are low, occasionally dropping below 20 percent in the spring. Low humidity moderates the effect of summer afternoon high temperatures, permits evaporative cooling systems to be very effective, and provides many pleasant evenings and nights.

Severe local storms are infrequent throughout the cool season, but occasional thunderstorms with large hail, lightning, and damaging wind occur during the warm season, especially during the spring. These storms are often accompanied by heavy rain, which can produce local flooding, particularly of roads and streets.

Pantex Plant is located in an area with a relatively high frequency of tornados; an average of 16 tornadoes each year occurred in the 20 counties of the Texas Panhandle during the period between 1950 and 2009 (DOCb). While the threat of tornadoes is real, tornado occurrences in Amarillo are generally rare. Tornadoes are most common from April to June. There were 13 tornadoes reported over the Texas Panhandle during 2009 (DOCc), close to the average, but 52 fewer than those that were observed during the very active year of 2007.

The normal annual mean temperature in Amarillo is 13.9˚C (57˚F), while the normal annual rainfall for Amarillo is 50.1 cm (19.71 in) (DOCa). The mean temperature at the official Amarillo Airport National Weather Service (NWS) location during 2009 was only slightly (0.1˚C [0.4˚F]) above normal. However, the NWS noted that the average temperature from January through March ranked as the 8th warmest all time for that three month period while the average temperature during the August through October period ranked as the 5th coolest all time during that three month period. The year 2009 was slightly wetter than normal in the area of the Pantex Plant, as the official NWS rain gauge recorded 53.8 cm (21.1 in) of precipitation.[2] This amount is approximately 7 percent above the normal. From January through June, only April observed above normal precipitation. These drier conditions made the Panhandle susceptible to wildfires as from January through April, over 40,000 acres of land burned in the area. In July and August, 11.85 inches of rain fell in Amarillo which ranked second all time for that two month period. Snowfall totaled 46.7 cm (18.4 in) at the NWS, or about 3 percent above the normal. The potential gross lake surface evaporation in the area is estimated to be about 140 cm (55 in) (Bomar, 1995) or 280 percent of the average annual precipitation.

The Pantex Plant maintains a meteorological monitoring station located on the northeast corner of the site. The monitoring station is an instrumented 60 m (197 ft) tower located approximately 3.7 km (2.3 mi) north of the Zone 12 production area. The tower is equipped with two sets of sensors, located at the 10 and 60 m (33 and 197 ft) levels. Wind speed, wind direction, and temperature sensors are located at both levels and a relative humidity sensor is located at the 10 m (33 ft) level. A barometer measures the atmospheric pressure on the tower approximately 1.8 m (6 ft) above the tower base. A pyranometer (instrument that measures insolation or incoming solar radiation) and a tipping bucket rain gauge are located adjacent to the tower at approximately 1 m (3.3 ft) above ground level. Sensor measurements are taken every 2-8 seconds. The tower's datalogger calculates and stores 15 minute averages of the data. Every 15 minutes, the system uploads the meteorological data for the latest 15 minute interval to a stand-alone personal computer located in the Operations Center. The data from the Plant's meteorological tower are compared with those obtained from the Amarillo Airport NWS site located approximately 16 km (10 mi) to the west-southwest of the Pantex Plant's meteorological tower on a bi-weekly basis to determine if the instrumentation is operating correctly. On a monthly basis, data outliers are identified and, when necessary, eliminated from the meteorological data set.

[2] Precipitation includes the liquid water equivalent from snowfall.

The frequencies of wind direction and speed during 2009 at the Pantex Plant are illustrated by the "wind roses" (graphical depictions of the annual frequency distribution of wind speed and the direction from which the wind has blown) in Figures 1.3 and 1.4. Figure 1.3 indicates that, as in most previous years, a large percentage (nearly 50 percent) of the winds blew from the southeast through southwest during the year. Figure 1.4 shows that wind direction and speed frequencies vary by season: Northwesterly winds are most frequent during winter [Figure 1.4(a)], wind direction frequency is more bi-modal during spring [Figure 1.4(b)] and fall (Figure 1.4(d)] and the vast majority of winds are from the southern sector in summer, including over 40 percent from the south and south-southwest directions [Figure 1.4(c)]. In addition, wind speeds are highest in winter and spring and lowest in summer and autumn.

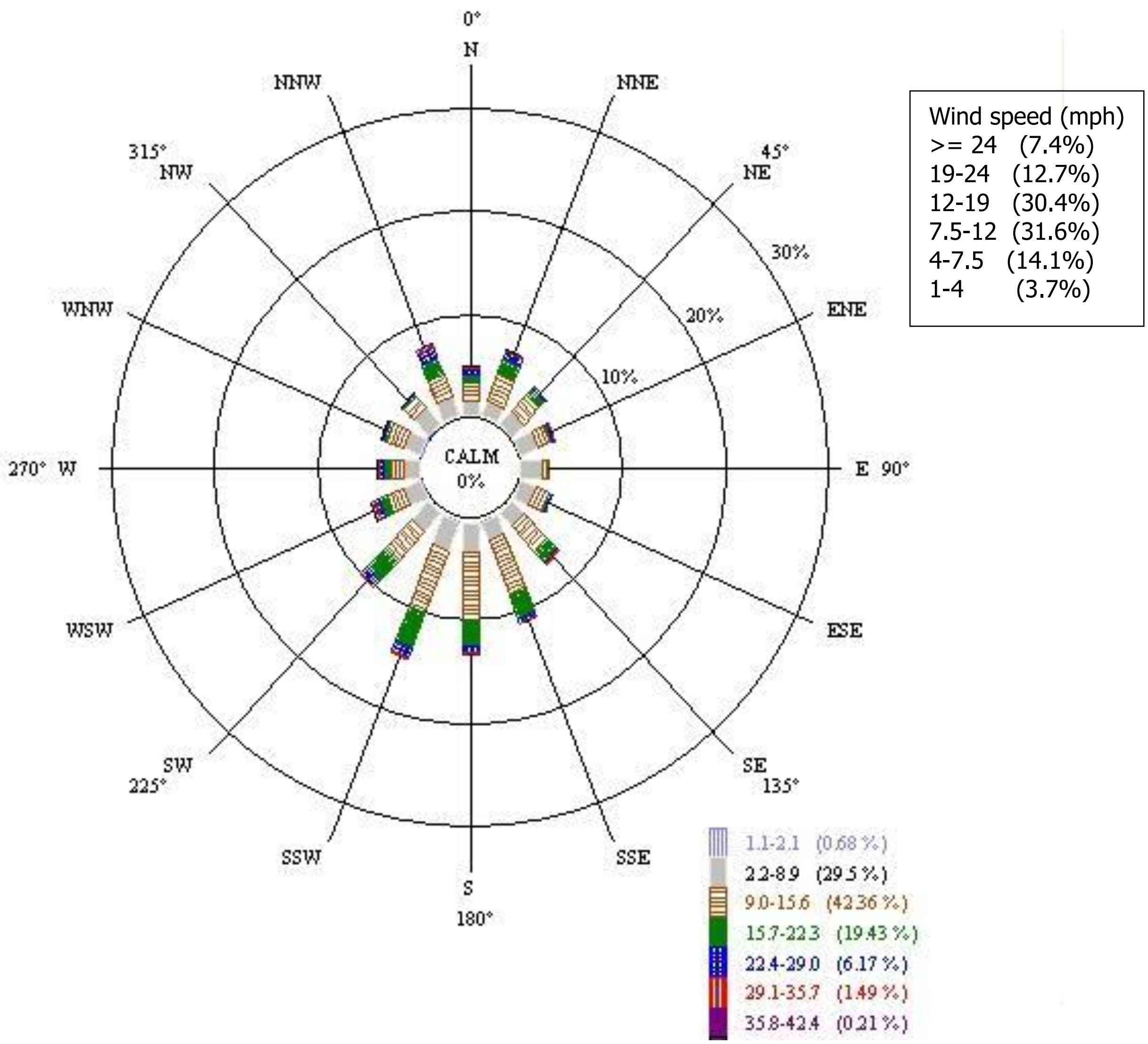
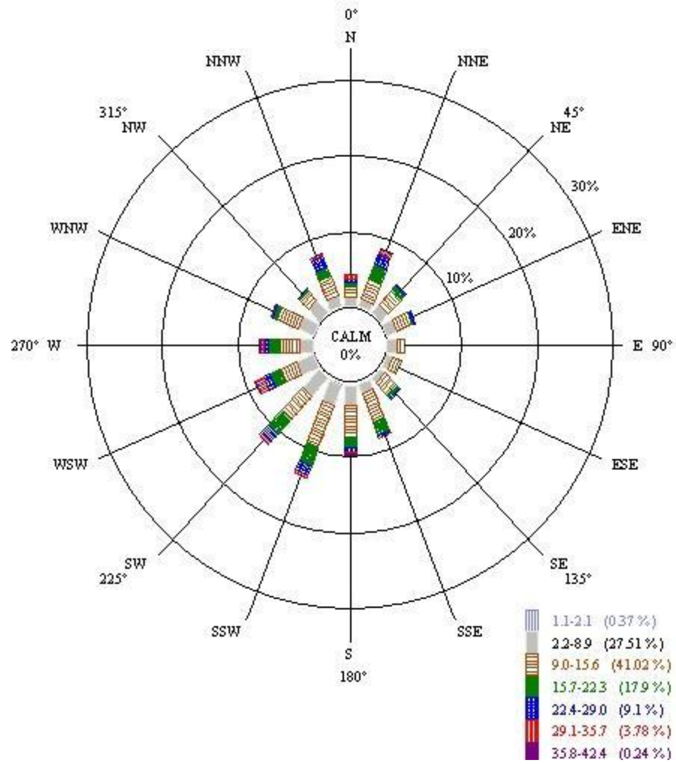
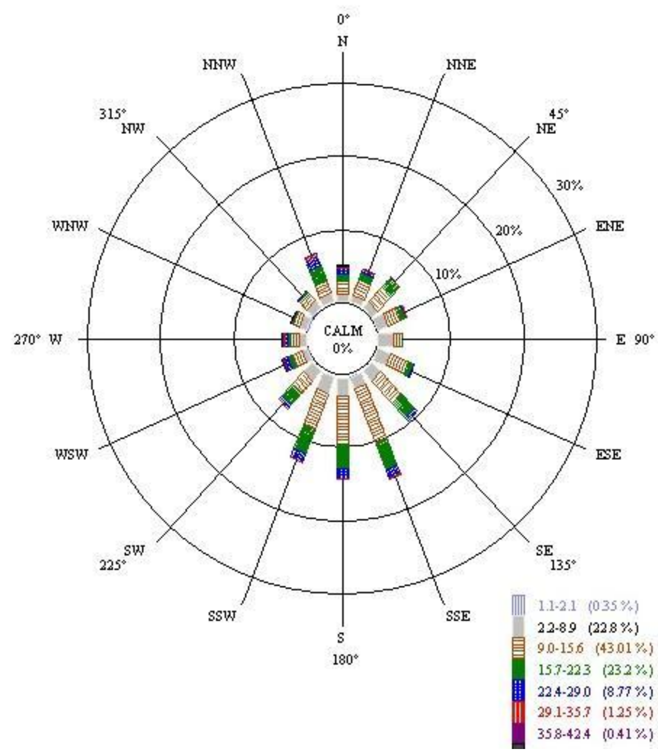


FIGURE 1.3 — ***Pantex Plant Wind Rose for 2009***

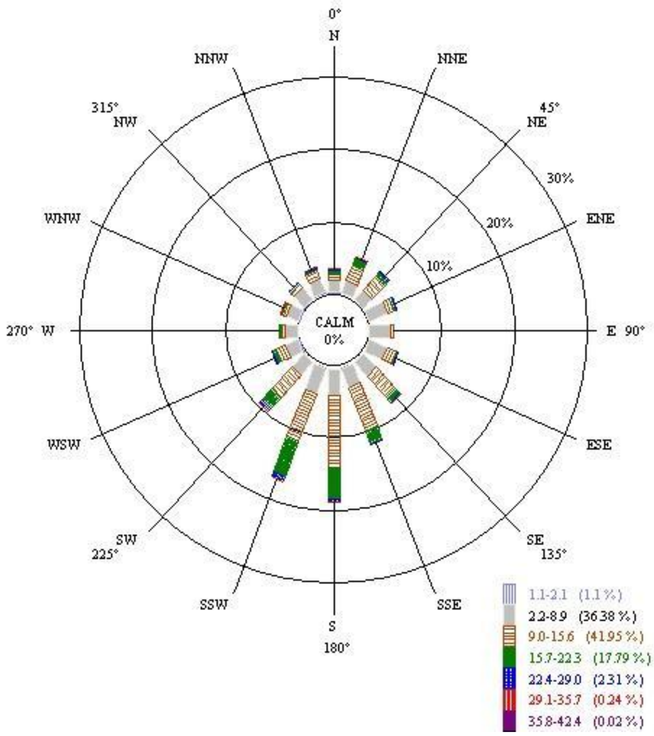


a)

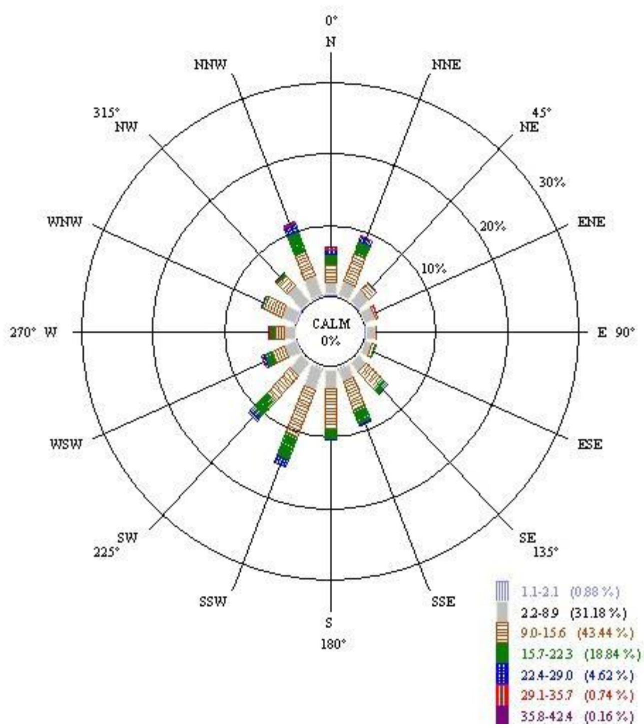


b)

FIGURE 1.4 — ***Pantex Plant Wind Roses for a) Winter (Jan-Mar) & b) Spring (Apr-Jun) 2009***



c)



d)

FIGURE 1.4 (cont'd)— ***Pantex Plant Wind Roses for c) Summer (Jul-Sep) & d) Fall (Oct-Dec) 2009***

Table 1.1 is a compilation of climatological data [temperature, relative humidity, precipitation (including the water equivalent of any snowfall) and wind speed] for 2009 from the Pantex Plant meteorological instrumentation. The range of mean monthly temperatures and monthly precipitation totals during the year measured at the meteorological tower are shown in Figure 1.5.

TABLE 1.1 — *Pantex 2009 Climatological Data by Month*

Month	Temperature °C (°F)			Mean Relative Humidity (%)	Precipitation[a] mm (inches)	Wind Speed M/s (mph)	
	Maximum	Minimum	Mean Monthly			Mean	Maximum
January	22.2 (72.0)	-13.2 (8.3)	2.9 (37.3)	44	0.00 (0.00)	5.6 (12.5)	15.4 (34.2)
February	25.2 (77.4)	-8.2 (17.3)	7.1 (44.8)	42	12.95 (0.51)	6.1 (13.5)	19.2 (42.7)
March	28.0 (82.4)	-7.7 (18.2)	10.0 (50.0)	45	4.06 (0.16)	6.7 (14.8)	17.5 (38.9)
April	30.6 (87.0)	-4.2 (24.5)	13.1 (55.5)	51	44.70 (1.76)	7.3 (16.2)	20.9 (46.4)
May	33.6 (92.5)	5.4 (41.8)	17.1 (62.7)	61	24.38 (0.96)	5.7 (12.7)	15.6 (34.7)
June	35.2 (95.4)	10.4 (50.8)	23.5 (74.3)	56	67.31 (2.65)	5.8 (12.8)	14.2 (31.5)
July	39.0 (102.2)	14.3 (57.7)	25.3 (77.6)	55	94.23 (3.71)	5.2 (11.5)	17.6 (39.2)
August	36.3 (97.4)	13.1 (55.6)	24.0 (75.2)	59	189.99 (7.48)	5.4 (12.0)	15.7 (34.8)
September	34.8 (94.6)	4.5 (40.1)	19.1 (66.4)	64	23.11 (0.91)	4.5 (10.1)	16.6 (37.0)
October	31.6 (88.8)	-3.8 (25.1)	10.9 (51.7)	69	39.12 (1.54)	5.7 (12.7)	20.8 (46.1)
November	28.4 (83.1)	-5.1 (22.8)	9.3 (48.8)	55	1.27 (0.05)	5.3 (11.8)	13.7 (30.5)
December	19.0 (66.2)	-15.6 (3.9)	-0.3 (31.5)	62	2.03 (0.08)	5.3 (11.7)	18.2 (40.5)
Annual[b]			13.5 (56.3)	55	503.17 (19.81)	5.7 (12.7)	

[a] Includes water equivalent of snowfall.
[b] Annual mean of parameter (when indicated) except for precipitation. Total precipitation is indicated. Annual maximum and/or minimum values of temperature and annual maximum wind speed may be obtained by reviewing the data in the appropriate column.

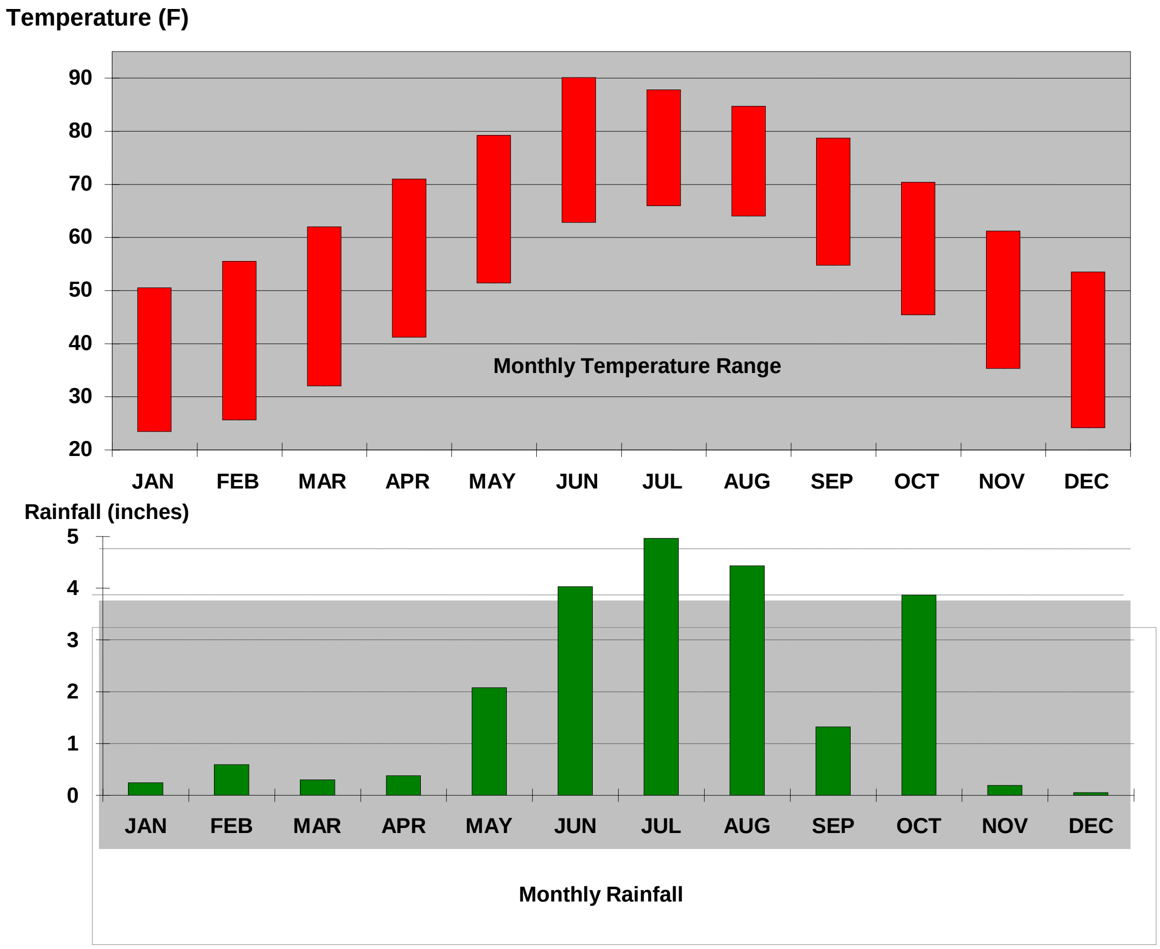


FIGURE 1.5 — *Pantex Plant Monthly Temperature Range and Amarillo National Weather Service (NWS) Precipitation during 2009*

1.5 Geology

The primary surface deposits at Pantex Plant are the Pullman and Randall soil series, which grade downward to the Blackwater Draw Formation. This formation consists of about 15 m (50 ft) of interbedded silty clays with caliche and very fine sands with caliche.

Underlying the Blackwater Draw Formation, the Ogallala Formation consists of interbedded sands, silts, clays, and gravels. The base of the Ogallala Formation is an irregular surface that represents the pre-Ogallala topography. As a result, depths to the base of the Ogallala vary. At Pantex Plant, the vertical distance to the base of the Ogallala varies from 90 m (300 ft) at the southwest corner to 220 m (720 ft) at the northeast corner of the Plant. (Purtymun and Becker, 1982)

Underlying the Ogallala Formation is sedimentary rock of the Dockum Group, consisting of shale, clayey siltstone, and sandstone. A detailed discussion of rocks older than Triassic age, as well as the regional structural setting, is provided in Chapter 3 of the *Environmental Information Document (EID)* (Pantex Plant, 1998). The deep geology (1,200 m or 4,000 ft) below the Plant has a major influence on the natural radiation environment, because radon is released from the granitic rocks there. (See Section 4.3.3 of this document for more information concerning natural radiation.)

1.6 Hydrology

The principal surface water feature on the Southern High Plains is the Canadian River, which flows southwest to northeast approximately 27 km (17 mi) north of the Plant. Plant surface waters do not drain into this system, but for the most part discharge into onsite playas. Storm water from agricultural areas at the periphery of the Plant drains into offsite playas. From the various playas, water either evaporates or infiltrates the soil. Two principal subsurface water-bearing units exist beneath Pantex Plant and adjacent areas: the Ogallala Aquifer and the underlying Dockum Group Aquifer. The vadose, or unsaturated, zone above the Ogallala Aquifer consists of as much as 140 m (460 ft) of sediment that lies between the land surface and the Ogallala Aquifer.

1.6.1 Ogallala Aquifer

The water-bearing units within the Ogallala Formation beneath Pantex Plant are the perched aquifer in the vadose zone and the Ogallala Aquifer below. A discontinuous perched aquifer is present above the main zone of saturation. Perched aquifers form above clayey layers that have lower permeability. Data collected from wells at Pantex Plant indicate that the zone of saturation in the perched aquifer varies in thickness by as much as 15 to 25 m (~70 ft). Depths from the surface to the perched aquifer range from 64 to 85 m (209 to 280 ft).

The main Ogallala Aquifer lies beneath the perched water zones. Depth to the main Ogallala Aquifer ranges from 102 to 168 m (~325 to 500 ft) below ground surface. The saturated thickness varies from 12 to 98 m [~39 to ~400 ft; Panhandle Ground Water Conservation District (PGWCD), 1980]. The aquifer is defined as the basal water-saturated portion of the Ogallala Formation and is a principal water supply on the High Plains. The regional gradient of the Ogallala Aquifer beneath Pantex Plant trends from the southwest to the northeast, where the zone of saturation is thickest. The Plant's production wells are located in this northeast area. The City of Amarillo's Carson County Well Field is located north and northeast of Pantex Plant's well field.

1.6.2 Dockum Group Aquifer

The Dockum Group Aquifer lies under the Ogallala Formation at Pantex Plant. Water contained in sandstone layers within the Dockum Group supplies domestic and livestock wells south and southeast of Pantex Plant. Other wells reaching the Dockum Group Aquifer are located 16 km (10 mi) south and west of the Plant. The aquifer may be semiconfined with respect to the overlying Ogallala Aquifer because of lateral variations in the Ogallala and shale layers within the Dockum Group.

1.6.3 Water Use

The major surface water source near Pantex Plant is the Canadian River, which flows into man-made Lake Meredith approximately 40 km (25 mi) north of the Plant. Many local communities use water from Lake Meredith for domestic purposes. The major groundwater source in the vicinity of the Plant is the Ogallala Aquifer, which is used as a domestic source by numerous municipalities, and by industries in the High Plains. Historical groundwater withdrawals, and long-term pumping from the Ogallala in Carson County and the surrounding eight-county area, have exceeded the natural recharge rate to the Ogallala. These overdrafts have removed large volumes of groundwater from recoverable storage, and have caused substantial water-level declines.

The large demands of the Amarillo area, which are primarily agricultural, are responsible for the drop in the water table. The average change in “depth to water” from 1,209 Ogallala Aquifer observation wells in the Panhandle during 1988 to 1997 was 1.49 ft. Groundwater withdrawals from the Ogallala Aquifer in Carson County have averaged 121,000 acre-ft (14,931 hectare-meters) over the last several years (Brady, 2005). This withdrawal rate is more than 10 times greater than the estimated annual recharge rate of 11,500 acre-ft (1,419 hectare-meters). Withdrawal rates are expected to decline each decade to approximately 65,000 acre-ft in 2060 (Crowell, 2007).

The City of Amarillo, the largest municipal Ogallala water user in the area, pumps water for public use from the Carson County Well Field north and northeast of the Plant. Pantex Plant obtains water from four wells in the northeast corner of the site. In 2009, Pantex pumped approximately 374 million liters (98.8 million gallons) from the Ogallala Aquifer. Most of the water used at Pantex Plant is for domestic purposes. Through an agreement with Texas Tech University, Pantex Plant provides water for its domestic and livestock uses.

1.7 Seismology

Seismic events have occurred infrequently in the region, and their magnitudes have been low. The stress conditions at the site are such that the possibility of high-order seismic events is extremely unlikely. A qualitative understanding of present conditions at Pantex Plant indicates that anticipated seismic activity is well below the level that is necessary to cause significant damage to structures at the Plant. The potential for local or regional earthquakes (with a magnitude great enough to damage structures at the site to the degree that hazardous materials would be released) is extremely low (McGrath, 1995).

1.8 Land Use and Population

The land around Pantex Plant is used mainly for winter wheat and grain sorghum farming, for ranching, and for mining (oil and gas). Although dryland farming is dominant, some fields are irrigated from the Ogallala Aquifer or, less commonly, from local playas. Ranching in the region consists of cow-calf and yearling operations. The economy of the rural Panhandle region depends mainly on agriculture, but diversification has occurred in the more populated counties of the region in such areas as manufacturing, distribution, food processing, and medical services. Nationally known businesses that are major employers in the greater Amarillo area include Bell Helicopter, Tyson Foods, a single rail beef-slaughtering operation; Pantex Plant; Owens-Corning Fiberglass, a fiberglass reinforcement plant; ASARCO, a large silver and copper refiner; and Cactus Feeders, one of the largest cattle-feeding operations in the world. Conoco-Phillips Petroleum and Xcel Energy are also major industrial presences in the Panhandle region.

A land-use census of the residential population surrounding Pantex Plant showed that most of the population is located west-southwest of Pantex Plant in the Amarillo metropolitan area. Figure 1.6 shows the population distribution. In 2000, the population within an 8 km (5 mi) radius of Pantex Plant was 130; the population within 80 km (50 mi) of the Plant was estimated at 295,837 (2000 census figures). The population within the 80 km (50 mi) circle is fairly evenly distributed at a density of about 5,916 people per square mile.

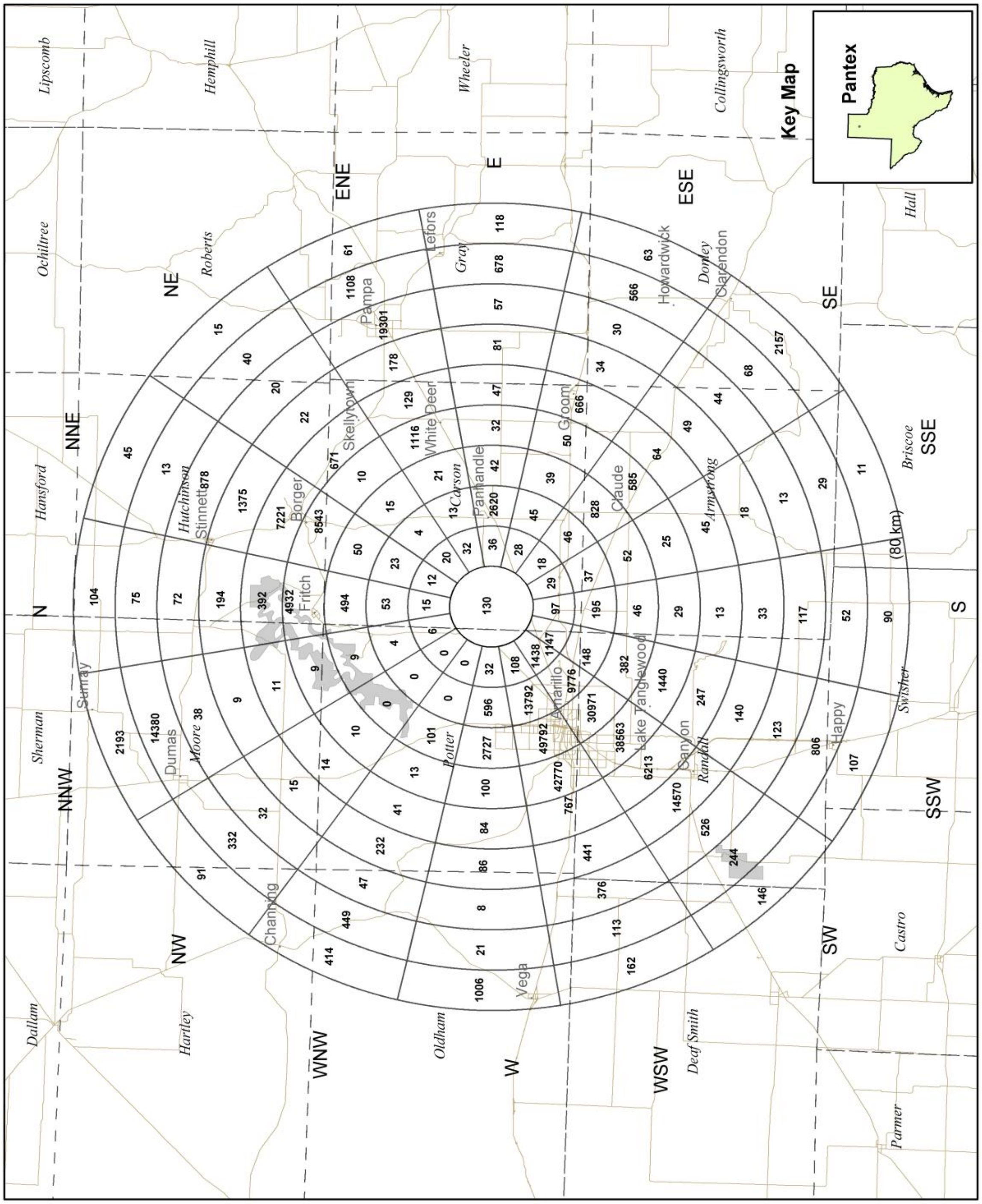


FIGURE 1.6 — *Population Distribution Within 50 Miles of Pantex Plant (2000)*

The total population of the 20 county area (defined as the Texas Panhandle) surrounding the Plant is 334,410. The population of the City of Amarillo (173,627 in 2000) represents about 52 percent of the counties' population. Another approximately 32 percent of the population lives in other incorporated cities, and about 16 percent reside in unincorporated areas. The communities of Pampa, Borger, Hereford, Dumas, and Canyon each have populations between 12,000 and 18,000. The population density of these counties ranges from 1 to 125 persons per square mile. The 20 county area can be described as sparsely populated, with Potter and Randall Counties being the exception. Potter, Randall, Carson, and Armstrong Counties make up the Amarillo Metropolitan Statistical Area (MSA). Hutchinson County (in which Borger is located) and Gray County (in which Pampa is located) are now classified as micropolitan statistical areas (DOC, 2007). Hartley, Moore, Roberts, Oldham, Deaf Smith, Donley, Dallam, Sherman, Hansford, Ochiltree, Lipscomb, Hemphill, Wheeler, and Collingsworth are the remaining counties of the defined area, although the population contained in the northerly portions of Castro, Swisher, and Briscoe counties is also included in the 80 km population estimate described above.

1.9 Organization of the Report

The remainder of this report is organized into 12 chapters and 3 appendices:
Chapter 2 discusses regulatory requirements for environmental compliance during 2009 and describes the Plant's compliance-related issues and activities. It presents results of various regulatory inspections and environmental activities and lists the environmental permits issued to the Plant.

Chapter 3 provides a brief summary of the environmental programs that are conducted at Pantex Plant. Overviews are provided for environmental management, pollution prevention, natural and cultural resources management, and environmental restoration. The Plant's *Environmental Monitoring Plan* (EMP) (Pantex Plant, 2009) is also discussed.

Chapter 4 describes the environmental radiological monitoring program, which deals with the potential exposure of the public and the environment to radiation resulting from Plant operations. Also discussed are results of the environmental thermoluminescent dosimetry program and other radiological monitoring programs for various environmental media, i.e., air, groundwater, surface water, soil, plants, and animals.

Chapters 5 through 12 discuss radiological and nonradiological monitoring and surveillance programs for individual environmental media. Chapter 5 discusses the air-monitoring program. The groundwater, drinking water, wastewater, and surface water monitoring programs are discussed in Chapters 6, 7, 8, and 9, respectively. Chapter 10 describes the soil-monitoring program, and vegetation and faunal monitoring are discussed in Chapters 11 and 12. Each of these chapters includes a description of the monitoring program for the specific medium and an analysis of radiological and nonradiological data for the 2009 samples.

Chapter 13 reviews Pantex Plant's quality assurance program for environmental monitoring efforts, as initiated in response to 10 CFR 830.120 and DOE Order 414.1.C (Quality Assurance). The chapter also includes an analysis of quality control samples collected during 2009 and a data validation summary.

Appendix A lists all of the materials for which environmental analyses were conducted, Appendix B lists all of the birds sighted at Pantex Plant, and Appendix C provides references.

This page was intentionally left blank.

Compliance Issues and Activities

Pantex's policy is to conduct all operations in compliance with applicable environmental statutes, regulations, and the requirements of the various permits issued to the Plant. This chapter reviews current issues and actions related to these requirements. In 2009, Pantex Plant operated in compliance with all applicable environmental permits, laws, and regulations. Pantex remains committed to maintaining full compliance with all applicable environmental requirements.

2.1 Environmental Regulations

This chapter summarizes the compliance status of Pantex Plant for 2009. It contains a discussion of initiatives and clean-up agreements in place, as well as measures to support the U.S. Department of Energy (DOE) health, safety, and environmental performance indicators. Table 2.1 presents the major environmental regulations pertaining to the Pantex Plant.

TABLE 2.1 — *Major Environmental Regulations Applicable to Pantex Plant*

Regulatory Description	Authority	Codification	Status
ARCHAEOLOGICAL RESOURCE PROTECTION ACT (ARPA) ARPA provides for the protection of archeological resources and sites located on public and Native American lands.	Federal: Advisory Council on Historic Preservation State: State Historic Preservation Office (SHPO)	Federal: Title 36 of the Code of Federal Regulations, Chapter 79 (39 CFR §79), 43 CFR §7	All archeological surveys and testing at Pantex Plant conformed to ARPA standards.
CLEAN AIR ACT (CAA) CAA and the Texas Clean Air Act (TCAA), through their implementing regulations, controls the release of regulated emissions to the atmosphere and provide for the maintenance of ambient air quality.	Federal: U.S. Environmental Protection Agency (EPA) State: Texas Commission on Environmental Quality (TCEQ) Texas Department of State Health Services (TDSHS)	Federal: 40 CFR §50-§82 State: Title 30 of the Texas Administrative Code, Chapter 101 through Chapter 125 (30 TAC §101-§125) & §305 25 TAC §295 (Asbestos only)	Pantex Plant complies with permits and Permits-by-Rule issued or promulgated by the TCEQ to authorize releases of pollutants to the atmosphere. Pantex Plant complies with the requirements of 40 CFR §61, Subpart H (emissions of radionuclides other than radon from DOE facilities), 40 CFR §61, Subpart M (concerning asbestos), 40 CFR §68 (concerning chemical accident prevention), and with 40 CFR §82 (concerning stratospheric ozone protection).
COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA) CERCLA provides the regulatory framework for the remediation of releases of hazardous substances and cleanup of inactive hazardous substance disposal sites.	Federal: U.S. Environmental Protection Agency	Federal: 40 CFR §300, §302, §355, & §370	Pantex Plant has been on the National Priorities List since 1994. The EPA, TCEQ, and the PXSO have signed an Interagency Agreement concerning the conduct of the remediation at the Pantex Plant. A Record of Decision (ROD) was issued and approved in 2008 and Pantex was added to the Construction Completion List in 2009. Interested Co-Trustees have been involved in the planning and completion of the ecological risk assessment (ERA) for Pantex,

Regulatory Description	Authority	Codification	Status
Section 107 provides for the protection of natural resources on publicly owned property through designation of Natural Resource Trustees.			and selection of the final remediation. The Agency for Toxic Substances and Disease Registry published its final report *Public Health Assessment-Pantex Plant* in September 1998.
ENDANGERED SPECIES ACT (ESA) ESA prohibits federal agencies from taking any action that would jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat.	Federal: U.S. Fish and Wildlife Service State: Texas Parks and Wildlife Department (TPWD)	Federal: 50 CFR §10; 50 CFR §17; Title 16 of the United States Code USC, Chapter 153 (16 USC §153), et seq. State: Texas Parks and Wildlife Code, §68, §88	Ongoing and proposed actions are assessed as to their potential adverse effects on threatened and endangered species.
FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA) FIFRA governs the manufacture and use of biocides, specifically the use, storage, and disposal of all pesticides and pesticide containers and residues.	Federal: EPA State: Texas Department of Agriculture; Structural Pest Control Board	Federal: 40 CFR §170-§171 State: 4 TAC §7.1-§7.40; Structural Pest Control Act (Art. 135b-5), 22 TAC §591-§599	State-licensed personnel apply pesticides in accordance with regulations. The Plant implemented a land-applied chemical use plan in 1996. The plan was most recently updated in 2004.
FEDERAL WATER POLLUTION CONTROL ACT / CLEAN WATER ACT (CWA) The Texas Water Code, through its implementing regulations, regulates the quality of water discharged to waters of the State of Texas	State: TCEQ	State: 30 TAC §205-§299, §305, §309, §317 & §319.	As currently defined, the Pantex Plant does not discharge it's wastewaters to 'Waters of the United States'. The Pantex Plant discharges it's industrial wastewaters pursuant to Permits WQ0002296000, WQ0004397000, and UIC 5W2000017. The Plant has coverage under TPDES Construction General Permit, for storm water via Permit No. TXR150000. It complies with requirements of the permit whenever applicable to a project As of the end of 2009; two active projects had been registered with the TCEQ. The Plant operates under TCEQ General Permit for Discharges of Storm Water from Industrial Sources Registration No. TXR05P506
MEDICAL WASTE	Federal: US Department of Transportation State: Texas Department of State Health Services	Federal: 29 CFR §1910 State: 30 TAC §330.1010 and 25 TAC §1.131-§1.137	The Plant manages medical waste in accordance with applicable regulations.

Regulatory Description	Authority	Codification	Status
MIGRATORY BIRD TREATY ACT Decreed that all migratory birds, their parts, and their nests were fully protected. Pantex provides habitat for many migratory bird species protected by federal law.	Federal: U.S. Fish and Wildlife Service State: TPWD	Federal: Code of Federal Regulations, 50 CFR §10 pursuant to 16 USC 703-704 State: Texas Parks and Wildlife Code, 64	Actions being considered at Pantex Plant are reviewed through the NEPA process, which considers impacts to migratory species. Nuisance and other bird situations are handled within compliance of the Migratory Bird Treaty Act.
Executive Order 13186: Responsibilities for Federal Agencies to Protect Migratory Birds Establishes commitment to migratory bird protection, management, research, and outreach on federal properties. Reaffirms relationship between the U.S. Fish and Wildlife Service and other federal agencies.	Federal: U.S. Department of Energy	66 FR 3853	Actions being considered at Pantex Plant are reviewed through the NEPA process, which considers impacts to migratory species. The order provides a driver for management, research and outreach.
NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) NEPA establishes a broad national policy to conduct federal activities in ways that promote the general welfare and are in harmony with the environment. NEPA procedures must ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken.	Federal: U.S. Department of Energy; Council for Environmental Quality	Federal: Code of Federal Regulations, 10 CFR §1021, 40 CFR §1500-§1508	In 2009, 11 Standard NEPA Review Forms, 46 Internal NEPA Review Forms, and 20 amendments were prepared. Preparation began on one Environmental Assessment (EA). The 5-year Supplement Analysis was approved by DOE.
PROTECTION OF BIRDS, NONGAME SPECIES, AND FUR-BEARING ANIMALS This statute requires the protection of all indigenous birds and ring-necked pheasants, non-game species, and fur-bearing animals except where exceptions are stated in the Texas Parks & Wildlife Code.	Federal: U.S. Fish and Wildlife Service State: TPWD	Federal: Code of Federal Regulations, 50 CFR §10 State: Texas Parks and Wildlife Code, 67, 71	Actions being considered at Pantex Plant are reviewed, including through the NEPA process, which considers impacts to all protected species.
RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) RCRA and the Texas Solid Waste Disposal Act govern the generation, storage, handling, treatment, and disposal of hazardous waste. These statutes and regulations also regulate underground storage tanks and spill release cleanup.	Federal: EPA State: TCEQ	Federal: Code of Federal Regulations, 40 CFR §260-§280 State: Texas Administrative Code, 30 TAC §305, §327, §334, and §335	Pantex Plant is defined as a large-quantity generator. Permit HW-50284 authorizes the management of hazardous wastes in various storage and processing units at the Plant. Permit CP-50284, addresses corrective action requirements at the Plant.

Regulatory Description	Authority	Codification	Status
SAFE DRINKING WATER ACT (SDWA) SDWA and the Texas Water Code govern public water supplies. Pantex Plant's water distribution system is classified as a non-transient, non-community, public water supply system.	Federal: EPA State: TCEQ	Federal: Code of Federal Regulations, 40 CFR §141-§143 State: Texas Administrative Code, 30 TAC §290	Pantex operates a Non-Transient, Non-Community Public Water Supply system (No. 030007). In 2009, the system was recognized as a Superior Public Water System by the TCEQ.
TOXIC SUBSTANCES CONTROL ACT (TSCA) TSCA requires the characterization of toxicity and other harmful properties of manufactured substances and regulates the manufacture, distribution, and use of regulated materials.	Federal: EPA	Federal: Code of Federal Regulations, 40 CFR §700-§766, 10 CFR §850	The Plant manages PCBs, asbestos, beryllium, and chemicals in compliance with applicable regulations.

2.2 Clean Air Act

Most requirements of the Federal Clean Air Act in Texas are implemented under the Texas Clean Air Act, which is administered by the TCEQ. The exceptions to this delegation of authority from the EPA include: 40 CFR §61, Subpart H (Emissions of Radionuclides Other Than Radon from Department of Energy Facilities), and 40 CFR §61, Subpart M (National Emissions Standard for Asbestos). The primary regulatory authority for 40 CFR §61, Subpart M is delegated to the Texas Department of State Health Services (TDSHS).

2.2.1 40 CFR §61 Subpart H (Emissions of Radionuclides Other Than Radon from DOE Facilities)

All new projects are evaluated to determine the applicability of Subpart H to the project. Under 40 CFR §61.92, emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive an effective dose equivalent of 10 millirem per year (10 mrem/yr) or 0.10 milliSievert per year (0.10 mSv/yr). Evaluations, using the most conservative assumptions about the emissions of radionuclides from several Plant locations that have the potential to emit radioactive materials, were conducted during 2009. B&W Pantex has determined that the maximum effective dose equivalent that any member of the public received in 2009 was 2.86×10^{-7} mrem (2.86×10^{-9} mSv), which is in compliance with the EPA standard.

Continuous emission monitoring, as described in 40 CFR §61.93, is not required of any source at Pantex Plant, based on each source's emission potential. The Plant does perform periodic confirmatory measurements, as well as modeling, to assure compliance with 40 CFR §61, Subpart H regulations.

2.2.2 40 CFR §61 Subpart M (National Emissions Standard for Asbestos)

Each year, Pantex files a "Notification of Consolidated Small Operations Removing Asbestos-Containing Material" with the Texas Department of Health Services for maintenance activities to be conducted by the

Plant in the next calendar year. To verify that operations are consistent with the notification, Pantex keeps a log of all its affected maintenance activities during the year to track quantities of material disturbed.

Subcontractors at Pantex Plant are required to prepare separate notifications for work that qualifies as "demolition" or "renovation" as defined in 40 CFR §61, Subpart M, and 25 TAC §295.61, which implements the "Texas Asbestos Health Protection Act." Separate notifications are also required for jobs conducted by Pantex personnel that involve amounts that would require job-specific notifications. Pantex maintains the required certifications for the personnel who plan, oversee, and conduct these efforts. By filing the required forms and maintaining the described records, Pantex demonstrates that it is in compliance with 40 CFR §61, Subpart M.

2.2.3 40 CFR §68 (Risk Management Planning)

Pantex has established and maintains controls on the introduction of new chemicals to any area of the Plant. Through this process, Pantex has been able to demonstrate that it has control of the chemicals in use. It continues to ensure that the quantities of chemicals in process at any location are below the threshold quantities stated in 40 CFR §68, thus, exempting Pantex from having to perform risk management planning.

2.2.4 40 CFR §82 (Ozone Depleting Substances)

Pantex maintains fixed and mobile air conditioning systems at the Plant. Technicians conducting this work have been trained in the proper use of approved recycling devices while conducting these efforts. Pantex maintains records of training and maintenance activities to demonstrate compliance with these regulations.

2.2.5 Air Provisions in RCRA Permit

Permit HW-50284 authorizes the storage and treatment of hazardous waste at Pantex Plant and the emissions to the atmosphere from these units, including the emissions and operations associated with non-hazardous waste. On May 5, 2009, the TCEQ issued Permit 84802 which included authorization for emission from RCRA units. On November 3, 2009 the TCEQ approved a modification to Permit HW-50284 which removed the Texas Clean Air Act provisions from Permit HW-50284.

2.2.6 Air Quality Permits and Authorizations

On May 5, 2009, the TCEQ issued Air Quality Permit 84802, which incorporated Air Quality Permits 18379, 21233, the Texas Clean Air Act Provisions in Permit HW-50284 and several Permits-by-Rule. Permit 84802 is a Flexible Air Permit that includes an aggregate hourly and annual maximum emission rate for all emission points included in the Permit. Pantex also maintained its claim to a number of Permits-by-Rule for sources not included in Permit 84802.

2.2.7 Federal Operating Permit Program

The Title V Federal Operating Permit Program is administered and enforced by regulatory oversight agencies, namely the Environmental Protection Agency (EPA) Region 6 Office and the TCEQ. During 2009, Pantex maintained documentation demonstrating that it was not a major source, as defined by the

Federal Operating Permit Program. Pantex currently operates under a PTE Certification submitted in April of 2006.

2.2.8 Air Quality Inspection

During 2009, the TCEQ did not perform an air quality-related inspection of Pantex Plant; this is a benefit to both the State and the site, flowing from the Plant's Gold status under the Clean Texas program. The Pantex Plant did respond to a TCEQ request in July 2009 to provide data in support of a state-wide Minor Source Emission Inventory review.

2.2.9 Emission Tracking and Calculation

2.2.9.1 Scope of the Pantex Plant Emission Tracking System

Pantex Plant, being an industrial facility, is subject to the federal Clean Air Act (CAA) and State of Texas regulations under 30 Texas Administrative Code (TAC) §§101, 106, 111, 112, 114, 116, & 122. The main scope or function of the Plant's air emission tracking system is to monitor process emissions, in order to (a) maintain the facility designation of "Synthetic Minor" under the federal Title V program, and (b) demonstrate compliance with permit limits.

The Pantex Plant initiated a comprehensive system for tracking emissions from specific sources (facilities) in September of 1999, and has continued to update the tracking process to comply with changing regulations and best management practices. Pantex Plant processes that have emissions are conducted under the authority of various regulations and authorizations (Permits, Standard Exemptions [SE], and Permits-by-Rule [PBR]).

Table 2.2, below, identifies the tracked emission sources at Pantex and their authorizations.

TABLE 2.2 — *Tracked Emission Sources at Pantex*

Process:*	Authorization Permit #	Standard Exemption	Permit By Rule
HE Synthesis Facility	Permit 84802		
HE Fabrication	Permit 84802		
Firing Site Activities	Permit 84802		
Boiler House, Natural Gas Usage	Permit 84802		
Boiler House, Diesel Usage	Permit 84802		
Permitted Standby Emergency Generators	Permit 84802		
Boiler House, Diesel Storage	Permit 84802		
Burning Ground Activities	Permit 84802		
Hazardous Waste Storage	Permit 84802		
Hazardous Waste Processing	Permit 84802		
Welding and Cutting		SE 39	
Dual Chamber Incinerator	Permit 84802		
Plastics Shop	Permit 84802		
Parts Cleaning		SE 118	
Epoxy Foam Production	Registration #43702		PBR 262
Component Sanitization	Registration #41577		PBR 261 & 262

Process:*	Authorization Permit #	Standard Exemption	Permit By Rule
Machining		SE 39, 41, 42	PBR 433 & 452
VMF Fueling Operations	Permit 84802		PBR 412
Body Shop			PBR 227 & 436
HWTF Liquid Processing Facility	Registration #48297		PBR 261
Chlorination Facilities			PBR 531 & 532
Pantex Site-wide Cooling Towers	Permit 84802		PBR 371
Load Leveling Engines	Permit 84802	SE 6	
Standby Emergency Engines	Permit 84802		PBR 511
Painting Facilities	Registration # 32674, 52638, 52639	SE 75	
Pressing & Transferring HE & Mock		SE 106 & 118	
Burning Grounds-Soil Vapor Extraction	Registration # 70894		PBR 533
Miscellaneous Chemical Tracking		NA	
Chemical Transfer Operations	Registration # 72373		PBR 262, 472, & 473
Zone-11 Soil-Vapor Extraction System	Discontinued in 2009		PBR 533

***** Authorization dates (the effective dates) can be found in Table 2.5.

2.2.9.2 Program Structure and Requirements

As stated earlier, Pantex Plant is designated as a Synthetic Minor. The upper threshold of emission limits for a facility to remain in this category is 25 tons per year Hazardous Air Pollutants (HAP), (or 10 tons of a single HAP) and 100 tons per year of the other criteria pollutants. Under this designation, a facility is not required to declare its emissions every year to the TCEQ; however, a certification of Potential-to-Emit (PTE) is required by 30 TAC § 122.122 when significant changes of emissions take place. The PTE, once submitted to the TCEQ, becomes a federally enforceable document for allowable emissions. Essentially, the PTE establishes emission limits that are administratively set by Pantex and authorized/enforceable by the TCEQ.

The Pantex Plant has and maintains a tracking process to verify compliance with certified emissions limits. This tracking process is implemented through Air Quality Management Requirement (AQMR) documents, which are placed into the every-day operational procedures/activities that have either point source or fugitive emissions. AQMRs are management driven documents that outline regulatory requirements for operators to follow based upon process activities and the requirements of the federal and state air emission regulations. The approved AQMRs usually incorporate sections of the authorization that outline the internal reporting and recordkeeping requirements for process operators.

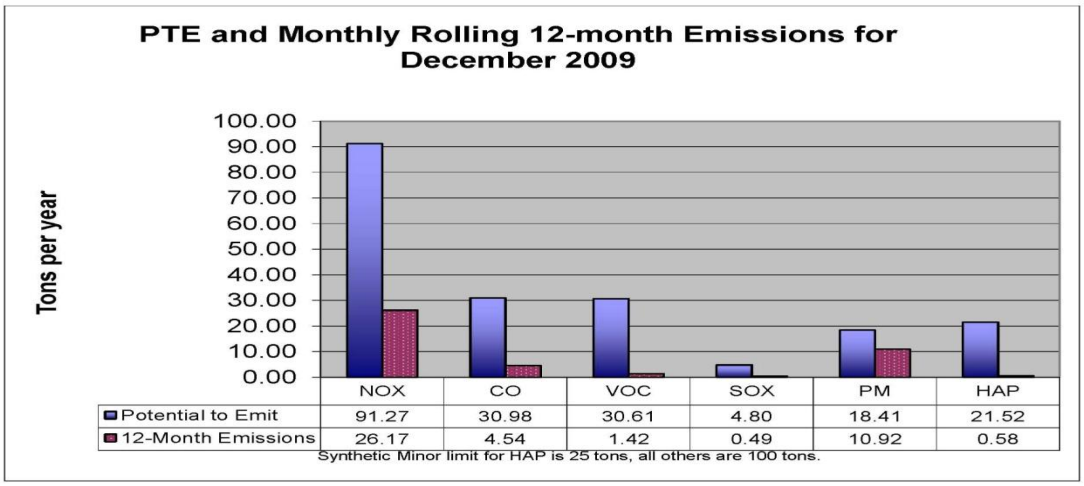
Operational data are gathered by process operators and then input on a monthly basis into enhanced commercial off-the-shelf computer software. The software uses emission factors from source tests, manufacturer's data, and EPA documentation to calculate both hourly and rolling 12-month emissions.

2.2.9.3 Types and Tracking of Emissions

During 2009, Pantex tracked the emissions from 30 different processes both at specific locations and across the Plant. Pantex personnel responsible for air program compliance gathered plant data on emissions of common air pollutants including nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOC), sulfur oxides (SOx), particulate matter (PM), and hazardous air pollutants (HAP). The data, once gathered, are compiled into a monthly report that compares the cumulative past 12 month emissions for the Plant, to the annual limits set in the authorized PTE.

2.2.9.4 Conclusions of Air Emission Tracking for 2009

Over the 12 months of air emission tracking for 2009, operations at the Pantex Plant remained well below the certified and authorized PTE levels for each of the pollutants tracked. Figure 2.1 below is a graphic representation of the emission information gathered over the 12-month period from January through December, expressed in relation to the PTE certification in Tons per Year. Figure 2.1 is a demonstration that Pantex Plant continues to meet the requirements of the Title V program for the designation as a Synthetic Minor Source.



	NOX	CO	VOC	SOX	PM	HAP
Potential to Emit	91.27	30.98	30.61	4.80	18.41	21.52
12-Month Emissions	26.17	4.54	1.42	0.49	10.92	0.58

FIGURE 2.1 — ***PTE versus Actual Yearly Emissions***

2.3 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)

The Environmental Restoration program at Pantex Plant is conducted in compliance with all regulatory requirements, with the goal of gaining full acceptance by the public, regulatory agencies, and natural resource trustees.

As Pantex Plant is listed on the National Priorities List, CERCLA Section 107 (Title 42 of the United States Code, Chapter 9607) is applicable to Pantex Plant. Section 107 provides for the designation of federal and state trustees who are responsible for assessing damages for injury to, destruction of, and loss of natural resources. As Pantex Plant's primary Natural Resource Trustee [per 40 CFR §300.600(b)(3)], the DOE is responsible for encouraging the involvement of designated federal and state trustees. To meet this responsibility, DOE held meetings with state and federal agencies. DOE and EPA jointly issued an Interagency Agreement in December 2007 in conclusion of negotiations between DOE, B&W Pantex, EPA, and TCEQ. This agreement became effective in February 2008.

Pantex submitted the Site Management Plan (SMP), a primary document required by Article 7.2 of the Interagency Agreement for the Plant, in November 2008. The SMP is a schedule with deadlines and timetables for completion of all primary documents required by the Interagency Agreement. Pantex completed four of the primary documents required by the IAG before 2009. During 2009 the Preliminary Construction Completion Report was finalized and the Interim Remedial Action Completion Report was submitted for review and approval. Future document submittals will focus on evaluation of the remedies and documentation of the completion of the remedies.

2.4 Endangered Species Act

Pantex Plant provides habitat for several species protected by federal and state endangered species laws. In 1992, Pantex Plant began a program to assess its natural resources (See Chapter 3). Each year, wildlife observations are recorded and state and federal rare species lists are examined for changes. Pantex personnel have confirmed the presence of several species listed by the state and federal governments, as well as the potential presence of others. The current status of endangered or threatened species, as well as species of concern, known to appear on or near Pantex Plant (Carson and Potter counties) is summarized in Table 2.3. Pantex Plant is in compliance with the provisions of the Endangered Species Act.

TABLE 2.3 — *Endangered, Threatened, and Candidate Species and Species of Concern Known to Appear on or near Pantex Plant*

Common Name	Scientific Name	Present in 2009	Federal Status	State Status
<u>Birds</u>				
American peregrine falcon	*Falco peregrinus anatum*		Concern	Endangered
Arctic peregrine falcon	*Falco peregrinus tundrius*		Concern	Threatened
Baird's sparrow	*Ammodramus bairdii*		Concern	Not listed
Bald eagle	*Haliaeetus leucocephalus*	[a]	Concern	Threatened
Ferruginous hawk	*Buteo regalis*	[a]	Concern	Not listed
Interior least tern	*Sterna antillarum athalassos*		Endangered	Endangered
Lesser prairie chicken	*Tympanuchus pallidicinctus*		Candidate[b]	Not listed
Mountain plover	*Charadrius montanus*		Concern	Not listed
Snowy plover	*Charadrius alexandrinus*		Concern	Not listed
Western burrowing owl	*Athene cunicularia hypugea*	[a]	Concern	Not listed
Prairie falcon	*Falco mexicanus*	[a]	Concern	Not listed
Whooping crane	*Grus Americana*		Endangered	Endangered
<u>Mammals</u>				
Big free-tailed bat	*Nyctinomops macrotis*		Concern	Not listed
Black bear	*Ursus americanus*		Concern	Threatened
Black-tailed prairie dog	*Cynomys ludovicianus*	[a]	Concern	Not listed
Cave myotis bat	*Myotis velifer*		Concern	Not listed
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*		Concern	Not listed
Plains spotted skunk	*Spilogale putorius interrupta*		Concern	Not listed
Swift fox	*Vulpes velox*		Concern	Not listed
Western small-footed bat	*Myotis ciliolabrum*		Concern	Not listed
<u>Reptiles</u>				
Texas horned lizard	*Phrynosoma cornutum*	[a]	Concern	Threatened

[a] Presence documented at Pantex Plant in 2009.
[b] Candidate, threatened.
[c] Proposed for federal listing as threatened of endangered.

Several species are listed for Carson or surrounding counties, yet are not included in Table 2.3 because of their dependence on habitat not found on High Plains soils, or because they are considered extirpated from the region. The Arkansas River shiner (*Notropis girardi*) and Arkansas River speckled chub (*Macrhybopsis tetranemus*) would only be expected in streams on the Canadian River floodplain located in adjacent Potter County. The Wiest's sphinx moth (*Euproserpinus wiesti*) is listed, but its host plants are restricted to aeolian dunes in the Canadian River valley. The Mexican mud-plantain (*Heteranthera mexicana*) is an aquatic plant that grows sporadically and has been documented a few times growing in Panhandle ditches and ponds. The gray wolf (*Canis lupus*) and black-footed ferret (*Mustela nigripes*) are listed but are considered extirpated in this area. Ferret releases are being made in surrounding states, as the captive-reared program has resulted in an ample captive population. Captive ferret numbers are so high that the U.S. Fish and Wildlife Service is relaxing protocol concerning requirements for acceptable release sites. Thus, dispersing ferrets could potentially be observed in the region.

As described in Section 2.8, federal actions being considered at Pantex Plant are reviewed through the NEPA process, which includes consideration of impacts to species of concern. A biological assessment associated with the *Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components* (DOE, 1996) was completed in April 1996. (See discussion in Section 3.4.)

2.5 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act regulates the manufacture and use of pesticides. The EPA has federal jurisdiction pursuant to 40 CFR §150-§189; and the Texas Department of Agriculture and the Structural Pest Control Board have state jurisdiction pursuant to 4 TAC, Chapter 7, and 22 TAC §591-§599. Regulations promulgated under the statute govern the use, storage, and disposal of pesticides and pesticide containers. State-licensed personnel in accordance with federal and state regulations apply pesticides needed for Pantex Plant operations.

The Texas Herbicide Law and the Texas Structural Pest Control Act regulate applications of pesticides at Pantex Plant, which are administered by the Texas Department of Agriculture and the Structural Pest Control Board, respectively.

The federal and state statutes and regulations establish standards for application of pesticides to prevent unreasonable risk to human health and to protect workers and others during the production of agricultural field crops or structural maintenance. Compliance with these statutes at Pantex Plant accommodates agricultural production, infrastructure maintenance, and vegetation control onsite, while ensuring the safety and protection of employees and the environment from improper use of pesticides.

Guidance for pesticide use at Pantex Plant is outlined in the *Land-Applied Chemical Use Plan for Pantex Plant* (Pantex Plant, 2005). This plan coordinates procedures for communication, worker notification, record keeping, applicator education and licensing, and application of pesticides. The plan also requires review and approval of all land-applied pesticides used at the Plant.

2.5.1 Agricultural Pesticide Use in 2009

Texas Tech Research Farm submitted 34 agricultural spray requests during the 2009 growing season. Although all 34 agricultural spray requests were reviewed and approved by B&W Pantex and the Pantex Site Office, two of the approved applications were not made due to inclement weather. (See Table 2.4.)

TABLE 2.4 — *Numbers of Pesticide Applications Conducted at Pantex*

Year of Pesticide Applications	Texas Tech Research Farm	Maintenance Department	Contractors	Total
2003	22	90	35	147
2004	22	86	28	136
2005	29	174	2	205
2006	16	151	11	178
2007	25	84	13	122
2008	28	105	2	135
2009	32	81	23	136

2.5.2 Maintenance Department and Contractor Pesticide Use in 2009

The B&W Pantex Maintenance Department made 81 applications of pesticides during 2009. The majority of these applications were for weed control in Zone 4, Zone 11, Zone 12, and the associated Perimeter Intrusion Detection and Surveillance beds. The second most frequent pesticide use was Aquashade and Cutrene-Plus for algae suppression in the facultative lagoon and the irrigation storage ponds. Contractors made 23 applications that accounted for the remainder of pesticide use in 2009. The majority of the 23 contractor applications were herbicides applied as soil sterilants before roads or structures were built.

2.5.3 Pesticide Use Summary

The *Land-Applied Chemical Use Plan for Pantex Plant* has provided an adequate framework for use of pesticides at Pantex Plant. The Plan provides guidance to request, approve, notify, apply, and document pesticide applications at Pantex Plant.

2.6 Federal Water Pollution Control Act (or Clean Water Act) and Texas Water Code

The Pantex Plant does not discharge any wastewater into or adjacent to waters of the United States; thus, it is not subject to the Federal Water Pollution Control Act. Its discharges are subject to the requirements of the Texas Water Code; and all discharges must be done in compliance with the requirements of the Texas Water Code and its implementing regulations.

Pantex has obtained several authorizations to discharge wastewater and storm water into and adjacent to waters of the State of Texas. These Permits are listed in Table 2.5.

In calendar year 2009, Pantex discharged a majority of its industrial wastewaters pursuant to WQ0004397000, which authorizes the Plant to apply treated wastewater to crops via an underground drip irrigation system to approximately 300 acres. This authorization was issued in conjunction with Underground Injection Control (UIC) Permit 5W2000017. UIC Permit 5W2000017 authorizes Pantex to apply treated wastewater to fallow ground via the underground, drip irrigation system to approximately 300 acres.

TABLE 2.5 — *Permits Issued to Pantex Plant*

Building or Activity	Permit Number	Issuing Agency	Effective Date	Expiration Date
Air				
Flexible Air Quality Permit	84802	TCEQ	05/05/2009	05/04/2019
All other small sources	Standard Exemptions & Permit-by Rule	TCEQ	Various dates	When changes occur to the process that modify the character or nature of the air emission, or modify the process so that the Permit-by-Rule may not longer be used.
Clean Air Act Title V Declaration, 30 TAC §122	Permit 1667	TCEQ	05/22/2000	None
Solid Waste				
Solid Waste Registration Number	TX-4890110527 30459	EPA TCEQ	10/30/1980 10/30/1980	None None
Industrial and Solid Waste Management Site Permit RCRA Compliance Plan	TX-4890110527 HW-50284 CP-50284	EPA TCEQ TCEQ	10/21/2003 10/21/2003 06/09/2003	10/20/2013 10/20/2013 06/08/2013
Underground Injection TLAP associated ER Program	 5W2000017 5X2600215 5X2500106	TCEQ TCEQ TCEQ TCEQ	06/27/2003 11/29/2004 10/23/2001 11/28/2005	When canceled. When canceled. When canceled. When canceled.
Water				
Texas Water Quality Permit	WQ0002296000	TCEQ	06/24/2009	12/01/2010
Texas Land Application Permit	WQ0004397000	TCEQ	10/06/2003	12/01/2010
TPDES Multi-Sector (Industrial) Storm Water Permit	TXR05P506	TCEQ	11/14/2006	08/14/2011
TPDES Storm Water General Permit for Construction Activities Perched Aquifer Dewatering Project High Explosive Pressing Facility Interior Gas Main Replacement	TXR150000 TXR15LK43 TXR15LI64 TXR15PN86	TCEQ TCEQ TCEQ TCEQ	03/05/2009 07/13/2007 05/15/2008 04/29/2009	03/05/2013 08/04/2009 05/20/2009 When completed.
Natural Resources				
Scientific Permit	SPR-1296-844	TXPWD	12/05/1997	12/05/2011
Letter of Authorization: Trap and Release Fur-bearing Animals		TXPWD	07/28/2000	Renewed annually.
Letter of Authorization: Transportation of Skunks for Euthanization		USDA-APHIS Wildlife Services	03/16/2000	When canceled.

2.6.1 Discharge Permit Inspections

The TCEQ did not conduct a Comprehensive Compliance Inspection relevant to WQ0002296000, WQ0004397000, or 5W2000017 during 2009.

2.7 Medical Waste

Medical waste at Pantex Plant is regulated by the Department of Transportation, the State of Texas, and associated Plant requirements and remains in compliance with their provisions.

2.8 National Environmental Policy Act

The National Environmental Policy Act (NEPA) establishes requirements that federal agencies must meet to make well-informed decisions on proposed activities. The decisions must be based on alternatives that consider, in part, detailed information concerning potential significant environmental impacts. To minimize environmental impacts from Pantex Plant operations, proposed activities are reviewed for NEPA requirements. At Pantex, the NEPA process is initiated by completing a NEPA Review Form (NRF). The NRF includes a description of the proposed action and subject matter experts review for potential environmental concerns. The NRF is used to determine which level of NEPA documentation will be required, if any. The levels of NEPA documentation range from internal reviews that tier off previously approved NEPA documents, categorical exclusions, environmental assessments (EA), and environmental impact statements (EIS).

Every five years, the DOE is required to evaluate site wide EISs (SWEIS) by means of a Supplement Analysis. Based on the Supplement Analysis, DOE determines whether the existing EIS remains adequate, or whether to prepare a new SWEIS or supplement the existing EIS. The determination and supporting analysis will be made available in the appropriate DOE public reading room(s) or in other appropriate location(s) for a reasonable time. In 2009, a final Supplement Analysis for the 10-year review of the SWEIS, was approved by DOE/NNSA.

In addition, in 2009, eleven Standard NEPA Review Forms (Categorical Exclusion determinations), 46 Internal NEPA Review Forms, and 20 amendments were prepared and approved. (See Table 2.1 for all major environmental regulations pertaining to the Plant.)

2.9 National Historic Preservation Act, Archaeological Resource Protection Act, and Native American Graves Protection and Repatriation Act

In October 2004, PXSO, B&W Pantex, the Texas State Historic Preservation Office (SHPO), and the President's Advisory Council on Historic Preservation (Advisory Council) completed execution of a new *Programmatic Agreement and Cultural Resource Management Plan* (PA/CRMP). This PA/CRMP ensures compliance with Sections 106 and 110 of the NHPA, providing for more efficient and effective review of Plant projects having the potential to impact prehistoric, World War II era, or Cold War era properties. In addition, the PA/CRMP outlines a range of preservation activities planned for the Plant's compliance program. The PA/CRMP provides for the systematic management of all archeological and historic resources at Pantex Plant under a single document.

Compliance with the Archaeological Resource Protection Act's requirements for site protection and collections curation is addressed in the PA/CRMP. Even though Native American mortuary remains or funerary artifacts have not been found at the Plant, compliance with the Native American Graves Protection and Repatriation Act is also addressed in the plan. Both archeological and natural resources at Pantex Plant are closely concentrated around four playa lakes. These playa and floodplain areas have been reserved for comprehensive ecosystem management, resulting in preservation of many of the Plant's archeological sites.

Fulfilling the Plant's cultural resource management obligations under Section 106 of the National Historic Preservation Act, 46 projects were evaluated in 2009 under the PA/CRMP. Of these projects, 41 either did not involve National Register-eligible properties or possible adverse effects, or design modifications were suggested and incorporated to avoid impacts to National Register-eligible properties. A number of modification projects are continuing at the Plant, involving historic eligible National Register properties. The modifications would not adversely impact the historical characteristics of the building. Continued use and reuse of buildings is the strongest and most effective preservation possible at Pantex.

2.10 Resource Conservation and Recovery Act

The TCEQ has been granted authority for administering and enforcing the RCRA program in Texas. The current permit for Industrial Solid Waste Management (Permit Number HW-50284) was renewed on October 21, 2003, by the TCEQ. This permit authorizes storage, processing of wastes and the associated emissions to the atmosphere, in accordance with limitations, requirements, and conditions set forth in the permit.

2.10.1 Active Waste Management

The types of wastes generated at Pantex Plant include hazardous waste, universal waste, non-hazardous waste, waste regulated by the Toxic Substance Control Act (TSCA), low-level radioactive waste, mixed low-level radioactive waste, and sanitary waste. Wastes generated from the operation, maintenance, and environmental cleanup of Pantex Plant in calendar year 2009 are summarized in Table 2.6. Overall, the amount of waste generated in 2009 decreased 60.8 percent from 2008. This is due primarily to a decrease in the generation of non-hazardous wastes from deactivation and decommissioning of excess facilities and construction projects.

During 2009, Pantex Plant generated 506.6 cubic meters (m^3) of hazardous waste. Typical hazardous wastes generated at Pantex Plant included explosives-contaminated solids, spent organic solvents, and solids contaminated with spent organic solvents, metals, and/or explosives. Hazardous wastes were managed in satellite accumulation areas, less than 90-day waste accumulation sites, or RCRA permit authorized waste management units. Some hazardous wastes, such as explosives, were processed onsite before the process residues were shipped offsite for final treatment and disposal. During the year, environmental restoration projects, deactivation and decommissioning of excess facilities, and construction projects contributed 10.4 percent of the total hazardous waste generated. Hazardous wastes and residues from hazardous waste processing are shipped to commercial facilities authorized for final treatment and disposal or, as applicable, recycling.

During 2009, Pantex Plant generated 7,962.7 m^3 of non-hazardous waste. Non-hazardous wastes generated at the Plant were characterized as either Class 1 non-hazardous industrial solid or Class 2 non-hazardous industrial solid waste, as defined by Title 30 of the Texas Administrative Code. Class 1 non-hazardous wastes generated at Pantex were managed in a similar manner as hazardous waste, including shipment to offsite treatment and/or disposal facilities. Some Class 2 non-hazardous wastes (inert and insoluble materials such as bricks, concrete, glass, dirt, and certain plastics and rubber items that are not readily degradable) were disposed of in an onsite Class 2 non-hazardous waste landfill. Other Class 2 non-hazardous wastes, generally liquids, were shipped to commercial facilities for treatment and disposal.

The Pantex Plant's environmental restoration projects, deactivation and decommissioning of excess facilities and construction projects contributed 65.6 percent of the total non-hazardous waste generated, during 2009. In addition, during the year, Pantex Plant generated 1,230.1 m^3 of sanitary waste (cafeteria waste and general office trash). Sanitary wastes were also characterized as Class 2 non-hazardous wastes and disposed of at authorized offsite landfills.

TABLE 2.6 — *Waste Volumes Generated at Pantex (in cubic meters)*

Waste Type	1993	2006	2007	2008	2009	% Increase or (Decrease) from 1993	% Increase or (Decrease) from 2008
Non-hazardous Waste	10,885	9,786.21	5,751.5	22,934.93	7,962.7	(26.8)	(65.3)
Sanitary Waste	612	672.23	1,377.04	1,465.56	1,230.1	101.0	(16.1)
Hazardous Waste	369.6	701.7	561.9	411.9	506.6	37.1	23.0
Low-Level Waste	287	66.05	32.71	34.01	21.6	(92.5)	(36.5)
Mixed Waste	37.5	0.22	0.32	0.076	0.14	(99.6)	84.2
TSCA Waste	112.9	112.5	25.02	115.2	64.3	(43.0)	(44.2)
Universal Waste [a]	-	9.11	20.35	16.3	6.2	-	(62.0)
Total	12,304	11,348.02	7,768.85	24,977.98	9791.64	(20.4)	(60.8)

[a] In 2001, Pantex began managing some Hazardous Waste under the Universal Waste Rules.

Pantex Plant generated 64.3 m^3 of wastes regulated by the Toxic Substances Control Act (TSCA), during 2009. These wastes include asbestos, asbestos-containing material, and materials containing or contaminated by polychlorinated biphenyls (PCBs). During the year, construction projects and deactivation and decommissioning of excess facilities contributed 95.5 percent of the total TSCA waste generated. All TSCA wastes were shipped offsite for final treatment and disposal.

During 2009, Pantex Plant generated 6.2 m^3 of waste that were managed as universal wastes. Universal wastes are defined as hazardous wastes that are subject to alternative management standards in lieu of regulation, except as provided in applicable sections of the Texas Administrative Code. Universal wastes include batteries, pesticides, paint and paint-related waste, and fluorescent lamps. During the year, deactivation and decommissioning of excess facilities contributed 2.4 percent of the total universal waste generated. These wastes are shipped offsite for final treatment, disposal, or, as applicable, recycling.

Pantex Plant generated 21.6 m^3 of low-level radioactive waste, during 2009. The low-level radioactive wastes were generated by weapons-related and weapons-support activities.

Assembly and disassembly of weapons also results in some wastes that include both radioactive and hazardous constituents, which are referred to as "mixed waste." The hazardous portion of the mixed waste is regulated by the TCEQ pursuant to RCRA regulations. The radioactive portion is regulated under the Atomic Energy Act. During 2009, Pantex Plant generated 0.14 m^3 of mixed waste. The mixed wastes generated at the Plant were generated by weapons-related and weapons-support activities.

2.10.2 Hazardous Waste Permit Modifications

On November 3, 2009 the TCEQ modified Permit HW-50284 to remove the Texas Clean Air Act provisions from the Permit and move them to Air Quality Permit 84802.

2.10.3 Release Site and Potential Release Site Investigation, Monitoring, and Corrective Action

Pursuant to Compliance Plan No. 50284, Pantex began finalizing RCRA Facility Investigation activities during 2009 for inactive units. These activities included groundwater monitoring and implementation of final corrective/remedial actions.

In July 2009, Pantex submitted an application to modify Permit CP-50284 (the interim compliance plan) to include the final selected remedies for inactive units at Pantex. A new Sampling and Analysis Plan and Long-term Monitoring Design were also submitted to finalize the monitoring network for the selected remedies. The TCEQ approved the Sampling and Analysis Plan and Long-Term Monitoring Design in 2009. The Compliance Plan permit modification is expected to be approved in 2010. (See Section 3.7 for additional information.)

Progress reports, required by Section VII.C.2 of the Compliance Plan, and Article 16.4 of the Pantex Interagency Agreement were submitted in 2009. The annual report contained a full reporting of all monitoring information for 2008. Quarterly progress reports were submitted in late 2009 in accordance with the approved Sampling and Analysis Plan and Long-term Monitoring Design. Those reports focus on the continued operation of the remedies and on monitoring results from key wells.

2.10.4 Underground Storage Tanks

The Plant operated five regulated underground Petroleum Storage Tanks (PSTs) during 2009. Of the five regulated underground storage tanks at Pantex, two are used for emergency generator fuel storage. Three other USTs at the Plant are used for vehicle fueling, storing unleaded gasoline, diesel, and ethanol (E-85).

No inspections were conducted by the EPA or State of Texas regulatory agencies on these PST systems during calendar year 2009, due, in-part because the Automatic Tank Gage Systems and inventory control procedures indicate no problems with tank integrity.

2.11 Safe Drinking Water Act

The Plant operates non-community, non-transient Public Drinking Water System No. 0330007, as registered with the TCEQ. The Plant obtains its drinking water from the Ogallala Aquifer through five wells located at the northeast corner of the Plant. The water is chlorinated onsite and tested in accordance with requirements for public drinking water systems pursuant to the Safe Drinking Water Act and the implementing regulations of the State of Texas. Chapter 7 details the Plant's activities to ensure compliance with the requirements of the TCEQ regulations and the Safe Drinking Water Act.

2.11.1 Drinking Water Inspection

On September 16, 2009, a TCEQ subcontractor conducted required sampling of the Drinking Water system. No problems were noted in the results from sampling. On September 30, 2009, the TCEQ Region 1 office conducted a Comprehensive Compliance Inspection of the Pantex Public Drinking Water system. Samples of the system were also collected. No program deficiencies were noted in the TCEQ's inspection and the analytical results indicated that the system was providing water of appropriate quality to the Plant population.

2.11.2 Drinking Water System Achievements

On December 17, 2009, the TCEQ notified Pantex that its Public Water System had achieved a "Superior Rating." Organizations receiving the Superior Public Drinking Water System Award are recognized for their overall excellence in all aspects of operating a public water system (PWS). To be recognized, a PWS must go above and beyond the minimum standards in protecting public health and ensuring reliable operation. Public water systems receiving this award have demonstrated no violations (frequency, number, or MCL) of the drinking water standards for microbiological quality parameters during the years 2004 through 2007 and all chemical primary and secondary water quality parameters and constituents. The system must have implemented a source water protection program. The system must be well maintained, staffed and maintained by trained operators, and designed to exceed the minimum storage and production requirements of the State of Texas.

2.12 Toxic Substances Control Act

The major objective of Toxic Substances Control Act (TSCA) is to ensure that the risk to humans and the environment, posed by toxic materials, has been characterized and understood before it is introduced into commerce. The goal is not to regulate all chemicals that pose a risk, but to regulate those that present unreasonable risk to human health or the environment. Of the materials regulated by TSCA, those containing asbestos, beryllium and materials and parts containing, contaminated, or potentially contaminated by PCBs are of concern at the Pantex Plant.

As a user of chemical substances, Pantex complies with regulations issued under the Act, refrains from using PCBs, except as allowed by EPA regulations, and refrains from using any chemical substance that Plant personnel know, or have reason to believe, has been manufactured, produced, or distributed in violation of the Act.

As of December 31, 1996, all new parts and equipment that contain PCBs, used at Pantex Plant, have PCBs that are in concentrations of less than 50 parts per million.

2.13 Emergency Planning and Community Right-to-Know Act

The Emergency Planning and Community Right-to-Know Act, which was enacted as part of the Superfund Amendment and Reauthorization Act of 1986 (SARA), requires that the public be provided with information about hazardous chemicals in the community; and establishes emergency planning and notification procedures to protect the public in the event of a release. In order to accomplish these goals, the Emergency Planning and Community Right-to-Know Act and Executive Order 12856 require that Pantex Plant file several annual reports with EPA (Table 2.7) and participate in local Emergency Planning Committee activities. Pantex Plant remains in compliance with provisions of this statute.

TABLE 2.7 — *2009 Activities for Compliance with the Emergency Planning and Community Right-to-Know Act*

Requirement	Applicable	Comment
Planning Notification (SARA 302-303)	Yes	Six chemicals were stored at Pantex in quantities above the threshold planning quantities in 2009.
Extremely Hazardous Substance Notification (SARA 304)	Yes	Two chemicals were stored at Pantex in quantities above the threshold planning quantities in 2009.
Material Safety Data Sheet/Chemical Inventory (SARA 311-312)	Yes	This requirement was satisfied by the Texas Tier Two Report.[a] Six chemicals were listed in the report for 2009.
Toxic Chemical Release Inventory Reporting (SARA 313)	Yes	A Toxic Chemical Release Inventory Report was required for calendar year 2009.

[a] Letter report submitted annually to the Chief, Hazard Communication Branch, Occupational Safety and Health Division, Texas Department of Health, the Local Emergency Planning Committee, and the local Fire Department.

2.14 Floodplains/Wetlands Environmental Review Requirements (10 CFR §1022)

Floodplain management is taken into account when surface water or land use plans are prepared or evaluated. Use of these resources must be determined to be appropriate, relative to the degree of impacts involved. The U.S. Army Corps of Engineers, Tulsa District, completed a floodplain delineation report in January 1995 (USACE, 1995), revising an earlier delineation. In calendar year 2009, all proposed activities at Pantex Plant were evaluated during the NEPA process for potential impacts on floodplains and wetlands and other criteria required by 10 CFR §1022.

The Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components (DOE, 1996) describes compliance with 10 CFR §1022 for the following ongoing activities at Pantex Plant:

- Monitoring and characterization activities related to environmental restoration and waste management
- Environmental surveillance and permit monitoring
- Natural resource management in floodplains, wetlands, and playa management units
- Texas Tech University agriculture
- Cultural resource management.

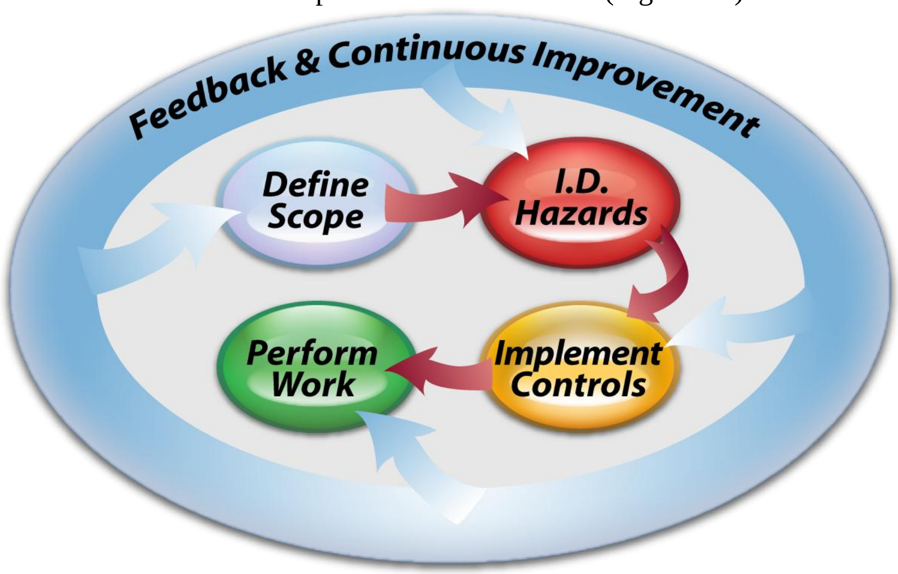
Management of floodplains and protection of the wetlands is addressed in the *Integrated Plan for Playa Management at Pantex Plant* (Pantex Plant, 2002). One floodplain assessment was completed in 2009 for the MotoMESH Expansion and Systems Integration project. The resulting Floodplain Statement of Findings was published on September 24, 2009.

Environmental Management Information

To implement sound stewardship practices that are protective of the air, water, land, and other natural and cultural resources impacted by U.S. Department of Energy (DOE) operations, a comprehensive Environmental Management System (EMS) was developed that is a major component of the Integrated Safety Management System (ISMS). These integrated systems envelop all personnel that work at the Plant and all of the Plant's activities, products, and services and are the means by which DOE cost effectively meets or exceeds compliance with applicable environmental, public health, and resource protection requirements. In addition to environmental compliance and monitoring, environmental management at Pantex Plant includes a pollution prevention (P2) element to reduce emissions, effluent, and waste. EMS emphasizes natural resource management to minimize the impacts of both production and agricultural activities onsite. A cultural resource management element addresses archeology, the World War II era, and Cold War era contexts. The environmental restoration element includes characterization, remediation, and post-closure care of release sites. State and Federal regulatory agencies conduct oversight of the Plant to ensure compliance with stewardship guidelines.

3.1 Environmental Management System

The B&W Pantex approach to managing the environmental aspects of its operations is in accordance with the DOE Policy 450.4, *Safety Management System Policy* (DOE, 1996), and DOE Guidance 450.4-1B (Volumes 1&2), *Integrated Safety Management System Guide* (DOE, 2001) . This policy sets forth DOE's expectations of line management to ensure that operations are adequately implementing environment, safety, and health requirements. The EMS is organized according to the five core functions of the ISMS that are essential to planning and safely performing hazardous work. It defines the current EMS for Pantex. This system promotes the active protection of personnel doing work and the environment in which that work is performed. Feedback and continuous improvement are integrated into a structure that includes scope definition, hazards identification and analysis, development and implementation of hazard controls, and performance of work within scope of identified controls (Figure 3.1).



Provides the necessary structure for work activity that could potentially affect the public, worker, or the environment.

FIGURE 3.1 — *Work Activity Structure of the Pantex Integrated Safety Management System*

Pantex has an EMS that meets the requirements of DOE Order 450.1A, *Environmental Protection Program* (DOE, 2008). (Please see the *Executive Summary*, pp. xxx and xxxi, for the official B&W Pantex and PXSO Environmental Policies.) It provides for systematic planning, integrated execution, and evaluation of programs for: 1) public health and environmental protection, 2) P2, 3) recycling, and 4) compliance with applicable environmental protection requirements. It includes policies, procedures, and training to identify activities with significant environmental impacts, to manage, control, and mitigate the impacts of these activities, and to assess performance and implement corrective actions where needed. Measurable environmental goals, objectives, and targets are reviewed annually and updated when appropriate.

The Plant's EMS is modeled on the International Organization for Standardization's (ISO) 14001, *Environmental Management Systems – Requirements with Guidance for Use, 2004*. The following are specific requirements for an EMS according to that model and are included in the Pantex EMS:

Define the Scope of the Work:

- Develop and maintain an environmental policy.

Identify and Analyze the Hazards:

- Evaluate impacts of activities, products, and services to determine environmental aspects/prioritize impacts to determine significance;
- Identify environmental objectives to specifically target reduction of environmental impacts; and
- Legal and other requirements.

Develop and Implement Hazard Controls:

- Resources, roles, responsibility and authority;
- Competence, training, and awareness;
- Communication;
- Documentation;
- Control of documents;
- Operational controls; and
- Emergency preparedness and response.

Perform Work Within Controls:

- Monitoring and measurement;

- Evaluation of compliance;
- Nonconformity, corrective action and preventive action;
- Control of records; and
- Internal audit.

Provide Feedback and Continuous Improvement:

- Evaluation of compliance, and
- Management review.

Complementary components of the EMS related to the DOE Order or other requirements are:

- Regular building assessments to evaluate the effectiveness of the site EMS;
- Environmental reviews to support compliance with the National Environmental Policy Act (NEPA);
- Systematic planning, integrated execution, and evaluation of programs for protection of the public and the environment;
- Cultural, historical, and natural resource management;
- P2 (waste elimination, material substitution, waste minimization, recycling, energy and water conservation), water, and Resource Conservation Recovery Act (RCRA) permitting and compliance;
- Environmental restoration [solid waste management unit remediation, technical development, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) integration];
- Assisting the DOE in meeting its requirements for Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (2007); along with the newly released Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (2009)*;*
- A procurement program to consider P2 in the specification and acquisition of supplies to cost effectively maximize procurement of recycled-content and bio-based content materials, and other environmentally preferable products and services; and
- Procedures to maximize the use of safe alternatives to ozone depleting substances (ODSs).

Each year, significant environmental impacts associated with Plant operations are evaluated to determine potential goals for the following year. The objectives and associated specific targets are set to improve the management of identified environmental aspects (a potential to impact the environment) related to Pantex activities, products, and services. By adopting objectives, B&W Pantex commits to achieving the management goals and ensures that appropriate resources (technical, organizational infrastructure, financial, human, and special skills) will be made available to accomplish the environmental targets. Appropriate authority and responsibility are assigned to each relevant function and level within the organization to meet the objectives. During 2009, the aspects review team developed and recommended six objectives/targets. The six items successfully met their targets as scheduled. Table 3.1 represents the status of Objectives and Targets for 2009.

TABLE 3.1 - *B&W Pantex Objectives and Targets for 2009*

Objective	Target(s)	Status/Comments
Reduce Waste & Save Landfill Space	• Provide Recycling Training to thirteen (13) departments that responded to the annual EMS electronic questionnaire as not recycling. • Develop Work Instruction (WI) providing a flow-down procedure for contractual requirements mandating recycling.	Department training completed. TARGET MET WI.02.01.04.05.32 - *Pantex Recycling Programs for Consumer Products* was published on July 15, 2009. TARGET MET
Reduce the Plant's Consumption of Natural Resources (Material Cost & Waste Reduction)	• Implement a Plant-wide policy and set-up 90% of network printers with a default setting for duplex printing. This will save on paper, and reduce waste.	100% of unclassified network printers converted via use of new Windows print queue. TARGET MET
Reduce the Plant's Consumption of Fossil Fuel	• Maintain trend for reduction of the fleet total consumption of petroleum products by 2 percent, while increasing the use of non-petroleum based fuel by 10 percent annually (base-lined against FY 2005).	Efficiencies were met and exceeded. TARGET MET
Identify alternative uses for treated groundwater	• Develop a letter that will generate discussion with the State of Texas for exploring alternative uses of treated groundwater from the Pump & Treat Systems.	Letter completed and signed by Division Manager. Forwarded to Pantex Site Office (PXSO) on Wednesday (12/17/08). TARGET MET
Upgrade the Pump & Treat electrical system from Greenbelt grid to the Xcel grid.	• To provide improved system reliability so perched water can be consistently extracted & treated in accordance with the compliance plan and the Superfund "Record of Decision".	System energized on May 7, 2009. TARGET MET
Reduce the Consumption of Water	• Reconfigure the sampling cooler in the lab of 16-13 to use re-circulated reverse osmosis water rather than once through cooling water.	On Friday December 12, 2008 system began operation. TARGET MET

EMS Accomplishments for 2009

- In 2009 the Pantex EMS received a Pollution Prevention Award for "Environmental Stewardship" for exemplary contribution to National Nuclear Security Administration (NNSA) and the DOE's pollution prevention/waste minimization goals.

- The regular schedule of building assessments (mini-audits) continued with a frequency of approximately two per month. These assessments emphasize EMS principles, energy conservation, recycling, safety, and P2. Issues identified during these assessments provide opportunities for continuous improvement.

- The aspects review process began in May 2009 and resulted in three Objectives and Targets that were approved as FY 2010 goals for environmental improvement.

- Prior to performing the annual aspects review, each Department Manager submitted responses to an EMS questionnaire (electronically). The Environmental Aspects questionnaire was updated for easier and quicker departmental responses.

3.1.1 Energy

Continued success is realized from energy savings activities performed at Pantex. Lighting up-grades, alternative energy equipment, use of Energy Star equipment, use of an energy management control system, installation and use of ultra violet lighting in air handling units to reduce bio and dust build-up on coils causing improved efficiency of air handling units, along with the upgrade of energy reliability to one of the plant groundwater recovery systems are included as some of the positive management techniques used.

Executive Order 13423 mandates Pantex to reduce energy intensity by 30 percent by the end of FY 2015, relative to the required baseline of the agency's energy use in FY 2003 (Figures 3.2). Total plant energy use continues to exhibit a downward trend as energy cost trends upward (Figure 3.3).

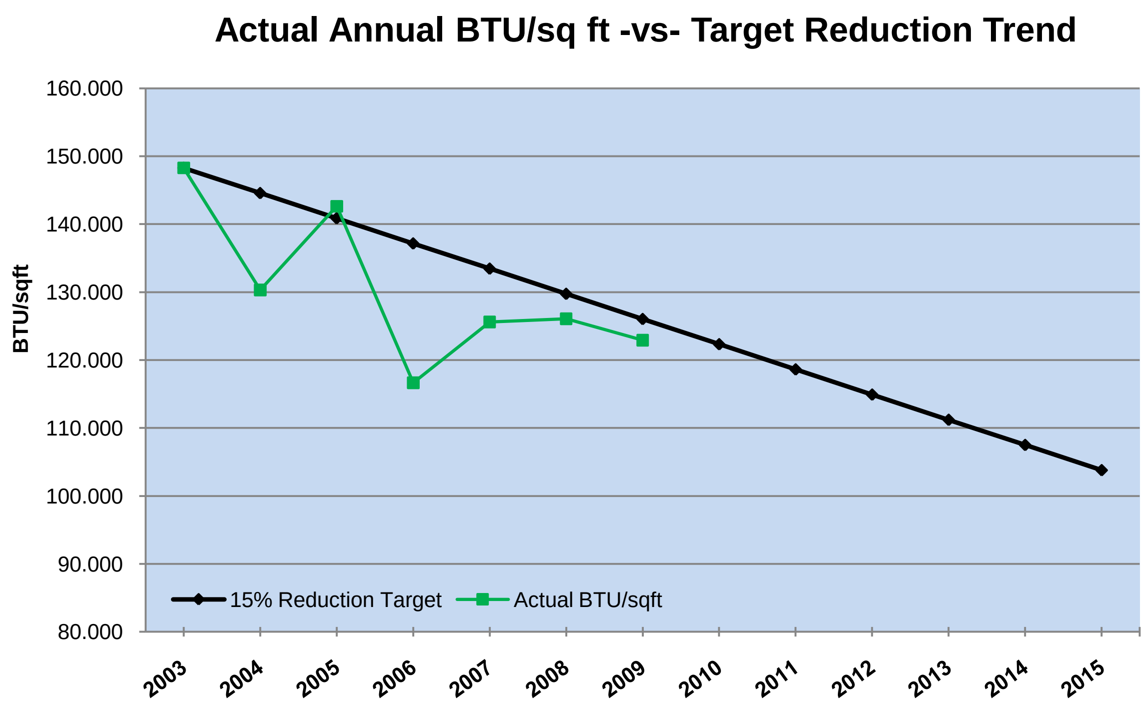


FIGURE 3.2 - ***Energy Use versus Required Target Reduction Rate***

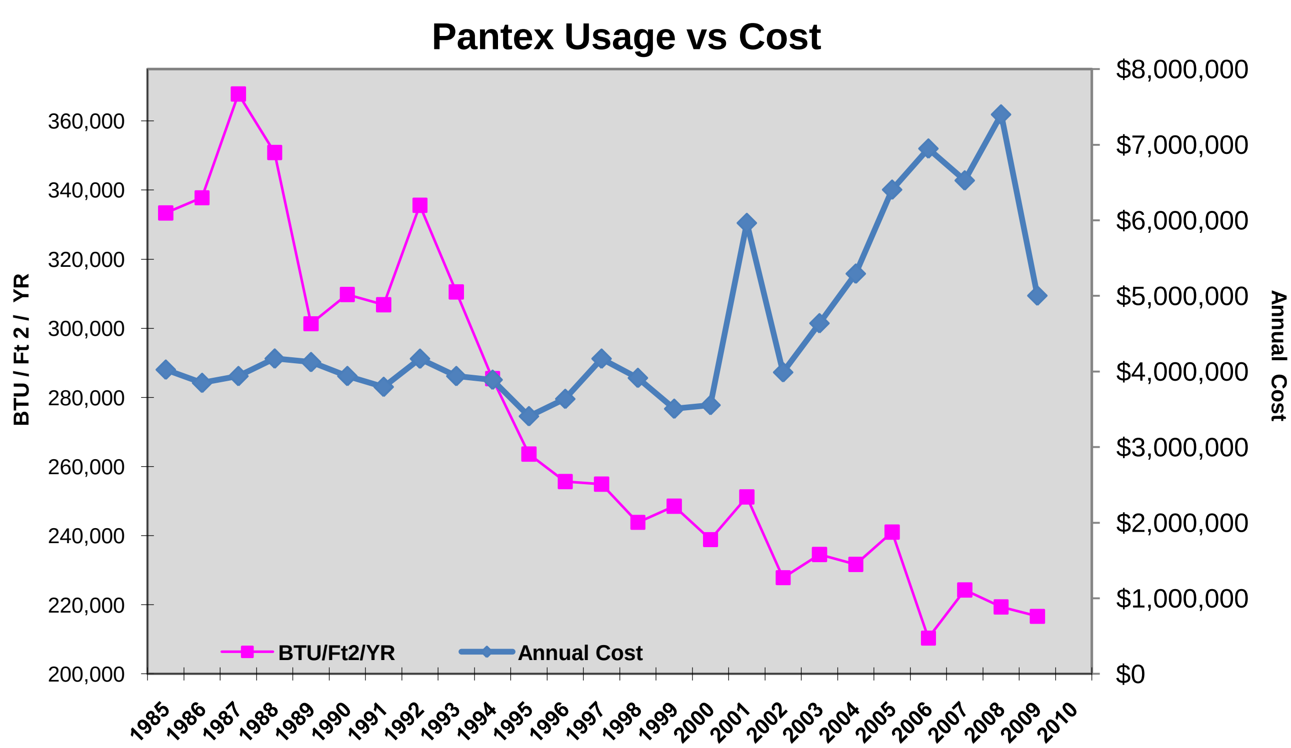


FIGURE 3.3 - ***Energy Use versus Cost***

3.1.2 Water

Benefits from activities identified since the inception of the Pantex EMS are included as part of the significant improvements in potable water consumption at the plant. Repair of leaking WWII vintage water lines, reconfiguration or replacement of equipment using inefficient water cooled equipment, elimination of chlorine from use with water systems through permitting strategies and installation of a "mixed oxidant" system, along with general awareness of water use strategies assisted Pantex.

Executive Order 13423 requires Pantex, beginning in FY 2008, to reduce water consumption intensity, relative to the baseline of the agency's water consumption in FY 2007, through life-cycle cost-effective measures by 2 percent annually through the end of FY 2015 or 16 percent by the end of FY 2015. Pantex has excelled in reducing water consumption by over 19 percent compared to 2007 use. (Figure 3.4)

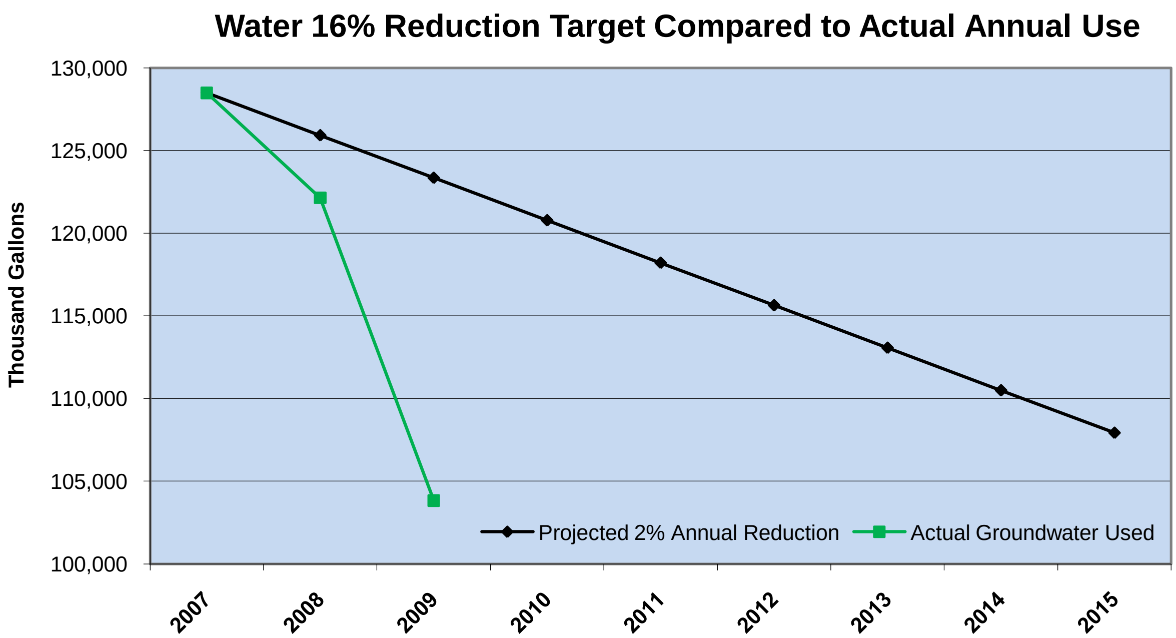
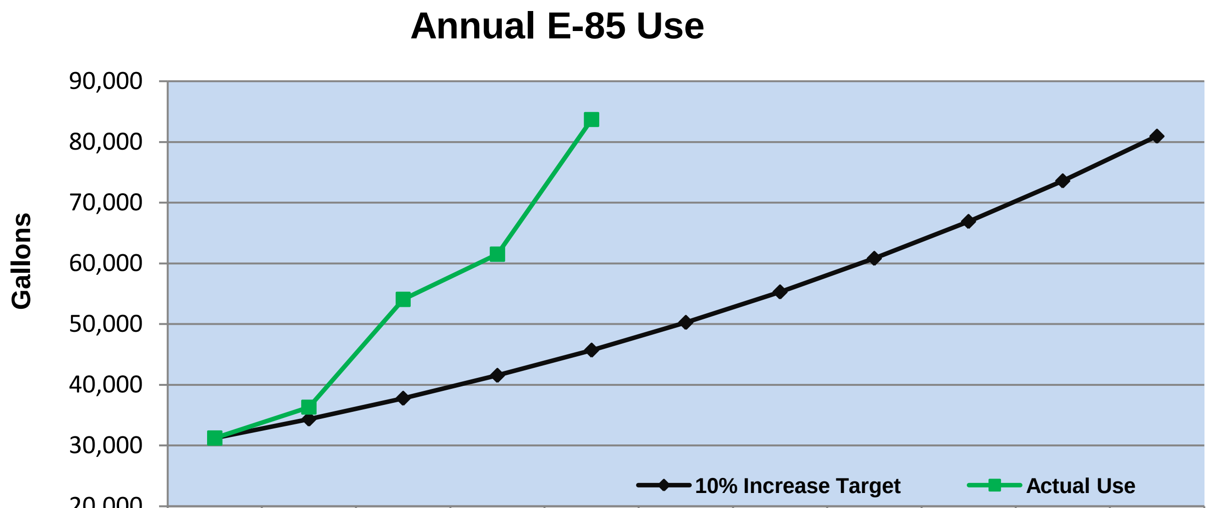


FIGURE 3.4 - *Actual Water Use versus Required Target Reduction* Rate

3.1.2 Fuel

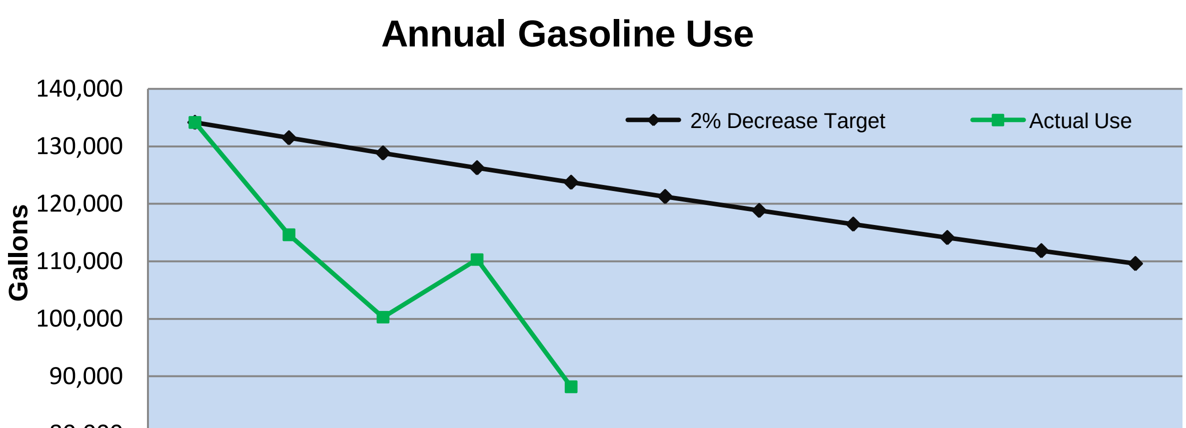
Engineered controls and fleet management strategies have led to great success when it comes to fuel management at Pantex.

Executive Order 13423 promotes the use of alternative fuels (Figure 3.5), while reducing the use of petroleum products (Figure 3.6). Pantex Plant continues to successfully meet and exceed these goals.



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
10% Increase Target	31,217	34,339	37,773	41,550	45,705	50,275	55,303	60,833	66,916	73,608	80,969
Actual Use	31,217	36,313	54,092	61,522	83,704						

FIGURE 3.5 - ***Alternative Fuel Use versus Target Increase Rate***



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2% Decrease Target	134,153	131,470	128,841	126,264	123,738	121,264	118,838	116,462	114,132	111,850	109,613
Actual Use	134,153	114,616	100,273	110,310	88,180						

FIGURE 3.6 - ***Gasoline Use versus Target Reduction Rate***

3.2 Oversight

Federal Agencies. The results of compliance inspections and/or other oversight activities conducted by the U.S. Environmental Protection Agency (EPA) in 2009 are discussed in Chapter 2 of this document.

State of Texas. The results of compliance inspections conducted by various state agencies in 2009 are discussed in Chapter 2 of this document. An additional oversight mechanism was initiated in 1989 when the Secretary of Energy invited the host state of each DOE facility to oversee the evaluation of environmental impacts from facility operations. As a result, the DOE entered into a five-year Agreement in Principle with the State of Texas in August 1990, which was renegotiated in 1995, 2000, and 2005. The current agreement is effective until September 30, 2010. It focuses on three activities: general cooperation with all state agencies, environmental monitoring, and emergency management. Six state agencies are involved: the Governor's Office (acting through the State Energy Conservation Office), the Texas Attorney General's Office, the Texas Commission on Environmental Quality (TCEQ), the Texas Department of Public Safety-Division of Emergency Management, the Texas Department of State Health Services-Radiation Control, and the Texas Bureau of Economic Geology.

The agreement also provides for joint emergency planning with Carson, Armstrong, and Potter counties, and the City of Amarillo. A number of meetings between DOE and these agencies were held in 2009; in addition, DOE provided information to the State of Texas, as required, and the State conducted its own environmental sampling and research, and participated in joint emergency exercises and drills with Pantex Plant and local jurisdictions.

Working in cooperation with EMS is Emergency Services (i.e., emergency preparedness and response), a robust emergency management program. An integral part of the emergency management program at Pantex Plant is the Public Alert and Warning System within the 10-mile radius Emergency Planning Zone. The design and installation of this warning system was closely coordinated with local jurisdictions of Carson, Armstrong, and Potter counties, and the City of Amarillo. The warning system consists of eight electronic sirens and all weather radios, available to the general public.

Local jurisdictions have the capability of activating their portion of this system, or the Pantex Emergency Operations Center can activate the entire warning system. This system consists of 16 additional electronic sirens and strobe lights that are installed on Pantex Plant and adjacent Texas Tech University (TTU) property. The system provides an effective outdoor warning for Plant personnel and immediate neighbors. Energy conservation is designed into the system in the form of photovoltaic solar cells used to charge its batteries. This renewable energy source design avoids substantial electricity costs and eliminates the need for overhead electrical power lines to remote areas.

3.3 Pollution Prevention

Activities in support of the pollution prevention program are waste elimination, material substitution, waste minimization, recycling, and energy and water conservation. The Waste Operations Department's Pollution Prevention Section performs pollution prevention opportunity assessments (PPOAs) on Plant processes to identify new ideas for waste reduction. At Pantex Plant, the team that performs the PPOA works with the owner of the process to implement the waste reduction recommendations. In 2009, 12 PPOAs were performed.

Efforts to reduce and eliminate waste from routine operations at Pantex Plant have resulted in significant waste reductions over the last 20 years. From 1987 to 2009, the Plant population and workload increased as the focus of the Plant's mission changed from weapons assembly during the Cold War to dismantlement. Even with these increases, the Pollution Prevention Program's efforts were successful in reducing the generation of hazardous waste by more than 99%.

The Secretary of Energy established two goals for the reduction of Ozone Depleting Substances (ODSs). B&W Pantex has already met the first goal by replacing all chillers with greater than 150 tons of cooling capacity that were manufactured before 1984 and used Class 1 ODS refrigerants. This was completed during 2001, well ahead of the goal for completion by 2006. Pantex has made good progress on the second goal, which is to eliminate the use of Class 1 ODS by 2010. Pantex restricts the purchase of ODS for Plant use through the Pantex Chemical Control System. All new purchases of Class 1 ODS are rejected unless a critical need can be justified.

In November 1999, the Secretary of Energy updated the waste reduction goals and established 2005 as the year that the new goals were to be met. By the end of 2005, B&W Pantex met and exceeded the Secretary's goals for low level radioactive, low level mixed, and hazardous waste. Routine sanitary waste was reduced by 21.2 percent from 1993 levels. This successful reduction was primarily the result of increasing the percentage of office & mixed paper that is disintegrated and recycled. B&W Pantex is aggressively seeking cost-effective means of recycling more of the sanitary waste streams.

To continue the success achieved through the pollution prevention leadership goals that expired in 2005, DOE has established five performance-based P2 and Sustainable Environmental Stewardship goals that are to be demonstrated by DOE sites through the integration of P2 into environmental management systems pursuant to DOE Order 450.1A (DOE, 2008).

Goals set by the DOE/NNSA include protecting the environment and enhancing mission accomplishment through:

- Waste prevention,
- Reduction of environmental releases,
- Environmentally preferable purchasing,
- Environmental stewardship in program planning and operations design, and
- Post consumer recycling.

These goals have been incorporated into the Pollution Prevention and EMS programs at Pantex. These programs have been effectively used to identify specific sitewide environmental goals associated with pollution prevention and waste minimization.

B&W Pantex has continued an active recycling program, which reduces the waste disposal volumes and saves taxpayers' money. Results of ongoing recycling initiatives in 2009 are shown in Table 3.2.

TABLE 3.2 — *Pantex Plant Sitewide Recycling for 2009*

Recycled Material	2009 Totals	
	Pounds	Kilograms
Non-Suspension Scrap Metals	681,762	309,242
Office and Mixed Paper	185,600	84,187
Batteries	125,662	56,999
Corrugated Cardboard	118,830	53,900
Computers & Other Electronics	46,742	21,202
Engine Oils	34,280	15,549
Newspapers/Magazines	25,172	11,418
Tires/Scrap Rubber	24,448	11,089
Oil Filters	8,900	4,037
Plastic	8,200	3,719
Toner Cartridges	6,840	3,103
Food Waste	5,450	2,472
Aluminum Cans	1,825	828
Paint-related Waste	1,744	791
Fluorescent Bulbs	1,120	508
Total	**1,276,575**	**579,044**

In 2006, B&W Pantex joined and became an ongoing partner of the EPA Federal Electronics Challenge (FEC) and pledged to make progress toward meeting all FEC criteria for environmentally responsible management of electronic equipment. The B&W Pantex process for computer disposition meets the FEC criteria for recycling and reuse of computer equipment. Through these ongoing efforts, B&W Pantex has demonstrated an environmentally friendly approach to lifecycle management of electronic equipment while ensuring the protection of national security information from unauthorized disclosure. Because of the progress made, B&W Pantex received the EPA FEC Bronze Award for Electronics Stewardship in 2007. B&W Pantex participated in the EPA 2008-2009 FEC, "Electronics Reuse and Recycling Campaign." B&W Pantex reused/recycled a total of 34,308 pounds of electronics during the campaign.

During 2009, NNSA recognized Pantex Plant's groundwater management strategy with a Pollution Prevention Award for initiatives associated with implementation of its EMS. These initiatives not only reduced the amount of water pumped from the Ogallala aquifer but also the electricity required for water harvest and treatment. Pantex employees discovered two pumps that were utilizing water to cool the pump's bearings. Annually, these pumps used approximately 8 to 10 million gallons of potable water as a "once through" cooling stream. After use, the water was discharged to the plant's waste water treatment plant. These pumps were replaced with oil cooled bearings. The result was a potable water savings with a secondary benefit of less water to manage in the wastewater treatment system. Pantex also reconfigured a sampling cooler in a lab so that it now uses re-circulated reverse osmosis water rather than once through cooling water. This change reduced potable water consumption by 9 million gallons per year.

In 2000, the DOE suspended the unrestricted release of scrap metal from radiological areas for recycling. Pantex's conservative approach applied a Pantex-specific definition of radiological area. Over an eight year period, approximately 537,000 lbs of scrap metal were accumulated at the site. This resulted in the accumulation of a large pile of scrap metal (Figure 3.7). With the volume of metal coming to a critical point and with an identified need to improve the management of scrap metal, efforts were taken by the Pantex team to reevaluate the conservative approach used in the application of the scrap metal suspension.

As a result, the application of the scrap metal suspension was changed to apply strictly as intended and in accordance with the regulatory definition of radiological area.

A plan was developed to address the historical inventory of metal held since the start of the suspension in 2000. This plan was implemented in a coordinated effort between the Pantex's Waste Operations Department personnel, Radiation Safety Department personnel, and the current contracted recycling company. Through this extensive effort, approximately 90% (492,520 lbs) of the accumulated scrap metal being released was shipped offsite for recycling. A total of 44,298 lbs of suspension-impacted scrap metal remained on-site for further evaluation or further guidance from DOE-Headquarters on handling and disposition.

Through the efforts of this Pantex team in preventing disposal of nearly 500,000 lbs of metal, valuable landfill space was saved and recycling was enhanced. This resulted in a cost savings of $140,000 and generated revenue of over $34,000. By recycling the eight year accumulation, 1,782 ft^2 of space was freed up to be used for other projects (Figure 3.8).

FIGURE 3.7 – Accumulation of Scrap Metal

FIGURE 3.8 – After Recycling of Scrap Metal

3.4 Natural Resources

Flora and Fauna. As across most of the Southern High Plains, cultivation and industrial activities have reduced acreage of native habitat at Pantex Plant. The remaining areas of near-native habitat at the Plant are small, and include wetlands and shortgrass prairie uplands, which are primarily around the playas.

A biological assessment of Pantex Plant, completed in 1996, addressed the impacts of continuing Plant operations on endangered or threatened species and species of concern that may occur in or migrate through the area (Table 2.3). The assessment was approved by the U.S. Fish and Wildlife Service and it concurred with the conclusion that continued Plant operation would not be likely to adversely affect any federally-listed threatened or endangered species (Pantex Plant, 1998). Descriptions of the plant and animal species found at Pantex Plant, as well as management activities designed to enhance biodiversity, are provided below. Results of the plant and animal sampling are also discussed in Chapters 11 and 12.
Flora. Most of the flora occurring on Pantex Plant were identified during field surveys conducted in 1993

and 1995 (Johnston and Williams, 1993; Johnston, 1995). The surveys focused on the remaining natural areas of the Plant. Many of the species found were not native and some of the native species were represented by only a few individuals.

As discussed in past annual reports, Pantex Plant developed and implemented plans for the revegetation of some formerly cultivated areas. Areas of formerly cultivated land were planted with native grasses several years ago. These areas included formerly cultivated land around Playas 1, 2, and 3, an area southeast of Playa 2, and fields within Zone 11. Moisture during the early years helped to fully establish the native grasses in these revegetated areas. In Zone 11, revegetated areas have been mowed each year to reduce fuel load for wildfire potential. Grasses in the other revegetated areas were sufficiently established that mowing for weed control was not necessary. The Plant mission was expanded into 550 acres of restored prairie and all 550 acres were planted with buffalograss and blue grama at that time. This area was fully established with good native grass cover in the summer of 2008. Two years before, it was also determined that additional cultivated areas (166 acres) would be taken out of production and revegetated with native grass species. These areas were identified as being within the agreed to Solid Waste Management Unit extent lines.

Approximately 50 acres of this area were planted in 2007. Late winter and early spring rains helped the native grasses to germinate and establish 50 to 55 percent coverage by the end of the growing season and was fully established by the end of 2008. The remaining 111 acres were planted in the spring of 2008. This planting was not well established by the end of the 2008 growing season, but was 35-40 percent established at the end of 2009.

In past years, native grasses were seeded in several disturbed areas such as abandoned parking areas, well construction sites, denuded ditches, landfill covers, and roadsides, in an effort to minimize soil erosion. Areas reseeded remained in poor to fair condition for several years because of poor soil moisture conditions during the growing season. Grasses and plantings in these areas were sufficiently established by 2006. A living visual barrier of four-wing saltbush (*Atriplex canescens*) and aromatic sumac (*Rhus aromatica*) was planted several years ago on the south boundary of Playa 2 for controlling the spread of prairie dogs from that area, and for improving biodiversity. The monitoring continued and dead shrubs are replaced, as necessary. Prescribed grazing was used in 2009 at Playas 1 and 2. Pantex Lake was not grazed in 2009. Other rangeland areas and some cultivated croplands, managed by the Texas Tech Research Facility and their cooperators, were grazed in earlier years. Areas grazed in 2009 included most rangeland areas on DOE/NNSA, grass in FS-21, and formerly cultivated but now revegetated with native grasses behind range 1.

Fauna (Mammals). At least 15 species (Table 3.3) of mammals were recorded at Pantex Plant in 2009 during field activities, nuisance animal responses, and fall spotlight surveys. The all-time mammal list for Pantex includes 44 species.

In 2009, a survey of black-tailed prairie dog (*Cynomys ludovicianus*) colonies conducted with the assistance of Global Positioning Satellite (GPS) equipment revealed that the colonies occupied about 189.0 hectares (467 acres) at the Plant and Pantex Lake. Figures 3.9 and 3.10 show the locations of prairie dog colonies on the Plant site. Areas of operational concern were treated in 2009 to remove black-tailed prairie dogs.

Environmental Stewardship Department (ESD) personnel have conducted spotlight surveys for nocturnal species since 2000. These are conducted during three evenings each October, November, or December.

Occasionally, weather delays completion into January or suspends them, all together. The 24-mile survey route transverses the DOE/NNSA and Texas Tech properties, and includes scans of the Pantex Lake property. All mammal species observed, other than bats and small rodents are recorded. Nocturnal animals observed in 2009 were black-tailed jackrabbits, bobcats, cottontails, coyotes, feral cats, striped skunks, raccoons, mule deer, and white-tailed deer. All these species are commonly observed at Pantex. See two common Pantex residents in Figure 3.11 and Figure 3.12.

TABLE 3.3 — *Mammals Identified at Pantex Plant During 2009*

Common Name	Scientific Name	Playa 1	Playa 2	Playa 3	Pantex Lake	East Property	Other Area
Black-tailed jackrabbit	*Lepus californicus*	X	X		X	X	X
Black-tailed prairie dog	*Cynomys ludovicianus*		X	X	X		X
Bobcat	*Lynx rufus*	X	X	X		X	X
Cottontail	*Sylvilagus spp.**	X	X	X	X	X	X
Coyote	*Canis latrans*	X	X		X		X
Mule deer	*Odocoileus hemionus*	X				X	X
Pronghorn	*Antilocapra Americana*						X
Raccoon	*Procyon lotor*		X			X	X
Silver-haired bat	*Lasionycteris noctivagans*						X
Southern plains woodrat	*Neotoma micropus*						X
Striped skunk	*Mephitis mephitis*		X			X	X
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*		X				
Virginia opossum	*Didelphis virginiana*						X
White-tailed deer	*Odocoileus virginianus*						X
Yellow-faced pocket gopher	*Cratogeomys castanops*						X

* Desert (*S. audubonii*) and eastern (*S. floridanus*) cottontails could occur on the Plant and, thus, the "at least 29 species".

Fauna (Birds). Migratory birds are an important part of Pantex Plant's natural resources. A bird checklist for Pantex Plant compiled by Seyffert (1994) indicates the species and their abundances expected at the Pantex Plant area during various seasons of the year, based on habitat types and knowledge of migrations through the local area.

The *Integrated Plan for Playa Management at Pantex Plant* (Pantex Plant, 2002) provides for monitoring of birds at the playas. Ninety-three species of birds were recorded on the Plant during 2009 (Appendix B). Observations of double-crested cormorant (*Phalacrocorax auritus*), greater scaup (*Aythya marila)*, and bobolink (*Dolichonyx oryzivorus*) were all first sightings at Pantex.

The all-time bird list for Pantex includes 192 species. This list has been generated from past transect surveys, research projects, and observations incidental to various work activities. Current objectives are primarily geared towards recording incidental observations of birds among Playa Management Units (PMUs), Pantex Lake, the new East property (purchased in 2008), and other areas outside of the PMUs. Current fieldwork associated with research on amphibians, reptiles, and bobcats will likely result in more incidental bird sightings. The new contract on effects of wind turbines on wildlife has systematic surveys for birds. Additional, more comprehensive studies are not required, nor planned, at this time.

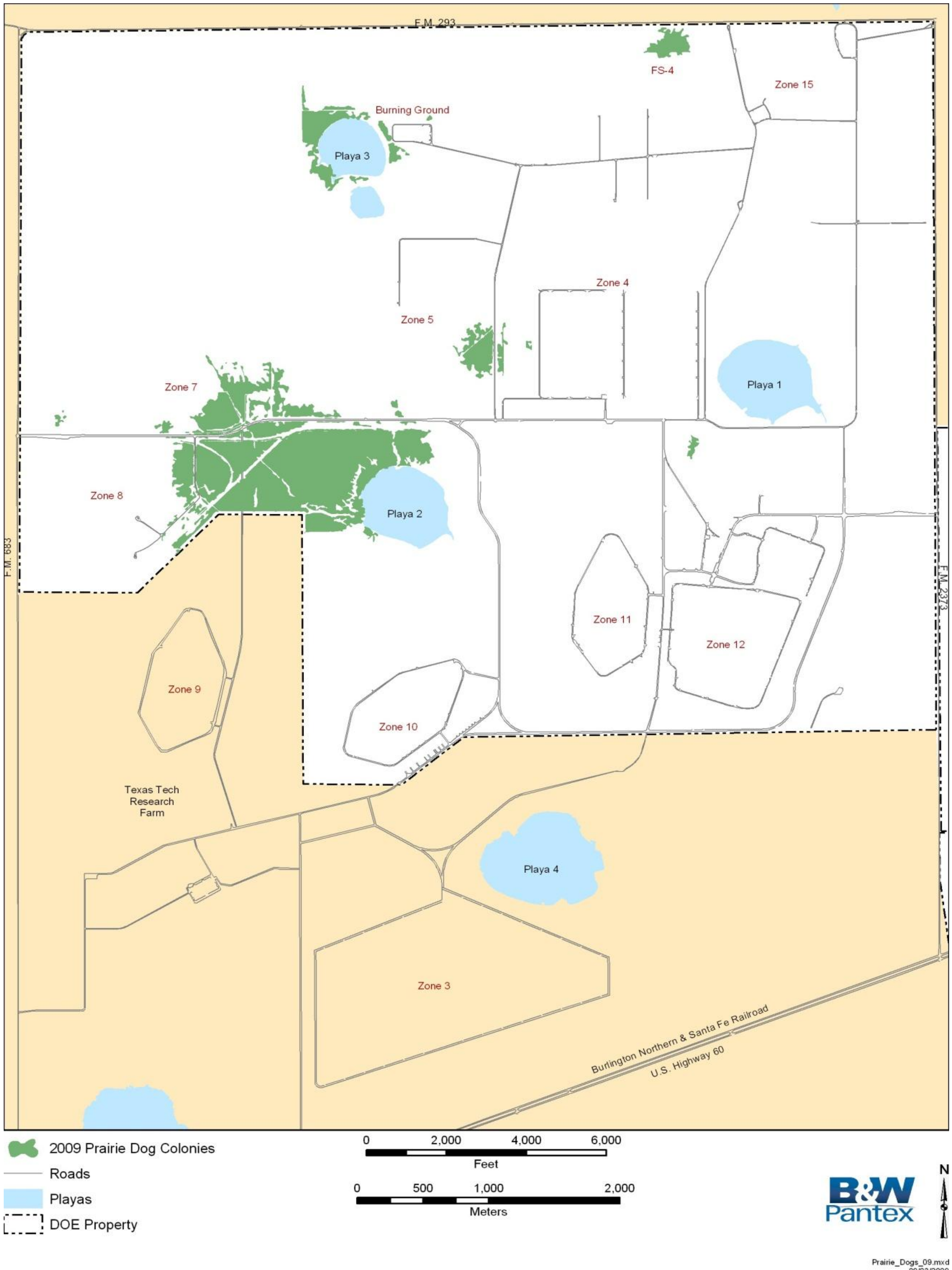


FIGURE 3.9 — *Locations of Prairie Dog Colonies at Pantex Plant*

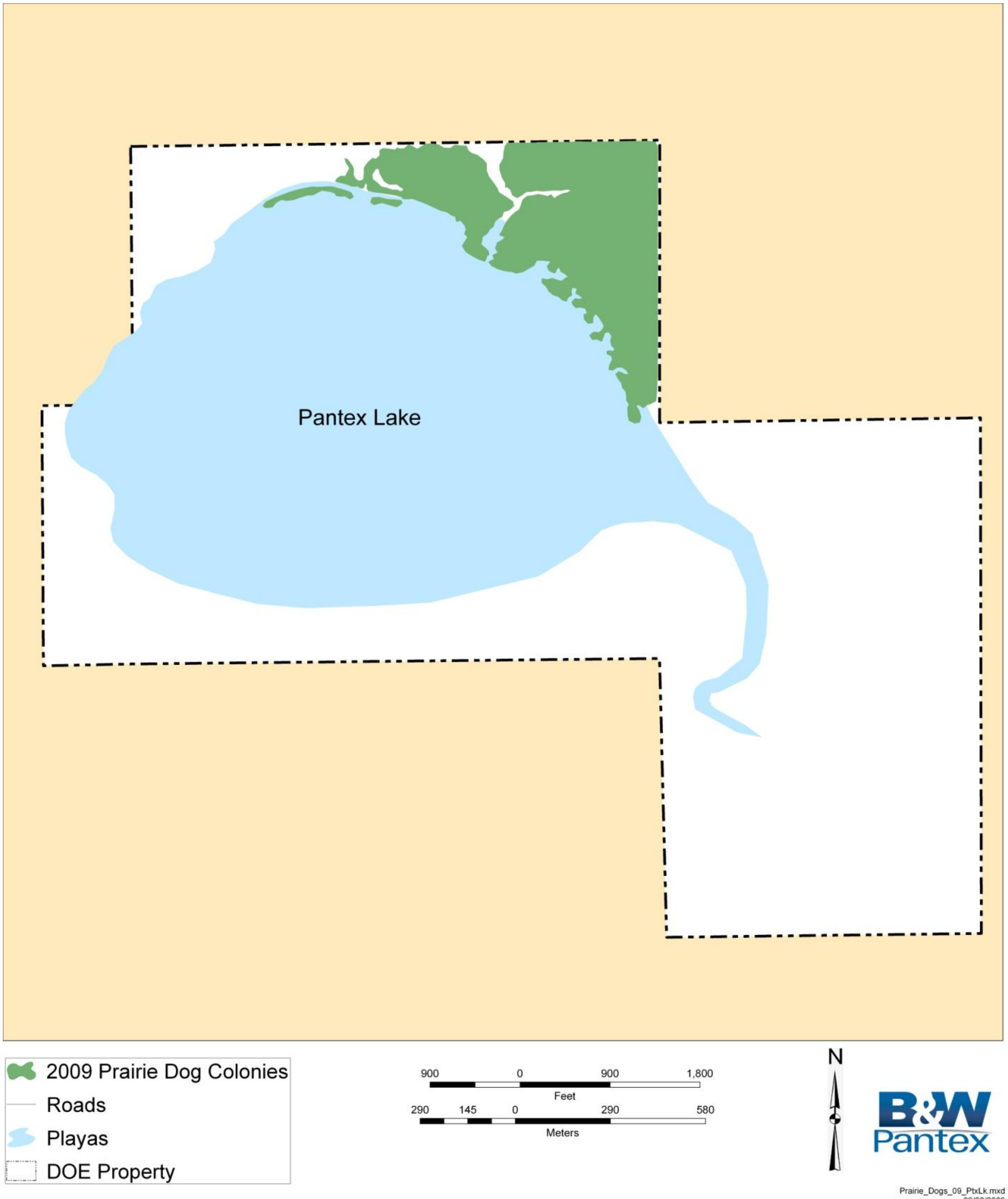


FIGURE 3.10 — *Location of the Prairie Dog Colonies at Pantex Lake*

FIGURE 3.11 — ***Bobcat on the Lookout***

FIGURE 3.12 — ***Jackrabbit on the Alert***

The number of species observed on or near playas in 2009 was forty-three, compared to thirteen in 2008. Sampling of water areas revealed five species of shrimp, adult frogs and toads, tadpoles of several species, and larvae of barred tiger salamanders, all of which serve as food sources for shore and water birds. Other potential factors affecting variability between areas and years include grazing differences among areas, presence of prairie dogs, operational areas versus rangeland, areas with trees and other structure versus areas without structure, frequency of visits among areas, objectives of contracts, competing priorities, and conflicts with activity at the Weapons Tactical Training Facility (Surface Danger Zones). For example, the Playa 3 PMU was rarely visited, because of its inclusion in the Surface Danger Zones and proximity to the Burning Ground. A goal of 2010 will be to try to increase sampling/observation efforts in the Playa 3 PMU, as well as Pantex Lake, and tree and shrub settings.

In 2008, the Electrical Distribution System Upgrade Project included raptor protection on 20 miles of new power poles to reduce electrocution of raptors that use poles for perching. Additional protection devices were purchased in 2009 to affix to existing poles as opportunities or problems arise. Two styles allow for fitting and protecting two different kinds of pole-transmission line configurations.

Staff members continue to promote bird conservation through public outreach, such as presentations, and the Purple Martin Outreach Program. In 2009, 348 nestling purple martins (*Progne subis*) were banded at four residences in two communities in the Texas Panhandle.

Fauna (Reptiles and Amphibians). At least 14 species of reptiles and amphibians were recorded at Pantex in 2009 during field activities, research projects, and nuisance animal responses (Table 3.4). None of the species documented were new to the Panhandle. The all-time list of amphibians and reptiles at Pantex includes 27 species.

Table 3.4 — *Reptiles and Amphibians Identified at Pantex Plant During 2009*

Common Name	Scientific Name	Playa 1	Playa 2	Playa 3	Pantex Lake	East Property	Other Area
Barred tiger salamander	*Ambystoma tigrinum mavortium*		X				
Bullsnake	*Pituophis melanoleucus sayi*	X	X			X	X
Checkered garter snake	*Thamnophis marcianus marcianus*	X	X		X	X	X
Common kingsnake	*Lampropeltis getulus*					X	X
Eastern yellowbelly racer	*Coluber constrictor flaviventris*					X	X
Great Plains skink	*Eurneces obsoletus*		X			X	X
Great Plains toad	*Bufo cognatus*	X	X		X	X	X
Lined snake	*Tropidoclonion lineatum*						X
New Mexico spadefoot	*Scaphiopus multiplicatus*		X				X
Plains spadefoot	*Scaphiopus bombifrons*	X	X				
Prairie rattlesnake	*Crotalus viridis viridis*	X	X		X	X	X
Spotted chorus frog	*Pseudacris clarkii*	X	X		X	X	X
Texas horned lizard	*Phrynosoma cornutum*	X	X				X
Woodhouse's toad	*Bufo woodhouseii woodhouseii*	X	X		X	X	X

Cooperative Contract Studies with Universities. Subcontracts were secured with West Texas A&M University (WTAMU) for FY 2003 - FY 2006 and FY 2008 - FY 2010 to evaluate abundance, habitat use, and seasonal activity patterns of Texas horned lizards at Pantex Plant, as well as a general herpetological survey at Pantex Plant. Results from the first portion of the study were reported in a final project report, as well as various annual reports. Radio-marked rattlesnakes suggest that the species is very abundant, particularly in prairie dog colonies, and that prairie rattlesnakes utilizing prairie dog towns have smaller home range sizes than those outside prairie dog colonies. This suggests that prairie dog colonies provide high quality habitat for prairie rattlesnakes. No radio-marked rattlesnakes have ventured into main work areas of the Plant, and this includes snakes originally captured in nuisance animal situations. Also indicated, is that away from prairie dog colonies, deep winter dens are not highly available and could service snakes of many species from a large land area.

The focus of the current work includes an evaluation of the importance of sink holes and other "artificial burrows" as wintering habitat for herpetofauna not associated with prairie dog towns, and further investigate the association of Texas horned lizards to two-track travel lanes. Objectives are also incorporated to evaluate the response of herptofauna to prescribed burning or wildfire, should such fires occur during the contract years. Although of lower priority, activity and mortality comparisons continue for translocated nuisance snakes versus snakes not involved in translocations.

Due to needs associated with pre-monitoring for the Pantex Renewable Energy Project, priority in 2009 focused on horned lizard use of two-track pasture roads. Data from three different techniques (plot searches, radio telemetry, and powder tracking) clearly indicate a preference for two-track travel lanes that traverse taller grass structure utilized as escape cover. Monitoring horned lizards for mortality has shown that Pantex can be successful in reducing roadkill mortality on these two-tracks.

Displacement of native grasses by Old World Blue Stem (OWBS) grass was identified as a major threat to horned lizards at Pantex. Horned lizard numbers are believed to be declining in these areas, and there is evidence that mortality is higher where formerly native-grass-associated two-tracks have recently converted to OWBS-associated two-tracks. Evidently, when approached by vehicles, remaining horned lizards in this cover type "crouch and hide," instead of running down and then off the two-tracks into adjacent cover as they do in the shorter buffalograss and blue grama, and western wheatgrass communities.

In 2008, a contract was initiated with WTAMU to assess biological and nuisance aspects of bobcats at Pantex. The project involves testing of trapping techniques, ear-tagging of bobcats, and radio-marking and tracking of adult resident females. Trapping was initiated in March 2009, with trapping performed first at known bobcat focus sites, and then was extended to outlying Pantex areas, Texas Tech sites, and then, finally to locations outside of the home ranges of monitored bobcats. The initial goals involved testing of trapping techniques, ear-tagging of bobcats, and satellite-marking and tracking of adult resident females. Once, it was confirmed that territories were large, and thus would limit the number of bobcats on-site, goals were modified to also satellite-mark any adult male bobcats captured.

In 2009, two 20-pound female bobcats and one 23-pound male bobcat were captured and marked. The three home ranges are shown in Figure 3-13. The male's home range (35 mi^2) is comprised of only a few data points, because his collar went off-line after only a week of tracking. The "Westside" female's home range (53 mi^2) was the largest of the three cats. However, this is influenced by activity to the north and to the east, only after this female apparently lost her kittens. The "Eastside" female's home range (9 mi^2) was more within the reported norm for female bobcats in the scientific literature (5-17 mi^2). Her home range was defined soon after collaring and this cat rarely extended her boundaries. The two females' clearly avoided each other's home ranges, and after the initial male visit, no other adult cats were documented within the females' territories.

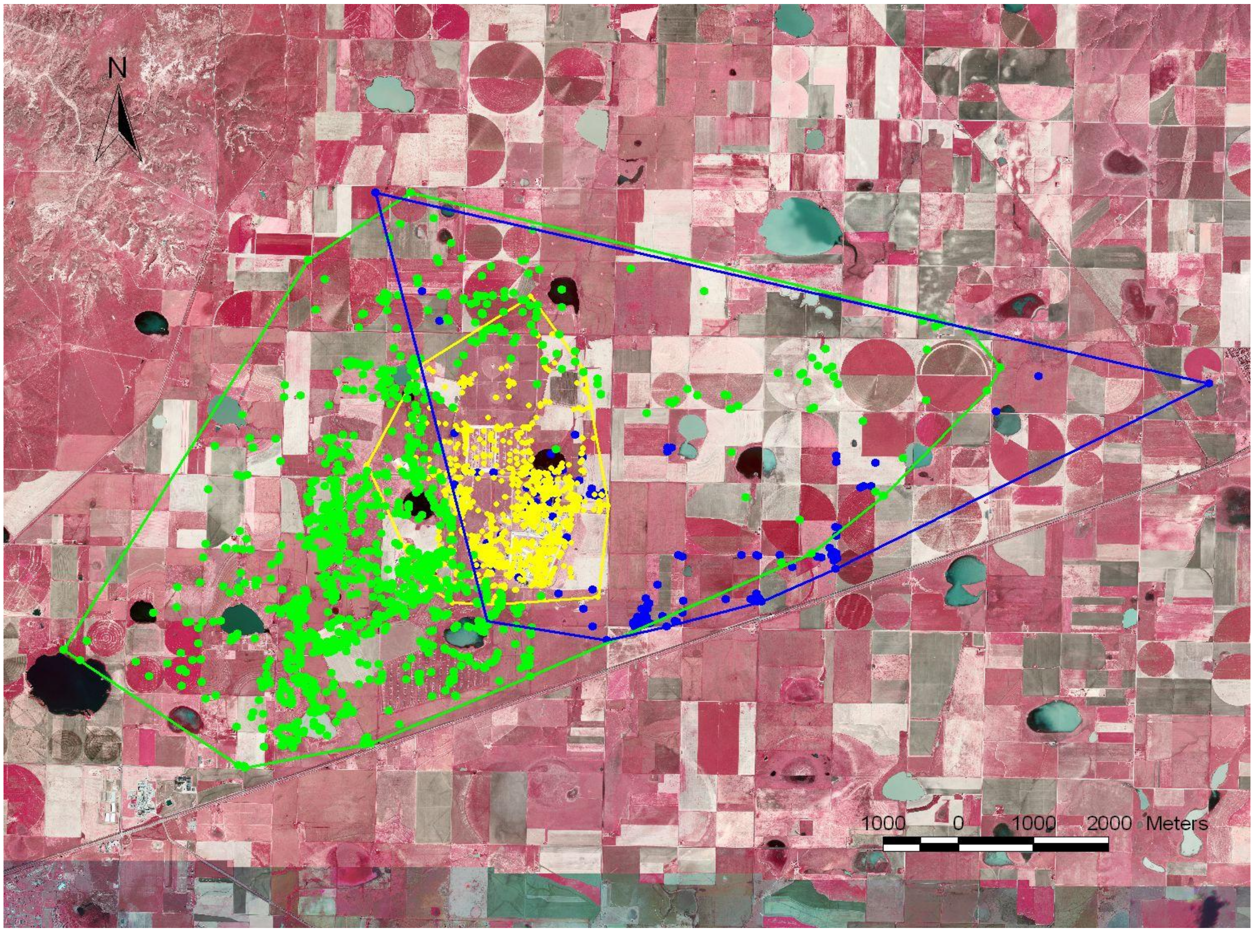


FIGURE 3.13 — *Locations and Home Ranges of Two Adult Females (green, yellow) and One Adult Male Bobcat Tracked at Pantex*

A subcontract was secured with WTAMU for FY 2009 - FY 2014 to conduct pre-, post-, and control-site monitoring associated with the Pantex Renewable Energy Project. The multi-year study is based on recent criteria published in Wildlife Society journals (Anderson et al. 1999 and Kunz et al. 2007), but exceeds the recommended duration of both pre- and post-monitoring. The emphasis includes bat and bird mortality at turbines and associated infrastructure, but also bird avoidance of wind farm sites and roadkill mortality on associated roadways. Pre-monitoring was initiated, and bat monitoring equipment located on meteorological towers successfully recorded bat passage during the recent migrational period. At the conclusion of the contract, information will be incorporated into a revision of this Plan.

<u>Nuisance Animal Management.</u> Nuisance wildlife problems in the areas of health, safety, and interferences with operations continued at Pantex Plant in 2009. The primary species causing problems were the striped skunk, feral pigeon, feral cat, and cottontail rabbit. Nuisance feral cats, stray dogs, and

skunks are captured and removed. Other fur-bearing species are relocated to other onsite locations in accordance with a letter of authority issued to Pantex Plant by the Texas Parks and Wildlife Department. In 2009, nine feral cats were captured and transported to the City of Amarillo Animal Control Facility. Seventeen skunks were captured and euthanized, and a number of snakes and Virginia opossums (*Didelphis virginiana*) were removed from operational areas and released elsewhere on the Plant.

In the vicinity of perimeter intrusion detection and assessment system (PIDAS) beds, cottontail rabbits and black-tailed jackrabbits are controlled by the Pantex Security Department. In 2009, 136 cottontails and jackrabbits were removed from PIDAS bed protected areas.

Pigeons, swallows, and house sparrows nesting around doorways, walkways, and air intakes cause both nuisance conditions and health concerns. Nixalite® wire was previously installed on walls and on nesting surfaces to discourage birds from these areas of concern, and smooth plastic strips were installed beneath overhangs of some buildings to prevent swallows from nesting over doorways. In 2009, 60 feral pigeons were controlled under procedures that allow Security to control pigeons at the request of building managers.

3.5 Cultural Resources

Cultural resources identified at Pantex Plant include archeological sites from prehistoric Native American use of Plant land; standing structures that were once part of the World War II-era Pantex Ordnance Plant (1942-1945); and buildings, structures, and equipment associated with the Plant's Cold War operations (1951-1991). In addition, many artifacts and historical documents have been preserved that are valuable sources for interpreting prehistoric and historic human activities at the Plant. Some of these cultural resources are eligible for inclusion in the *National Register of Historic Places* (*National Register*), thus requiring protection and preservation under the National Historic Preservation Act (NHPA) and related cultural resource management (CRM) requirements. The Plant's CRM program ensures compliance with all applicable State and Federal requirements.

The goal of the CRM program is to manage the Plant's cultural resources efficiently and systematically, taking into account both the Plant's continuing mission and historic preservation concerns. This goal is achieved through coordination with the Plant's project review process for compliance with the National Environmental Policy Act, and through consultation with the Texas State Historic Preservation Office (SHPO) and the President's Advisory Council on Historic Preservation (Advisory Council).

In October 2004, PXSO, Pantex Plant, the Texas SHPO, and the Advisory Council completed execution of a Programmatic Agreement and Cultural Resource Management Plan (PA/CRMP). This PA/CRMP ensures compliance with Section 106 of the NHPA, providing for more efficient and effective review of Plant projects having the potential to impact prehistoric, World War II era, or Cold War era properties. In addition, the PA/CRMP outlines a range of preservation activities planned for the Plant's compliance program. The PA/CRMP provides for the systematic management of all archeological and historic resources at Pantex Plant under a single document. No changes were made to the program in 2009.

Archeology. Approximately half of the DOE-owned and -leased land at Pantex Plant has been systematically surveyed for archeological resources, and a site-location model has been developed. In 1995, a 960-hectare (2,400-acre) survey confirmed that prehistoric archeological sites at Pantex Plant are situated within approximately 0.4 kilometer (0.25 mile) of playas or their major drainage locations. Conversely, such sites do not occur in interplaya upland areas (Largent, 1995).

The 69 archeological sites identified at Pantex Plant consist of 57 prehistoric sites represented by scatters of bone artifacts, and 12 Euro-American farmstead sites represented by foundation remains and small artifact scatters. In consultation with the SHPO, Pantex determined that the 12 historic sites are not eligible for inclusion in the *National Register*. Pantex and the SHPO concluded that two of the 57 prehistoric sites (41CZ66 and 41CZ23) are potentially eligible for the *National Register*, but that additional field work would be required to make a final eligibility determination. Pantex will continue to protect these two sites and monitor them on a regular basis, as though they are eligible. If additional features are exposed and found, excavation will proceed if they cannot be adequately protected in-situ. These exposed features will be analyzed, mapped, collected, and excavated by archeological methods. In addition, 22 prehistoric sites are protected within playa management units surrounding the four DOE-owned playas. Plant procedures have been implemented for the protection and preservation of these sites. This was reinforced through a Plant-wide publication requiring early ESD staff notification and coordination of any projects requiring ground disturbing activities relating to these prehistoric sites. In fall of 1996, Plant personnel monitoring for erosion discovered a number of large bones. An emergency excavation was completed under the supervision of a qualified archaeologist. Today the bones have been incorporated into a permanent exhibit within our visitor center, highlighting the plant prehistoric history and the archeology activities that were implemented during the excavation (Figure 3.14).

FIGURE 3.14 — *A Scene From the Visitors Center in Building 16-12*

World War II. In 1942, the U.S. Army Ordnance Department chose this site for construction of a bomb-loading facility. The 16,000-acre industrial Pantex Ordnance Plant, designed and constructed in only 9 months, sprang up in the middle of a traditional rural farming and ranching community, bringing with it great social and demographic change. It was constructed by the U.S. Army Corps of Engineers and operated by the Certain-teed Products Corporation to produce general-purpose bombs and artillery shells.

The World War II-era historical resources of Pantex Plant consist of 118 standing buildings and structures, all of which have been surveyed and recorded. In consultation with the SHPO, Pantex has determined that these properties are not eligible for inclusion in the *National Register* within a World War II context. However, 69 buildings that were constructed during World War II and used during the Cold War are eligible for inclusion in the *National Register* under the Cold War context. The WWII era buildings and structures have been preserved to some extent through survey documentation, photographs, individual site forms, and oral histories.

A World War II historical display has been completed in the new visitor center (Figure 3.15). This portion of the exhibit focuses on world events including the beginnings of the fundamental activities for tactical and thermonuclear weapons that were developed and proved, creating the physical infrastructure to the nuclear weapon complex leading to the growth of the stockpile and the impact on Pantex.

FIGURE 3.15 — *A World War II Montage Displayed in the Visitors Center*

Cold War. The National Historic Preservation Act typically applies only to historic properties that are at least 50 years old, unless they are of "exceptional importance" (NPS Bulletin 15, 1991). Many properties at Pantex Plant are associated with the Cold War arms race and are of exceptional importance. As the final assembly, maintenance, surveillance, and disassembly facility for the nation's nuclear weapons arsenal, Pantex Plant lies at the very heart of Cold War history.

The period of Cold War operations at Pantex Plant dated from 1951, when the Plant was reclaimed by the Atomic Energy Commission (AEC) as part of the expanding nuclear weapons complex, to the September 1991 address to the nation by then-President George H.W. Bush directing the dismantlement of a portion of the nation's nuclear weapon stockpile; thereby fundamentally changing the Pantex Mission from one of nuclear weapon assembly to one of disassembly.

The Cold War-era historical resources of Pantex Plant consist of approximately 650 buildings and structures and a large inventory of process-related equipment and documents. The historical resources of this period are among the Plant's most significant, and offer a valuable contribution to the nation's cultural heritage.

Today. The Plant's CRM program is now focused on implementing the new PA/CRMP and completing the range of preservation activities described therein. The Plant's commitment to the PA/CRMP to comply with state and federal regulations has been visible all year long. Initiatives outlining objectives throughout the Plant have been implemented through a 10-year site plan and incorporate historical preservation goals.

Under the Cold War directive, six Cold War railcars were preserved and an exhibit is being developed to interpret the significance of the railcars and the role they played in the Cold War. The railcars played a major role in the transportation of weapons on and offsite. An accompanying exhibit will include diagrams of the different car types. The display will also feature illustrations and photos of the train in action and of the loading process (Figure 3.16).

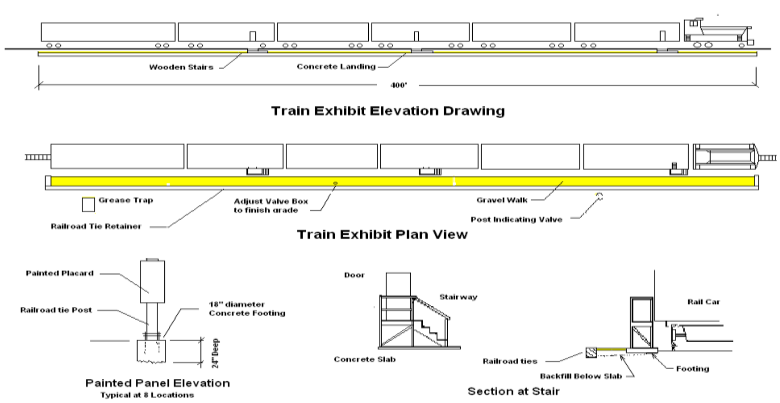


FIGURE 3.16 — ***An Elevation Drawing of the Prospective Train Exhibit***

A multi-themed high-level exhibit has been developed, focusing on archeology and natural resources and representing the historic context of Pantex Plant. The archeological exhibit is displayed in the entry of the new Visitors Center and includes the natural and cultural history of the Pantex site (Figure 3.17). The display highlights the Plant's dedication to environmental stewardship, the protection of flora and fauna, and the preservation of archaeological remains (bison bones).

The Visitors Center emphasizes present history and modern functions of Pantex Plant within the context of U.S. and global history, in particular in the context of the U.S. nuclear stockpile (Figure 3.18). The exhibits show the historical influences that have shaped the operations at this site, and how Pantex operations have contributed and continue to contribute to the U.S. defense system (Figure 3.19).

The Cultural Resources Program made great strides toward the completion of its Visitors Center in 2009 through the receipt of newly acquired funding. The exhibits in the Center fulfilled Section 110 of the Programmatic Agreement and focus on Prehistory, World War II, the Cold War Era, and Pantex missions today.

FIGURE 3.17 — *Additional Exhibits - Historical and Modern Functions of Pantex Plant*

FIGURE 3.18 — *A Cold War Replica of the W-7 Boar Displayed at the Building16-12 Visitor Entry*

Phase II of the Visitor Center is underway. A high level multimedia center will include actual Pantex oral histories and other visual-related information, conference table, and screen. The room will serve as dual purpose area, Visitor Center/conference room. The Visitor Center/conference room offers a centrally located meeting space for all Pantex groups to host meetings, give presentations and will be a great venue for other events and conferences. The center will allow for other programs that do not want to interrupt plant operations, and assist as a welcome center with the prime use of the facility as background information about Plant's history and today's mission. Incoming visitors will be able to understand the events known as the Cold War and experience the site, which provides a framework and a starting point for conveying a broad interpretive story.

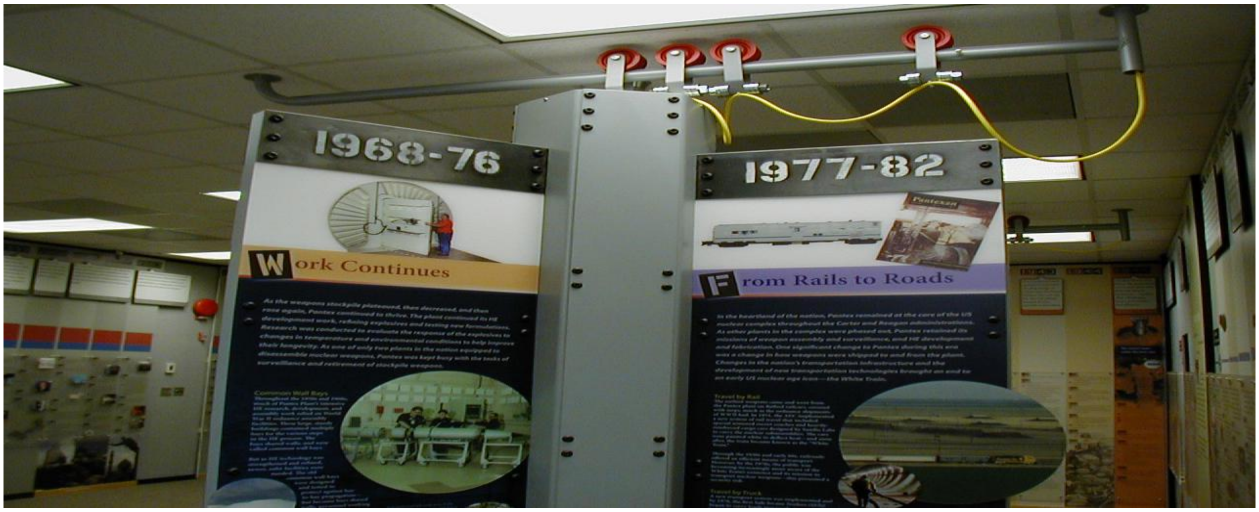


FIGURE 3.19 — *Exhibits Focusing on Continuing Operations at Pantex Plant*

3.6 Educational Resources and Outreach Opportunities at Pantex Plant

Educational Outreach is an important part of B&W Pantex's community commitment. B&W Pantex sponsors more than 25 educational programs from elementary school through graduate school. B&W Pantex is funding a $300,000 technical scholarship program. The company also initiated collaboration with TTU, WTAMU, and the Amarillo Economic Development Corporation for a new engineering graduate studies program in Amarillo. B&W Pantex also supports an Amarillo Independent School District (AISD) tutoring program to help students improve their reading and math skills. Pantex scientists also donate their time and talent to middle school groups by working with the schools Future Scientists and Engineers Club. AISD often recognizes these employees for their dedication to the students.
The Pollution Prevention Team has continued its efforts in public outreach and pollution prevention education during 2009. Through increased emphasis on public outreach, B&W Pantex efforts have resulted in a positive impact on the local community with regard to pollution prevention and recycling. The Pollution Prevention Team has partnered with local organizations to sponsor public events for Earth Day and Pollution Prevention Week. B&W Pantex has also partnered with local communities to help expand their recycling efforts including the ongoing partnership with the City of Panhandle in which Pantex provides cardboard, magazines, newspapers and phonebooks.

The sixth annual Pantex Earth Day Event was held offsite at Wildcat Bluff Nature Center on a beautiful Saturday in April. B&W Pantex co-sponsored "Earth Fest 2009" with Xcel Energy and Wildcat Bluff. (Figure 3.20) Personnel from across the Plant along with volunteers, contributed their time and efforts to make the event a huge success. Activities included Frisbee toss, basketball throw, ring toss, Earth Day *Jeopardy*, watershed in a cup, energy conservation quiz, and other Earth Day games. This event provided more than 2,000 children and their parents the opportunity to learn more about recycling, waste reduction, resource conservation, and things everyone can do to help protect the environment.

FIGURE 3.20 ─ ***Earth Day Jeopardy at Earth Fest 2009***

Science Bowl competitions for middle schools and high schools throughout the Panhandle have been in place for several years. They are educational events developed by DOE in 1990, which were created to recognize outstanding students and motivate them to higher learning in math and science. B&W Pantex employees organize and staff these competitions each year.

The Middle School Fuel Car Race, held each spring, challenges students to design and build a vehicle to complete the race in the shortest possible time. Some cars can run the 10-meter track in 4 seconds. The car is powered by solar energy. This project gives the students a chance to see how much they can do with a science or engineering education. B&W Pantex also has sponsored the Nuclear Science Merit Badge program for Boy and Girl Scouts since 1969. In addition, B&W Pantex sponsors the Nuclear Science Merit Badge at the National Boy Scout Jamboree in Virginia.

Pantex staff provided several presentations to school and community groups on a variety of topics including backyard wildlife and *Ecology of Prairie Rattlesnakes*. In addition, staff members banded Purple Martins through the Purple Martin Outreach Program and provided outreach at five locations in two communities in the Panhandle. A total of 348 nestlings were banded during 2009.

3.7 Environmental Restoration

Environmental Restoration at Pantex is conducted in accordance with CERCLA and RCRA, as discussed in Chapter 2. During 2009 Pantex completed installation of the remedial actions for the solid waste management units identified under RCRA and CERCLA (except for active units), and transitioned into long-term stewardship of the remedial actions and units.

Introduction. Historical waste management practices at the Plant resulted in impacts to onsite soil and perched groundwater. These historical practices included disposal of spent solvents to unlined pits and sumps, and disposal of high explosive (HE) wastewater and industrial wastes to unlined ditches and playas. As a result, HEs, solvents, and metals were found in the soil at solid waste management units at Pantex and in the uppermost (perched) groundwater beneath Pantex Plant. Pantex and regulatory agencies identified 254 units at the Pantex Plant for further investigation and cleanup. Investigations that identified the nature and extent of contamination at solid waste management units and associated groundwater were submitted to the TCEQ and EPA in the form of RCRA Facility Investigation Reports. Those investigation reports closed many units through interim remedial actions and no further active controls are necessary for those units. Other units were evaluated in human health and ecological risk assessments to identify further remedial actions to protect human health and the environment. Figure 3.21 depicts the location and status of the 254 units. The 16 units still in active use will be closed in accordance with CERCLA and RCRA permit provisions when they become inactive and are determined to be of no further use.

Those units requiring further remedial actions were then assessed in a corrective measures study to identify and recommend final remedial actions. A detailed summary of actions for the 254 units can be found in the Pantex Site-Wide Record of Decision (ROD), (Pantex Plant, 2008). The final approved remedial actions are detailed in the ROD.

Remedial Actions focus on:

- Cleanup of perched groundwater and reduction of perched water levels to protect the underlying drinking water aquifer;
- Cleanup of soil gas and residual non-aqueous phase liquid (NAPL) in soil at the Burning Ground for future protection of groundwater resources;
- Institutional controls to protect workers, control perched groundwater use, and control drilling into and through perched groundwater; and
- Maintenance of soil remedies (ditch liner and soil covers) for future protection of groundwater resources.

Remedial Actions at Pantex

Groundwater Remedies:

2 Pump & Treat Systems
- Playa 1 Pump and Treat
- Southeast Pump and Treat

2 In-Situ Bioremediation (ISB) Systems
- Zone 11 ISB
- Southeast ISB

Institutional Controls

Soil Remedies:

Ditch Liner
Soil Covers on Landfills
Institutional Controls
Soil Vapor Extraction System

Soil areas requiring continued maintenance are depicted with the Solid Waste Management Unit (SWMUs) in Figure 3.21.

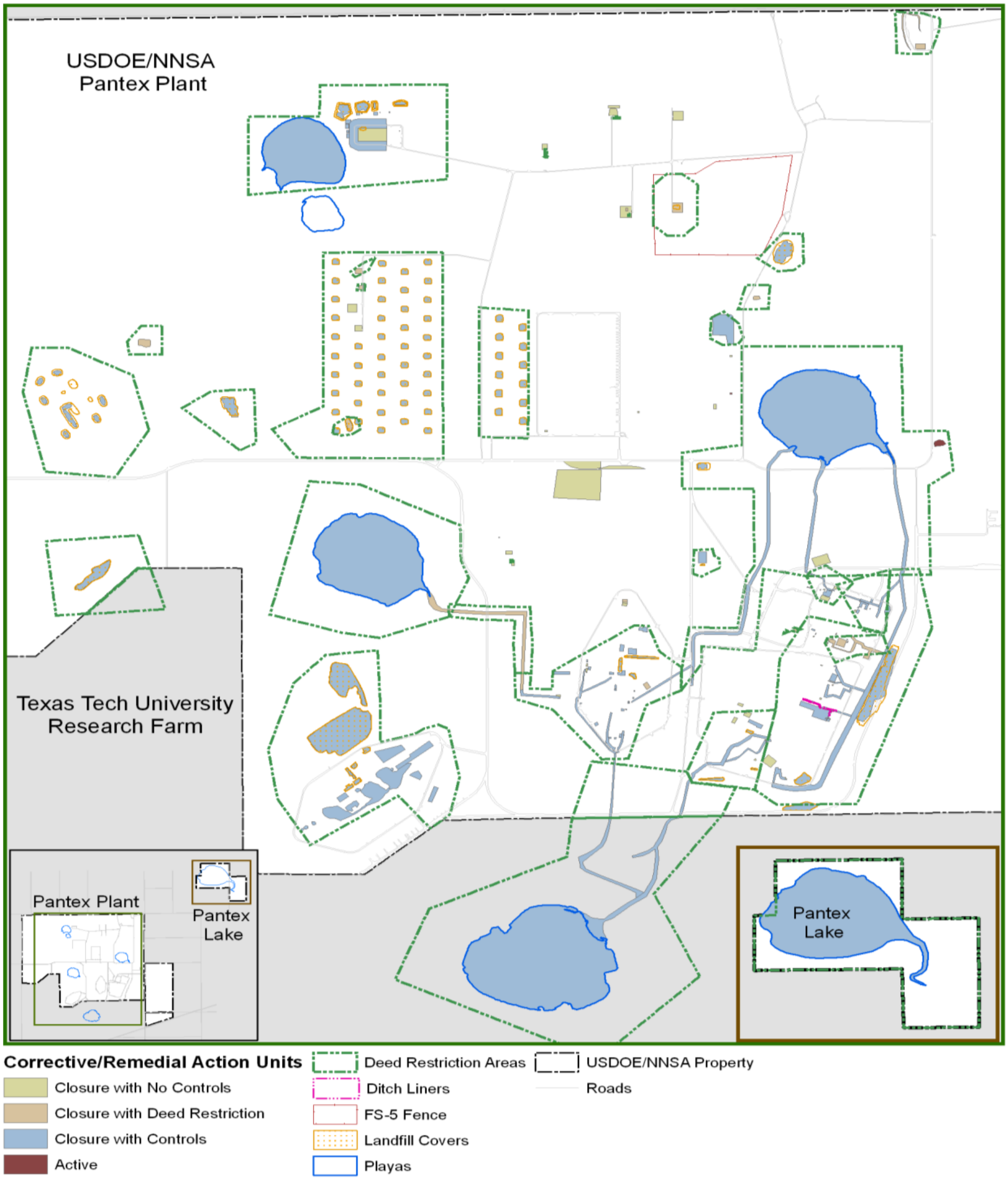


FIGURE 3.21 —*Location and Status of Solid Waste Management Units*

Environmental Restoration Milestones. During 2009 Pantex completed several milestones to transition to long-term stewardship (see milestones highlight). Long-term stewardship includes the long-term operation and maintenance (O&M) of the remediation systems, monitoring of the systems to ensure that cleanup goals established in the ROD and Compliance Plan will be met, maintenance of soil remedies and institutional controls, and reporting of that information to regulatory agencies and the public. Pantex transitioned to long-term stewardship in July 2009. The construction complete milestone for 2009 is detailed in the following sections.

> **Environmental Restoration 2009 Milestones**
>
> - Construction Completed for all Soil and Groundwater Remedial Actions
> - Implementation and Operation of Remedial Actions
> - Approval and Implementation of Long-Term Groundwater Monitoring Network
> - Submittal of Application to Include Final Remedies into the Pantex Compliance Plan 50284

Remedial Action Systems. The remediation systems at Pantex are depicted in Figures 3.21 and 3.22. Most systems were installed prior to 2009. However, some remedial actions were installed in 2009 as part of the construction complete milestone:

- Zone 11 ISB installation completed and first amendment injection completed in June 2009,
- Landfill covers inspected and maintained during 2009,
- New groundwater wells installed as part of the long-term monitoring (LTM) system,
- Firing Site 5 (FS-5) fence installed, and
- Remedial units surveyed for deed recordation.

Each of the systems are evaluated in an annual and quarterly progress reports. The evaluation of the systems operations is summarized below.

Pump and Treat Systems. The pump and treat systems were installed to address contamination in areas where there is generally greater than 15 ft of saturation in the perched groundwater. These systems are designed to remove and treat groundwater to achieve contaminant mass reduction and reduction in the saturated thickness of the perched aquifer. Reduction in saturated thickness will significantly reduce the migration of contaminants both vertically and horizontally so that natural breakdown processes can occur over time. To achieve mass reduction and reduction in saturated thickness, the pump and treat systems treat the extracted water to remove contaminant mass from the water before the effluent is sent to the Wastewater Treatment Facility (WWTF) and irrigation system for beneficial reuse, although the Southeast Pump and Treat System (SEPTS) retains the capability for injection back into the perched zone when necessary. The SEPTS has been operating since 1995 when it started as a treatability study. It has been expanded with more extraction wells and the capacity to treat boron and hexavalent chromium to become the final remediation system for the southeastern portion of the groundwater plumes. The Playa 1 Pump and Treat System (P1PTS) was started in late 2008, and the system became fully operational in January 2009.

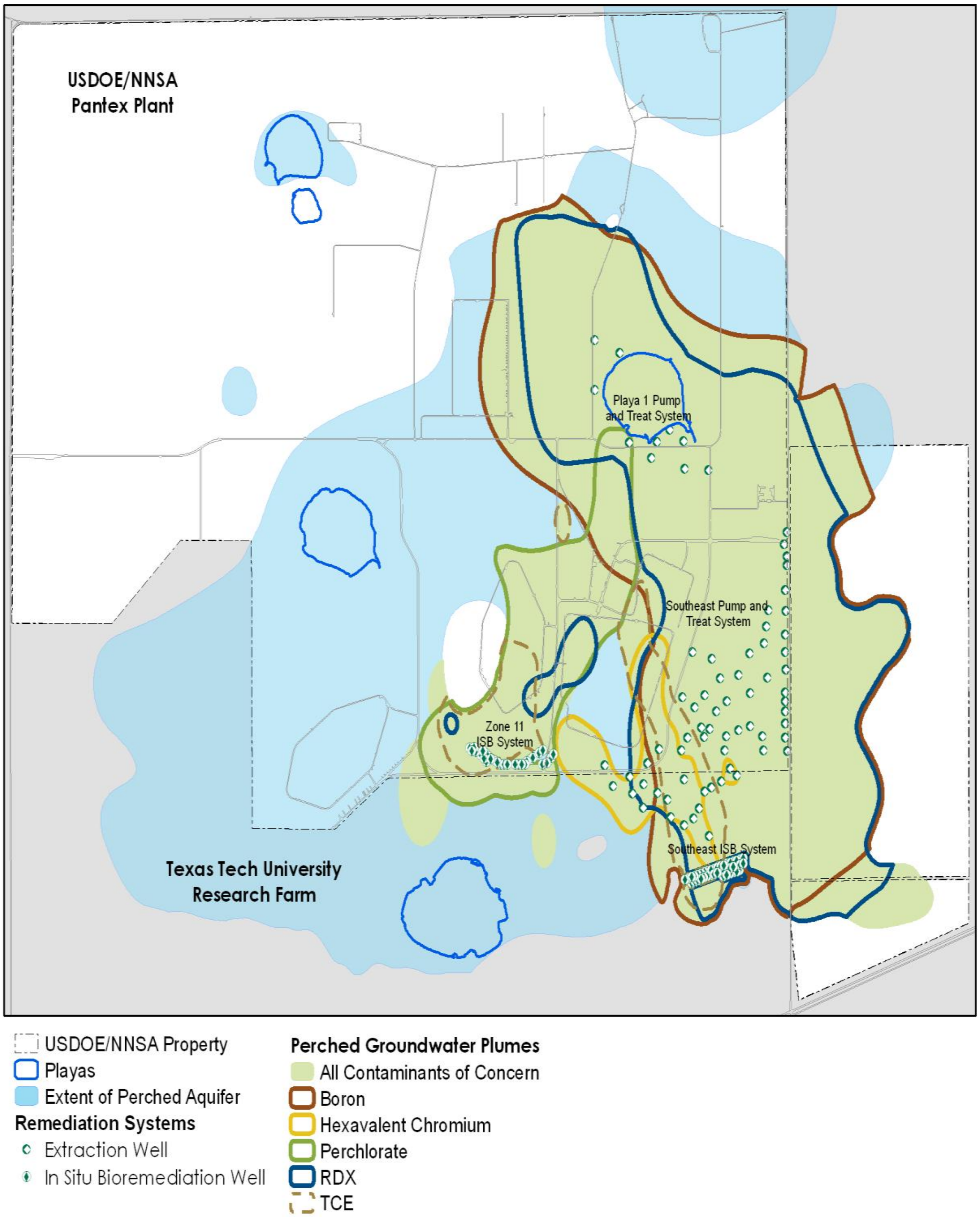


FIGURE 3.22 - ***Perched Groundwater Plumes and Treatment Systems***

To reach the goal of reducing saturated thickness, the Pump and Treat Systems have a goal of operating 90% of the time and at 90% of treatment capacity. The Pump and Treat Systems performance for 2009 is depicted in Figure 3.23. The SEPTS exceeded the operational goal for 2009 by operating 97% of the time and treated an average of 379,061 gallons per day (gpd) of impacted perched groundwater. The P1PTS operated 75% of the time and treated an average of 259,672 gpd during 2009. As depicted in Figure 3.23, system treatment performance has improved during the year, with the SEPTS exceeding or meeting the goal in the last half of the year. The P1PTS also continually improved treatment performance during the year.

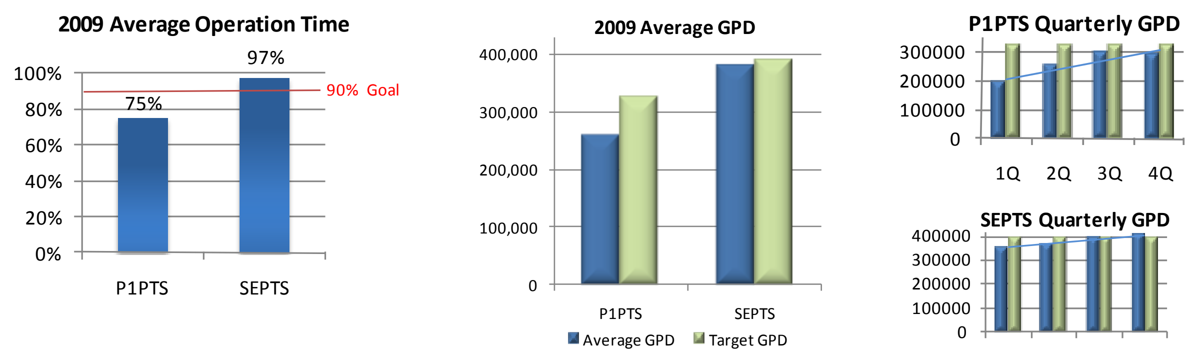


FIGURE 3.23 – *Pump and Treat Systems Performance*

The P1PTS is in its first year of operation and performance is expected to improve with time as Pantex upgrades the WWTF and irrigation system to receive more water. The P1PTS can only send treated water through the WWTF and irrigation system, so if those systems cannot receive water because of excessive rainfall or shutdown, the P1PTS shuts down or operates at a reduced capacity. Operation and performance at the P1PTS has improved (Figure 3.23) and will continue to improve as the SEPTS continues to temporarily inject a portion of the treated water into the perched zone. This helps minimize impacts to the operation of the P1PTS while the upgrades to the WWTF and the irrigation system are being planned and implemented.

The P1PTS primarily removes the high explosive RDX and the SEPTS primarily removes RDX and hexavalent chromium (Cr^6). The figures below provide the mass removal for high explosives (HEs) and chromium for 2009, as well as totals since startup of the systems.

Evaluation of the concentration trends and water levels is included in Chapter 6 Groundwater Monitoring.

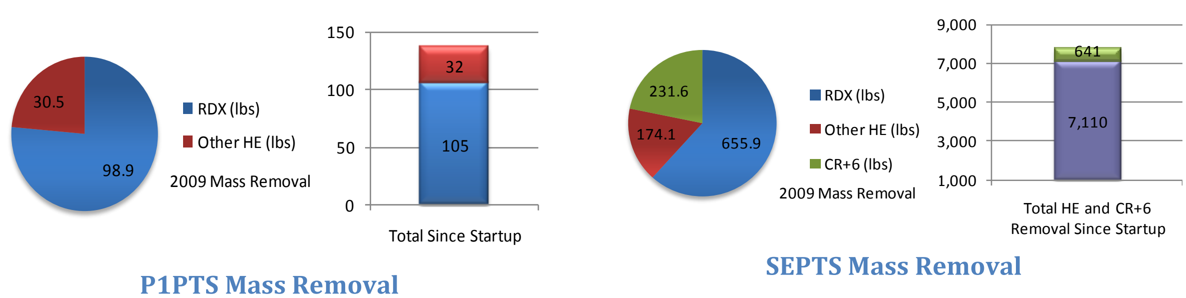


FIGURE 3.24 – *Pump and Treat Systems Mass Removal*

ISB Systems. Two ISB systems (Zone 11 ISB and Southeast ISB) were installed at Pantex. These systems are designed with closely spaced wells to set up a treatment zone in areas of the perched groundwater to control plumes migrating to TTU south of Zone 11 or where the area is sensitive to vertical migration of contaminants of concern (COCs) to the underlying aquifer and pump and treat technology is not effective. These systems use injected amendment to set up reducing zones where COCs are degraded. Monitoring wells were drilled down-gradient of the groundwater flow to monitor whether the system is effectively degrading the COCs. Injection of amendment is anticipated every twelve to twenty-four months for both systems. The treatment zone and down-gradient performance monitoring well information is included in Chapter 6.

Installation of the Zone 11 ISB Remedial Action was completed in 2009, with initial amendment injection completed in June 2009. The system was expanded to include nine new injection wells in 2009, for a total of 32 treatment zone wells. Amendment was injected into the new wells in November 2009. The system also includes three down-gradient performance monitoring wells.

The Southeast ISB was installed in 2007, with injection completed in March 2008. The system was installed with 42 treatment zone wells and six performance monitoring wells. This system was monitored in 2009 to ensure that the treatment zone conditions were adequate to achieve continued reduction of COPCs. Although treatment zone conditions were favorable in 2009, an evaluation of the wells was started in December 2009 to prepare the wells for another amendment injection in 2010.

Burning Ground SVE. A soil vapor extraction (SVE) system has been installed and operating at the Burning Ground since February 2002. A small-scale SVE was installed at the Burning Ground in late 2006 after the large-scale system became inefficient at continued removal of soil gas and residual NAPL once the larger area had been remediated. This small-scale system focuses on treating residual NAPL and soil gas at a single soil gas well (SVE-S-20), where soil gas concentrations continue to remain high. The current system consists of a series of activated carbon drums and a small blower motor for extraction.

The system was down for most of 2009 while data were gathered to evaluate a new enhanced attenuation process and to decommission the previous SVE system. The current system restarted on September 21, 2009 and will be operated until approval is received to implement the new process. The system is intermittently operated and is also down during granular activated carbon (GAC) drum change-out as well as for maintenance and repairs. Mass removal calculated for the 2009 is presented in Figure 3.25. All effluent photo ionization detector (PID) readings indicate that no volatile organic compounds (VOCs) were present after treatment with the exception of one reading of 0.2 parts per million by volume (ppmv) in November and one reading of 0.1 ppmv in December. These concentrations are significantly lower than allowed by the permit by rule for any single VOC. The GAC drums were replaced after the readings.

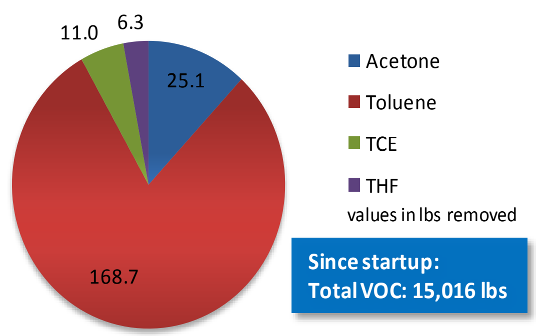


Figure 3.25 Burning Ground SVE Mass Removal

Soil Remedies and Institutional Controls. Institutional controls are required as part of the long-term stewardship of soil remedial action units at Pantex. Pantex drafted all deed restrictions required as part of the final remedy during 2009. Those deed restrictions will be filed in 2010 after approval by regulatory agencies. All SWMUs at Pantex are restricted to industrial use. To support the deed restrictions, Pantex maintains long-term control of any type of soil disturbance in SWMUs to protect human health and to prevent spread of contaminated soils. Pantex also regularly inspects and maintains soil covers on landfills to prevent infiltration of water into the landfill contents and migration of impacted water to groundwater. Pantex installed and inspects and maintains a fence around FS-5 to control access and use of an area that is impacted by depleted uranium that was dispersed through testing of high explosives. Pantex installed a ditch liner along a ditch system in Zone 12 where investigations indicate that the ditches continue to act as a source to perched groundwater. Installation of the ditch liner will mitigate migration of contamination because it prevents rain water from infiltrating into soils. Pantex regularly inspects and maintains this ditch liner.

During 2009 Pantex conducted quarterly inspections of landfills as well as after rainfall events of greater than 0.5 inch. Inspections were also conducted for the ditch liner and SWMU signs and postings at various times during 2009. Key findings of the inspections and resulting actions are included in Table 3.5.

Pantex also conducts reviews of projects that will disturb SWMU soils. Project plans or work requests for repairs were reviewed to ensure that workers used necessary protective equipment and that soils were not removed from the SWMU. In 2009, twelve work requests/construction projects in or near remedial action units were approved. Of the twelve, eight were completed and the others are ongoing or have been cancelled. The areas were inspected after completion of work to ensure all soils were returned to the excavation or kept within the SWMU boundaries. One area required soil removal. All removed soils were properly disposed of by the Pantex Waste Operations Department.

Table 3.5 Key Findings and Corrective Actions for Soil SWMUs

Findings	Corrective Actions
Missing SWMU signs in miscellaneous areas.	Signs replaced by Pantex.
Small holes in miscellaneous landfills.	Holes filled in by Pantex.
Vehicle tracks found on Landfill 6.	Placed barriers on landfill to prevent traffic on landfill cover.
Prairie dogs present in landfills near Zone 4, Landfill 13, and Landfill 15.	Prairie dogs controlled.
Settling observed in certain landfills. Debris was evident in some areas.	Contracted for additional cover to be placed on landfills identified during inspection. Covers were compacted and reseeded.
Sediment collecting in ditch liner. Gravel used to keep liner in place is collecting sediment and allowing plant growth.	Attempts to flush sediment out of gravel was not effective. Pantex identified funding to contract for gravel and sediment to be removed in 2011 and replaced with cylindrical ballasts.

Long-Term Groundwater Monitoring. Pantex transitioned to the LTM network in July 2009. The groundwater monitoring network was developed to evaluate the effectiveness of the remedial actions. The information collected is reported in annual and quarterly progress reports and is summarized in Chapter 6 of this report.

The annual report focuses on all aspects of the remediation and monitoring system (see highlight box to the right) and is scheduled to be complete by June 30 of each year. The quarterly reports focus on pump and treat, ISB, and SVE operation effectiveness as well as uncertainty management and early detection of COCs. The annual and quarterly reports provide more detailed information than contained here and are available on the Pantex website: (http://www.pantex.com/about/environment/erDocs).

Monitoring Data Evaluation

Plume Stability

- Determine if COC concentrations stabilize or decline outside pump and treat systems
- Perform capture zone analysis in pump and treat areas

Response Action Effectiveness

- Determine if COC concentrations decline at treatment systems
- Determine if water levels decline

Uncertainty Management

- Identify any new contamination from remedial action units

Early Detection

- Identify COCs entering the drinking water aquifer

Natural Attenuation of COCs

- Identify degradation products in areas outside influence of treatment systems

During 2009, 13 new monitoring wells (five perched and eight Ogallala) were installed as part of the final LTM network. The LTM network design was approved by TCEQ and EPA in 2009 and sampling was implemented in July. Pantex also submitted the application to incorporate the final remedies and monitoring network approved through CERCLA into the RCRA permit (Compliance Plan 50284 – see Chapter 2).

3.8 Environmental Monitoring

Prior to the release of DOE Order 450.1A, "Environmental Protection Program" in January 2003, the superseded DOE Order 5400.1, "General Environmental Protection Program," required the preparation, or annual review and updating, of a plan containing the rationale and design criteria for the monitoring program as well as the extent and frequency of monitoring and measurements. Although DOE Order 450.1 contains no equivalent requirement, B&W Pantex (and its predecessor organizations) has continued to produce monitoring plans as a best management practice to implement changes required by environmental permits and regulations, advances in industry practices, and public input. As in previous years, the plan prepared for 2009 monitoring was implemented using a consistent system for collecting, assessing, and documenting environmental data of known and documented quality in order to: detect, characterize and respond to releases from DOE activities; assess impacts and characterize exposures and doses to individual members of the general public, to the population, and to biota in the vicinity of the Pantex Plant; and demonstrate compliance with applicable regulatory and permit limits. The potential pathways along which contaminants could travel are illustrated in Figure 3.26

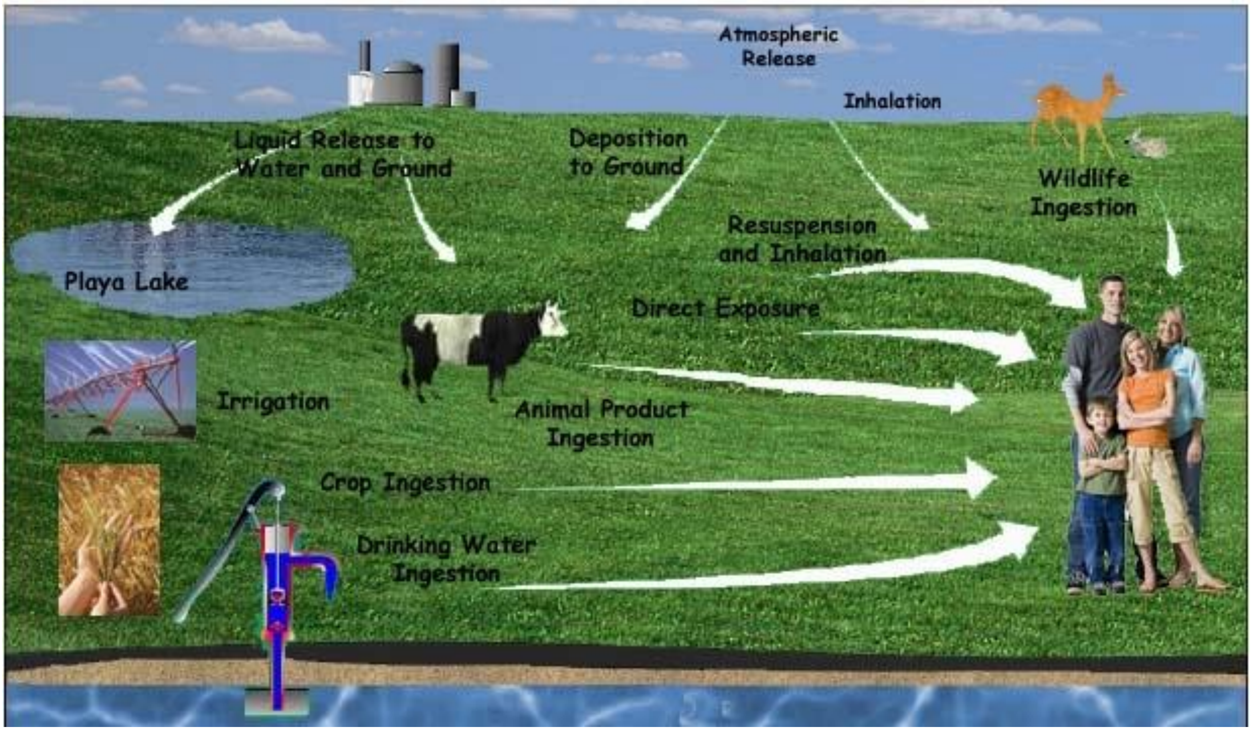


FIGURE 3.26— *Potential Pathways for Environmental Transport of Contaminants*

The referenced plan describes the comprehensive environmental monitoring program in place at the Pantex Plant and the process for the acquisition and assessment of environmental monitoring data. In this process, each environmental media scientist/subject matter expert for the environmental radiological, air, groundwater, drinking water, surface water, soil, floral, and faunal monitoring programs defined data collection requirements using guidance developed from the EPA process for developing data quality specifications and data quality objectives. The specific monitoring program was scheduled and executed based upon the technical specifications indicated in the approved objectives for the specific program. These specifications included such items as the sampling location, sampling frequency, and analytical method. Samples were analyzed for a variety of substances, including radionuclides, metals, water quality indicators, organic chemicals, and explosives.

Control samples for most media were collected in the vicinity of Bushland, Texas, at the U.S. Department of Agriculture (USDA) Agricultural Research Service's Conservation and Production Research Laboratory or the Texas Agrilife Bush Research Farm[1]. Both facilities are located 56 kilometers (35 miles) from the Plant. Control samples for the fauna monitoring program are collected at the U.S. Fish and Wildlife Service's Buffalo Lake National Wildlife Refuge, 72 kilometers (45 miles) from the Plant. Target analytes for each medium are listed in Appendix A.

Several data assessment processes were employed by B&W Pantex to verify that the data collected for all of the monitoring programs met the specified data acceptance criteria. These processes included

[1] In December 2009, sampling equipment located on USDA property was removed. The equipment is to be re-located approximately 1 mile north on property leased from the Bush Research Farm during CY 2010.

evaluation of sampling quality assurance, laboratory technical performance and quality assurance, and data validation. Media-specific descriptions, as well as the results of the monitoring program for samples collected during 2009, are contained in the remaining chapters of this report. Table 3.6 identifies the number of sampling locations for the year.

TABLE 3.6 — *Number of Environmental Media Sampling Locations in 2009*

Media	Onsite	Offsite [a]
Air	4	21
Ambient External Radiation (TLDs[b])	5	12
Drinking Water	32	0
Fauna	9	1
Groundwater	172	58
Soil/Sediment	14	0
Surface Water	12	0
Vegetation (crops, native species)	27	14
Wastewater	3	0
Total	278	106

[a] Includes fence line.
[b] Thermoluminescent dosimeters.

This page was intentionally left blank.

Environmental Radiological Monitoring

Most nuclear weapon parts that include radioactive materials are sealed, thus minimizing the likelihood of contamination of the weapons themselves, the workers, the public, or the environment. However, some operations involve the potential release of small amounts of radionuclides. Monitoring of environmental pathways in 2009 indicated levels below relevant standards and similar to background conditions.

4.1 The Scope of the Program

This chapter summarizes radiological emissions from normal Plant operations. There were no emissions due to unplanned releases during the reporting period. This section of the ASER would evaluate these releases in the unlikely event an unplanned incident were to occur.

During 2009, Pantex Plant's environmental radiological monitoring program was conducted according to U.S. Department of Energy (DOE) Orders 450.1A, *Environmental Protection Program* (DOE, 2008) and 5400.5, *Radiation Protection of the Public and the Environment* (DOE, 1993). In October 2009, a draft version of DOE Order 458.1 "Radiation Protection of the Public and the Environment" was forwarded to DOE offices and contractors for review and comment. This proposed order, which will supersede DOE Order 5400.5 when finalized, will refine and explicitly state requirements to protect the public and the environment against risks associated with radiological activities conducted by the DOE. However, as of December 31, 2009, the new order had not been finalized, and DOE Order 5400.5 was the relevant order.

The program involved measuring radioactivity in environmental samples in addition to calculating the potential radiological dose to the offsite public. The program monitored for the principal radionuclides associated with Plant operations: tritium (^{3}H), uranium^{234} (^{234}U), uranium^{238} (^{238}U), and plutonium^{239} (^{239}Pu) in air, groundwater, drinking water, surface water, soil, flora, and fauna samples (see Chapters 5, 6, 7, 9, 10, 11, and 12). The radionuclides ^{234}U, ^{238}U, and ^{239}Pu emit primarily alpha particles.[1] Tritium emits beta particles. Gamma radiation emissions from these radionuclides were also monitored and evaluated.

Based on the 2009 operational data, Pantex emitted a dose to the maximally exposed member of the general public of 2.86 x 10^{-7} mrem/yr. This dose is significantly below the U.S. Environmental Protection Agency (EPA) maximum permissible exposure limit to the public (and the DOE "air pathway" limit) of 10 mrem/yr. The regulatory limits are purposely set at levels well below those known to cause any adverse effects on the public and/or the environment. The monitoring and analysis results demonstrate that no adverse effects occurred from Plant operations in 2009.

[1] The alpha energies of ^{233}U (4.82 MeV and 4.78 MeV) and ^{234}U (4.77 MeV and 4.72 MeV) are very similar. Alpha-spectroscopy techniques used to perform analyses can not distinguish between the two isotopes. Accordingly a single analysis result will indicate both isotopes in the "pair" (as $^{233/234}U$). Similarly, the alpha energies of ^{239}Pu (5.16 MeV and 5.11 MeV) and ^{240}Pu (5.17 MeV and 5.12 MeV) are not distinguishable by alpha-spectroscopy and analysis will indicate both isotopes in a single analysis result (as $^{239/240}Pu$).

4.2 Radiological Units and Reporting

Radiological results are reported in units that are specific to different types of exposure and environmental media (i.e., air, water, soil, etc.). For example:

- Individual doses from airborne emissions of radionuclides and from gamma radiation are reported in millirem per year (mrem/yr)[2] or millisievert per year (mSv/yr).[3]
- Population dose[4] is reported in person-rem per year or person-sievert per year.
- Exposure rates are reported in microroentgen per hour (μR/hour).

Further descriptions of the radiological and statistical parameters discussed in this chapter may be found in many publications dealing with measurements of radioactivity (NCRP, 1985) or statistical texts (Gilbert, 1987).

4.3 Radiological Emissions and Doses

4.3.1 Doses to Members of the Public

The exposure of members of the public to all DOE sources of radiation is limited by the DOE to levels that shall not cause, in a year, an effective dose equivalent greater than 100 mrem (1 mSv). Demonstration of compliance with this limit is documented by a combination of measurements and calculations including the comparison of concentrations of radioactive material in air and water to "Derived Concentration Guides" (DCGs) listed in Chapter III of DOE Order 5400.5.[5] The potential environmental pathways for radioactive material released from Pantex Plant are illustrated in Figure 3.26.

The DOE provides a level of protection for persons consuming water from a public drinking water supply equivalent to the drinking water criteria in 40 CFR 141 by limiting the effective

---

2 The reader should note that various prefixes, e.g., milli (m), micro (μ), can be used to modify the "base units" of radiation measurement, e.g., rem, Sievert (Sv), Curie (Ci), Roentgen (R). These various prefixes are related as indicated in the "Scientific Notation Used for Units" section of the "Helpful Information" table located on the inside back cover. Thus, for example, 0.00125 mrem could also be written as 1.25×10^{-3} mrem, as 1.25×10^{-6} rem, or even as 1.25 μrem. Additionally, 1.25×10^{-6} mSv could also be written as 1.25 nSv. However, to afford comparison with the aforementioned DOE Order, doses will be reported as indicated.

3 The Système Internationale unit for dose equivalent analogous to the rem is the Sievert (Sv). One Sievert is equivalent to 100 rem and 1 millisievert (mSv) is equivalent to 100 mrem.

4 The summation of the product of the calculated effective dose equivalent for the average exposed individual in each of the sectors illustrated in Figure 1.6 multiplied by the number of people living in that sector.

5 A DCG is defined as the concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year would result in an effective dose equivalent of 100 mrem. The DCG values were themselves derived from dose rate conversion factors and other parameters in accordance with dose limitation systems recommended by the International Commission on Radiological Protection (ICRP) in its several publications (e.g., ICRP, 1985; ICRP, 1991) and used by the EPA, the Nuclear Regulatory Commission, and DOE in establishing standards for radiological protection.

dose equivalent in a year to 4 mrem (0.04 mSv). Current Pantex Plant policy does not allow the discharge of radioactive material into liquid effluent, thus eliminating any future potential impact to groundwater from that source. Compliance with the aforementioned criterion is accomplished by comparing measured concentrations of radionuclides in drinking water to 4 percent of the DCG values for ingested water. The results of these measurements as well as those for other water monitoring programs are discussed in Chapters 6-9.

The DOE further limits emissions of radionuclides to the ambient air from DOE facilities to those amounts that would not cause any member of the public to receive, in any year, an effective dose equivalent of 10 mrem/yr (0.1 mSv/year). This limit is equivalent to the limit for emissions of radionuclides other than radon to this pathway established by the EPA at 40 CFR 61.92. Compliance with the dose limit specified in 40 CFR 61.92 (and hence that for the air pathway specified in DOE Order 5400.5) is demonstrated by calculating the effective dose equivalent received by the maximally exposed individual member of the general public. This individual is a person who resides near Pantex Plant, and who would receive, based on theoretical assumptions about lifestyle that maximize exposure to radiological emissions, the highest effective dose equivalent from Plant operations. Calculations are performed using the EPA's CAP88-PC model (EPA, 1992).

Since 1994, the meteorological data used in this modeling effort have been obtained from the meteorological tower at Pantex Plant (see Section 1.4). Sensors at the tower automatically record average wind speed and direction, and several other parameters, every 15 minutes. Information about average tropospheric mixing height is obtained from the Amarillo National Weather Service station at the Rick Husband International Airport. The source term for releases to air was calculated based on process knowledge of the releases of radionuclides from the routine operations at Pantex (e.g., calibration of radiation detection instrumentation, sanitization[6] of components at the Burning Ground and Firing Sites, etc.), the number of operations conducted during the year, and other modifying factors. In estimating the emissions, conservative assumptions concerning the form of the radioactive material and the presence or absence of engineering controls such as High-Efficiency Particulate Air (HEPA) filters were made to maximize the potential emissions. A very small percentage (6.5E-06 percent) of these calculated emissions is due to emissions of ^{238}U and other radionuclides from various routine Plant activities, while the balance is due to emissions of ^{3}H.[7] These emissions are summarized in Table 4.1 below.

TABLE 4.1 — *Pantex Radiological Atmospheric Emissions in Curies (Bq)*

Tritium	Total Uranium[a]	Total Plutonium	Total Other Actinides	Other[b]
1.48E-02 (5.49E+08)	9.65E-10 (3.57E+01)	None	1.80E-14 (6.67E-04)	None

[a] Total Uranium (grams) = 2.89E-03

[6] See the definition of this term in the glossary.

[7] The overwhelming majority (94.4%) of these emissions arose from activities conducted in Buildings 12-42 and 12-53 within the southern portion of Zone 12 (see Section 1.3 above). The balance of the emissions arose from sanitization activities conducted at the Burning Ground and Firing Sites.

[b] This category includes the following: ^{85}Kr, Total Radioiodine, Total Radiostrontium, Noble Gases ($T_{1/2}$ < 40 day), Short-lived Fission and Activation Products ($T_{1/2}$ < 3 hr), and Fission and Activation Products ($T_{1/2}$ > 3 hr).

Based on the results of the CAP88-PC modeling, the maximally exposed individual for 2009 (located approximately 5230 meters [3.25 miles] north [N] of Building12-53) would have received a dose of 2.86×10^{-7} mrem (2.86×10^{-9}mSv). This dose equivalent is 2.86×10^{-7} percent of the DOE Public Dose Limit for all pathways, is 2.86×10^{-6} percent of the effective dose equivalent standard specified in 40 CFR 61, Subpart H, and is also only 0.0003 percent of the level requiring emission monitoring (set at 1 percent of the standard). Based upon the same CAP88-PC modeling results, the collective population dose equivalent received by those living within 80 kilometers (50 miles) of Pantex Plant would have been 3.57×10^{-6} person-rem/year (3.57×10^{-8} person-sievert/year) in 2009. The majority of this collective population dose equivalent is contributed by ^{3}H.

The dose equivalent received by the maximally exposed individual during 2009, the 2009 collective population dose, and the 2009 natural background population dose are tabulated in Table 4.2. Because there were no releases from Pantex Plant to the water pathway or any other pathway, the indicated dose represents that for the *air* pathway as well as *all* pathways. The calculated effective dose equivalents received by the maximally exposed individual in Calendar Years 2007, 2008, and 2009 are illustrated in Figure 4.1. As noted previously, all doses are several orders of magnitude less than the EPA limit (10mrem/yr).

TABLE 4.2 — *Pantex Radiological Doses in 2009*

Dose to Maximally Exposed Individual from Pantex Operations (mrem)	(mSv)	% of DOE 100-mrem Limit	Estimated Population Dose from Pantex Operations (person-rem)	(person-Sv)	Population within 80 km (50 miles)	Estimated Background Radiation Population Dose at Pantex Plant (person-rem)
2.86×10^{-7}	2.86×10^{-9}	2.86×10^{-7}	3.57×10^{-6}	3.57×10^{-8}	296,000	29,600

4.3.2 Protection of Biota

The DOE limits the dose to aquatic animals, to terrestrial plants, and to terrestrial animals to 1 rad/day, 1 rad/day and 0.1 rad/day, respectively. In the past, it has been assumed that compliance with dose limits established for the protection of humans would provide sufficient protection for other living organisms. This assumption is no longer considered valid, since plant and/or animal populations may be exposed to radionuclides from both natural and man-made sources to a greater extent than are humans. Accordingly, the DOE prepared a technical standard DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE, 2002), to provide methods and guidance to be used to evaluate doses of ionizing radiation to populations of aquatic animals, terrestrial plants and terrestrial animals.

B&W Pantex has used a calculation tool (RAD-BCG) provided by the DOE for implementing the technical standard to compare existing radionuclide concentration data from co-located sampling locations for surface water, sediments and soils on and around the Pantex site during 2009 to

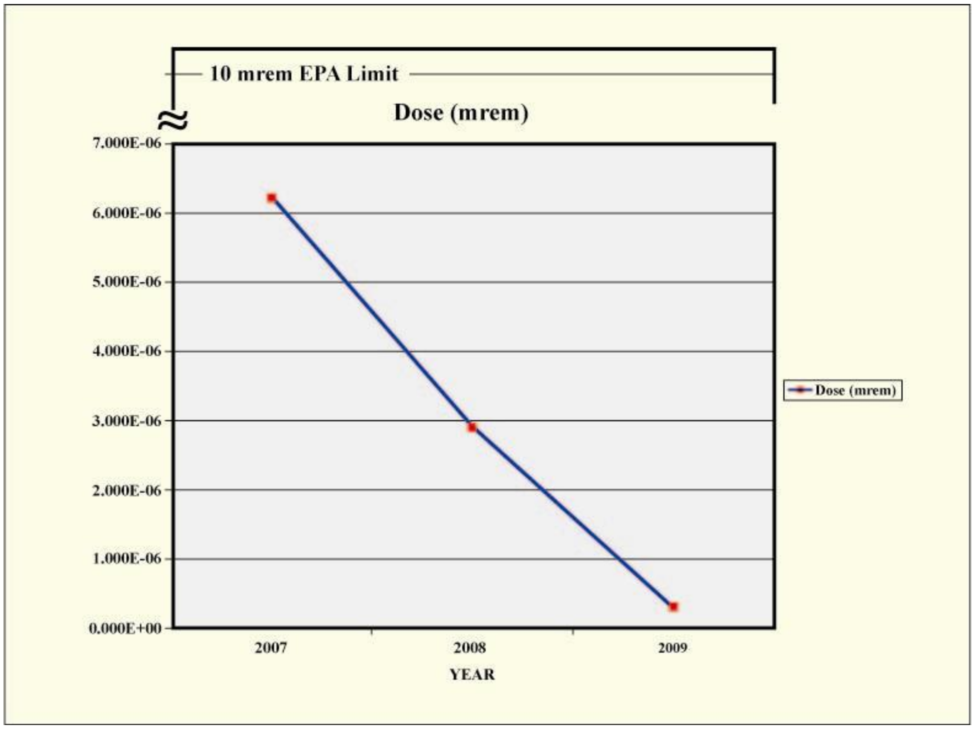


FIGURE 4.1 — *Trend of Cumulative Effective Dose Equivalent for Maximally Exposed Individual Member of the General Population 2007-2009*

biota concentration guide (BCG) limits in the technical standard. Available concentration data for radionuclides in each environmental medium were entered into the calculation tool. The value for each radionuclide was automatically divided by the BCG for that radionuclide to calculate a partial fraction for each nuclide for each medium. Partial fractions for each medium were added to produce a sum of fractions.

The dose limit for aquatic animals may be assumed to have been met if the sum of fractions for the water medium plus that for the sediment medium is less than 1.0. Similarly, the dose limits for both terrestrial plants and animals may be assumed to have been met if the sum of fractions for the water medium plus that for the soil medium is less than 1.0. The maximum site concentrations for each medium, applicable BCGs, partial fractions, and sums of fractions are illustrated in Tables 4.3a and 4.3b. As the sum of fractions for the aquatic system and the terrestrial system are 2.20×10^{-2} and 7.42×10^{-4} respectively, applicable BCGs were met for both evaluations. It can, therefore, be concluded that populations of aquatic and terrestrial biota on and near the Pantex site are not being exposed to doses in excess of the existing DOE dose limits.
and near the Pantex site are not being exposed to doses in excess of the existing DOE dose limits.[8]

---

[8] The largest results from similar calculations using data obtained during monitoring in several offsite playa basins performed by the TDSHS during 2009 (Tucker, 2010) were total fractions of 2.14×10^{-4} and 1.21×10^{-7} for the aquatic and terrestrial systems respectively. As was the case with the B&W Pantex data, a limited amount of co-located sediment and water samples required the use of an isotope-specific solid/solution distribution coefficient to determine the aforementioned fractions.

TABLE 4.3a — *Evaluation of Dose to Aquatic Biota in 2009*

Nuclide	Water Concentration (pCi/L)	BCG (Water) (pCi/L)	Partial Fraction (Water)	Sediment Concentration (pCi/g)	BCG (Sediment) (pCi/g)	Partial Fraction (Sediment)	Sum of Fractions (Water & Sediment)
Hydrogen-3	47.60	2.65E+08	1.80 E-07	0.21	3.74 E+05	5.61 E-07	7.40 E-07
Uranium-234	2.62	2.02E+02	1.30 E-02	0.96	5.27 E+03	1.82 E-04	1.32 E-02
Uranium-235	0.01	2.18E+02	4.60 E-05	5.00 E-04[a]	3.72 E+03	1.34 E-07	4.61 E-05
Uranium-238	1.86	2.23E+02	8.33 E-02	0.85	2.49 E+03	3.42 E-04	8.67 E-03
Plutonium-239	0.01	1.87E+02	5.36 E-04	0.02	5.86 E+03	3.41E-06	5.70 E-05
Sum of Fractions			2.14 E-02			5.28 E-04	2.20 E-02

[a] In both Table 4.3a and 4.3b, the sediment/soil concentration value for this isotope (nuclide) is estimated and is the product of an isotope–specific solid/solution distribution coefficient and the concentration of the isotope in the water sample.

TABLE 4.3b — *Evaluation of Dose to Terrestrial Biota in 2009*

Nuclide	Water Concentration (pCi/L)	BCG (Water) (pCi/L)	Partial Fraction (Water)	Soil Concentration[a] (pCi/g)	BCG (Soil) (pCi/g)	Partial Fraction (Soil)	Sum of Fractions (Water & Soil)
Hydrogen-3	47.60	2.31 E+08	2.06 E-07	0.21	1.71 E+05	1.23 E-06	1.44 E-06
Uranium-234	2.62	4.04 E+05	6.48 E-06	0.96	5.13 E+03	1.87 E-04	1.94 E-04
Uranium-235	0.01	4.19 E+05	2.38 E-08	5.00 E-04[a]	2.84 E+03	1.76 E-07	2.00 E-07
Uranium-238	1.86	4.06E+05	4.58 E-06	0.85	1.58 E+03	5.39 E-04	5.43 E-04
Plutonium-239	0.01	2.00 E+05	4.99 E-08	0.02	6.12 E+03	3.28 E-06	3.32 E-06
Sum of Fractions			1.13 E-05			7.31 E-04	7.42 E-04

B&W Pantex intends to continue to evaluate the exposure of aquatic and terrestrial biota and make changes to the monitoring program for affected populations in future years based upon the results obtained.

4.3.3. Dose Comparisons

The calculated doses to the public and to the environment from Plant operations discussed above are minute when compared to those from naturally occurring sources and those from other man-made sources such as medical treatments and consumer products (TV, smoke detectors, etc.)[9]. The estimated total average annual effective dose equivalent to any individual member of the U.S. population from ubiquitous background (formerly known as natural background) sources [including approximately 0.33mSv (33mrem) from external radiation from space (primarily cosmic-rays that strike the upper atmosphere); 0.21mSv (21mrem) from external terrestrial radiation sources; 0.29mSv (29mrem) resulting from the ingestion of radionuclides into the body; and 2.28mSv (228mrem) from inhalation of radionuclides (such as radon) into the body] is 3.11 mSv (311mrem) (NCRP, 2009). A comparison of the dose rates from several sources is illustrated at Figure 4.2. The Pantex doses are several orders of magnitude smaller than the smallest doses illustrated.

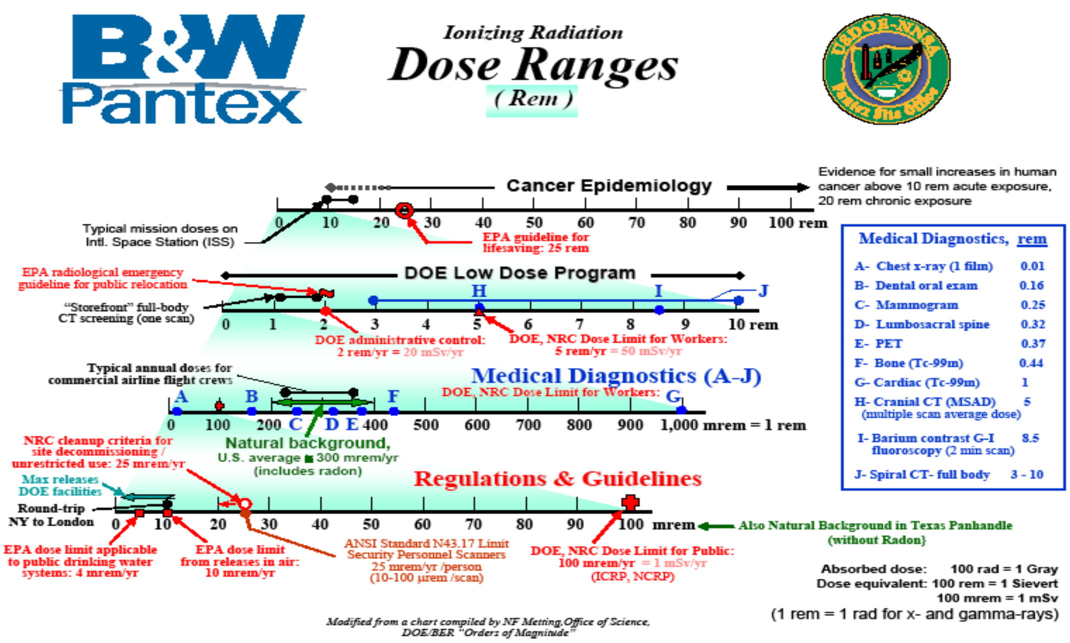


FIGURE 4.2 – *Comparison of Ionizing Dose Ranges*

4.4 Release of Property Containing Residual Radioactive Material

DOE Order 5400.5 provides release limits and requirements for the release of potentially contaminated materials from the Pantex Plant to the public. The order distinguishes real property

[9] The National Council on Radiation Protection and Measurement (NCRP) has recently published a detailed report on exposures from these and other types of radiation sources in NCRP Report No. 160 "Ionizing Radiation Exposure of the Population of the United States" (NCRP, 2009). This report updates and replaces NCRP Report No. 93 (NCRP, 1987a) with the same title.

(land and structures) from personal or non-real property (any materials not land and structures) in its discussion of release protocol and limits. To implement the requirements of this Order, DOE requires that the property that has been or is suspected of being contaminated with radioactive material be adequately surveyed (radiologically characterized) to ensure that the property meets approved authorized limits or release guidelines prior to release to the public. The requirements for release of materials and equipment from radiological areas to controlled areas within the Plant are provided in 10 CFR 835. The application of DOE 5400.5 and 10 CFR 835 release requirements independently would provide a two-tiered system for release; i.e., one set of criteria would apply to release of property from a radiological area to a controlled area, and then another set of criteria would then be applied to release the property from the controlled area to the public. At Pantex, in the interest of efficiency, simplicity, and effectiveness, property is released with the consistent and appropriate application of one set of release criteria. In effect, DOE 5400.5 provides the limits and protocol for all property release. Table 4.4 indicates the DOE 5400.5 (and, therefore, the Pantex) release limits.

TABLE 4.4 — ***Surface Activity Limits -Allowable Total Residual Surface Activity (dpm/100 cm^2)***

Radionuclides	Average	Maximum	Removable
Group 1 - Transuranics, I-125, I-129, Ac-227, Ra-226, Ra-228, Th-228, Th-230, Pa-231	100	300	20
Group 2 - Th-natural, Sr-90, I-126, I-131, I-133, Ra-223, Ra-224, U-232, Th-232	1,000	15,000	200
Group 3 - U-natural, U-235, U-238 and associated decay products, alpha emitters	5,000	15,000	1,000
Group 4 - Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000	15,000	1,000
Tritium (applicable to surface and subsurface)	NA	NA	10,000

Since 1993 the Pantex Plant's release process, as stated in the *Pantex Radiological Control Manual* (PRCM), requires the Radiation Safety Department's (RSD's) evaluation of any materials exiting a radiological area to ensure criteria for unrestricted release. To release material from Pantex Plant in general requires:

- RSD approval for material that is to be excessed
- PX-4008, "Waste Operations Department Scrap Metal Disposition Form," for disposition of any scrap metal (in compliance with Secretary Richardson's moratorium on recycling certain metals)
- PX-2643, "Material Evaluation Form," for release of all waste
- PX-691, "Shipment Request," for release of outbound non-weapon shipments
- PX-2189, "Radiation Safety Material Clearance," for components and other items not covered by one of the preceding methods.

The volume of radiological waste generated at Pantex during 2009 is discussed in Section 2.10.1. No other releases of property containing residual radioactive material occurred.

4.5 Unplanned Releases

No unplanned releases of radioactive material occurred at Pantex Plant during 2009.

4.6 Environmental Radiological Monitoring

4.6.1 Environmental Dosimetry

The environmental dosimetry program uses thermoluminescent dosimeters (TLDs) to measure gamma radiation on and around Pantex Plant. This program has been conducted at several locations in parallel with the Texas Department of State Health Services (TDSHS) since the early 1980s (Table 4.5). During 2009, Pantex Plant and TDSHS co-sampled at eight locations (one onsite, six along the perimeter fence, and one offsite). The Plant also monitored independently at four other locations onsite and four offsite or perimeter locations while TDSHS monitored independently at four other offsite or perimeter locations. Pantex Plant's TLDs are generally placed at the same locations where Pantex Plant operates air monitors, as discussed in Chapter 5 (Figure 5.3). Figure 4.3 shows the locations of the Plant's dosimeters during 2009. Pantex Plant's TLDs are analyzed and replaced at the end of each calendar quarter. The data provide the cumulative radiation exposure at each location over the approximately 90 days of uninterrupted deployment they receive while exposed to the environment at the various locations.

Table 4.5 lists results for 2009, and reflects the dose that an individual would have received at the TLD location, if the person were present continuously for a full quarter. The average quarterly dose for all onsite locations during 2009 was approximately 19.4 mrem. The equivalent average annual dose is 77.8 mrem/year (0.78 mSv/year). The average quarterly dose at TLD monitoring locations which are located in the direction of the predominant wind direction at the Pantex Plant (and thus the expected direction in which theoretical releases of radiological material from Pantex in excess of background would be expected to travel) was 20.9 mrem (equivalent to 83.6 mrem/year or 0.84 mSv/year), while the quarterly dose at upwind locations (those locations which are located in the direction opposite to the predominant wind direction) averaged 21.1 mrem (equivalent to 84.3 mrem/yr or 0.84 mSv/year). Although quarterly measurements during the winter quarter (when the northern hemisphere is closest to the sun and levels of cosmic radiation are highest) were generally higher than during other quarters, the average of quarterly measurements at only one location (FD-06) exceeded the quarterly average dose of 22.2 mrem (equivalent to 89.0 mrem/year or 0.89 mSv/year) measured at the background or control location at Bushland, Texas, for the same period. All of the measured doses are similar to those obtained during previous years, and the equivalent average annual doses are of the same magnitude as the sum of the external components of ubiquitous background.[10]

[10] The external components of ubiquitous radiation include radiation from space incident on the earth's atmosphere and radiation from radionuclides in the environment (primarily the earth). Although on the average, these sources are of approximately equal magnitude, soil concentrations of the principal sources of terrestrial radiation are variable (NCRP, 2009). Accordingly, due to slightly higher soil concentrations of these sources, the indicated sum in the Texas Panhandle is slightly higher than the national average and is approximately 1 mSv/yr (100 mrem/yr).

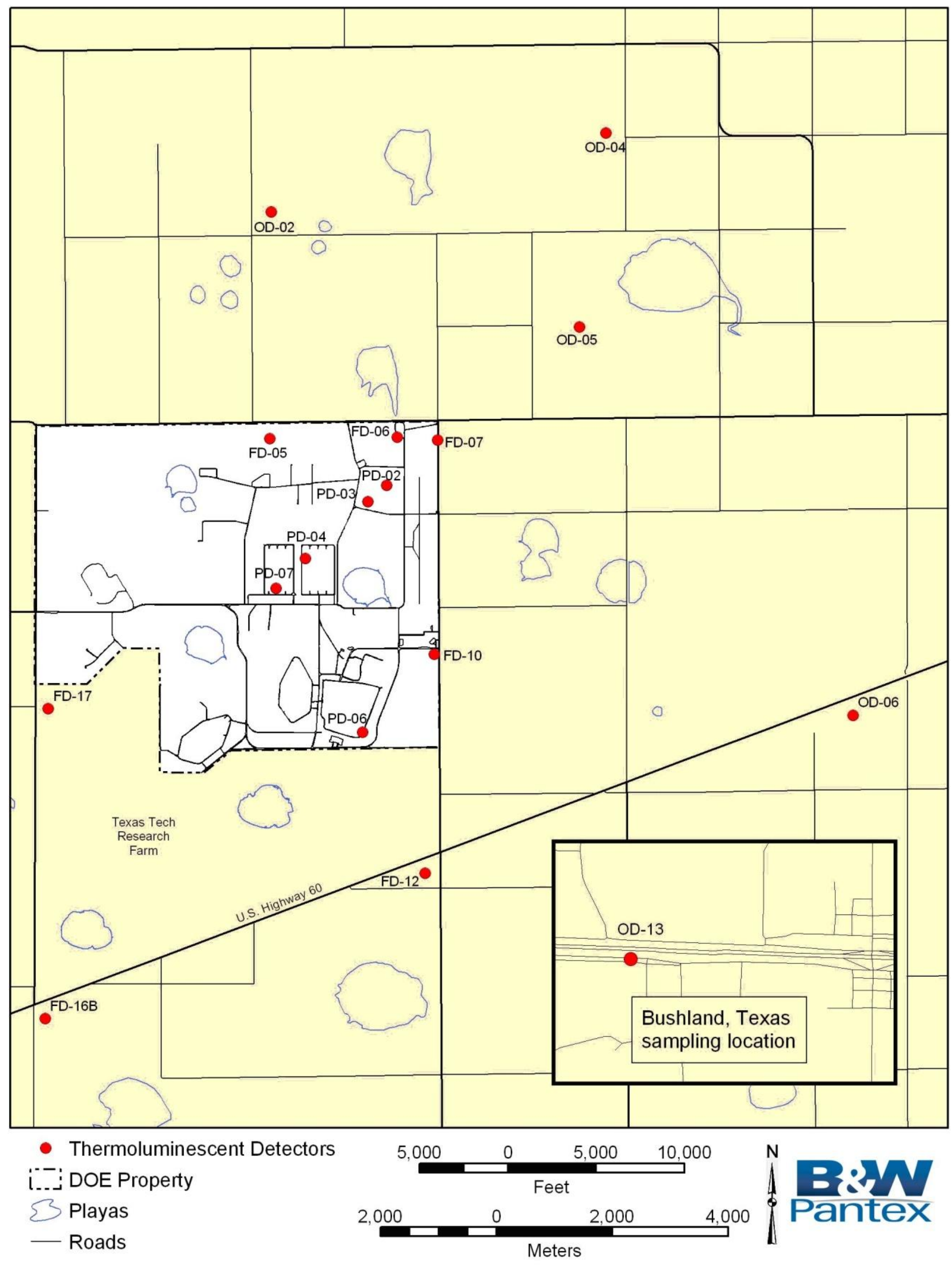


FIGURE 4.3 — *Locations of Pantex Plant Thermoluminescent Dosimeters*

TABLE 4.5 — *Environmental Doses Measured by Thermoluminescent Dosimeters in 2009, in millirem*[11]

Location	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Avg. Qtrly
Onsite					
PD-02	19.0	19.0	20.0	20.0	19.5
PD-03	18.0	17.0	17.0	19.0	17.8
PD-04	24.0	20.0	21.0	22.0	21.8
PD-06 [a]	20.0	18.0	18.0	19.0	18.8
PD-07	20.0	19.0	19.0	20.0	19.5
Upwind					
FD-10 [a]	22.0	20.0	20.0	N/S[b]	20.7
FD-12 [a]	24.0	20.0	21.0	22.0	21.8
FD-16B [a]	22.0	19.0	20.0	21.0	20.5
FD-17[a]	23.0	20.0	20.0	24.0	21.8
OD-06	23.0	19.0	20.0	21.0	20.8
Downwind					
FD-05 [a]	23.0	20.0	21.0	21.0	21.2
FD-06 [a]	24.0	22.0	23.0	24.0	23.2
FD-07 [a]	20.0	18.0	20.0	N/S[b]	19.3
OD-02	20.0	19.0	20.0	21.0	20.0
OD-04 [a]	22.0	20.0	20.0	21.0	20.8
OD-05	23.0	19.0	17.0	24.0	20.8
Control					
OD-13	24.0	20.0	21.0	24.0	22.2
Blank Correction	2.0	2.0	1.0	0.0	

[a] Locations co-sampled with Texas Department of State Health Services (TDSHS). Results for the TDSHS monitoring program during 2009 at the indicated co-sampling locations were not available at the time this document was prepared.
[b] The TLDs from these locations appeared to have been damaged during rain and/or snowfall which occurred in the vicinity of Pantex during the fall of 2009. The average quarterly doses for the indicated locations are the averages of the remaining quarterly measurements.

4.6.2 Other Environmental Measurements of Radiation

Gamma monitoring within Zone 4 West, which was discussed in the *2005 Site Environmental Report*, using Reuter-Stokes™ gamma radiation detectors/monitors (pressurized ionization chambers) was discontinued in 2006. A review of records from the RSD's periodic surveys conducted within and near the several magazines within Zone 4 during 2009 continued to indicate evidence of seasonality between the several quarterly measurements as the measurements taken

[11] All measurements have been "blank corrected." This is accomplished by measuring the residual doses on dosimeters which have been stored in a location where they receive no exposure during the same period as those dosimeters which have been deployed at the indicated locations. The residual dose (the blank correction for each quarter) which was subtracted from the raw data of the deployed dosimeters is indicated in the table.

during the winter quarter (when the northern hemisphere is closest to the sun and levels of cosmic radiation are highest) are generally higher than those taken during the remainder of the year. However, in a similar manner to measurements taken during the last several years, the background dose rate baseline (15.2 μrem/hr) from the survey conducted in 1994 at the time the (then) Secretary of Energy signed a Record of Decision (ROD) for the *Interim Storage of Plutonium Components at Pantex* was not exceeded during 2009.

B&W Pantex will continue to obtain and review records of the RSD's periodic surveys conducted within and near the several magazines within Zone 4 West as a portion of continuing to ensure that the DOE/NNSA public dose limit for all exposure modes from all DOE/NNSA sources of radiation is not exceeded.

As discussed in the previous section, none of the doses measured by the Pantex Radiological Environmental Monitoring Program is distinguishable from the external components of ubiquitous background radiation levels during the past 5 years in the Texas Panhandle (about 100 mrem).

4.7 Conclusions

The environmental radiological monitoring program at Pantex Plant continues to provide information that supports the hypothesis that current Plant operations do not have a detrimental effect on the quality of the environment at or near the Pantex Plant.

Air Monitoring

Radiological ambient air monitoring was conducted at 26 locations; the maximum radiation levels measured at any station were less than 0.08 percent of the allowable standard.

5.1 The Scope of the Program

Monitoring and sampling to detect possible airborne emissions of pollutants at Pantex Plant is conducted as a part of environmental surveillance conducted at onsite and offsite locations. The monitoring program at Pantex Plant has been described in several documents [e.g., the *Environmental Information Document* (Pantex Plant, 1998)]. Some Pantex Plant operations are sources or potential sources of airborne emissions. Monitoring of ambient air[1] for releases of airborne emissions from Pantex Plant facilities has historically been done at fixed remote locations, primarily because of the lack of discrete release points at the facilities.

During current operations at Pantex Plant, various radioactive materials including tritium, plutonium, uranium, and miscellaneous sources (e.g., thorium, cobalt and cesium) may be present in the components of nuclear weapons being managed. However, in normal operating situations, the nature of the work at Pantex Plant and the physical form of the material are such that there is very little potential for the public, the environment, or Pantex Plant personnel to be affected by releases of radioactive materials as a result of Plant operations. As shown in Table 4.1, most of the small numbers of radionuclide releases during normal operations at Pantex Plant are tritium releases. Very small amounts of tritium escape as gas or vapor during normal operations, although some tritium vapor continues to be released into the atmosphere from the area of the accidental release that occurred in 1989. This incident is described in the *Environmental Information Document.*

5.2 Non-radiological Monitoring

As has been noted in previous annual reports, Pantex ceased using non-radiological ambient air monitors in 2003. However, a qualitative monitoring system has continued to operate at the Pantex Plant. During 2009, the Plant had three people certified by the Texas Commission on Environmental Quality under Title 30 of the Texas Administrative Code (TAC) Chapter 111 to perform Visual Emission Evaluations (VEE). A VEE is conducted to Visually Determine the Opacity of Emissions from Stationary Sources (exhaust stacks). A certified VEE Evaluator must renew certification every 6 months. No VEEs were conducted during the calendar year 2009.

5.3 Routine Radiological Air Monitoring

5.3.1 Collection of Samples

A total of 26 air monitoring stations were used to monitor for radionuclides in air in 2009. Four onsite monitoring stations, designated as PA-AR-XX (for Plant air) in the tables and as PA on the figures, are placed near operating areas where airborne releases could potentially occur (Figure 5.1).

---

[1] Ambient air monitoring refers to the monitoring of air at remote locations where it is assumed that the material (either radioactive material or hazardous pollutants) being measured and compared to some risk-based standard is well mixed in the atmosphere and that any concentration present represents what might be inhaled by an individual. This type of monitoring is distinguished from direct monitoring of emissions of the material at the stack or point of release.

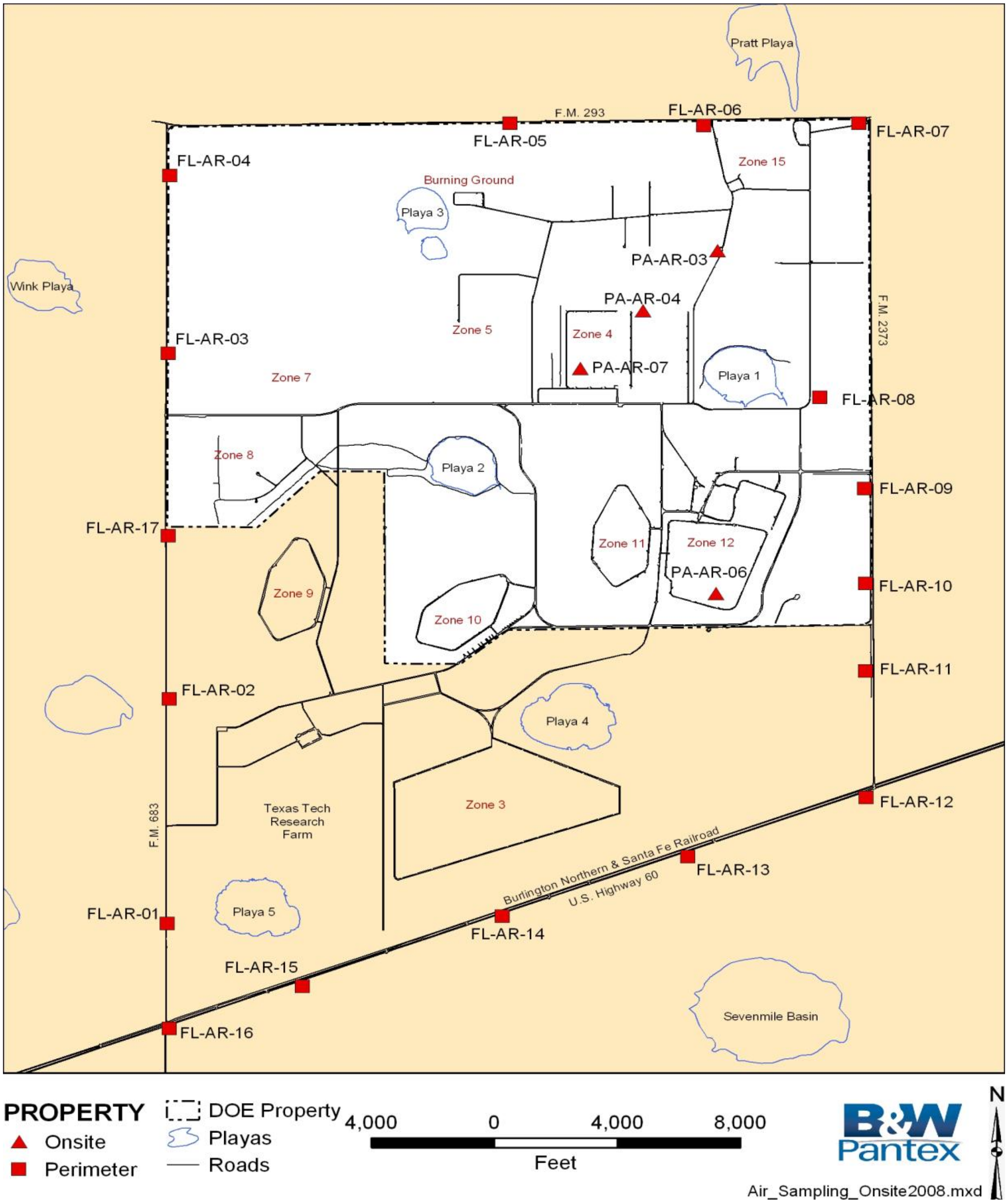


FIGURE 5.1 — ***Locations of Onsite and Fence Line Air Monitoring Stations***

Stations PA-AR-03 and PA-AR-04 are located around the firing sites to monitor areas contaminated with depleted uranium during test firing of components that contained uranium, which ceased in 1986. Station PA-AR-04 is adjacent to the north fence of Zone 4 East. Since the winds are predominantly from the south to southwest, this station is also used to monitor ambient air for potential releases of radioactive material during shipping and receiving operations conducted in Zone 4. Station PA-AR-06 is located near an area where nuclear components have been handled, and close to where the unplanned release of tritium occurred in 1989. Station PA-AR-07 is located so that it can monitor potential releases of radioactive material during shipping and receiving operations conducted in Zone 4.

Sixteen radiological monitoring stations, designated as FL-AR-XX (for fence line), along the Plant perimeter provide coverage in the principal compass directions and in directions where residences are located. The concerns of the Texas Department of State Health Services and other stakeholders were considered in establishing the locations. The fence line samplers at the southern end of the Plant are located south of U.S. 60. These locations were chosen for convenient access, to avoid the collection of dust generated by activities on the railroad (which is located adjacent to the southern boundary of the Plant), and to better represent air quality near actual residences.

Five offsite air monitoring stations designated as OA-AR-XX surround Pantex Plant (Figure 5.2). Stations OA-AR-02, OA-AR-04, OA-AR-05, and OA-AR-06 are about 8 kilometers (5 miles) from the center of Pantex Plant. The fifth offsite station, designated as OA-AR-13, is a control station and is located upwind at the U.S. Department of Agriculture - Agricultural Research Service Conservation and Production Research Laboratory at Bushland, Texas.

Air monitors were operated according to the schedule shown in Table 5.1 below. This schedule was designed to reduce costs associated with environmental monitoring while still ensuring that any hypothetical releases of radiological material to the atmosphere from Pantex Plant operations could still be adequately characterized. The four remaining onsite locations as well as the control location were scheduled to be operated continuously.

Several fence line monitoring stations (those designated as FL-AR-03, -04, -05, -06, -07, and -08 in addition to those designated as OA-AR-02, -04, and -05) located in the direction of the predominant wind direction at the Pantex Plant (and thus the expected direction in which theoretical releases of radiological material from Pantex would be expected to travel) were operated more frequently than those which are located in the direction opposite to the predominant wind direction (i.e., those located upwind from the Pantex Plant). Monitoring stations designated as FL-AR-01, -02, -09, -10, -11, -13, -14, -15, -16, and -17, as well as that designated OA-AR-06 are included in the latter category. (As noted previously, all locations are illustrated at Figures 5.1 and 5.2.)

Each monitoring station was equipped with a high-volume air sampler and a low-volume air sampler (See Figure 5.3). At far-left is a container for the co-located TLD discussed in Chapter 4. The high-volume sampler is located on the left and a "doghouse" containing the low-volume sampler on the right.) The samplers (when operated) ran continuously, and filters or silica gel samples were collected from the samplers on a (nominally) weekly basis. Operational characteristics of the samplers, such as the length of the sample collection period (known as the "run time"), the beginning and ending flow rates, and other parameters were recorded by the sampling technicians at the initiation and/or at the completion of the sampling activity.

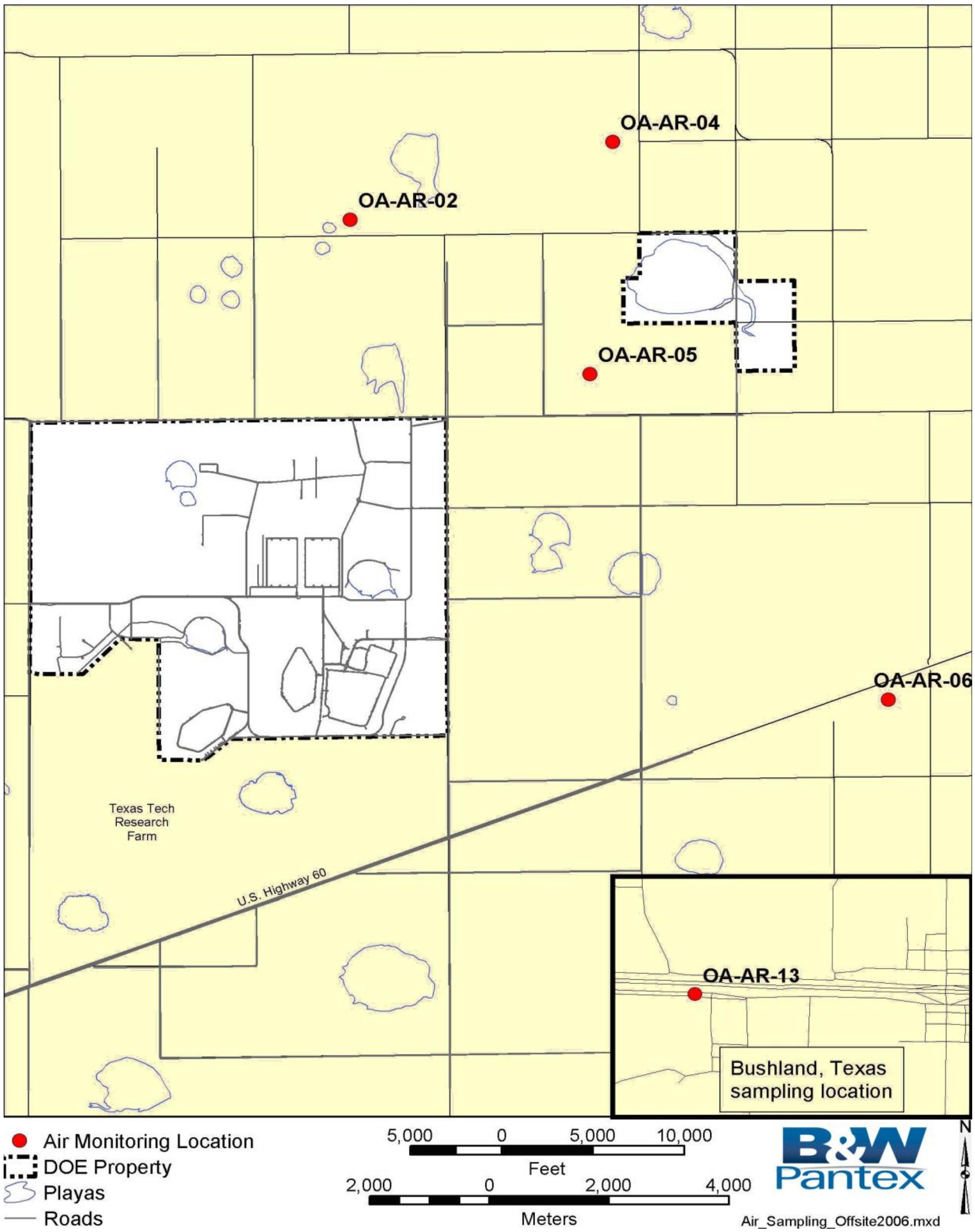


FIGURE 5.2 — ***Offsite Air Sampling Stations***

TABLE 5.1 — *2009 Schedule for Air Sampling and Analysis*

Location	Month											
Onsite	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
PA-AR-03	X	X	X	X	X	X	X	X	X	X	X	X
PA-AR-04	X	X	X	X	X	X	X	X	X	X	X	X
PA-AR-05	X	X	X	X	X	X	X	X	X	X	X	X
PA-AR-06	X	X	X	X	X	X	X	X	X	X	X	X
Fence line												
FL-AR-01	X			X			X			X		
FL-AR-02		X			X			X			X	
FL-AR-03	X			X	X		X	X		X		
FL-AR-04		X		X		X	X		X		X	
FL-AR-05			X		X			X	X			X
FL-AR-06	X	X		X			X			X	X	
FL-AR-07	X		X		X			X		X		X
FL-AR-08		X	X			X			X		X	X
FL-AR-09	X			X			X			X		
FL-AR-10		X			X			X			X	
FL-AR-11			X			X			X			X
FL-AR-12	X			X			X			X		
FL-AR-13		X			X			X			X	
FL-AR-14			X			X			X			X
FL-AR-15	X			X			X			X		
FL-AR-16		X			X			X			X	
FL-AR-17			X			X			X			X
Offsite												
OA-AR-02	X	X		X			X			X	X	
OA-AR-04	X		X		X			X		X		X
OA-AR-05		X	X			X			X		X	X
OA-AR-06	X			X			X			X		
Control												
OA-AR-13	X	X	X	X	X	X	X	X	X	X	X	X

FIGURE 5.3 – *Typical Air Monitoring Site*

The high-volume samplers operated at a flow rate of approximately 1.13 cubic meters per minute [40 ft^3 per minute (ft^3/min or more commonly cfm)]. During sampling, particles were collected on 20 × 25-centimeter (8 × 10-inch) filters. Each air filter sample included particulate matter from about 11,400 cubic meters of air (~ 403,000 ft^3). Weekly samples for a given month were combined as one sample for later analysis for ^{234}U, ^{238}U, and ^{239}Pu by a radiological analysis laboratory.

Nominal airflow through the low-volume air samplers was much smaller than that for the high-volume samplers, being 42.5 liters per minute (1.5 ft^3/min). Each low-volume sampler contained silica gel within the "U-tube" illustrated at Figure 5.4. The silica gel acted as a desiccant, removing water vapor (including any tritiated water vapor) from air as it flowed through the sampler. The silica gel samples were collected at the same time as the individual filters were collected from the high-volume samplers (i.e., weekly). Any tritiated water vapor present in the sampled air was recovered and quantified during later analysis of the silica gel by a radiological analysis laboratory.

FIGURE 5.4 – ***Low-Vol Sampling Apparatus***

5.3.2 Sample Analysis Results

All analytical results obtained from the laboratory were converted to concentrations in air by dividing the quantity of radionuclide collected in the sample by the volume of air sampled. This quantity was calculated using the operational characteristics recorded by the sampling technicians and (when necessary) temperature, pressure, and relative humidity data obtained from the meteorological tower described in Section 1.4.

Tables 5.2 through 5.5 summarize several values for each of the several analytes in each of the four categories of monitoring stations [onsite, upwind, downwind, and control (or background)]. The values indicated are: the mean and the standard deviation; the maximum value and its associated counting error; the historical background; and the Derived Concentration Guide (DCG) are also shown for comparison.

TABLE 5.2 —*Concentrations of Radionuclides in Air[a] for 2009 at Onsite Locations*

Radionuclide	Number of Samples Collected/Planned[b]	Mean ±Std. Dev.	Max ±Counting Error	Hist. Bkgd.	DCG
^{3}H	192/200	6.07 ± 14.42	70.76 ± 7.26	12.30	1,000,000
$^{233/234}U$	46/48	23.36 ± 9.12	42.32 ± 6.75	115.00	90,000
^{238}U	47/48	22.29 ± 9.78	44.95 ± 6.98	121.00	100,000
$^{239/240}Pu$	47/48	0.32± 0.57	3.78 ± 1.82	0.84	20,000

[a] Units in all tables are x 10^{-13} µCi/mL for ^{3}H measurements and x 10^{-18} µCi/mL for α-emitting radionuclides ($^{233/234}U$, ^{238}U, and $^{239/240}Pu$).
[b] Differences between the number of samples planned and those collected in all tables was due to sample non-collection during a period when the power supply to the monitor was disabled, sample breakage at the analysis laboratory, resource constraints, or other reasons.

TABLE 5.3 — *Concentrations of Radionuclides in Air[a] for 2009 at Upwind Locations*

Radionuclide	Number of Samples Collected/Planned[bc]	Mean ±Std. Dev.	Max ±Counting Error	Hist. Bkgd	DCG
^{3}H	117/182	0.99 ± 4.98	28.59 ± 15.69	12.30	1,000,000
$^{233/234}U$	29/44	23.17 ± 7.76	39.69 ± 6.76	115.00	90,000
^{238}U	29/44	20.82 ± 9.44	39.82 ± 7.41	121.00	100,000
$^{239/240}Pu$	29/44	0.27 ± 0.29	0.94 ± 0.88	0.84	20,000

[C] See the discussion concerning the percentage of sample collection for this category of locations below.

TABLE 5.4 —*Concentrations of Radionuclides in Air[a] for 2009 at Downwind Locations*

Radionuclide	Number of Samples Collected/Planned[b]	Mean ±Std. Dev.	Max ±Counting Error	Hist. Bkgd	DCG
^{3}H	123/220	1.04 ± 4.38	15.83 ± 15.22	12.30	1,000,000
$^{233/234}U$	30/54	24.16 ± 7.41	44.92 ± 6.80	115.00	90,000
^{238}U	30/54	22.66 ± 7.32	43.55 ± 6.58	121.00	100,000
$^{239/240}Pu$	30/54	0.19 ± 0.20	0.62 ± 0.97	0.84	20,000

TABLE 5.5 — *Concentrations of Radionuclides in Air[a] for 2009 at the Background Location*

Radionuclide	Number of Samples Collected/Planned[b]	Mean ±Std. Dev.	Max ±Counting Error	Hist. Bkgd	DCG
^{3}H	28/50	-0.64 ± 5.50	14.14 ± 10.28	12.30	1,000,000
$^{233/234}U$	7/12	51.13 ± 14.36	72.88 ± 8.43	115.00	90,000
^{238}U	7/12	51.45 ± 15.62	73.80 ± 8.43	121.00	100,000
$^{239/240}Pu$	7/12	0.31 ± 0.30	0.75 ± 0.84	0.84	20,000

As shown in Table 5.3 above, a large number of planned samples were not collected for the upwind category of locations. Pantex collected approximately 96 percent of the planned samples at onsite locations but only 65 percent at upwind locations, 55 percent at downwind locations and 57 percent at the Bushland control location. Most of the "missing" samples are due to resource constraints caused by the increased groundwater sampling program discussed in Chapter 6. Intermittent power losses at other locations, low "moisture content" for tritium samples during the summer months, the destruction of the sampling equipment and infrastructure at the monitoring location designated as FL-AR-16 in a grassfire near that location in May 2008 and laboratory errors accounted for the remaining "missing" samples.

5.3.3. Data Interpretation

As in previous years, relatively high values of tritium at PA-AR-06 during 2009 occurred during periods of rapid changes in barometric pressure with the highest value (7.08 ± 0.73 aCi/mL) recorded on April 8, 2009. These measurements likely result from continued off-gassing from soils near Cell 1 during these pressure fluctuations. These measurements, however, continue a relative downward trend from those measured during the first few years after the 1989 release near this location.

The maximum measurements for the α-emitting radionuclides ($^{233/234}U$, ^{238}U, and $^{239/240}Pu$) during the year occurred during periods of agricultural activity and/or periods of high winds in the Texas Panhandle. Because these activities and/or meteorological phenomena would be expected to cause increased resuspension of dust into the atmosphere and because the relative maxima were observed to be occurring both upwind and downwind from Pantex Plant, it is likely that many of the maximum measurements represent the collection of increased quantities of naturally occurring radioactive material during these periods.

A review of the ratio of the mean values of the concentrations of $^{233/234}U$ and ^{238}U in each of the four categories of locations shows good correlations between the calculated means. The fact that the ratio of the activities of ^{234}U and ^{238}U is not much different from unity indicates radiological equilibrium between the two radionuclides and is another indication of the absence of any anthropogenic discharges of uranium during Pantex operations.

No radiological concentrations in ambient air during 2009 exceeded the applicable DCG for the radiological materials analyzed. Comparisons of the 2009 population and the data used to calculate the historical means in each of the four categories of monitoring stations, as well as comparisons of the 2009 data population for individual locations to historical data from the background location for each α-emitting radionuclide and tritium, generally indicate that all results are equivalent (i.e., results from areas affected by Pantex operations are not distinguishable from background).

5.4 Conclusions

The air monitoring program at Pantex Plant continues to provide information that supports the hypothesis that current Plant operations do not have a detrimental effect on the quality of the environment at or near Pantex Plant.

This page was intentionally left blank.

Groundwater Monitoring

Groundwater monitoring at Pantex Plant began in 1975, when the first investigative wells were installed. B&W Pantex completed its investigations in 2005 with the identification of contaminant plumes in the perched groundwater beneath Pantex Plant, Texas Tech University (TTU) property (south of Pantex), and to the east of Pantex. Previous investigative wells and new monitoring wells in the perched groundwater are now being used to monitor two remedial action systems: 2 pump and treat systems, with 72 operating extraction wells and 3 injection wells that are currently treating up to 550 gallons per minute of contaminated perched groundwater; and 2 in-situ bioremediation (ISB) systems southeast of Pantex Plant on TTU property and south of Zone 11 consisting of 74 treatment zone wells. The monitoring system was also developed to evaluate uncertainties at the remedial action units, provide early detection in the drinking water aquifer, and assess natural attenuation of contaminants of concerns (COCs) in the perched groundwater.

6.1 Groundwater at Pantex

Groundwater beneath the Pantex Plant and vicinity occurs in the Ogallala and Dockum Formations at two intervals (Figure 6.1). The first water-bearing unit below the Pantex Plant in the Ogallala Formation is a discontinuous zone of perched groundwater located at approximately 200 to 300 feet below ground surface and 100 to 200 feet above the drinking water aquifer. A zone of fine-grained sediment (consisting of sand, silt, and clay) that created the perched groundwater is found between the perched groundwater and the underlying drinking water aquifer. The fine-grained zone acts as a significant barrier to downward migration of contaminated water. The perched groundwater ranges in saturated thickness from less than a foot at the margins to more than 75 feet beneath Playa 1. Perched groundwater is formed by surface water in the playas that initially migrates down to the fine-grained zone. It then flows outward in a radial manner away from the playa lakes and is then influenced by the regional south to southeast gradient. The largest area of perched groundwater beneath Pantex is associated with natural recharge from Playas 1, 2, and 4, treated wastewater discharge to Playa 1, historical releases to the ditches draining Zones 11 and 12, and storm water runoff that drains to the unlined ditches and playas. Two hydraulically separate, relatively small, perched zones occur around Playa 3, near the Burning Ground in the north central portion of the Plant, and near the Old Sewage Treatment Plant in the northeast corner of Pantex (Figure 6.2).

The second water-bearing zone, known as the High Plains Aquifer, is located below the fine-grained zone in the Ogallala and Dockum Formations. The High Plains Aquifer is a primary drinking and irrigation water source for most of the High Plains. The groundwater surface beneath the Plant is approximately 400-500 feet below ground surface; saturated thickness is approximately 1 to 100 feet in the southern regions of the Plant and approximately 250 to 400 feet in the northern regions. In the vicinity of the Plant, the primary flow direction of the High Plains Aquifer is north to northeast due to the influence of the City of Amarillo's well field located north of the Plant.

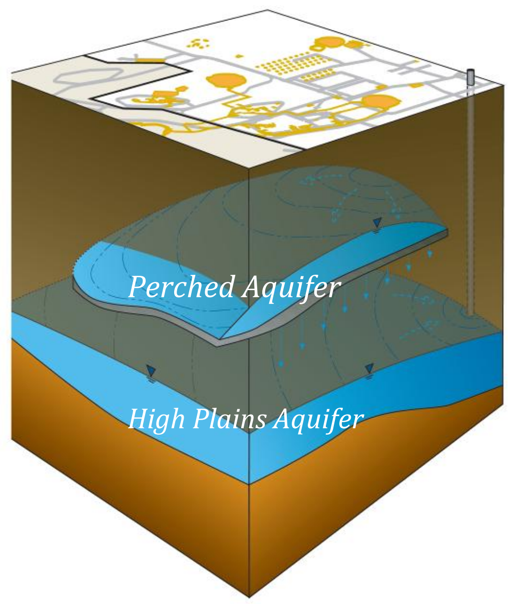


Figure 6.1 – *Groundwater Beneath Pantex*

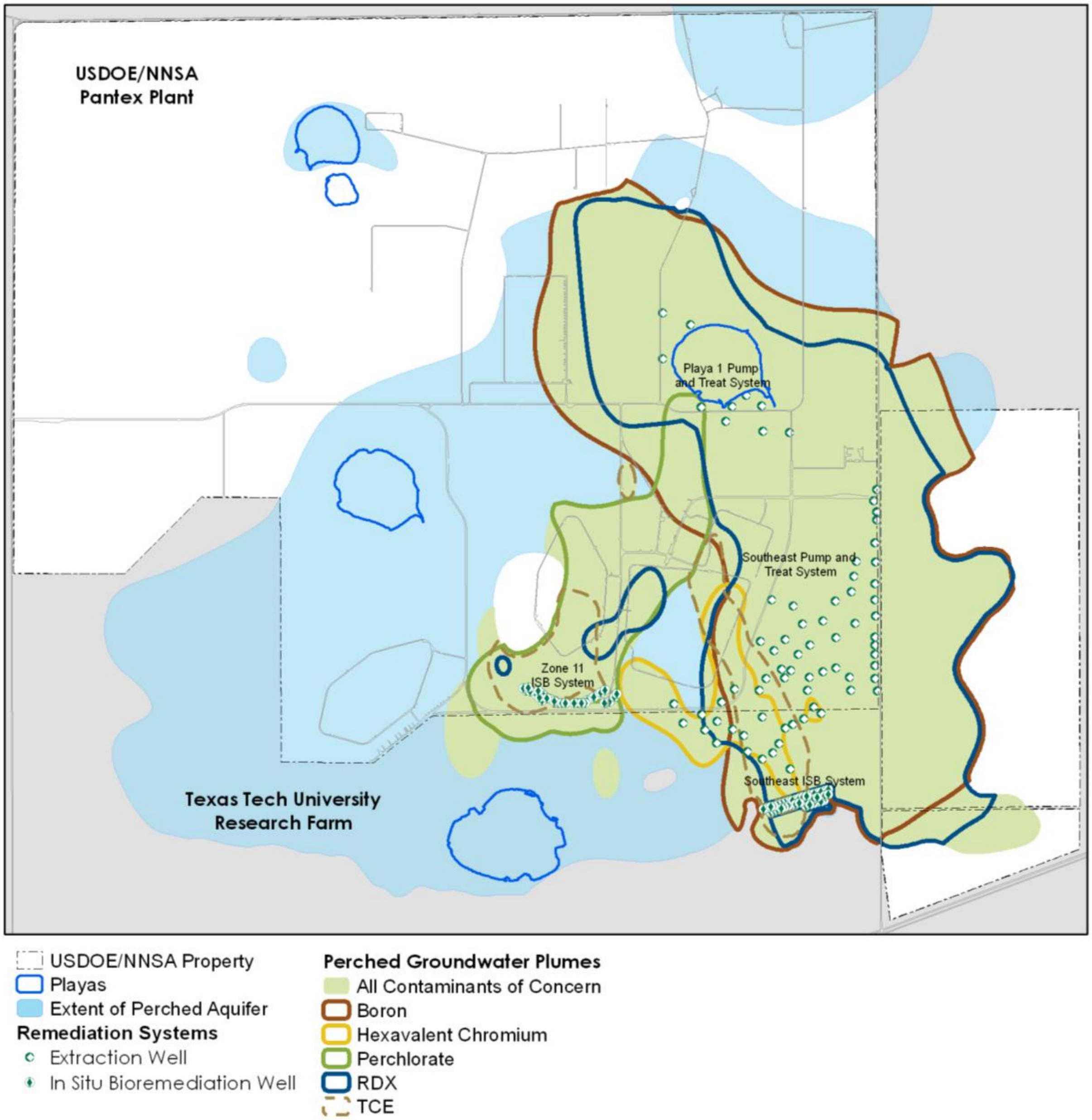


FIGURE 6.2 — ***Perched Groundwater Plumes and Remediation Systems***

Historical operations at Pantex Plant resulted in contamination of the larger perched groundwater area, and the contaminant plume has migrated past the Plant boundaries and beneath adjacent property to the south and east. Most of the impacted property to the east was purchased in 2008 to allow better access for monitoring and control of perched groundwater. The primary COCs in the perched aquifer are the explosives RDX and TNT and breakdown products, perchlorate, boron, hexavalent chromium, and trichloroethene (Figure 6.2). With the exception of one domestic supply well north of Pantex Plant, no public or private wells are completed in the perched groundwater in the immediate vicinity of Pantex

Plant. The domestic well north of the Plant is in an area that has not been impacted by historic operations. Perched groundwater is not used for industrial purposes at Pantex, although the treated perched groundwater is routed through the Wastewater Treatment Facility (WWTF) and is beneficially used for irrigation of crops.

Because concentrations of contaminants in the perched groundwater beneath the Plant's property and offsite to the south and east currently exceed drinking water standards, the water is not safe for domestic or industrial use. Onsite use of perched groundwater is restricted by Pantex Plant. TTU and one offsite property owner to the east have placed a deed restriction on their property to control use of perched groundwater and restrict drilling through the perched groundwater in areas that are impacted.

6.2 Long-Term Monitoring (LTM) Network

The purpose of the LTM network is to ensure that Remedial Action Objectives (RAOs) are being achieved. The RAOs and the corresponding LTM objectives are provided in the highlight box below.

Remedial Action Objectives	LTM Network Objectives
❖ Reduce risk of exposure to perched groundwater through contact prevention ❖ Achieve cleanup standard for perched COCs ❖ Prevent growth of perched groundwater contaminant plumes ❖ Prevent COCs from exceeding cleanup standards in the drinking water aquifer	❖ Remedial Action Effectiveness ❖ Plume Stability ❖ Uncertainty Management ❖ Early Detection ❖ Natural Attenuation of COCs

To ensure that the RAOs are achieved, wells and monitoring information were chosen with respect to specific objectives developed for the LTM network. The objectives are applied to perched and drinking water aquifer wells as appropriate. Pantex developed an *LTM System Design Report* (Pantex Plant, 2009a) and a *Sampling and Analysis Plan* (Pantex Pantex, 2009b) to detail the LTM network and monitoring. Those reports will be updated as the monitoring data are evaluated and changes are required.

The network monitoring information is evaluated quarterly, annually, and on a 5-year basis, with evaluations increasing in detail and complexity for each type of report. Those reports can be found online, as they become available, at www.pantex.com/about/environment/erDocs. This chapter is a summary of the information from the annual report. The following sections provide a summary of the evaluation of each LTM Network Objective.

6.3 The Scope of the Groundwater Monitoring Program

Groundwater is monitored at Pantex Plant in accordance with U.S. Department of Energy (DOE) Order 450.1A, "Environmental Protection Program," and the requirements of the Texas Commission on Environmental Quality (TCEQ) Compliance Plan CP-50284 (issued October 21, 2003 and corrected on March 15, 2004) associated with Hazardous Waste Permit HW-50284. Pantex is also subject to requirements in the Interagency Agreement (IAG), signed jointly by the U.S. Environmental Protection Agency (EPA) and TCEQ, and issued effective in 2008. A *Long-Term Monitoring System Design Report* and a new *Sampling and Analysis Plan*, approved by the EPA and TCEQ in July 2009, identified the final monitoring well network and the parameters to be monitored.

Table 6.1 summarizes the number of wells sampled in 2009 by function currently used in monitoring of the remedial actions and the number of samples taken at each well.

TABLE 6.1 — *Summary of Well Monitoring in 2009*

Well Type	Drinking Water Aquifer		Perched Groundwater	
	# Wells	# Analytes Sampled	# Wells	# Analytes Sampled
Long-Term Monitoring Well	34	2273	93	5574
Parked Wells (water level monitoring)	2	--	60	--
Pump & Treat Extraction Well	--	--	69	1215
***In Situ* Bioremediation Injection Well**	--	--	32	2669
Total	36	2273	254	9458

6.4 Remedial Action Effectiveness and Plume Stability

The purpose of the remedial action evaluation is to determine the effectiveness of remedial measures, indicate when remedial action objectives for perched groundwater have been achieved, and validate groundwater modeling results or provide data that can be used to refine modeling. The expected conditions for the remedial action effectiveness wells are that, over time, indicators of the reduction in volume, toxicity and mobility of constituents will be observed. These indicators include stable or decreasing concentrations of constituents or declining water levels in areas where remedial measures have been implemented.

The purpose of plume stability wells is to determine if impacted areas (plumes) of perched groundwater are expanding and affecting clean perched groundwater and to monitor the changes occurring within the perched plumes. The expected conditions for the plume stability wells are that, over time, a reduction in the toxicity and mobility of constituents will be observed.

The pump and treat systems and the ISB systems are the focus of remedial action effectiveness and plume stability evaluation for groundwater.

6.4.1 Pump and Treat Systems

The two pump and treat systems are designed to remove and treat perched groundwater, provide hydraulic control of plume movement away from Pantex, and reduce the saturated thickness of the perched to lessen the potential for impacted perched groundwater to migrate to the drinking water aquifer below. The systems were designed to remove and treat perched groundwater and reuse the treated water for beneficial use. The Southeast Pump and Treat System (SEPTS) was originally designed for injection of the treated water back into the perched zone and the injection capability remains while Pantex upgrades the WWTF and irrigation system to receive more water.

As presented in Section 3.7, the pump and treat systems continuously improved operations during the year. The SEPTS exceeded operational goals. The Playa 1 Pump and Treat System (P1PTS) is in its first year of operation and performance is expected to improve with time.

During the SEPTS long operational history, much of the treated water has been injected back into the perched zone until the remedial goal of reducing saturated thickness in the perched was evaluated. Pantex has focused on beneficial reuse of the water, to the extent possible, since release to the irrigation system began in May 2005. Despite some continued injection of treated water, water levels are beginning to decline in the areas downgradient of the pump and treat systems, with declines of up to 1 ft/yr in most wells that demonstrate a decreasing trend. A greater decline in water levels was observed around Playa 1, along the eastern fenceline, and on TTU property (Figure 6.3). Several wells did not demonstrate a trend in water levels and wells that were previously dry in 2008 remained dry. These observations indicated that the system is effective in reducing water levels in the perched aquifer and will assist with plume stability. The wells demonstrating an increasing trend were outside the influence of the pump and treat systems.

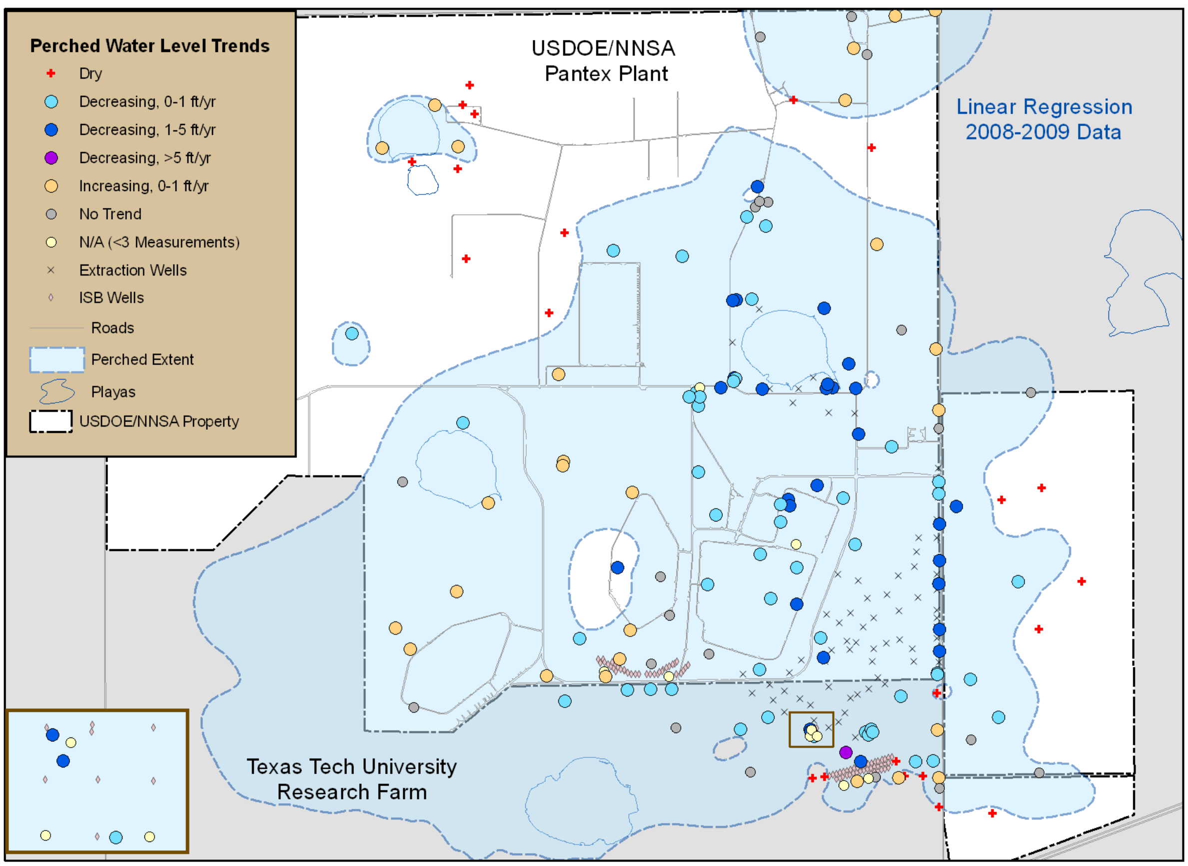


FIGURE 6.3 – ***Water Level Trends in the Perched Aquifer***

Plume stability is also evaluated to determine if the center of mass is still moving in the perched. Because many plumes are already to the extent of perched saturation, plume expansion is not a concern in most areas. Pantex evaluated RDX because its greatest extent has been known for a long period of time and it is the primary risk driver for groundwater. Because new wells were just installed over the last 1-2 years south of Zone 11, an evaluation of the plumes in that area is not yet possible. To represent the current impact of the remedial action systems on concentrations, the trends were calculated using the last 4 measurements.

Evaluation of concentration trends for RDX indicates that RDX is decreasing, stable, or does not demonstrate a trend at the source areas (Playa 1 and the ditch along the eastern side of Zone 12). This condition is expected as the source areas are predicted to continue contributing to the perched for up to 20 years, but at much lower concentrations than in the past. The SEPTS has had some effect on the plume as the majority of COC concentrations are declining or stable along the outer margins of the system, indicating that the plume is not continuing to move out towards the extent of the perched. The Southeast ISB has had some effect on wells to the south on TTU property as concentrations in those wells are stable or declining. This is a key area for declining concentrations because portions of that area are more sensitive to vertical migration to the deeper drinking water aquifer. Areas outside the influence of the remedial action systems were monitored in late 2009 for breakdown products of RDX to ensure that natural attenuation is occurring. That data will be evaluated over time to determine the rate of natural attenuation. RDX concentration trends are depicted in Figure 6.4.

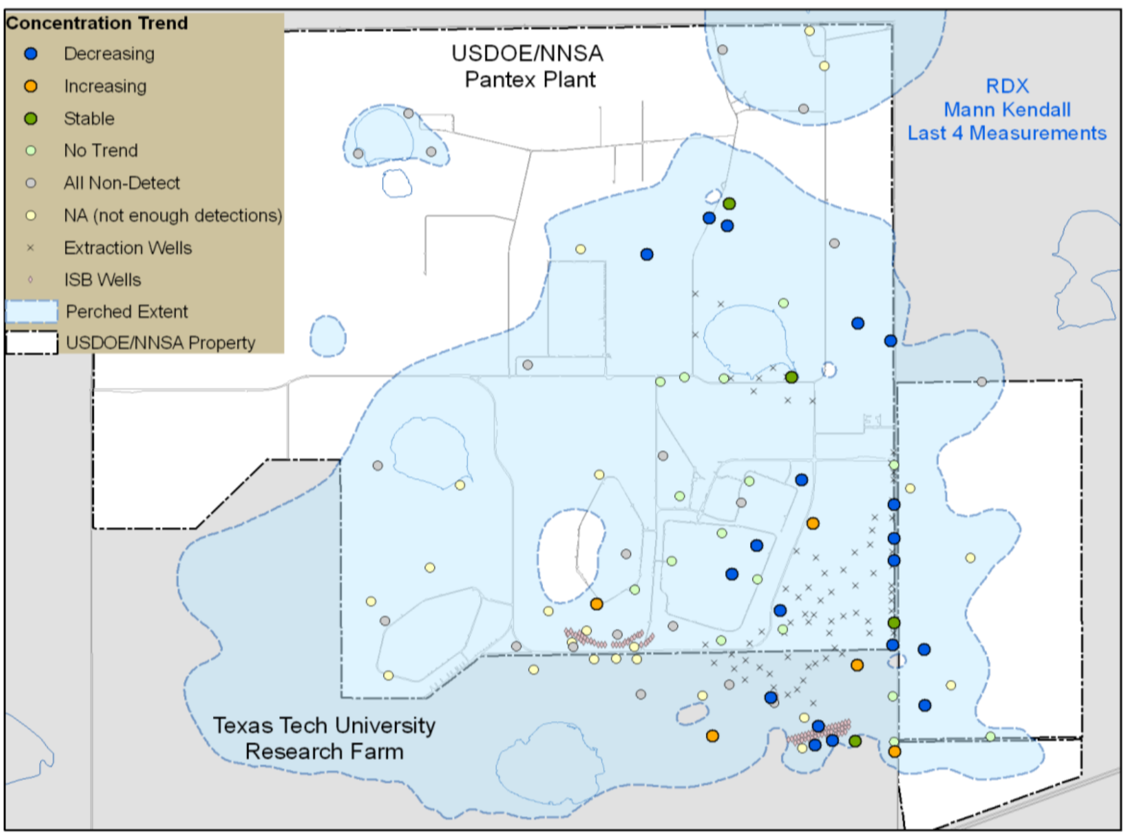


FIGURE 6.4 – *RDX Concentration Trends in the Perched Aquifer*

Other highlights of plume management include:

- Although not seen in trending because of few detections in the data set, perchlorate and trichloroethene (TCE) are increasing in wells southwest of Zone 11 on or near TTU property. The Zone 11 ISB system was installed to reduce concentrations in the plume. Those concentrations are expected to start declining in the next two years as the treatment zone reduces concentrations and the treated water moves downgradient.

- One well east of Zone 12, near the source areas, is increasing because of past effects of injection of treated water back into the perched zone. The previous lower concentrations are an artifact of injecting the treated water. Current plume concentrations are now entering that well and will be seen as an increasing trend.

6.4.2 In Situ Bioremediation Systems

The in situ bioremediation systems treat the impacted groundwater as it moves through the bioremediation zone with the goal of reducing concentrations below the Groundwater Protection Standard (GWPS) established in the CERCLA Record of Decision (ROD). This is achieved by injecting amendment and nutrients to stimulate resident bacteria. With complete reduction, the resident bacteria will reduce the COCs to less harmful substances.

Table 6.2 summarizes the treatment zone and downgradient conditions for each of the ISB systems. The conditions indicate that a reducing zone has been established at both ISB systems. The conditions found are expected for the zones, with the exception of the mild reducing conditions in the Zone 11 ISB. Generally, stronger reducing conditions are required for the reduction of TCE; however, the mild reducing conditions have been adequate for the reduction of TCE as presented in the following information for each ISB zone.

Table 6.2 -- ISB System Performance

	Treatment Zone Wells		Downgradient Performance Monitoring Wells	
System	**Reducing Conditions**	**Food Source Available**	**Primary Contaminate of Potential Concerns (COPCs) Reduced?**	**Degradation Products of COPCs Reduced?**
Zone 11 ISB	Mild	Yes	No[1]	No[1]
Southeast ISB	Mild	Yes	Yes	Yes

Mild conditions = 0 to -100 mV

[1] Downgradient wells are not expected to demonstrate reducing conditions for up to 2 years after treatment zone is established. Initial injection into treatment zone wells completed June 2009. Injection into new wells completed in November 2009.

The Southeast ISB was installed in 2007, with injection complete by March 2008. The system was installed with 42 treatment zone wells and six performance monitoring wells. Pantex monitors 8 treatment zone wells and five performance monitoring wells (see Figure 6.5 for wells that are sampled). This system has established an adequate reducing zone for the contamination that is present, based on geochemical conditions monitored at the treatment zone and results of monitoring. While the food source started declining during 2009, there is still a food source available for continued degradation of COPCs.

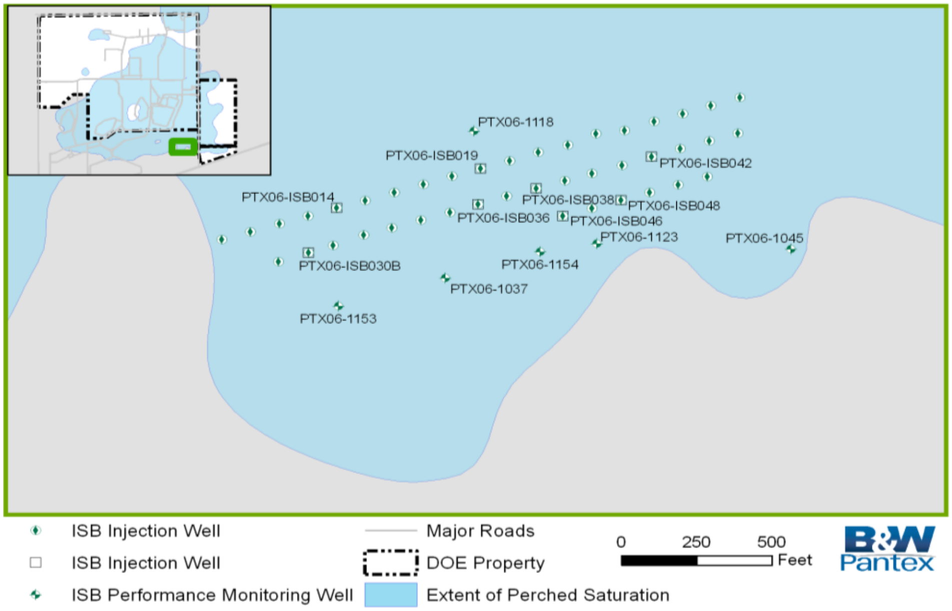


FIGURE 6.5 – *Wells Sampled at Southeast ISB*

The two closest downgradient monitoring wells for this system demonstrate that reduction of RDX is occurring as low concentrations of RDX and its breakdown products are present in samples. Although the hexavalent chromium (Cr^6) plume is primarily upgradient of the ISB, concentrations in the downgradient performance monitoring wells have declined below the GWPS established in the Compliance Plan and ROD. The downgradient performance monitoring well information is included in Table 6.3. Concentrations in wells further downgradient are expected to decline within the next year as the treated water moves into those areas. A second injection of amendment is planned for this system in early 2010 to ensure continued reducing conditions.

Pantex also monitors for degradation products of RDX to evaluate whether complete breakdown is occurring. Monitoring results for the system indicate that RDX and breakdown products (MNX, DNX, and TNX) are present in downgradient performance monitoring wells. TNX, the final degradation product, is the best indicator of degradation because the other intermediate products (MNX, DNX) degrade rapidly and do not accumulate in the environment. As shown in Figure 6.6, TNX concentrations are high relative to the GWPS of two ppb in the Southeast ISB area; however, initial RDX concentrations were high compared to TNX concentrations. Although TNX concentrations are high in PTX06-1123, the initial RDX concentrations measured in that well in 2008 were 3,620 ppb. TNX concentrations in the treatment zone areas are expected to decline as biodegradation continues. This can be seen in PTX06-1123. TNX concentrations spiked as RDX decreased and then TNX started declining in a sample taken in August 2009.

Table 6.3 – *Summary of Southeast ISB Performance Monitoring Well Data*

Well ID	Cr^{6} 2008 Max	Cr^{6} 1Q2009	Cr^{6} 2Q2009	Cr^{6} 3Q2009	Cr^{6} 4Q2009	RDX 2008 Max	RDX 1Q2009	RDX 2Q2009	RDX 3Q2009	RDX 4Q2009
PTX06-1037	66			<15		1570			74	
PTX06-1045				<15		2130			2100	
PTX06-1118*	325	--		323		1840	1500		1300	
PTX06-1123	4.44	--		<15		3620	590		160	
PTX06-1153					<15					170
PTX06-1154					<15					--

Concentrations provided in ug/L.
Highlights indicate the two downgradient wells that demonstrate the ISB system effectiveness.
Blank spaces indicate no samples were collected.
The "—" symbol indicates that the sample was rejected due to interferences or problems with the sample at the laboratory.
PTX06-1118* is upgradient to the ISB system and is used to monitor the influent COC concentrations. This well may not demonstrate decreasing concentrations unless it is affected by the treatment zone inadvertently.
PTX06-1153 and PTX06-1154 were installed in late 2009 so no preinjection data are available. These wells appear to be demonstrating decreasing concentrations already.

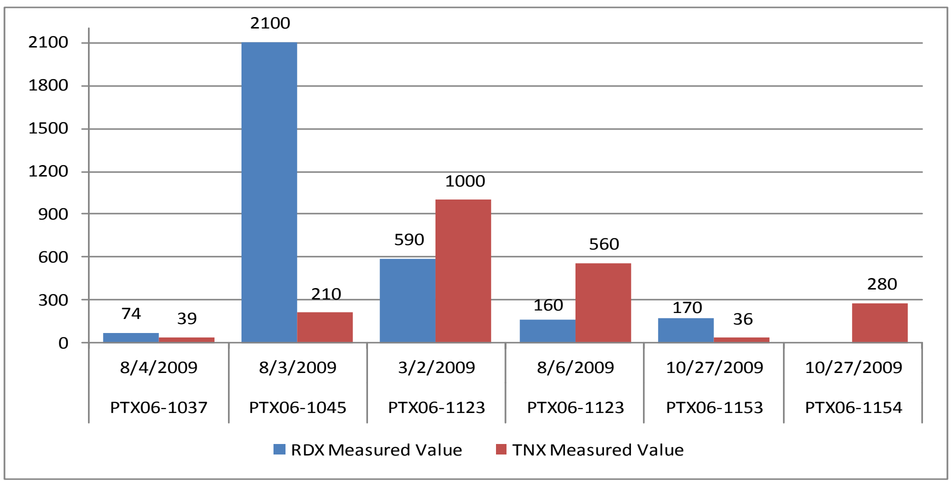


Figure 6.6 – RDX and TNX Concentrations (ppb) from
Southeast ISB Downgradient Performance Monitoring Wells

The Zone 11 ISB was installed by early 2009 with injection completed in the original 23 wells by June 2009. An additional nine wells were installed to better treat the perchlorate plume on the eastern side and the TCE plume on the western side of the ISB. Injection was completed in the new wells in November 2009. Eleven treatment zone wells and three downgradient performance monitoring wells are used to evaluate the Zone 11 ISB (Figure 6.7).

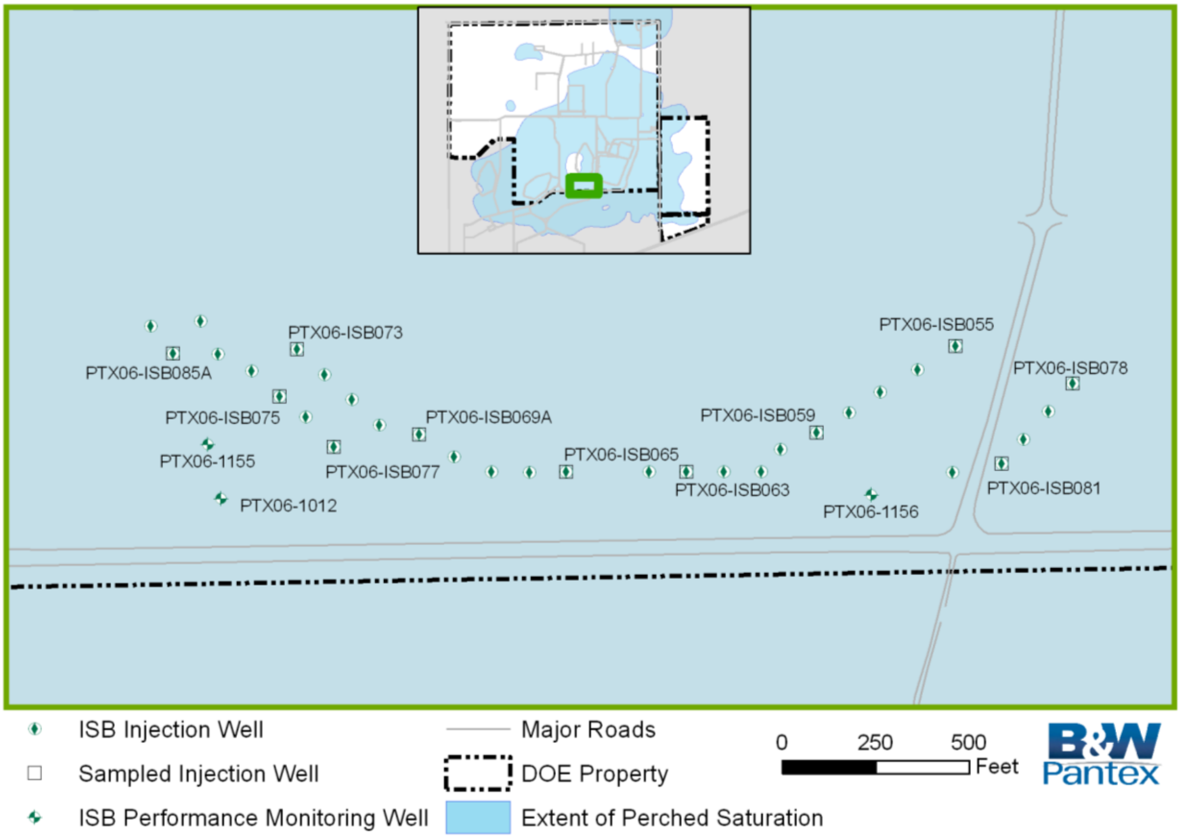


FIGURE 6.7 – *Wells Sampled at Zone 11 ISB*

Zone 11 ISB monitoring data are available for pre-injection and the last two quarters of 2009 (post-injection) for the original 23 wells. Baseline data are available for the additional 9 new wells installed later in 2009. Data indicate that an adequate reducing zone has been established for perchlorate and high explosives (HEs) in the original wells. Stronger reducing conditions are usually required for reduction of TCE. Stronger reducing conditions are expected to be established after a second amendment injection. Despite the mild treatment zone conditions, monitoring results from the original 23 treatment zone wells indicate that TCE is being reduced to concentrations near or below the GWPS (see Table 6.4). Complete reduction of TCE is also evident, because its final breakdown product, vinyl chloride, has not been detected except in one well, at a concentration well below the GWPS. In addition, concentrations of the intermediate breakdown product 1,2-dichloroethene have also decreased to concentrations below the practical quantitation limit (PQL). Perchlorate concentrations have been reduced below the PQL and the GWPS in the treatment zone. Treatment zone conditions will continue to be monitored over time to determine when a second injection is required. COC concentrations in downgradient in situ performance monitoring wells are not expected to decline for about two years.

Table 6.4 – *Summary of Zone 11 ISB Monitoring Well Data*

Well ID	Perchlorate (1Q2009)	Perchlorate (2Q2009)	Perchlorate (3Q2009)	Perchlorate (4Q2009)	TCE (1Q2009)	TCE (2Q2009)	TCE (3Q2009)	TCE (4Q2009)
In Situ Bioremediation Wells								
PTX06-ISB055		3000	<20	<20		16	<3	<3
PTX06-ISB059		970	<20	<20		<5	<3	<3
PTX06-ISB063		39	<20	<20		<5	<3	<3
PTX06-ISB065		340	<20	<20		7.2	<3	<3
PTX06-ISB069A		880	<20	<20		62	<3	<3
PTX06-ISB073		380	<20	<20		520	2.7	1.4
PTX06-ISB075		97	<20	<20		420	1.6	<3
PTX06-ISB077		840	<200	<20		300	12	5.4
PTX06-ISB078				1.9				<3
PTX06-ISB081				153				<3
PTX06-ISB085A				558				89
In Situ Performance Monitoring Wells								
PTX06-1012	131	216	260		30	53.4	110	
PTX06-1155				372				460
PTX06-1156				1560				7.4

Highlighted cells indicate concentrations less than the GWPS.
Blank spaces indicate no samples were collected
Blue text represents the baseline concentrations for each well.
When COC was not detected, a "less than" with the detection limit is provided.

6.5 Uncertainty Management and Early Detection

Because the evaluation of uncertainty management and early detection well types is similar, they are evaluated together for unexpected conditions. The purpose of uncertainty management wells in perched groundwater is to confirm expected conditions identified in the RCRA Facility Investigations and ensure there are not any deviations, fill potential data gaps, and fulfill long-term monitoring requirements for soil units evaluated in the baseline risk assessment. The purpose of early detection wells is to identify breakthrough of constituents to the drinking water aquifer from overlying perched groundwater, if present, or potential source areas in the unsaturated zone, before potential points of exposure have been impacted.

The information from the quarterly progress reports and annual report are summarized here. Those reports focus on evaluating the wells for unexpected conditions at locations where contamination has not been detected or confirmed, or in previous plume locations where concentrations have fallen below GWPS, background, or PQL (e.g., Burning Ground and Old Sewage Treatment Plant areas). Only COCs are evaluated. The data are screened against natural background concentrations previously developed for Pantex. The data are also evaluated with respect to the PQL and the GWPS to provide an understanding of whether there is a threat of endangerment to human health or the drinking water aquifer. This evaluation includes all early detection and uncertainty management wells in the drinking water aquifer, as well as select wells in perched groundwater.

Perched aquifer uncertainty management wells that are within identified contaminant plumes are not evaluated until the five-year review when a larger list of constituents will be sampled to specifically evaluate those wells. Figure 6.8 depicts the wells used in this evaluation for 2009. A total of 45 wells were evaluated for unexpected conditions. Because of the differing frequency of sampling, all available data for these wells are used in this evaluation.

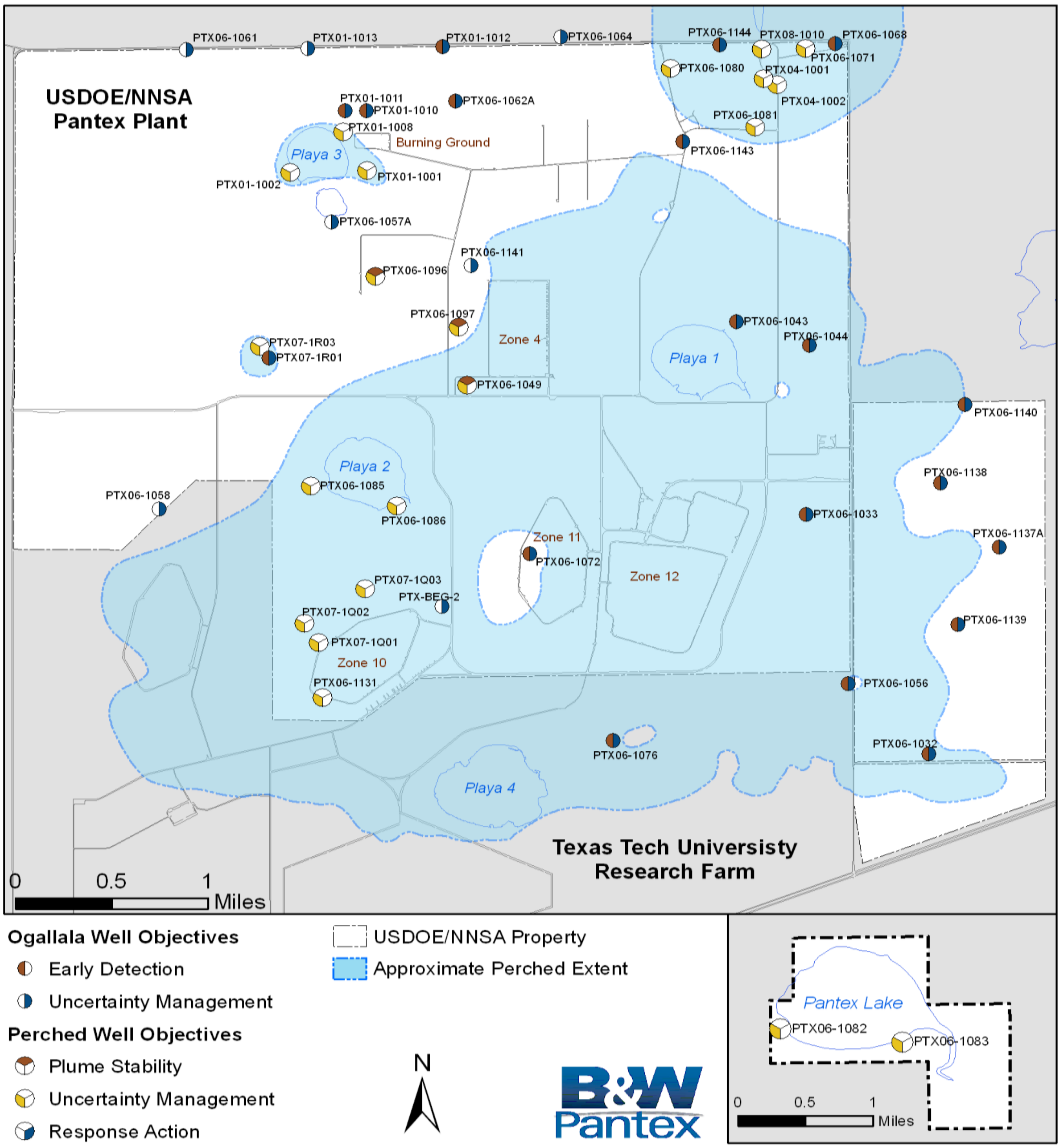


FIGURE 6.8 – *Uncertainty Management and Early Detection Wells*

Pantex monitors for the most widespread and leachable contaminants at the uncertainty management and early detection wells. The monitoring lists for these wells are included in the *Sampling and Analysis Plan* (Pantex Plant, 2009) and consist of all HEs found in perched groundwater, degradation products of RDX, PCE, TCE and its degradation products, chloroform, and boron. Perchlorate, hexavalent chromium, and total chromium are analyzed in select drinking water aquifer monitor wells that are downgradient from their respective plumes in perched groundwater.

The data for each well in each aquifer were evaluated for unexpected conditions. Those uncertainty management or early detection wells with unexpected conditions are discussed in the following sections.

6.5.1 Perched Groundwater Uncertainty Management

The summary of detections and expected conditions for perched groundwater is included in Table 6.5. This table includes all detections of COCs, with the exception of boron and total chromium. Those naturally occurring metals are compared to established background concentrations. Only concentrations that exceed background are included in the table.

Table 6.5 -- Summary of Detections and Expected Conditions in Perched Groundwater Wells

Well ID	Sample Date	Analyte	Measured Value (ug/L)	Above BKG or PQL?	BKG/ PQL (ug/L)	Above GWPS?	GWPS	Expected Condition?
				Perched Wells				
PTX01-1001	5/21/2009	Perchlorate	4.56	N	12	N	26	Y[1]
PTX01-1001	5/21/2009	Trichloroethene	0.495	N	3	N	5	Y[1]
PTX01-1001	11/16/2009	Trichloroethene	1.02	N	3	N	5	Y[1]
PTX04-1002	1/22/2009	Chromium, Hexavalent	6	N	15	N	15	Y[1]
PTX04-1002	1/22/2009	HMX	0.62	N	1	N	360	Y[1]
PTX04-1002	1/22/2009	Trichloroethene	0.44	N	3	N	5	Y[1]
PTX06-1049	**8/31/2009**	**4-Amino-2,6-Dinitrotoluene**	**0.65**	**N**	**1**	**N**	**1.2**	**N**
PTX06-1049	**8/31/2009 (duplicate)**	**4-Amino-2,6-Dinitrotoluene**	**0.63**	**N**	**1**	**N**	**1.2**	**N**
PTX06-1049	**8/31/2009**	**Trichloroethene**	**0.54**	**N**	**3**	**N**	**5**	**N**
PTX06-1081	1/29/2009	Trichloroethene	0.57	N	3	N	5	Y[2]

BKG = background value for naturally occurring constituents from the *Risk Reduction Rule Guidance to the Pantex RFI* (Pantex Plant, April 2002, rev March 2003).
PQL = Practical quantitation limit from the *Sampling and Analysis Plan* (Pantex Plant, April 2009).
GWPS – Groundwater protection standard published in the *Record of Decision* (Pantex Plant and Sapere, 2008).
Wells with unexpected conditions are in **bold**.
[1]This well was previously affected by these COCs; however, the concentrations have declined below the GWPS and PQL and are steadily decreasing.
[2]TCE has been detected at low levels in this well since the well was installed. All detections are estimated concentrations that are below the PQL and trending indicates that concentrations are declining. This well will continue to be monitored and trended to determine if there is a change in concentrations. New concentrations in PTX06-1049 may indicate that the COCs from Playa 1 are slowly moving into that area. This well will continue to be monitored over time.

Four perched monitoring wells had detections of COCs in 2009. Three of those conditions were expected, as those wells had previous detections of the COCs, but at higher concentrations. These wells will continue to be tracked to ensure that concentrations continue to decline.

One well, PTX06-1049, had new detections of a HE and TCE below the PQL and the GWPS. This well is near the southwest corner of Zone 4, west of Playa 1, and has not been affected by COCs historically. The recent impact observed in this well appears to be a result of contaminants that have expanded radially from Playa 1. This change may indicate that contamination is slowly moving into this well. This well will continue to be monitored over time to trend the concentrations.

6.5.2 High Plains Aquifer Uncertainty Management and Early Detection

The summary of detections and unexpected conditions is included in Table 6.6. This table includes all detections of COCs, with the exception of boron and total chromium. Those naturally occurring metals are compared to established background concentrations. Only concentrations that exceed background are provided in the table. Ten High Plains Aquifer (Ogallala/Dockum) wells had detections in 2009. Five of those wells had unexpected conditions and are discussed below. Wells with expected conditions are footnoted with explanations in Table 6.6.

Table 6.6 -- Summary of Detections and Expected Conditions in High Plains Aquifer Wells

Well ID	Sample Date	Analyte	Measured Value (ug/L)	Above BKG or PQL?	BKG/ PQL (ug/L)	Above GWPS?	GWPS	Expected Condition?
Drinking Water Aquifer Wells								
PTX06-1032	8/6/2009	4-Amino-2,6-Dinitrotoluene	0.529	N	1	N	1.2	N[1]
PTX06-1032	8/6/2009	RDX	0.413	N	1	N	2	N[1]
PTX06-1032	9/30/2009	4-Amino-2,6-Dinitrotoluene	0.934	N	1	N	1.2	N[1]
PTX06-1032	9/30/2009	4-Amino-2,6-Dinitrotoluene	1.03	Y	1	N	1.2	N[1]
PTX06-1032	9/30/2009	4-Amino-2,6-Dinitrotoluene	1	N	1	N	1.2	N[1]
PTX06-1032	9/30/2009	RDX	0.29	N	1	N	2	N[1]
PTX06-1032	9/30/2009	RDX	0.365	N	1	N	2	N[1]
PTX06-1032	9/30/2009	RDX	0.27	N	1	N	2	N[1]
PTX06-1032	11/4/2009	4-Amino-2,6-Dinitrotoluene	0.504	N	1	N	1.2	N[1]
PTX06-1032	11/4/2009	RDX	0.333	N	1	N	2	N[1]
PTX06-1032	11/5/2009	4-Amino-2,6-Dinitrotoluene	0.172	N	1	N	1.2	N[1]
PTX06-1032	11/5/2009	RDX	0.13	N	1	N	2	N[1]
PTX06-1032	12/15/2009	4-Amino-2,6-Dinitrotoluene	0.524	N	1	N	1.2	N[1]
PTX06-1032	12/15/2009	RDX	0.417	N	1	N	2	N[1]
PTX06-1033	1/26/2009	Chromium, Hexavalent	6	N	15	N	100	N
PTX06-1033	9/9/2009	Boron	211	Y	194	N	7300	Y[2]

Well ID	Sample Date	Analyte	Measured Value (ug/L)	Above BKG or PQL?	BKG/ PQL (ug/L)	Above GWPS?	GWPS	Expected Condition?
PTX06-1056	2/12/2009	Boron	242	Y	194	N	7300	Y[3]
PTX06-1056	8/4/2009	Boron	224	Y	194	N	7300	Y[3]
PTX06-1058	5/21/2009	Chloroform	0.361	N	3	N	80	N
PTX06-1068	2/4/2009	Chromium, Hexavalent	11	N	15	N	100	N
PTX06-1068	5/6/2009	Chromium, Hexavalent	10	N	15	N	100	N
PTX06-1068	9/29/2009	Chromium, Hexavalent	9	N	15	N	100	N
PTX06-1068	9/29/2009	Chromium, Hexavalent	10	N	15	N	100	N
PTX06-1137A-487	11/10/2009	Chloroform	0.27	N	3	N	80	Y[4]
PTX06-1139-467	9/30/2009	Boron	197	Y	194	N	7300	Y[5]
PTX06-1140-527	10/6/2009	Boron	204	Y	194	N	7300	Y[5]
PTX06-1140-527	10/6/2009 (duplicate)	Boron	196	Y	194	N	7300	Y[5]
PTX06-1141-532	10/14/2009	Boron	214	Y	194	N	7300	Y[5]
PTX06-1141-587	10/15/2009	Boron	222	Y	194	N	7300	Y[5]
PTX07-1R01	9/17/2009	Perchlorate	0.0771	N	12	N	26	N

BKG = background value for naturally occurring constituents from the *Risk Reduction Rule Guidance to the Pantex RFI* (Pantex Plant, April 2002, rev March 2003).
PQL = Practical quantitation limit from the *Sampling and Analysis Plan* (Pantex Pant, 2009).
GWPS = Groundwater protection standard published in the *Record of Decision* (Pantex Plant and Sapere, 2008).
Well names with a numbered extension indicate the depth (in ft below top of well casing) the sample was taken from.
Wells with unexpected conditions are in bold.
[1]This well had a confirmed condition that required further action. Pantex implemented actions outlined in the Groundwater Contingency Plan (Pantex Plant, 2009). Other wells with unexpected conditions will continue to be monitored according to the approved SAP (Pantex Plant, 2009).
[2] This well has continuously exhibited concentrations ranging from 157 to 217 ug/L. Trending indicates that boron is stable or decreasing in this well.
[3]This well is influenced by the Dockum Aquifer and has consistently demonstrated boron concentrations above background established for the Ogallala Aquifer.
[4]This well was chlorinated to treat iron bacteria so the chloroform is likely a result of that treatment.
[5]Background for boron is 194 ppb. This background was set based on samples collected across the entire saturated thickness and may not be representative of samples collected at discrete intervals. Higher concentrations have been consistently detected in PTX06-1033 and 1056 that are in deeper segments of the High Plains Aquifer. Because of this, boron concentrations slightly above background are expected in deeper segments of the High Plains Aquifer.

Unexpected conditions were observed in PTX06-1032 (a previous homestead well), on property that Pantex acquired to the east of Pantex and TTU property. Two HEs were detected in August and were verified through reanalysis in September 2009. After notifying the TCEQ and EPA, a confirmation sample was collected on September 30, 2009 with TCEQ co-sampling the well. The HE results were confirmed in the resample.

After review of surrounding monitoring data, well construction logs, and locations of previous homestead or irrigation wells, it was determined that PTX06-1032 may not be properly sealed at the fine-grained zone to prevent cross-contamination from perched groundwater to the drinking water aquifer. Pantex conducted a purge study in November 2009 to determine if a leak along the annulus of the well casing may be the problem. For the study, a sample was collected before purging, then after three consecutive 800-gallon purges. This purge study was set up with the understanding that if the HEs were present at similar concentrations throughout the study, this would indicate that the HEs are present further into the formation than would be expected from a leaking casing annulus. If the concentrations decline after the purge, then a leaking casing annulus would be the likely cause of the presence of the HEs. TCEQ also co-sampled during the purge study. The results of the purge study are provided in Table 6.7. Concentrations of RDX and 4-amino-2,6-dinitrotoluene were seen at the highest concentration in the initial sample prior to purging. The second sample indicated that concentrations were declining and there were no detections in the final samples. TCEQ results confirmed the Pantex results.

Table 6.7 -- Results of Purge Study for PTX06-1032

Well ID	Sample ID	Sample Date	Analyte	Purge Volume (gallons)	Measured Value (ug/L)	PQL	Qualifier	Above PQL?
PTX06-1032	20091104H00060	11/4/2009	4-Amino-2,6-DNT	0	0.504	0.325		N
PTX06-1032	20091105H00061	11/5/2009	4-Amino-2,6-DNT	800	0.172	0.325	J	N
PTX06-1032	20091105H00062	11/5/2009	4-Amino-2,6-DNT	1600		0.325	U	--
PTX06-1032	20091105H00063	11/5/2009	4-Amino-2,6-DNT	2400		0.325	UJ	--
PTX06-1032	20091104H00060	11/4/2009	RDX	0	0.333	0.325	J+	N
PTX06-1032	20091105H00061	11/5/2009	RDX	800	0.13	0.325	J	N
PTX06-1032	20091105H00062	11/5/2009	RDX	1600		0.325	UJ	--
PTX06-1032	20091105H00063	11/5/2009	RDX	2400		0.325	UJ	--

J = Estimated value representing an analyte detected at a concentration lower than the laboratory PQL and is considered an approximate value.

J+ = The associated numerical value is an estimated quantity with a suspected positive bias.

UJ = The sample was analyzed for the analyte, but it was not detected. The sample detection limit is an estimated quantity.

Based on the evaluation of the well logs and the purge study, Pantex recommended to the TCEQ and EPA in December 2009 to plug and abandon PTX06-1032. After a formal evaluation and recommendation was submitted in January 2010, EPA and TCEQ approved the recommendation in February. PTX06-1032 was subsequently plugged and abandoned.

Hexavalent chromium was detected early in 2009 in PTX06-1033 at a concentration below the practical quantitation limit (PQL). This result was qualified to note that the lab was not applying a turbidity correction to the results indicating that it may be a false positive. Pantex has worked to correct the problems with the labs. This well will continue to be monitored and evaluated for hexavalent chromium as identified in the Sampling and Analysis Plan.

In well PTX06-1058, chloroform was detected well below the PQL. This well has been sampled since 2001 for chloroform with no prior detections. Pantex will continue to monitor this well according to the Sampling and Analysis Plan.

In well PTX06-1068 (at the northeast corner of Pantex Plant), hexavalent chromium was detected below the PQL. Pantex resampled this well after working with the laboratory to improve analysis methods and turbidity corrections. Hexavalent chromium was detected in the resample at levels below the PQL. Total chromium was detected (5.1 and 5.6 ug/L) at levels below those measured for hexavalent chromium, indicating that the hexavalent chromium is likely a false positive. The approved colorimetric method is unreliable near the limit of detection. This well has been sampled since 2002 with sporadic detections of hexavalent chromium at low levels earlier in 2009, once in 2008, and once in 2005. The detections exceeded the measured concentration for total chromium in 2008 and 2009, indicating the results were a false positive. This well will continue to be monitored in accordance with the new Sampling and Analysis Plan.

Perchlorate was detected at a very low level in PTX07-1R01 (in the west central portion of Pantex Plant). The measured value was below the PQL established for analytical method 314 approved for use through the Remedial Design. Method 6850 is a high resolution method usually reserved for confirmation of sample detection; however, due to equipment problems at the lab, this method was used to analyze the sample for PTX07-1R01 to meet sample holding times and avoid resampling. The measured detection was also below the PQL for Method 6850. The sources for perchlorate are well known, this well is not downgradient of the perched groundwater perchlorate plume, and the perchlorate detected through this analysis is consistent with detected concentrations in the Texas Panhandle. Studies conducted through TTU in the Texas Panhandle (Rajagopalan et. al., 2006) indicate that perchlorate occurs naturally at very low levels in the Ogallala Aquifer. Therefore perchlorate is likely to occur naturally at this location at the very low concentrations observed through the high resolution method used for this analysis. Pantex will continue to monitor this well in accordance with the Sampling and Analysis Plan.

6.6 Natural Attenuation

Natural attenuation is the result of processes that naturally lower concentrations of contaminants over time. This process is monitored at Pantex to help determine where natural attenuation is occurring, under what conditions it is occurring, and to eventually determine a rate of attenuation. This is an important process for RDX, the primary risk driver in perched groundwater, because it is widespread and extends beyond the reach of the groundwater remediation systems in some areas. Because the right microbes for biodegradation are present in the perched sediments, Pantex is interested in monitoring for breakdown products of RDX. Pantex started monitoring for degradation products of RDX in all monitoring wells by July 2009 after testing analytical methods to ensure they

Natural Attenuation Processes

- Biodegradation – soil microbes can cause the contaminants to break down to less harmful products
- Sorption – the contaminants are bound to soil particles so that movement through groundwater is stopped or is slower allowing time for other processes to work
- Dispersion – the contaminants are dispersed through the groundwater as they move away from the source so that concentrations are diluted

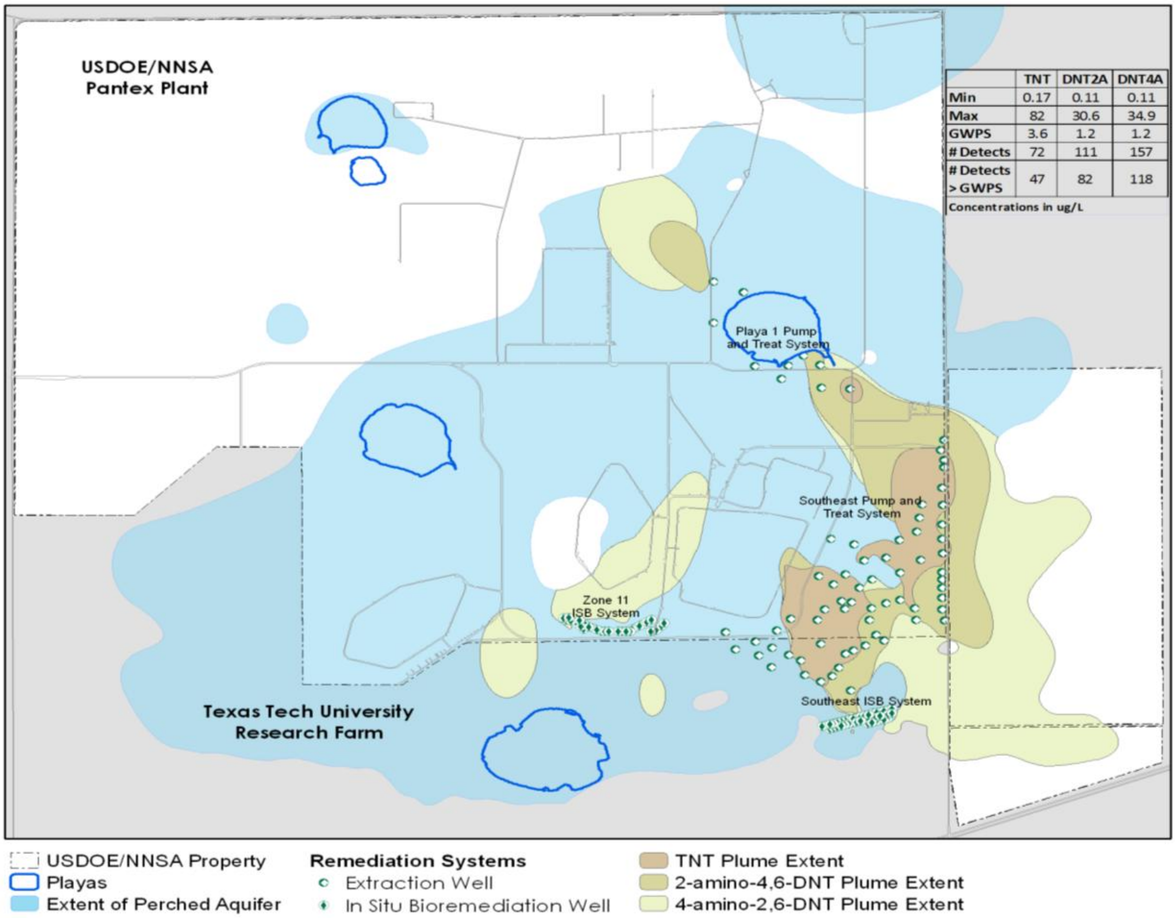
can reliably detect and quantify those products. Because analytical methods are readily available, Pantex has monitored for degradation products of TNT and TCE in the past and continues to monitor for those in key areas.

Other groundwater conditions that may impact attenuation, such as dissolved oxygen and redox potential, are also monitored in each well. RDX can degrade under aerobic and anaerobic conditions, but achieves best reduction under anaerobic conditions. As more data are collected, trending and statistical analysis can be used to evaluate the degradation of RDX. Trending of concentrations is also performed at each well to determine if concentrations are declining as expected.

Based on monitoring results for TNT and its breakdown products (2-amino-4,6-DNT and 4-amino-2,6-DNT), TNT has naturally attenuated over time (Figure 6.9). TNT has been manufactured at Pantex since the 1950's yet is only present in the central portion of the overall southeastern plume - within the SEPTS well field and near Playa 1. Its first breakdown product, 2-amino-4,6-DNT, occurs near the TNT plume and extends slightly beyond. The final breakdown, 4-amino-2,6-DNT, extends out to the edges of the perched saturation at low concentrations indicating that the older portions of the TNT plume is completely breaking down. Only TNT breakdown products are present in perched groundwater beneath Zone 11 and north of Playa 1. Concentrations of the breakdown products are still above GWPS, but most wells with detections are recently showing a decreasing or stable trend. A table of concentration ranges for wells outside the influence of the ISB systems is included in Figure 6.9.

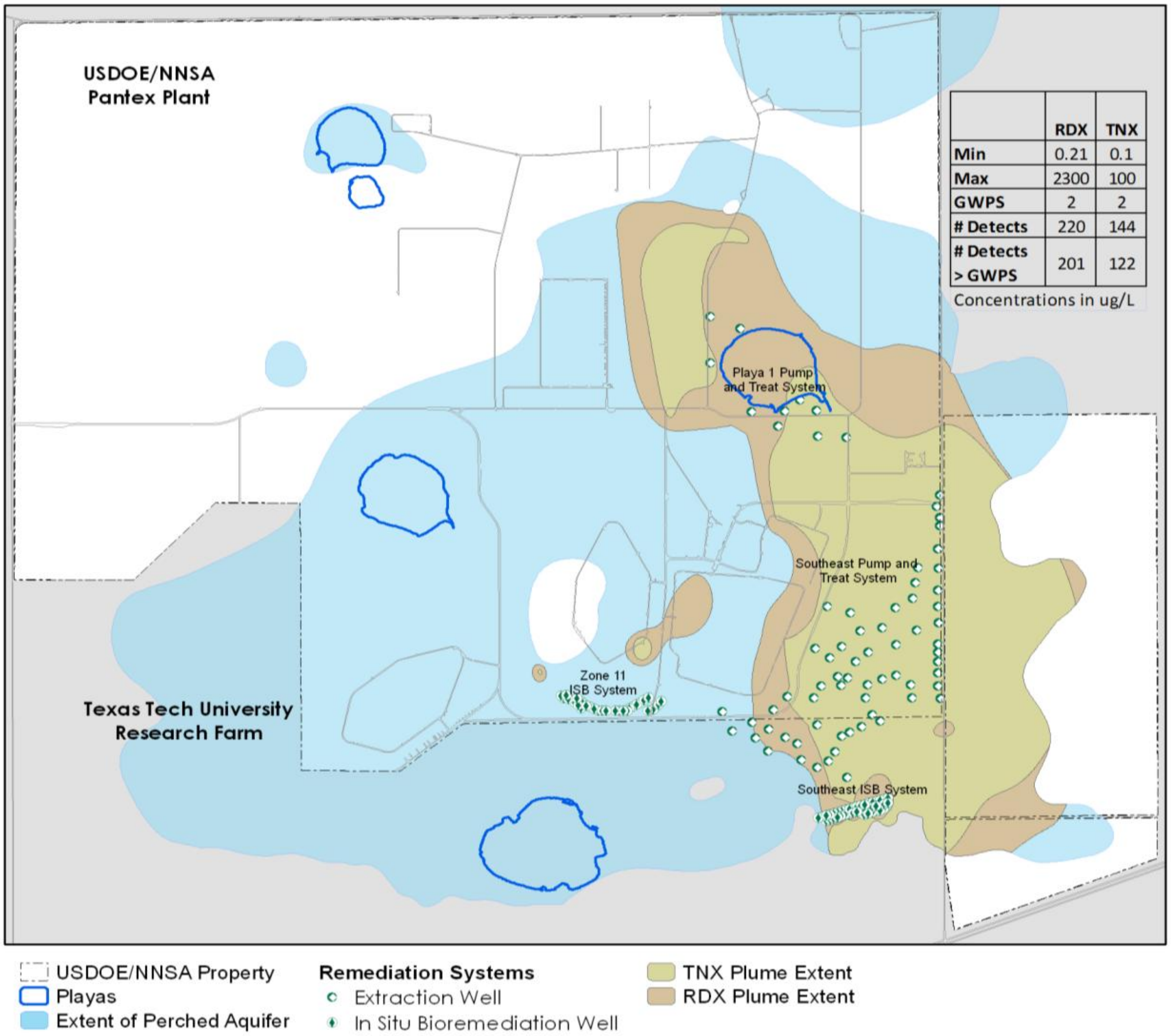
Perched groundwater sampling results for RDX and breakdown products (MNX, DNX, and TNX) indicate that the breakdown products are present throughout most of the RDX plume, with TNX being the most widespread. TNX, the final degradation product, is a better indicator of degradation because the other intermediate products (MNX, DNX) degrade rapidly and do not accumulate in the environment (SERDP, 2004). If complete biodegradation of RDX is occurring, RDX and all breakdown products would be expected to decrease over time. Figure 6.10 depicts the overall RDX and TNX plume. A table of concentration ranges for wells outside the influence of the ISB systems is included in the figure. More data will be required over time to determine trends and rates of attenuation.

Pantex has monitored for breakdowns of TCE for many years; however, a strong indication of natural attenuation of TCE has not been observed in perched groundwater. TCE has started degrading in the Zone 11 ISB treatment zone. The TCE plumes at Pantex are being actively treated by the SEPTS and the ISB treatment zones.



	TNT	DNT2A	DNT4A
Min	0.17	0.11	0.11
Max	82	30.6	34.9
GWPS	3.6	1.2	1.2
# Detects	72	111	157
# Detects > GWPS	47	82	118

Figure 6.9 – TNT and Degradation Product Plumes



	RDX	TNX
Min	0.21	0.1
Max	2300	100
GWPS	2	2
# Detects	220	144
# Detects > GWPS	201	122

FIGURE 6.10 – ***RDX and Degradation Product Plumes***

Drinking Water

By regulation, B&W Pantex is required to monitor for fecal coliform, lead & copper, pH and residual chlorine. Compliance monitoring for volatile/semi-volatile organic compounds, metals, and disinfection by-products is conducted by the Texas Commission on Environmental Quality (TCEQ). However, as a best management practice, Pantex monitors for organic/inorganic chemicals, metals, lead & copper, radionuclides, and miscellaneous water quality constituents. Results from routine drinking water compliance monitoring in 2009 confirmed that the drinking water system at Pantex Plant met all applicable regulatory requirements. All analytical results for radionuclides, volatile/semi-volatile organic compounds, and miscellaneous compounds were below regulatory limits.

7.1 The Scope of the Program

Pantex Plant's drinking water system (State of Texas Public Water System I.D. No. 0330007) is considered a non-transient, non-community public water supply (NTNCPWS) system under Federal Safe Drinking Water Act regulations. This category was created by the U.S. Environmental Protection Agency (EPA) to identify private systems that continuously supply water to small groups of people (for example, in schools and factories). Water supplied by such systems is consumed daily by the same group of people over long periods of time.

The Plant's drinking water is obtained from the Ogallala Aquifer. The drinking water production wells supply all of the Plant's water needs. In addition, the wells provide water to Texas Tech University for domestic and agricultural use. Before being transferred to the distribution system, all water is treated as approved by the TCEQ to provide disinfection protection throughout the system.

Samples from the drinking water system were collected and analyzed monthly for biological contaminants, and quarterly and/or annually for chemical and radiological contaminants identified in the Safe Drinking Water Act [Title 40 of the Code of Federal Regulations (40 CFR) Parts 141 and 143, and Title 30 of the Texas Administrative Code (30 TAC) Chapter 290].

Analytical results were evaluated, and compared to regulatory guidelines for drinking water. The constituents for which analyses were conducted in 2009 are listed in Appendix A. Sampling locations were chosen to meet regulatory requirements and to provide system operators with data that will assist their evaluation of the system's integrity.

7.2 New Requirements and Program Changes

Historically, Pantex injected chlorine gas into the drinking water as a means of providing required disinfection. In July 2007, B&W Pantex submitted a request to replace the existing chlorine (gas) injection system with a mixed-oxide (MIOX) liquid-injection system to provide disinfection for the water supply. The mixed-oxidant solution used for water disinfection provides durable chlorine residual yet reduces adverse Disinfectant By-Product (DBP) formation. MIOX system providers estimate that water systems can expect a 20 to 50 percent reduction in total trihalomethanes (TTHM) formation. The MIOX process is recognized as a successful method of disinfection for public water supplies and is typically much safer than using chlorine gas, while maintaining more consistent chlorine residual levels. The chlorine residual from mixed oxidants is expected to last longer in the distribution system as it is more stable than chlorine residual resulting from the use of chlorine gas, even at lower dosages. The MIOX process can enhance the elimination of bio-film caused by the accumulation of organic matter inside the water lines, resulting in improved taste and odor quality. The MIOX process also protects communities and on-site personnel by eliminating the transportation, handling, and storage of hazardous chlorine gas. TCEQ approved the use of MIOX in the Pantex system in 2009. The MIOX system was placed in-service in late 2009.

On December 1, 2009, the EPA's Ground Water Rule (GWR) became effective for water distribution systems such as Pantex. In preparation for the impact of this rule, Pantex revised its Drinking Water Monitoring Plan to meet the changes caused by this rule.

7.3 Water Production and Use

In 2009, Pantex Plant pumped approximately 374 million liters (98.8 million gallons) from the Ogallala Aquifer. This is a reduction of 67 million liters (17.8 million gallons), compared to water produced in 2008. B&W Pantex remains committed to reducing the amount of produced water by implementing a water reuse and recycling program. Examples of the program effectiveness include the reduction in water necessary for wastewater chlorination due to discharge of wastewater to a subsurface irrigation system (there is no chlorination of wastewater used for subsurface irrigation) and the procurement of more efficient industrial cooling equipment such as water re-circulating systems. Most of the water used at Pantex is for domestic purposes. The water used as industrial process water provides comfort cooling, heat exchange, and boiler operations. Through an agreement with Texas Tech University, Pantex Plant provides water to the adjacent and on-site Texas Tech operations for domestic and livestock uses.

7.4 Sampling Locations

Routine drinking water samples were collected at 32 locations during 2009. Ten locations were sampled for biological indicators and residual disinfectant levels, 20 locations for lead and copper and 2 locations were monitored for chemical and radiological constituents. These sampling sites are representative of drinking water at Pantex Plant. Their locations are listed in Table 7.1. Not all sampling locations are designated with the "DR" code because the sampling locations are periodically changed to assure adequate Plant coverage.

Samples for chemical and radiological analysis were collected at the inlet to the water distribution system during 2009. One additional location was monitored for water quality indicators, chemical, and radiological constituents. These tests are conducted as a "best management" practice to evaluate the integrity of the distribution system.

7.5 Results

In general, results for drinking water and production well monitoring in 2009 were similar to those reported for 2008. Trace amounts (below regulatory limits) of radionuclides and miscellaneous compounds were detected. Based on historical data, these concentrations are thought to be due to naturally occurring materials found in the Ogallala aquifer.

TABLE 7.1 — *Drinking Water and Production Well Sampling Locations, 2009*

Description	Location
Chemical and Radiological Sampling	
DR-43 DR-115	Firing Site 1 Building 15-27
Biological and Disinfectant Level Sampling	
DR-116 DR-117 DR-118 DR-119	Building 12-103 Building 18-1 Building 12-6 Building 16-12 Building 12-70 Building 11-2 Building 15-27 Building 16-1 Building 10-9 Texas Tech Facility
Lead/Copper Sampling	
	12-100 Women's Restroom 12-102 Men's Restroom 12-104 Men's Restroom 12-106 Men's Restroom 12-107 Men's Restroom T9-060 Men's Restroom 12-121 Mechanical Room #1 18-1 Killgore Lab Sink Texas Tech House 11-2 11-21 12-21 12-15 12-21 12-70 12-86 16-1 16-12 16-18 16-24

[a] Some drinking water sampling locations are designated by use of "DR" numbers.

7.5.1 Radiological Monitoring *(30 TAC §290.108)*

Radiological monitoring is not required for NTNCPWS; however, as a best management practice, Pantex Plant routinely monitors for these contaminants. Radiological monitoring results for 2009 documented compliance with federal Safe Drinking Water Act requirements (40 CFR §141), state water quality requirements (30 TAC §290), and U.S. Department of Energy Order 5400.5, "Radiation Protection of the Public and the Environment." For a more thorough discussion on radiological analysis, refer to Section 4.1 of this document.

In the unlikely event that either gross alpha or gross beta readings are significantly higher than the historical average or the maximum contaminant levels (MCLs), then additional testing (i.e., isotopic analysis) would be conducted to determine the cause. All detected radiological constituents were below the MCL.

7.5.2 Chemical Monitoring *(30 TAC §290.107)*

Chemical monitoring is conducted at two locations within the water distribution system. These locations were chosen to be representative of water entering and within the distribution system. Chemical analysis includes herbicides, pesticides, volatile and semi-volatile organic compounds. For a complete list of chemicals, please refer to Appendix A. Concentrations of chemical constituents in routine samples were below any regulatory limits established in the CFR and the TAC.

7.5.3 Lead and Copper Monitoring *(30 TAC §290.117)*

The Lead and Copper Rule of the Safe Drinking Water Act requires that concentrations of lead and copper remain below action levels (0.015 and 1.3 mg/L, respectively) for the 90th percentile[1] of the sampling locations. By regulation, the compliance monitoring frequency for lead and copper was reduced from annual sampling to triennial sampling in 1997. However, as a best management practice, Pantex conducts annual monitoring for lead and copper in the drinking water system.

7.5.4 Biological Monitoring *(30 TAC §290.109)*

Water distribution systems contain naturally occurring microorganisms and other organic matter that may enter a system through leaks, cross-connections, back-flow events or disinfection system failures. Bacterial growth may occur within the water itself, at or near the pipe surfaces (bio-film), or from suspended particulates. Factors that influence bacterial growth include water temperature, flow rate, and chlorination. All water at Pantex is chlorinated, prior to entry into the distribution system.

On October 15, 2009, routine bacteriologic monitoring of the water distribution system tested positive for total coliform bacteria and for E. coli bacteria at the Texas Tech Research Farm located on the southwest corner of the plant. On October 19, 2009, three additional samples were collected from the Texas Tech Research Farm and other locations on the same service line. Results of these tests indicated a positive

[1] Determination of 90th percentile levels shall be obtained by ranking the results of lead and copper samples collected during a monitoring period in ascending order (lowest concentration equal sample Number 1; highest concentration equal sample Numbers 10, 20, 30, 40, 50, etc.), up to the total number of samples collected. The number of samples collected during the monitoring period shall be multiplied by 0.9 and the concentration of lead and copper in the numbered sample yielded by this calculation is the 90th percentile sample contaminant level. The system is in compliance with the lead and/or copper action levels if the 90th percentile sample contaminant level is equal to or less than the action levels.

detection for total coliform bacteria at the Kilgore facility. Water to the Texas Tech Research Farm and the Killgore building was rerouted through an alternate distribution line that has hydraulic isolation capability and the service line was thoroughly flushed. In addition, samples were collected and re-tested daily and disinfectant levels were checked daily until the problem was corrected. Bottled water was supplied to the affected facilities. No other Pantex facilities were affected and residual chlorine levels in all samples collected have been of acceptable levels. Pursuant to the requirements found in 30 TAC 290.122, an Acute MCL Violation and a Boil Water Notice were posted in these facilities and filed with the TCEQ. Following additional testing in each of these facilities, no further coliform positive samples were detected.

7.5.5 Disinfection By-Products (DBP) *(30 TAC §290.113)*

DBPs are produced by the reaction between the disinfectant (chlorine) and organic matter in the water. Reducing the amount of organic matter in the source water before disinfection can help control the quantity of DBPs produced. In addition, limiting the amount of disinfectant introduced in the system reduces the formation of these byproducts. All public water systems where chlorine is used are required to maintain residual levels between 0.2 and 4.0 mg/L (milligrams per liter). These levels provide assurance that the water is safe from most water-borne pathogens while minimizing any adverse health risks to the population from DBPs or the higher concentrations of chlorine.

DBPs are broken into two groups: TTHM and Haloacetic Acids (HAA5). Total trihalomethanes are reported as the sum of the chloroform, dibromochloromethane, bromo-dichloromethane, and bromoform concentrations in milligrams per liter. Haloacetic acids are reported as the sum of the monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid concentrations in milligrams per liter. The MCL for TTHMs is 0.08 mg/L and the MCL for HAA5 is 0.06 mg/L.

All tests for DBPs were at or below safe drinking water MCLs (Table 7.2).

7.6 Comparisons

Constituent concentrations in routine samples in 2009 were within ranges observed in previous years. Table 7.2 shows a tabular representation of drinking water results from Pantex compared to the City of Amarillo, the City of Canyon, and regulatory limits under the Safe Drinking Water Act.

7.7 Inspections

As a cooperative effort between B&W Pantex and the TCEQ, the TCEQ collected samples for residual chlorine and nitrite from the drinking water supply system in December 2009. Results of this testing demonstrates that Pantex Plant meets or exceeds the related requirements of the Safe Drinking Water Act for Public Water Supplies.

TABLE 7.2 — *Water Quality Comparison*

Substance or Contaminant	Unit of Measure	Maximum Contaminant Level	City of Amarillo Average 2009 (latest results)	City of Canyon Max. 2002-2008 (latest results)	Pantex Water System Average 2009	*Typical Source*
Inorganics:						
Antimony	ppm	0.006	0.0028	NS	< 0.003	Discharge from petroleum refineries, fire retardants, ceramics, electronics, solder
Arsenic	ppm	0.05	NS	0.0046	< 0.005	Erosion of natural deposits, discharge from semiconductor mfg., petroleum refineries, herbicides, wood
Barium	ppm	2	0.148	0.087	0.119	Erosion of natural deposits, discharge from drilling waste, metal refineries
Beryllium	ppm	0.004	NS	NS	< 0.0005	Discharge from metal refineries, coal-burning factories, aerospace and defense industries
Boron	ppm	NA	NS	NS	0.162	Erosion of natural deposits, discharge from detergent factories
Copper*	ppm	Action Level = 1.3	100% below Action Level	100% below Action Level	100% below Action Level	Erosion of natural deposits, corrosion of plumbing, leaching from wood preservatives
Chromium	ppm	0.1	0.0039	NS	0.003	Erosion of natural deposits, discharge from steel and/or pulp mills, plating operations
Fluoride	ppm	4	0.89	3.04	< 0.001	Erosion of natural deposits, discharge from aluminum and/or fertilizer factories, water additives
Lead*	ppm	*Action Level = 0.015 (for compliance samples)	100% below Action Level	100% below Action	BMP sample was 0.009 above the Action Level	Erosion of natural deposits, corrosion of plumbing

Substance or Contaminant	Unit of Measure	Maximum Contaminant Level	City of Amarillo Average 2009 (latest results)	City of Canyon Max. 2002-2008 (latest results)	Pantex Water System Average 2009	*Typical Source*
Nitrate	ppm	10	1.17	1.62	1.41	Runoff from feedlots and the use of fertilizer, leaching from septic systems, erosion of natural deposits
Nitrite	ppm	1	< 0.01	< 0.01	< 0.04	Runoff from feedlots and the use of fertilizer, leaching from septic systems, erosion of natural deposits
Selenium	ppm	0.05	0.0048	0.0048	0.0032	Discharge from petroleum refineries, erosion of natural deposits, discharge from mining
Thallium	ppm	0.002	NS	NA	< 0.0005	Leaching from ore-processing, discharge from electronics, glass industries
Biological:						
Total Coliform		Action Level = more than 5% of samples show "positive"	4 samples showed "positive"	None showed "positive"	2 samples showed positive	Indicator organism for potential pathogens
Radionuclides: (avg.)						
Gross Alpha emitters	pCi/L	15	4.05	6.1	6.1	Naturally occurring elements found in the soil, manmade materials
Gross Beta photon emitters**	pCi/L	50	6.55	8.4	7.3	Naturally occurring elements found in the soil, manmade materials
Total Radium	pCi/L	5	0.1	0.09	NS	Naturally occurring elements found in the soil, manmade materials
Tritium	pCi/L	20,000	NS	NS	-11.25	Naturally occurring elements found in the soil, manmade materials
Secondary Contaminants:						
Chloride	ppm	300	NS	NS	11.08	Naturally occurring elements found in the soil

Substance or Contaminant	Unit of Measure	Maximum Contaminant Level	City of Amarillo Average 2009 (latest results)	City of Canyon Max. 2002-2008 (latest results)	Pantex Water System Average 2009	*Typical Source*
Corrosivity	mm/year	Noncorrosive	NS	NS	0.33	A secondary parameter (non-health related) indicating the aggressiveness of water to corrode piping
Iron	ppm	0.3	NS	NS	0.147	Naturally occurring elements found in the soil
Manganese	ppm	0.05	NS	NS	< 0.005	Naturally occurring elements found in the soil
<u>Total Trihalomethanes:</u>						
Chloroform	ppm	- -	0.0041	0.0011	0.0040	By-Product of Chlorination
Bromodichloromethane	ppm	- -	0.0038	0.0038	0.0065	By-Product of Chlorination
Chlorodibromomethane	ppm	- -	0.0128	0.0072	0.0081	By-Product of Chlorination
Bromoform	ppm	- -	0.0081	0.0047	0.0046	By-Product of Chlorination
Sum of all TTHMs	ppm	**0.08**	**0.031**	**0.052**	**0.023**	By-Products of Chlorination
<u>Total Haloacetic Acids:</u>						
Monochloroacetic Acid	ppm	- -	0.0013	NS	0.0032	By-Product of Chlorination
Monobromoacetic Acid	ppm	- -	0.0024	NS	0.0015	By-Product of Chlorination
Trichloroacetic Acid	ppm	- -	0.0012	NS	0.0008	By-Product of Chlorination
Dibromoacetic Acid	ppm	- -	0.0053	NS	0.0026	By-Product of Chlorination
Dichloroacetic Acid	ppm	- -	0.0019	NS	0.0032	By-Products of Chlorination
<u>Sum of all HA Acids:</u>	ppm	**0.06**	**0.008**	**0.0042**	**0.011**	By-Products of Chlorination
<u>Water Quality Constituents:</u>						
Alkalinity	ppm	- -	NS	NS	225	Naturally occurring elements found in the soil
Calcium Hardness	ppm	- -	NS	NS	183	Naturally occurring elements found in the soil
Chloride	ppm	- -	NS	NS	11.1	Naturally occurring elements found in the soil

Substance or Contaminant	Unit of Measure	Maximum Contaminant Level	City of Amarillo Average 2009 (latest results)	City of Canyon Max. 2002-2008 (latest results)	Pantex Water System Average 2009	*Typical Source*
Chlorine	ppm	0.2 min. 4.0 max.	0.2 min 2.2 max	0.64 min. 1.60 max.	0.47 min. 1.93 max.	Liquid chlorine used as a disinfectant
Important Definitions:						
* 90th percentile value as defined by the TCEQ						
** Primary MCL for the annual dose equivalent to the total body or to any internal organ. Compliance with this MCL is assumed if gross beta particle activity is less than 50 pCi/l, and if average annual concentration of tritium is less than 20,000 pCi/l and strontium-90 is less than 8 pCi/l.						
Maximum Contaminant Level (MCL) = The highest level of contaminant that is allowed in drinking water.						
Action Level = The concentration of a contaminant that triggers a treatment technique requirement.						
BMP = Best Management Practice monitoring is conducted in addition to monitoring for compliance purposes. Although there are no regulatory limits for BMP monitoring, sample results are compared to limits established under the Safe Drinking Water Act.						
Treatment Technique = If a contaminant exceeds the Action Level, EPA may require the system to use a treatment technique that will reduce the level of a contaminant(s) in drinking water.						
NS = No samples taken						
ND = Not detected						
ppm = Parts per million (milligrams/liter)						

This page was intentionally left blank

Wastewater

B&W Pantex owns and operates an onsite wastewater treatment facility. The wastewater treatment system consists of a facultative lagoon and two wastewater storage lagoons. This facility is permitted by the Texas Commission on Environmental Quality (TCEQ) to treat and dispose of domestic and industrial wastewater. Additionally, the plant maintains on-site sewage facilities (OSSF or Septic Systems), to manage domestic type wastewaters from locations that are not connected to the Plant's wastewater collection system.

8.1 The Scope of the Program

Domestic and industrial wastewaters generated at Pantex Plant are treated in an onsite Wastewater Treatment Facility (WWTF). Industrial effluents from plant operations are generally pre-treated and are directed into the WWTF for further treatment. All such effluents are routed to the sanitary sewer before either disposed of through an underground irrigation system or discharged to an onsite playa lake through the permitted outfall.[1] The playa is an ephemeral lake and is not connected to any other lakes, rivers, or streams.

The WWTF (Figure 8.1) is a clay-lined, facultative lagoon that covers approximately 1.58 hectares (3.94 acres) and has a capacity of 42 million liters (11 million gallons). Pantex also has two storage lagoons used for storage and retention of treated wastewater. The east lagoon is a storage lagoon with a polyethylene liner that covers an area the same size as the facultative lagoon and can serve as the facultative lagoon should the need arise (Figure 8.2).

FIGURE 8.1 — *Wastewater Treatment Facility, Facultative Lagoon*

[1] An outfall is a predetermined point of compliance for wastewater monitoring where effluent is discharged to the environment. All permit-required sampling is conducted at this point.

FIGURE 8.2 — *Wastewater Storage Lagoon*

The northern storage lagoon is a clay-lined lagoon, which covers approximately 1.05 hectares (2.6 acres) and has a capacity of 25.54 million liters (6.74 million gallons). This lagoon is used only for the storage of treated wastewater.

The treatment process in the facultative lagoon involves a combination of aerobic, anaerobic, and facultative bacteria. At the surface, aerobic bacteria and algae exist in a symbiotic relationship. Oxygen is provided by natural aeration processes, algal photosynthesis, and by mechanical aerators. Bacteria use the oxygen for the aerobic degradation of organic matter. Nutrients and carbon dioxide released in the degradation process are used by the algae. In the middle zone, treatment and degradation of organic matter is accomplished with facultative bacteria. At the bottom of the facultative lagoon, organic matter is deposited in a sludge layer and is decomposed by anaerobic bacteria. The wastewater treatment process in a facultative lagoon is complex; nearly all treatment is provided by biological activity.

8.2 Operational Description and Metrics

The TCEQ is the permitting authority for wastewater discharges. During 2009, Pantex had three permits for wastewater disposal. These permits require analytical monitoring and periodic reporting to the TCEQ. Pantex is permitted to dispose of treated wastewater by means of a subsurface irrigation system. This permit is referred to as a Texas Land Application Permit (TLAP WQ0004397000). During periods when the agricultural fields are fallow, B&W Pantex is authorized to apply limited quantities of water to the irrigation area under an Underground Injection Control (UIC) authorization (5W2000017). Finally, Pantex maintains a Texas Water Quality Permit that allows it to discharge treated wastewater to an on-site playa (WQ0002296000). Together, through compliance with these three permits, the Department of Energy and B&W Pantex manage and discharge treated effluent in a manner that protects the environment.

Prior to application in the fields, the treated wastewater passes through a series of filters designed to remove dirt, debris, and particulate matter. After filtration, the water is pumped to a field filter building where it is filtered again. From this point, water is distributed through manifold pipes to individual zones located within three 100-acre tracts of land. This irrigation system consists of more than 100 miles of piping, tubing, and pressure-compensating drip emitters. The irrigation area consists of three approximately 100-acre tracts of agricultural land farmed by Texas Tech University (TTU). Crops grown in this area may include winter wheat, sorghum, soybeans, cotton, corn, oats, and opportunity wheat. Crops will vary from field to field, depending on the cropping needs of TTU.

During 2009, B&W Pantex beneficially applied approximately 211.6 million gallons of treated wastewater and perched groundwater to crops managed by TTU. This is an increase of 100 million gallons compared to operations during 2008. This large increase in volume is a result of improved extraction from the Southwest Pump and Treat System and full operation of the Playa 1 Pump and Treat System. Since 2004, Pantex has beneficially reused more than 500 million gallons of treated wastewater for crop production. During 2009, opportunity wheat and corn were grown and harvested. During certain periods, the ground will remain fallow. This may occur during periods between harvesting, cultivating and planting, or during winter months.

Table 8.1 shows the volume of water and the nitrogen loading rate for each irrigation tract.

TABLE 8.1— ***Annual Irrigation Summary, 2009***

Irrigation Tract	Irrigation Area (acres)	Volume Applied (gallons)	Volume Applied (acre ft./ac)
101	100.86	40,644,000	1.24
201	100.5	87,061,000	2.66
301	98.75	83,939,000	2.61

8.3 Sampling Locations

Sampling was conducted at the incoming weir of the lagoon system (before treatment) and at the permitted discharge point for the subsurface irrigation system, Outfall 031. Monitoring the water quality at the incoming weir was done to determine the effectiveness of the wastewater treatment system. When using the irrigation system, water quality monitoring was conducted after treatment and filtration at Outfall 031 in accordance with the land application permit. During 2009, there was no discharge through, and thus no sampling at, Outfall 001.

8.4 Analytical Results

In 2009, sampling was routinely conducted at permitted Outfall 031. Permit-required analyses for the period September 2008 – August 2009 were reported to the TCEQ in December 2009. There were no exceedances under either permit. A summary of these results is shown in Table 8.2.

8.5 Historical Comparisons

Results for ammonia, biochemical oxygen demand (BOD), chemical oxygen demand (COD), explosives, metals, and oil and grease were comparable to data collected during 2008, and during previous years.

8.6 Conclusions

Approximately 381 analyses were accomplished for permit-required samples taken from Outfall 031, with no reported violations. All sample results were below any effluent limitations established in the Land Application Permit. As a best management practice and for process control, an additional 38 samples were collected from the influent weir and 38 samples for miscellaneous (non-permitted) constituents. These efforts provide information on the treatment capability and efficiency of the wastewater treatment system.

Through significant efforts on the part of many organizations, B&W Pantex has beneficially reused more than 500 million gallons of treated wastewater for agricultural purposes. These activities demonstrate not only the successful operation and maintenance of the irrigation system, but also provide a valuable benefit related to water conservation and corrective action remediation goals at Pantex.

TABLE 8.2 — *Water Quality Results from Outfall 031, 2009*

Analyte	TLAP Limits (mg/L) (Avg/Max)	Minimum Conc. (mg/L)	Maximum Conc. (mg/L)	Average Conc. (mg/L)	Permit Exceedances/ Violations	Percent Compliance
Ammonia	Report	< 0.05	1.12	0.21	0/0	100
BOD	Report	8.5	53.0	21.2	0/0	100
COD	Report	24.0	76.0	46.1	0/0	100
NO2/NO3	Report	0.05	0.51	0.19	0/0	100
Oil/Grease	Report	1.5	5.2	3.3	0/0	100
PH	6.0 Min. 10.0 Max.	8.3	9.0	8.6	0/0	100
Total Cyanide	Report	< 0.005	< 0.005	< 0.005	0/0	100

Note:
An exceedance is defined as a measured value above or below a permit limit.
A violation is defined as a missing permit parameter. For example, failure to obtain a permit-required sample.
ND = Not detected.

TABLE 8.2 — *Water Quality Results from Outfall 031, continued*

Analyte	TLAP Limits (mg/L) (Max)	Minimum Conc. (mg/L)	Maximum Conc. (mg/L)	Average Conc. (mg/L)	Permit Exceedance/ Violation	Percent Compliance
Antimony	Report	< 0.003	< 0.003	< 0.003	0/0	100
Arsenic	0.3	< 0.005	< 0.005	< 0.005	0/0	100
Beryllium	Report	< 0.0005	< 0.0005	< 0.0005	0/0	100
Cadmium	0.2	< 0.001	< 0.001	< 0.001	0/0	100
Chromium	5.0	< 0.005	< 0.005	< 0.005	0/0	100
Cobalt	Report	< 0.005	< 0.005	< 0.005	0/0	100
Copper	2.0	0.0003	0.065	0.020	0/0	100
Lead	1.5	< 0.002	< 0.002	< 0.002	0/0	100
Manganese	3.0	0.018	0.035	0.027	0/0	100
Mercury	0.01	ND	ND	ND	0/0	100
Molybdenum	Report	< 0.010	< 0.010	< 0.010	0/0	100
Nickel	3.0	< 0.005	< 0.005	< 0.005	0/0	100
Selenium	0.2	< 0.005	< 0.005	< 0.005	0/0	100
Silver	0.2	ND	ND	ND	0/0	100
Thallium	Report	< 0.001	< 0.001	< 0.001	0/0	100
Titanium	Report	< 0.005	< 0.005	< 0.005	0/0	100
Zinc	6.0	< 0.010	0.053	0.018	0/0	100
HMX	Report	ND	ND	ND	0/0	100
RDX	Report	ND	ND	ND	0/0	100
PETN	Report	ND	ND	ND	0/0	100
TNT	Report	ND	ND	ND	0/0	100

This page was intentionally left blank.

Surface Water

Data from the surface water program during 2009 were consistent with historical data from past monitoring activities, indicating that operations at Pantex Plant have not been adversely impacting the surface water environment at Pantex.

9.1 The Scope of the Program

Pantex Plant has a semi-arid climate and is located in a region of relatively flat topography. Surface water represented by rivers or streams does not exist around the facility site; all surface water drains to isolated playa lakes (Figure 9.1). Playa lakes are a unique topographic feature in the Texas Panhandle. They are shallow, ephemeral lakes that have clay-lined basins that fill periodically with surface water runoff. There are approximately 20,000 playas on the southern high plains. Playa lakes are extremely important hydrologic features that provide prime habitat for wildlife, especially waterfowl that winter in the southern High Plains. Playas are also believed by most authorities to be an important source of recharge for the Ogallala Aquifer, the area's primary source of groundwater.

Six playas are found on U.S Department of Energy (DOE)-owned and -leased property. Two of these are on property owned by Texas Tech University (TTU). Most of the surface drainage on the DOE-owned and -leased lands flows via man-made ditches, natural drainage channels, or by sheet-flow to these onsite playa basins. Playa basins consist of the ephemeral lakes themselves and their surrounding watersheds. Figure 9.2 is a map that shows the locations of the six playas at the facility site with their respective drainage basins (watersheds). Some storm water on the outer perimeter of the facility site flows to offsite playa basins. These areas are at the outer periphery of the site and, for the most part, a considerable distance from most Plant operations.

FIGURE 9.1 — *A Playa Lake at Pantex Plant*

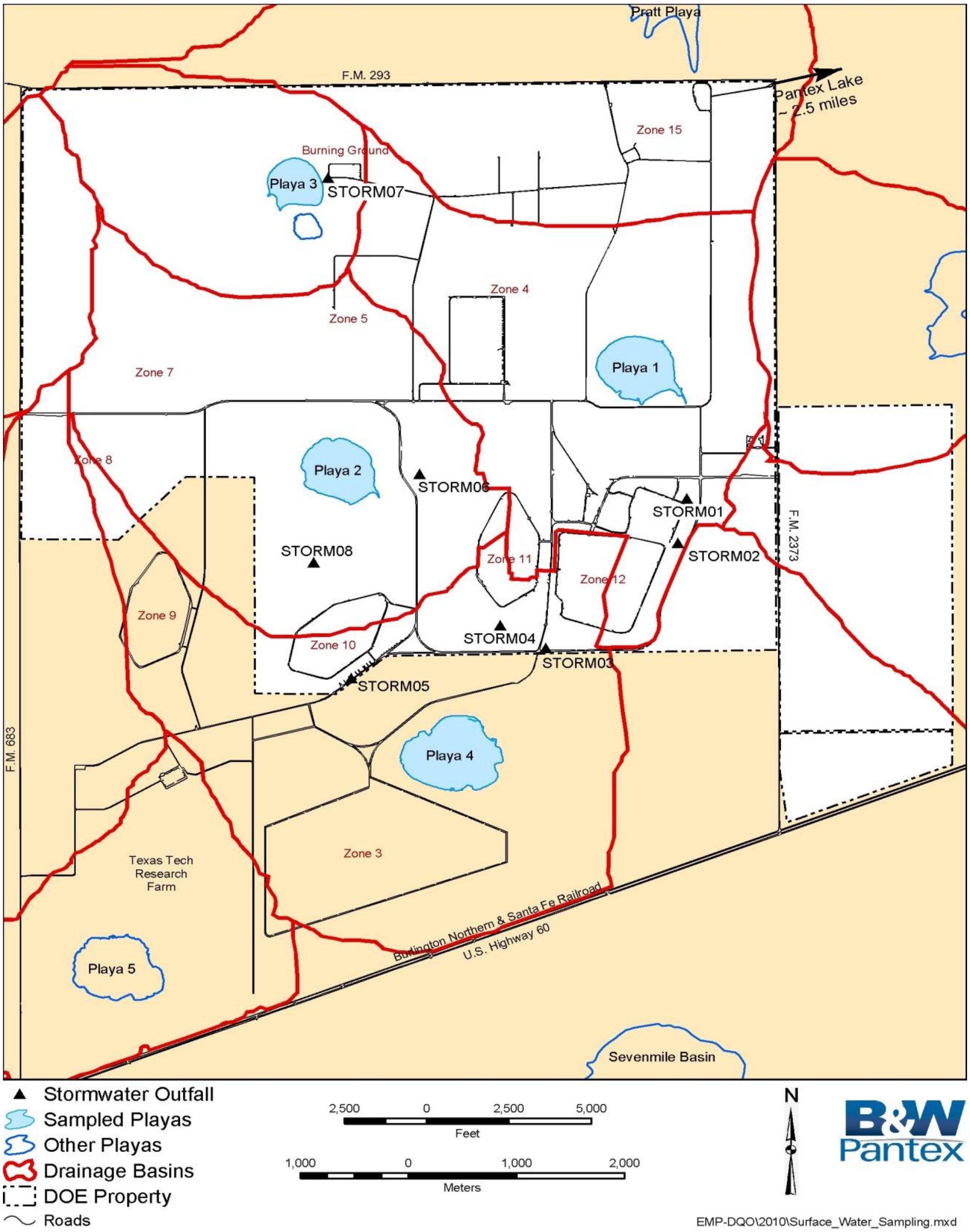


FIGURE 9.2 — *Drainage Basins, Playas, and Storm Water Outfalls at Pantex Plant*

Industrial effluents from Pantex operations, as well as domestic wastewater, are treated and directed into the onsite Wastewater Treatment Facility (WWTF). Wastewater management at Pantex is discussed in more detail in Chapter 8 of this report. Effluent from the WWTF and storm water runoff from Zones 4, 12, and the northeastern portion of Zone 11 are permitted to discharge through ditches to Playa 1. Storm water runoff from southwestern portions of Zone 11 is channeled to Playa 2 via the ditch system. Storm water runoff from the Burning Ground flows, primarily as sheet flow, into Playa 3. Storm water runoff from southern portions of Zones 10, 11, and 12, discharges into Playa 4 on Texas Tech University (TTU) property. There are no Plant discharges to Pantex Lake, which is located on DOE property to the northeast of the main Plant property, or to Playa 5, which is on TTU property to the southwest. Both of these playas receive storm water runoff from surrounding pastures and agricultural operations.

Surface water sampling occurs as a result of precipitation or discharge events. During 2009, storm water and playa sampling were conducted in accordance with permits issued by the Texas Commission on Environmental Quality (TCEQ) and the site's *Environmental Monitoring Plan* (Pantex Plant, 2009).

Storm water runoff at Pantex Plant is sampled in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Multi-Sector General Permit (MSGP) for storm water. The MSGP was issued in August of 2006. B&W Pantex filed for coverage under the MSGP in November of 2006. The permit expires in August 2011. Storm water sampling locations, known as "outfalls," are conveyances in which storm water accumulates and discharges (Figure 9.3). Locations have been selected based on their proximity to operational areas of the Plant.

FIGURE 9.3 — *Storm Water Discharging at Pantex Plant*

Only one TPDES permit for storm water involving construction activity was in effect at the end of 2009. These general permits do not require analytical monitoring, but rely on best management practices, such as storm water pollution prevention plans, erosion controls, soil stabilization controls, and routine field inspections. The State of Texas was delegated permitting authority for construction storm water from the U.S. Environmental Protection Agency. The TCEQ developed a 5-year general permit for construction storm water which expires in March 2013. This permit and the Plant's surface water compliance status are discussed in more detail in Chapter 2.

9.2 Sampling Locations and Monitoring Results

B&W Pantex conducted surface water monitoring during 2009 at designated sampling locations in accordance with permit requirements. Environmental surveillance monitoring was also conducted at selected locations as a best management practice. Ensuring that Plant operations are conducted in a manner so as to not impact storm water or the playas is of paramount importance at Pantex.

In addition to routine sampling at four onsite playas, Pantex Plant has two permitted industrial outfalls near the WWTF and eight storm water outfalls (Figure 9.2). The flow diagram in Figure 9.4 shows how storm water and treated industrial effluents discharge through these outfalls, and ultimately to the playas or the subsurface drip irrigation system on the Pantex site. During 2009, all of the Site's treated wastewater was used in the Site's subsurface drip irrigation system. No treated wastewater was discharged to Playa 1 during 2009. Appendix A lists the 2009 surface water analytes.

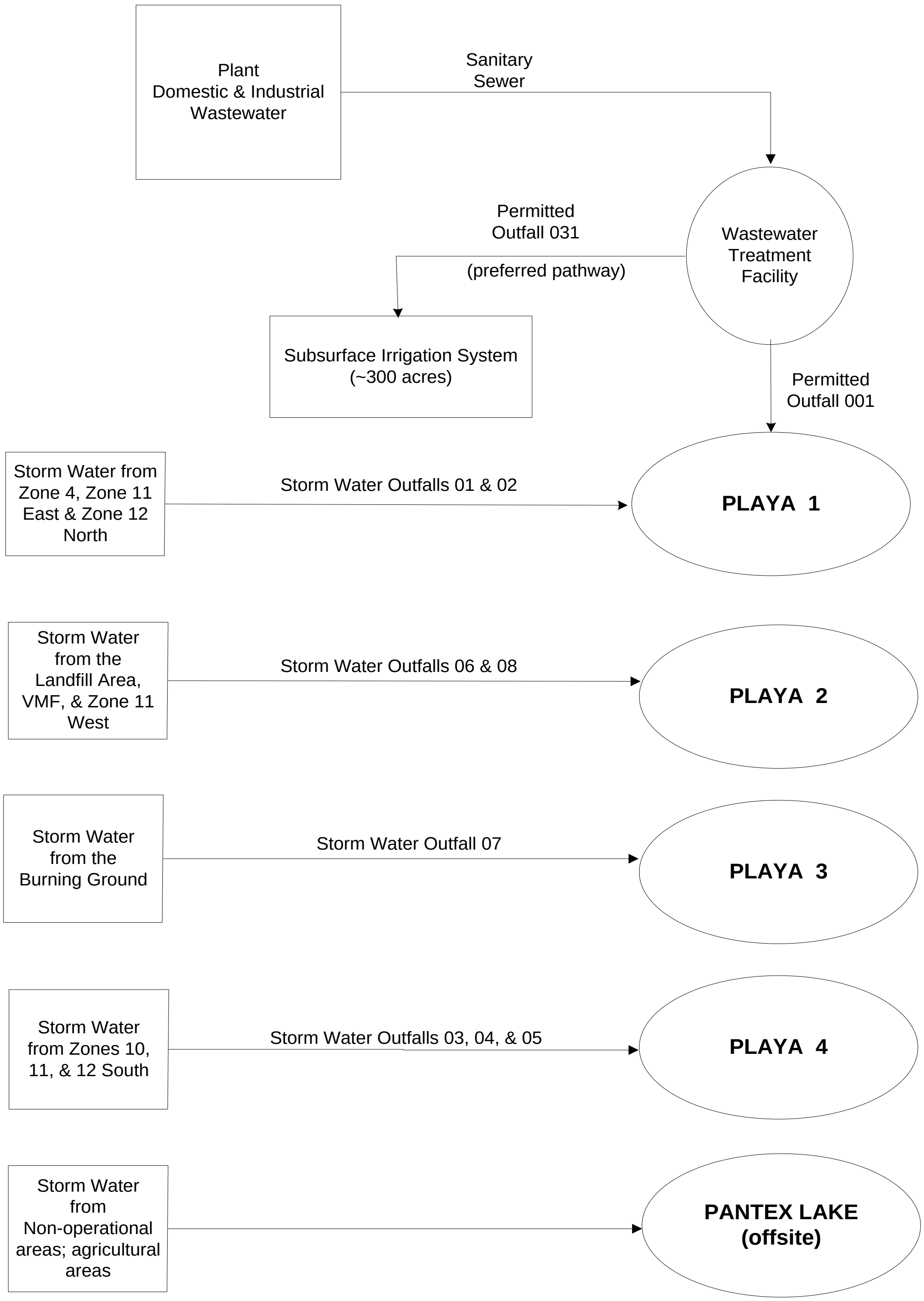


FIGURE 9.4 — *Pantex Surface Water Schematic, 2009*

During 2009, sampling was conducted at seven of eight storm water outfalls and at four of six playa lakes found on DOE-owned and –leased land. Based on data from the Amarillo National Weather Service northeast of Amarillo and southwest of Pantex Plant, rainfall during 2009 was approximately 53.7 cm for the year (21 inches). This is slightly above the annual average amount (49.7 cm or 19.56 inches) typically received each year.

Storm water monitoring required by the TPDES MSGP in 2009 consisted of visual monitoring and analytical monitoring and both are required each year of the General Permit. Visual monitoring involves the examination of the physical properties of storm water including color, clarity, odor, oil sheen, solids, and foam. Visual samples taken and examined in 2009 appeared to be of good quality, and none showed any abnormalities based on the criteria specified in the General Permit. Analytical monitoring consisted of metals [Inland Water Quality Parameters (IWQPs)] listed in 30 TAC 319.22 and sector-specific analytes required by the permit. Metals were compared with IWQPs in 2009. Sector-specific analytes are compared to benchmarks listed in the General Permit. Only seven of the eight storm water outfalls had sufficient flow for sampling during 2009. Sampling is weather-dependent and was conducted quarterly as storm events occurred. Table 9.1 lists the metal analyte results from the storm water outfalls in 2009 and compares them with the IWQPs.

Environmental surveillance sampling was conducted at the playas for both radiological and non-radiological constituents. Playas 1, 2, 3, and 4 are monitored as a best management practice to confirm that Plant operations are not impacting the water quality of those playas. In addition to the Site's playa sampling program, radiological co-sampling is performed at select playas in coordination with the Texas Department of State Health Services (TDSHS). Pantex performs confirmation co-samples at the playas with the TDSHS during each of their visits throughout the year.

Non-radiological sampling at the playas during 2009 included metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and explosives. Results of metal analyses were compared to IWQPs and with historical values. VOCs, SVOCs, and explosives were measured against their respective Practical Quantitation Limits (PQLs) and also compared to historic results.

Radiological sampling at the playas included isotopic uranium ($^{233/234}U$, $^{235/236}U$, ^{238}U) and plutonium (^{238}Pu, $^{239/240}Pu$), as well as tritium. Isotopic radiological analyses were compared to Derived Concentration Guides (DCGs) for water. Tritium analyses were compared to the Maximum Contaminant Levels (MCLs) for drinking water for tritium. Specific analytes detected are described in subsequent sections of this chapter.

9.2.1 Playa 1 Basin

Playa 1 is approximately 32 hectares (79.3 acres) and may receive treated wastewater effluent and storm water runoff from several small drainages. Any wastewater effluents are permitted with the TCEQ. One drainage to the playa is associated with Plant operations (Outfall 001); the others receive only storm water runoff from both agricultural and operational areas. There are three drainages along the southern perimeter of Playa 1. All three include storm water from both agricultural and operational areas. Storm Water Outfalls 01 and 02 are located upstream in one of these drainages, which originate from some of the operational areas of Zone 12 North.

TABLE 9.1 — *Annual Storm Water Results (metals), 2009 (mg/L)*

	Outfall STORM01	Outfall STORM02	Outfall STORM03	Outfall STORM04	Outfall STORM05	Outfall STORM06	Outfall STORM07	Outfall STORM08	IWQP
Arsenic	0.0002	0.002	0.003	0.002	0.006	0.002	NS	<0.005	**0.3**
Barium	0.132	0.071	0.095	0.080	0.538	0.042	NS	0.038	**4.0**
Cadmium	0.0005	0.0003	<0.001	0.0002	0.0008	0.0006	NS	0.0002	**0.2**
Chromium	0.003	<0.003	0.003	<0.003	0.028	<0.003	NS	0.002	**5.0**
Copper	0.011	0.006	0.006	0.005	0.025	0.005	NS	0.003	**2.0**
Lead	0.007	0.0007	0.003	0.001	0.020	0.002	NS	0.002	**1.5**
Manganese	0.107	0.019	0.055	0.035	0.472	0.034	NS	0.045	**3.0**
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NS	<0.0002	**0.01**
Nickel	0.004	0.002	0.004	0.002	0.024	0.002	NS	0.002	**3.0**
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NS	<0.005	**0.2**
Silver	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	NS	<0.001	**0.2**
Zinc	0.119	0.017	0.034	0.039	0.266	0.020	NS	0.012	**6.0**

IWQP= Inland Water Quality Parameter limits, 30 TAC 319.22
NS = No sample collected

The western edge of Playa 1 receives storm water runoff from the Zone 4 area. Two drainages transport storm water runoff from agricultural areas that are north of the playa. In 2009, storm water monitoring within the Playa 1 basin was conducted in the playa and at both Storm Water Outfalls 01 and 02.

Playa 1 was sampled in the first quarter for radionuclides and in the third and fourth quarters during 2009 for metals, VOCs, SVOCs, explosives, and radionuclides (Figure 9.5). Metals analyses at Playa 1 were all consistent with historic levels found at the playa and all were below the IWQPs.

VOCs, SVOCs, and explosives were below their respective PQLs (below detection limit). Tritium was below the MCLs for drinking water. Isotopic radiological analyses for uranium and plutonium were below the Derived Concentration Guides (DCGs) for ingested water.

Storm Water Outfall 01—Zone 12 North at BN5A. Flow through this outfall consists entirely of storm water and originates in the operational areas of Zone 12 North. Storm water flows northward from the outfall through the BN5A (east parking lot) ditch and on northward, finally discharging into Playa 1.

FIGURE 9.5 — *Sampling at Playa 1*

Permit-required monitoring at Storm Water Outfall 01 was conducted during the second, third, and fourth quarters of 2009. Sampling included visual monitoring, pH evaluation, and metals. Visual examinations showed no abnormalities based on the visual criteria described in the MSGP. All metals were below IWQPs in 2009.

Storm Water Outfall 02—Zone 12 East at S. 15th Street. Flow through this outfall includes storm water discharges from the eastern portions of Zone 12. Storm water flows northward through the BN5A ditch and on to Playa 1, ultimately draining into the same drainage as Storm Water Outfall 01 before entering the playa.

Permit-required monitoring at Storm Water Outfall 02 was conducted during the first, second, and third quarters of 2009. Monitoring included visual monitoring, pH evaluation, and metals. Visual examinations showed no abnormalities based on the visual criteria contained in the MSGP. All metals were below IWQPs in 2009.

9.2.2 Playa 2 Basin

Playa 2 is approximately 30 hectares (74 acres) and receives only storm water runoff. Playa 2 receives runoff from the west side of Zone 11, the north side of Zone 10, and an area of agricultural fields that

includes both pasture and cultivated fields. In 2009, storm water monitoring within the Playa 2 basin was conducted in the playa and at Storm Water Outfalls 06 and 08.
Playa 2 was sampled in the third quarter during 2009 for metals, VOCs, SVOCs, and explosives. Metals analyses at Playa 2 were all consistent with historic levels found at the playa and all metals were below the IWQPs. VOCs, SVOCs, and explosives were below their respective PQLs.

Storm Water Outfall 06 —Vehicle Maintenance Facility (VMF). This outfall receives storm water runoff from an area that includes the VMF, including portions of the parking lot around the VMF where vehicles awaiting maintenance are staged. The refueling stations for the Plant fleet are also located in this drainage area. The drainage area is primarily a paved area used for parking and staging vehicles on the south side of the VMF.

Monitoring at Storm Water Outfall 06 was conducted during all four quarters of 2009. Monitoring included visual monitoring, pH testing, total petroleum hydrocarbons (TPHs), and metals. Visual examinations showed no abnormalities based on the visual criteria contained in the MSGP. TPH results were low each quarter indicating that runoff from the VMF staging area and refueling operations is not contributing significant pollutants to the environment. All metals were below IWQPs in 2009.

Storm Water Outfall 08—Landfill. This outfall receives storm water runoff from an area that includes the Plant's active landfill. Runoff from active open landfill cells is retained within the cells. Storm water runoff at the outfall consists of runoff over the landfill area including over closed cells. Storm water from this area eventually flows on northward to Playa 2.

Permit-required monitoring at Storm Water Outfall 08 was conducted during the first and third quarters in 2009. Monitoring included visual monitoring, pH testing, total suspended solids (TSS), and metals. Visual examinations showed no abnormalities based on the visual criteria contained in the MSGP and pH was within the normal range. TSS was above benchmark values (100 mg/l) on one occasion, however, normal based on historical data. All metals at the outfall were below IWQPs in 2009.

9.2.3 Playa 3 Basin

Playa 3, the smallest playa at the Pantex site, is approximately 22 hectares (54 acres) and receives only storm water runoff. Playa 3 receives storm water runoff from pastureland, cultivated fields, and portions of the Burning Ground. No well-defined ditches feed into the playa, and runoff occurs primarily as sheet flow. Storm Water Outfall 07 is located northeast of Playa 3 between the playa and the Pantex Burning Ground.

Playa 3 was sampled in the third and fourth quarters during 2009 for metals, VOCs, SVOCs, explosives, and radionuclides. Metals analyses at Playa 3 were all consistent with historic levels found at the playa and all metals were below the IWQPs. VOCs, SVOCs, and explosives were below their respective PQLs. Tritium was below the MCLs for drinking water. Isotopic radiological analyses for uranium and plutonium were below the DCGs for ingested water.

Storm Water Outfall 07—Burning Ground. This outfall receives only storm water runoff, primarily as sheet flow, from the Burning Ground operational area. For this reason, sampling at the outfall can be a challenge. The drainage area is primarily grassland, and the outfall is located between the Burning Ground to the northeast and Playa 3 to the southwest (Figure 9.6). No sampling was conducted at Storm Water Outfall 07 during 2009 due to insufficient flow.

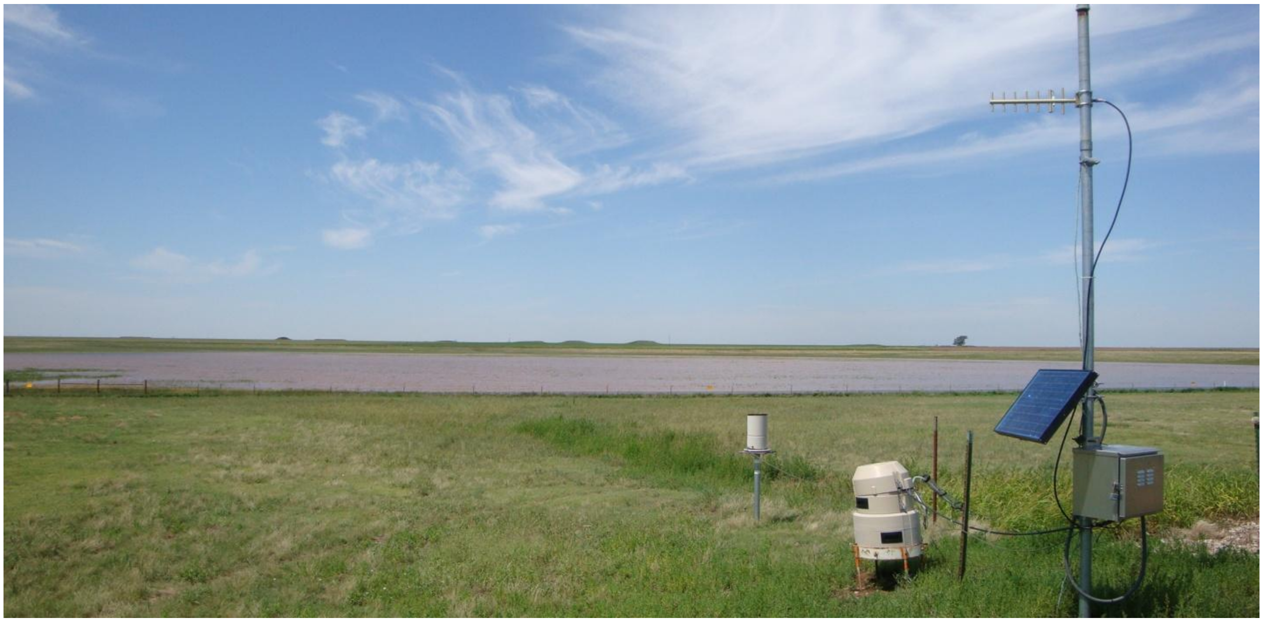


FIGURE 9.6 — *Monitoring Equipment at STORM 07; Playa 3 in Background*

9.2.4 Playa 4 Basin

Playa 4 is approximately 46 hectares (112.5 acres) and is located on property owned by Texas Tech University. The playa receives runoff from primarily pasture areas but does receive some storm water runoff from operational areas on the Pantex site. The playa receives discharges from portions of Zone 10 (through Storm Water Outfall 05), Zone 11 (through Storm Water Outfall 04), and Zone 12 South (through Storm Water Outfall 03). Discharges from Zone 12 are predominately storm water runoff; however, occasionally, Fire Department personnel discharge potable water when flushing the Fire Department's storage tanks or testing fire hydrants. In 2009, storm water monitoring was conducted in the playa and within the basin at Storm Water Outfalls 03, 04, and 05.

Playa 4 was sampled in the third and fourth quarters during 2009 for metals, VOCs, SVOCs, explosives, and radionuclides. Metals analyses at Playa 4 were all consistent with historic levels found at the playa and all metals were below the IWQPs. VOCs, SVOCs, and explosives were below their respective PQLs. Tritium was below the MCLs for drinking water. Isotopic radiological analyses for uranium and plutonium were below the DCGs for ingested water.

Storm Water Outfall 03—Zone 12 South. Surface water monitored at this outfall is primarily storm water runoff from the west half of Zone 12 South that flows to Playa 4. Three drainages along the Plant boundary with TTU, draining the southern portions of Zones 11 and 12, convey most of the water from Zones 11 and 12 to Playa 4. Periodically, potable water from the Plant's fire protection system is discharged through this outfall. There are no industrial effluents discharged through this outfall.

Permit-required monitoring at Storm Water Outfall 03 was conducted during all four quarters of 2009. Monitoring included visual monitoring, pH testing, and metals analyses. Visual examinations showed no abnormalities based on the visual criteria contained in the MSGP and pH was normal. All metals were below IWQPs in 2009.

Storm Water Outfall 04—Zone 11 South. Surface water monitored at this outfall is entirely storm water runoff from the southern half of Zone 11. Storm water from this area discharges southward to Playa 4. No industrial effluents are discharged through this outfall.

Permit-required monitoring at Storm Water Outfall 04 was conducted during the second and third quarters of 2009. Monitoring included visual monitoring, pH testing, and metals analyses. Visual examinations showed no abnormalities based on the visual criteria contained in the MSGP and pH was normal. All metals were below IWQPs in 2009.

Storm Water Outfall 05—Zone 10 South. Water monitored at this outfall is entirely storm water runoff from the southern half of Zone 10 in an area where several contractor laydown yards are located (Figure 9.7). Waste staging is conducted in the area and drainage in this vicinity is very flat. There are no industrial effluents discharged through this outfall.

Permit-required monitoring at Storm Water Outfall 05 was conducted during the second, third, and fourth quarters of 2009. Monitoring included visual monitoring, pH testing, and metals analyses. Visual examinations showed no abnormalities based on the visual criteria contained in the MSGP. All metals were below IWQPs in 2009.

9.2.5 Pantex Lake

Pantex Lake is the largest playa controlled by B&W Pantex and is approximately 136 hectares (337 acres) in size. The playa is located off the Plant proper in a remote area northeast of the main Plant site and receives only storm water runoff from surrounding pastures and cultivated fields. Although Plant discharges to Pantex Lake were discontinued in 1970, routine monitoring at the playa continued through 2003 because of historical wastewater discharges. There are no monitored storm water outfalls in the Pantex Lake basin. The area surrounding Pantex Lake is used for agricultural purposes, primarily livestock grazing. Since there are no Plant operations within the Pantex Lake watershed and a significant amount of historical data was collected through 2003, monitoring at Pantex Lake was discontinued.

FIGURE 9.7 — *Monitoring Equipment at STORM 05; Waste Staging Area in Background*

9.3 Historical Comparisons

Sampling performed at storm water outfalls during 2009 showed no significant changes during the year and was consistent with historical data from past years. All monitoring results for metals are within the IWQP established by the State of Texas. Total suspended solids and total petroleum hydrocarbons reflect similar results to samples taken in the past. Sampling continues to indicate that storm water discharges at Pantex are of good quality and that current operations at the Plant are not degrading storm water quality.

Playa sampling results that were obtained during 2009 were also consistent with past monitoring results. Metals, explosives, VOCs, SVOCs, and radionuclides remain relatively unchanged at the playas. This information continues to support the argument that operations at Pantex Plant do not have a negative impact on the water quality of the playas.

9.4 Conclusions

Monitoring storm water runoff and the playa lakes at Pantex Plant is performed as required by State environmental permits and as a best management practice. It is important to regularly monitor the surface waters at the site to ensure that as the Plant continues to operate, it does so in a manner that is environmentally acceptable. The surface water monitoring program at Pantex Plant continues to provide data that reinforces the premise that continuing Plant operations are having no detrimental impact to the quality of the surface waters at the Plant. Maintaining storm water quality and keeping environmental impacts to the playas to a minimum are important in maintaining the ecosystem, providing quality habitats for wildlife, and protecting groundwater recharge to the aquifer.

Soils

Onsite soil monitoring results for 2009 were, with one exception, within the background levels established for Burning Ground surface soils during 2006.

10.1 The Scope of the Program

This chapter presents the results of surface soil sampling at Pantex Plant. During 2009, soil samples were collected onsite and analyzed for metals and explosives in accordance with Provision VI.H of the Pantex Plant Hazardous Waste Permit HW-50284 (Permit HW-50284). Specific compounds are listed in Appendix A.

10.2 Sampling and Analysis

In 2009, soil samples were collected from two general landscape positions: playa bottoms and interplaya uplands. The characteristic soil types for these landscape positions are Randall clay in playas, and Pullman clay loam in the uplands. Samples for non-radiological analyses were collected as sub-samples from the first 2-inches depth from each associated grid area, and composited to form individual samples (Figure 10.1).

During 2009, soil was sampled at five onsite locations, representing three upland and two playa sampling areas associated with the Burning Ground. All samples were analyzed by offsite contract laboratories that meet U.S. Environmental Protection Agency requirements.

10.3 Data Comparisons

The background comparison levels were determined by obtaining samples taken during three consecutive calendar quarters in 2006 for each monitoring parameter indicated in Tables VI.D.2.b of the Permit HW-50284. If all of the analytical results of the background samples for a particular constituent at any location were less than the Method Detection Limit (MDL) identified in Table VI.D.2.b, the background value was set at the MDL or the Practical Quantitation Limit (PQL), whichever was greater. If the analytical results of less than 50 percent of the background samples for a particular constituent at any location were greater than the MDL identified in Table VI.D.2.b, the background value was set at the highest detected value, the MDL, or the PQL, whichever was greater. If the analytical results of more than 50 percent of the background samples for a particular constituent at any location were greater than the MDL identified in Table VI.D.2.b, the background value was calculated using a 95 percent upper tolerance limit with 99.9 percent coverage.

Interpretation of soils data is based on several comparisons, each of which is applicable or appropriate for some, but not necessarily all, analytical contexts. Comparison with the Texas Risk Reduction Standard (RRS), a site-specific administrative regulatory standard, is useful only for those contaminants of potential concern (COPC) with established values for the site.

10.4 Results

Analytical results are summarized in the following sections. Results for metals are reported in 10.4.1 and explosive compounds are reported in 10.4.2.

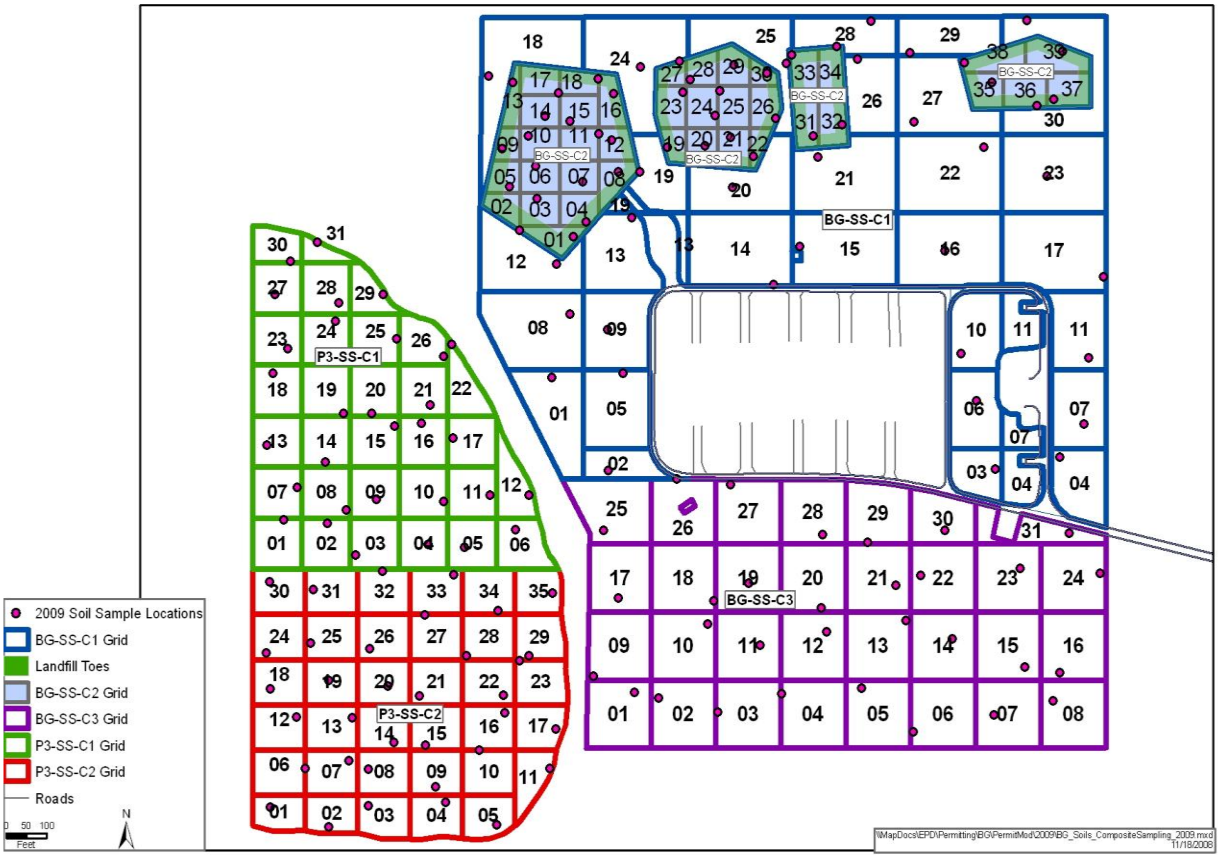


FIGURE 10.1 — *Burning Ground Multi-Incremental Soil Sampling Locations for 2009*

10.4.1 Metals Analysis

Soil samples from the Burning Ground and Playa 3 were analyzed for 10 metals. (See the "Soil" column in Appendix A.) With the exception of nickel at sampling location BG-SS-C3, all of the metal concentrations observed in 2009 were below the established permit background concentrations. The initial sampling results indicated potential statistically significant increases (SSIs) for nickel (60.3 mg/kg). The established background concentration is 30.88 mg/kg for nickel at this location. The confirmation sampling, as provided for in Provision VI.F.1.a of Permit HW-50284, result was 13.7 mg/kg for nickel, which is below the established background value at location BG-SS-C3.

10.4.2 Explosives Analysis

Soil samples collected from the Burning Ground and Playa 3 were analyzed for eight explosive compounds (Appendix A). All sampling results for explosives in 2009 were below the established permit background concentrations.

10.5 Conclusions

With the exception noted for the initial nickel results, onsite Burning Ground soil monitoring results for 2009 were within the concentration ranges of the established background levels. The complete Burning Ground soil sampling results are reported to the Texas Commission on Environmental Quality in the Annual Burning Ground Report. Assessment of the contaminant risk and remediation of the Burning Ground, if appropriate, is part of the B&W Pantex Environmental Restoration Program.

This page was intentionally left blank.

Fauna

Radionuclide concentrations in fauna samples (black-tailed prairie dogs and cottontail rabbits) were compared to historical values and values observed in samples from control locations. No sampling was accomplished during the planned Fall sampling period. Comparisons indicated no detrimental impacts from Plant operations in 2009.

11.1 The Scope of the Program

Fauna surveillance is complementary to air, flora, water, and soil monitoring in assessing potential short- and long-term effects of Pantex Plant operations on the environment. Animals at Pantex Plant were sampled to determine whether Plant activities have an impact on them. Prairie dogs and cottontail rabbits were the species selected for sampling because they interact with both primary (air, water, soil) and secondary (vegetation) environmental media being analyzed. Prairie dog samples were analyzed for radionuclides and for various diseases that could potentially impact Plant personnel working in areas where prairie dog colonies have been established. Cottontails were sampled for radionuclides, because the rabbits are present across the Plant, including around work areas in Zones 4 and 12. The results of fauna sampling are summarized in Sections 11.2 and 11.3.

Further explanations and the justification for the faunal surveillance monitoring program are contained within data quality objectives (DQOs) established as a part of the *Environmental Monitoring Plan* (Pantex Plant, 2009) described in Section 3.8 of this document. Analytical data are maintained in the Plant's Integrated Environmental Database, managed by the Projects Division.

11.2 Radiological Surveillance in Fauna

Radionuclide surveillance of fauna at Pantex was scheduled semi-annually at nine onsite locations and one control location. However, no sampling was accomplished during the planned Fall sampling period. Areas sampled are the Burning Ground, Firing Site-4 (FS-4), Zone 4, Zone 12 South, northwest of Building 12-36, west of Zone 4, Playa 2, Playa 3, and Zone 8 (Figure 3.9). Control samples are collected at Buffalo Lake National Wildlife Refuge near Umbarger, Texas. Buffalo Lake was chosen as the control site because populations there are far enough from the Pantex Plant (66 km/41 mi) to be unaffected by Plant operations, and more so than on private lands, affords a dependable availability of prairie dogs and property access.

Sample animals are live-trapped, euthanized, and shipped to the analytical lab. Whole-body composites are prepared for determination of tritium, $^{233/234}U$, and ^{238}U levels. These analytes are associated with Pantex activities, and all are naturally occurring in Pantex soils.

Analytical results of the 2009 faunal sampling are presented in Table 11.1 (prairie dogs) and 11.2 (cottontails), as are the historical means (1997-2000) for prairie dogs. Sixteen prairie dogs and 6 cottontails were sampled. Although historic means are not established for cottontails, or for prairie dogs collected at the FS-4, west of Zone 4, and 12-36 sites, all 2009 results for all cottontail and prairie dog samples were below minimum detection activity (mda) levels. For all analysts, values were similar between sites, and were similar or less than historic data.

TABLE 11.1 — *Tritium, $^{233/234}$U, and ^{238}U in Prairie Dogs in 2009, in pCi/g Dry Weight*

Location	No. of Samples (# ≤ MD)	Maximum[a]	Minimum[a]	Mean ± Std.[b]	No. of Samples in 1997-2000	1997-2000 Mean ± Std
Tritium						
Zone 4 (W)	1 (1)	-0.061[c] ± 0.431	--	--	--	--
Zone 8	2 (2)	0.137 ± 0.427	0.122 ± 0.455	0.130 ± 0.011	14	0.017 ± 0.065
Playa 2	2 (2)	0.310 ± 0.504	0.074 ± 0.454	0.192 ± 0.167	14	0.055 ± 0.136
Burning Ground	2 (2)	0.194 ± 0.407	0.072 ± 0.439	0.133 ± 0.086	11	0.152 ± 0.300
Playa 3	2 (2)	0.099 ± 0.458	-0.199 ± 0.400	-0.050 ± 0.211	14	0.019 ± 0.070
FS-4	2 (2)	0.428 ± 0.434	0.125 ± 0.431	0.277 ± 0.214	--	--
12-36	2 (2)	0.146 ± 0.456	0.024 ± 0.441	0.085 ± 0.086	--	--
Buffalo Lake[d]	3 (3)	0.502 ± 0.453	-0.063 ± 0.447	0.176 ± 0.292	14	0.015 ± 0.055
$^{233/234}$Uranium						
Zone 4 (W)	1 (1)	0.012 ± 0.015	--	--	--	--
Zone 8	2 (2)	0.014 ± 0.017	0.004 ± 0.015	0.009 ± 0.007	11	0.012 ± 0.019
Playa 2	2 (2)	0.017 ± 0.015	0.010 ± 0.012	0.013 ± 0.004	11	0.013 ± 0.022
Burning Ground	2 (2)	0.023 ± 0.015	0.015 ± 0.018	0.019 ± 0.005	9	0.018 ± 0.040
Playa 3	2 (2)	0.006 ± 0.013	0.002 ± 0.018	0.004 ± 0.003	11	0.020 ± 0.022
FS-4	2 (2)	0.017 ± 0.012	0.011 ± 0.022	0.014 ± 0.004	--	--
12-36	2 (2)	0.025 ± 0.078	0.016 ± 0.014	0.021 ± 0.006	--	--
Buffalo Lake	3 (3)	0.035 ± 0.019	0.008 ± 0.009	0.024 ± 0.014	11	0.017 ± 0.025
^{238}Uranium						
Zone 4 (W)	1 (1)	0.012 ± 0.010	--	--	--	--
Zone 8	2 (2)	0.024 ± 0.017	0.018 ± 0.012	0.021 ± 0.004	11	0.010 ± 0.021
Playa 2	2 (2)	0.014 ± 0.012	0.012 ± 0.013	0.013 ± 0.001	11	0.009 ± 0.009
Burning Ground	2 (2)	0.015 ± 0.011	0.012 ± 0.010	0.014 ± 0.002	9	0.013 ± 0.026
Playa 3	2 (2)	0.004± 0.013	0.002 ± 0.009	0.003 ± 0.001	11	0.011 ± 0.015
FS-4	2 (2)	0.009 ± 0.010	-0.002 ± 0.013	0.004 ± 0.008	--	--
12-36	2 (2)	0.012 ± 0.012	0.008 ± 0.008	0.010 ± 0.003	--	--
Buffalo Lake	3 (3)	0.021 ± 0.014	0.008 ± 0.011	0.013 ± 0.007	11	0.015 ± 0.029

a Counting error at 95 % confidence level. The second of each paired set of values in the "Max" and "Min" columns is the "error."
b Standard deviation. (See definition in Glossary.)
c Negative values indicate results below the (statistically determined) background level for the counting system used at the analytical laboratory.
d Control location.

TABLE 11.2 — *Tritium, $^{233/234}$U, and ^{238}U in Cottontail Rabbits in 2009, in pCi/g Dry Weight*

Location	No. of Samples (# ≤ MD)	Maximum[a]	Minimum[a]	Mean Std.[b]
Tritium				
Zone 4	2 (2)	0.436 ± 0.452	0.428 ± 0.444	0.432 ± 0.006
Zone 12 South	2 (2)	0.645 ± 0.448	0.472 ± 0.451	0.559 ± 0.122
Buffalo Lake[d]	2 (2)	0.197 ± 0.466	0.179 ± 0.439	0.188 ± 0.013
$^{233/234}$Uranium				
Zone 4	2 (2)	0.021 ± 0.016	-0.008[c] ± 0.014	0.006± 0.020
Zone 12 South	2 (2)	0.010 ± 0.015	0.004 ± 0.017	0.007 ± 0.004
Buffalo Lake[d]	2 (2)	0.031 ± 0.017	0.013 ± 0.016	0.022 ± 0.013
^{238}Uranium				
Zone 4	2 (2)	0.017 ± 0.013	0.000 ± 0.288	0.008 ± 0.012
Zone 12 South	2 (2)	0.013 ± 0.017	0.002 ± 0.011	0.007 ± 0.007
Buffalo Lake[d]	2 (2)	0.013 ± 0.013	0.009 ± 0.014	0.011 ± 0.003

[a] Counting error at 95 % confidence level. The second of each paired set of values in the "Max" and "Min" columns is the "error."
[b] Standard deviation. (See definition in Glossary.)
[c] Negative values indicate results below the (statistically determined) background level for the counting system used at the analytical laboratory.
[d] Control location.

11.3 General Health and Disease Surveillance in Prairie Dogs

Prairie dog analysis for disease at Pantex Plant began in July 1996. A veterinary medical diagnostic laboratory was subcontracted to assess the health of the prairie dogs through histopathological analysis, necropsy, and complete blood counts, using standard diagnostic laboratory procedures. The results provide information about the presence of diseases and the general health of the prairie dog populations at Pantex Plant, and at Buffalo Lake National Wildlife Refuge, the control site. Cottontails are not tested for disease, but would be subject to sampling should an outbreak be suspected or indicated.

Twelve prairie dogs (from Pantex and Buffalo Lake) were collected in 2009 and tested for diseases that might impact human or animal populations, including eastern and western equine encephalitis, tularemia, plague, and pseudorabies. Testing for West Nile virus was dropped in 2009. With the assumption that Pantex sites are close enough that disease would likely impact multiple areas, sampling for disease is only conducted at sites established prior to 2005, with the exception of Pantex Lake, which was added as a sixth onsite sampling location for health and disease monitoring in 2008. This site is located several miles from other sampled locations, is in close association to many private landowners, and thus is the subject of concerns that include disease issues.

Presence of herpesvirus and eastern/western encephalitis were detected in 2009. Low titers of both encephalitis strains were detected in a single prairie dog from Playa 3, but the low levels may not allow for differentiation between the two strains. Neither virus was isolated. Herpesvirus testing has been continued despite it not being a factor in human health. It is, however, of interest to researchers involved in wildlife diseases, with possible implications to research on human viruses. Many mammalian species have some form of associated herpesvirus, and some forms may become endemic to certain host populations. Prairie dogs at Pantex Plant, as well as the control site, have demonstrated the presence of a herpesvirus since sampling began in 1996. All 12 (control site and Pantex) individuals analyzed in 2009 tested positive for herpesvirus or titers of herpesvirus, up from 14 of 19 (74 percent) in 2008. Herpesvirus normally affects only its host species; it is not easily transmissible to humans and is therefore not a significant human health risk (Mock, 2004).

11.4 Conclusions

Radionuclide concentrations in fauna samples (black-tailed prairie dogs and cottontail rabbits) were comparable to values observed in samples from control locations and indicated no detrimental impacts from Plant operations in 2009.

Flora

Radionuclide concentrations in vegetation samples, which included both native vegetation and crops from onsite and offsite locations, were compared to historical values and values observed in samples from control locations. These comparisons indicated no detrimental impacts from Plant operations in 2009.

12.1 The Scope of the Program

Flora surveillance is complementary to air, fauna, water, and soil monitoring in assessing potential short- and long-term effects of Pantex Plant operations on the environment. Radionuclide analyses were performed on both native vegetation and crops. Native vegetation species on the southern High Plains consist primarily of prairie grasses and forbs. Crops are defined as any agricultural product harvested or gathered for animal or human food, including garden produce, forage, or fiber. Data for the 2009 onsite and offsite vegetation surveillance programs are summarized in Sections 12.2 and 12.3. Because various vegetation species accumulate contaminants differently under varied growing conditions, data interpretation is complex, and results must be evaluated in concert with other environmental media.

Further explanations and the justification for the floral surveillance monitoring program are contained within data quality objectives (DQOs) established as a part of the *Environmental Monitoring Plan* (Pantex Plant, 2009) described in Section 3.8 of this document. Analytical data are maintained in the Plant's Integrated Environmental Database, managed by the Environmental Projects Division.

12.2 Radiological Surveillance of Vegetation

Surveillance of vegetation at onsite and offsite locations monitors potential impacts from current Plant operations at the Burning Ground, the firing sites, Zone 12 (Figure 12.1), and offsite at the immediate perimeter of the Plant site and out to approximately 8 kilometers (5 miles) from the center of the Plant (Figure 12.2). Background samples of crop and native vegetation species were collected from control locations at Bushland, Texas. The control locations were selected because of their distance and direction from Pantex Plant, ease of access, lack of industrial activity, and the presence of typical Southern High Plains vegetation.

Sampling locations are approximately 10-meter diameter circles from which vegetation is collected, when it is available. Drought, cultivation, excessive grazing and/or mowing may limit vegetation availability during certain parts of the growing season. Vegetation samples were analyzed for tritium, $^{233/234}U$ and ^{238}U. All results were reported in pCi/g dry weight. The onsite and offsite data were compared to those from the control locations and 6-year mean values, where possible, to identify and interpret differences.

Although the U.S. Department of Energy limits the dose to terrestrial plants to one rad/day (see Section 4.3.2), there are currently no limiting concentrations for tritium or uranium in vegetation.

12.2.1 Native Vegetation Onsite and Offsite

Native vegetation samples, primarily consisting of stems and leaves from grasses and forbs, were collected from one control, seven onsite, and 13 offsite locations (Figures 12.1 and 12.2).

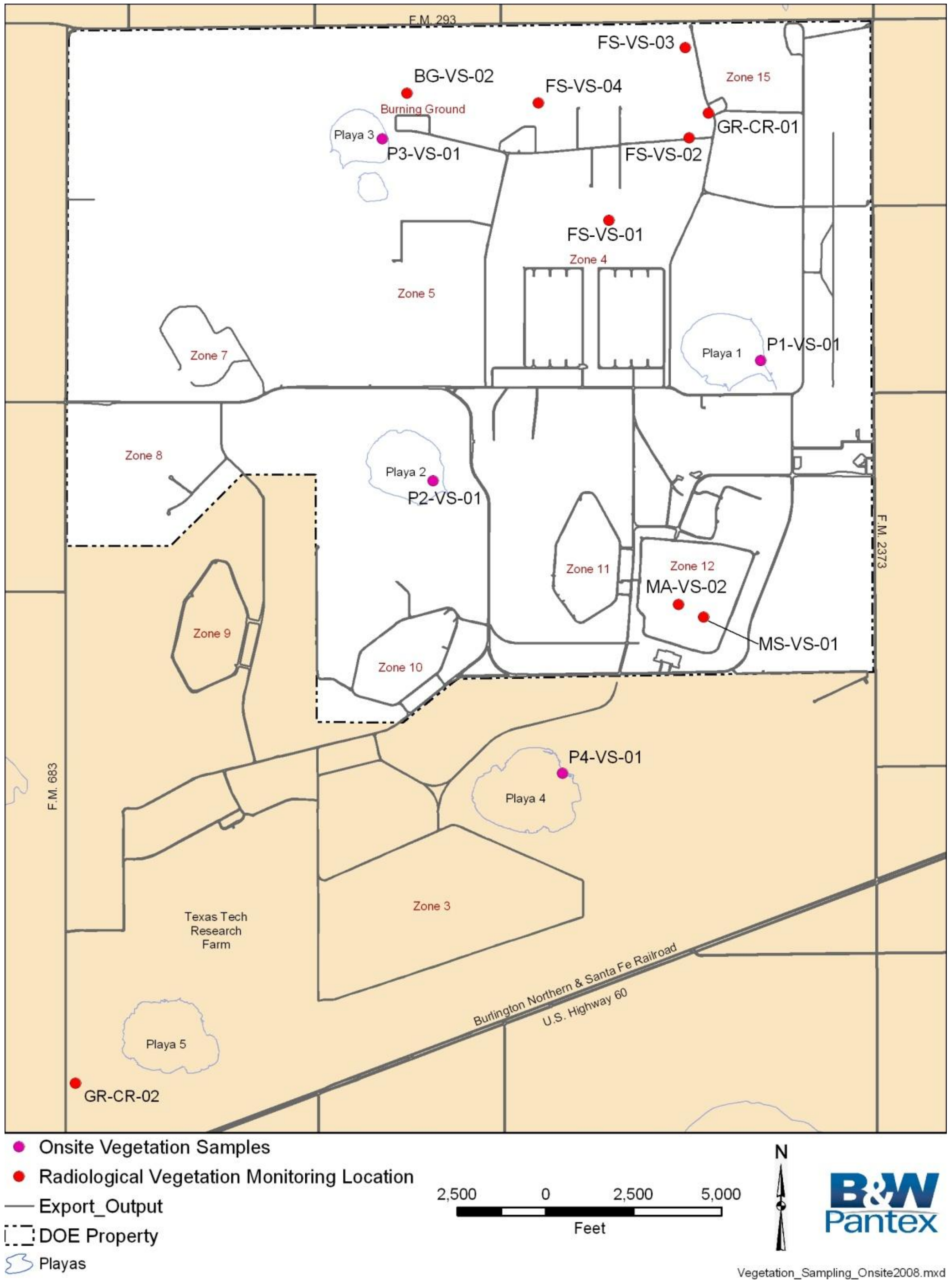


FIGURE 12.1 — *Onsite Vegetation Monitoring Locations*

NOTE: On Figures 12.1 and 12.2, see that O designates offsite, V is for vegetation, P designates playa, GR designates garden produce, and CR is for crops. Any sample location with H behind it is historical and not currently being sampled.

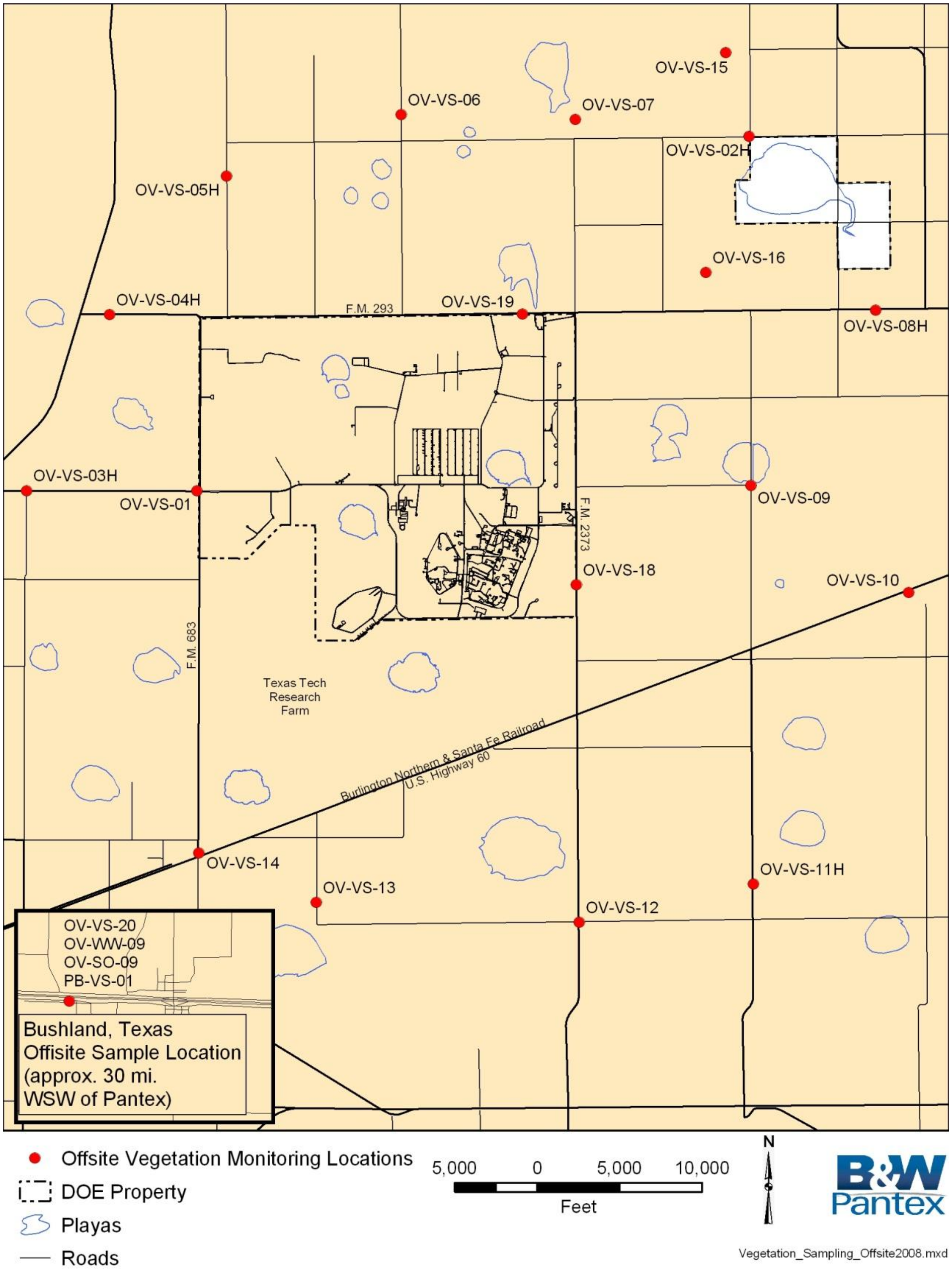


FIGURE 12.2 — *Offsite Vegetation Monitoring Locations*

12.2.2 Native Vegetation

Samples were collected during the growing season, no more frequently than once per month at any location, in 2009. The presence of adequate vegetation for sampling varies due to dry conditions during the growing season. All native vegetation samples were analyzed for tritium, $^{233/234}U$ and ^{238}U. Analytical data were corrected for moisture content and reported in pCi/g dry weight.

Tritium results from 73 percent of onsite and offsite sample locations were at or below minimum detectable activity (MDA) levels; the mean results of tritium analyses at onsite and offsite locations were similar to the results at the control location OV-VS-20 and the historical mean (calendar years 1997-2002). One sampling event during September at FS-VS-02 and OV-VS-19 resulted in a higher measured value for tritium than the control location. The sampling results for these locations were not greater than the all time offsite control location results. The measured value for tritium was an all-time high for the OV-VS-19 location. The location is northeast of the Plant. The tritium value at this location looks to be an outlier and sample results for this location earlier in the year were not elevated and were comparable to the control location. Results for all other offsite locations were consistent with those found in previous years. Concentrations of tritium in native vegetation indicate that no additional uptake of tritium into vascular plants has occurred.

The percentage of vegetation samples above the MDA level for $^{233/234}U$ and ^{238}U in all vegetation were 47 and 51 percent respectively and may be attributed to the fact that area soils have naturally occurring uranium. Since vegetation samples are not washed, they may contain some dirt and dust. Only one sample was higher than the offsite control location for 2009 data. The measured value for $^{233/234}U$ was an all time high at P4-VS-01 but was equivalent to the historical all time high reading for $^{233/234}U$ at the offsite control location. Measured values for ^{238}U at all onsite and offsite locations during 2009 were similar to the values obtained at the control location with the exception of samples at MA-VS-01, OV-VS-14, and P4-VS-01. These locations were slightly higher than the 2009 control location, but were not higher than the all time high historical control value.

12.2.3 Crops

Crop surveillance enables evaluation of potential impacts from Plant operations on humans and livestock. Samples consisting of stems and leaves of winter wheat and grain sorghum were collected onsite and at the Bushland control locations.

Crop sampling locations vary annually according to crop rotation. Garden produce was sampled at two specially-grown garden locations: one on the northeast side of the Pantex property, and one near the Killgore Building on the southwest side of the Texas Tech property (Figure 12.1). Seven winter wheat samples and a duplicate from onsite were collected in April 2009, and one control sample was collected from Bushland. Onsite winter wheat and grain sorghum sampling locations were near the Burning Ground, with the remainder evenly distributed across the Plant. Seven onsite samples and a duplicate sample of grain sorghum were collected in September 2009.

Fruits and leaves from garden plants were sampled in September 2009. All crop and garden samples were analyzed for tritium, $^{233/234}U$ and ^{238}U. The mean plus two standard deviations of the resulting values of tritium, $^{233/234}U$ and ^{238}U at the garden locations during 2009 were similar to the values obtained at the control location and to historical results.

Tritium results in grain sorghum were similar to the onsite and offsite vegetation samples. The results for all onsite wheat and grain sorghum locations in 2009 were comparable to historical figures. Results for $^{233/234}U$ and ^{238}U in wheat and grain sorghum were comparable to results from offsite control locations and to the value of the historical mean plus two standard deviations.

12.3 Conclusions

Radionuclide concentrations in flora samples were comparable to values observed in samples from control locations or historical data and indicated no detrimental impacts from Plant operations in 2009.

This page intentionally left blank.

Quality Assurance

Quality is an integral part of every function at Pantex Plant. An aggressive program is in place to ensure that all environmental monitoring data meet appropriate quality assurance/quality control requirements. Of the 23,679 individual results obtained from all laboratory analyses during 2009, the results determined to be useable amounted to 98.8 percent. Quality assurance (QA) practices are employed to ensure that highly reliable data were consistently produced as a result of the QA process.

13.1 The Scope of the Program

Pantex Plant has an established quality assurance/quality control (QA/QC) program designed to ensure the reliability of analytical data used to support all site environmental programs. This program also satisfies the quality requirements implemented under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Record of Decision, Texas Commission on Environmental Quality (TCEQ) Groundwater Compliance Plan, CP-50284, and U.S. Department of Energy (DOE) Order 450.1A, *Environmental Protection Program* (DOE, 2008). During 2009, the QA/QC program enhanced the reliability of data acquired for environmental monitoring, which includes air, soil, groundwater, surface water, flora, and fauna programs.

The ultimate goal of the Pantex QA/QC program is to generate reliable, high quality environmental monitoring data consistently. This program is also designed to maximize the amount of usable environmental data and minimize potential sources of error during sample collection, laboratory analysis, and data management that could impact data quality and associated environmental decisions.

13.2 Planning and Implementation

The QA/QC features of the Plant's environmental monitoring program are described in the *Environmental Monitoring Plan for 2009* (Pantex Plant, 2009). Acquisition of environmental monitoring data is planned with its end use in mind. Each media scientist or subject matter expert defines data collection requirements based on program needs and using guidance from the U.S. Environmental Protection Agency (EPA) process for developing data quality objectives (DQOs), such as EPA QA/G4 *Guidance for Data Quality Objective Process* (EPA/600/R-96/055, September 1994). DOE technical standards, such as *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE-STD-1153-2002), are also used as guidance. Media scientists prepared the DQOs based on the overall data collection needs, regulatory requirements, stakeholder concerns, technical factors, and historical data in their respective areas of expertise.

The approved DQO for a specific monitoring program was scheduled and executed by using technical specifications in the DQO. This includes sample location, sampling frequency, analytical method, and data acceptance criteria. During 2009, each DQO was associated with a procedure, defining requirements for sample collection and data management. Procedures were reviewed and updated, as necessary, to reflect new requirements in associated DQOs or enhancements to the sample collection and data management process.

13.3 Data Quality Assessment

Several assessment processes are employed by Pantex as part of an ongoing quality assurance program to verify that collected site environmental program data are compatible with the data collection goals. These processes included evaluation of laboratory quality assurance, data qualification, laboratory technical performance, and field operations quality assurance. Each of these individual quality elements provided a comprehensive indicator of the reliability of data generated from the program.

13.3.1 Laboratory Quality Assurance

During 2009, the Pantex Plant Laboratory Quality Assurance Program (LQAP) continued to provide qualified laboratory auditors to participate in the Department of Energy Consolidated Audit Program (DOECAP). The primary function of DOECAP is to evaluate laboratory quality assurance systems and verify that they are effective. Pantex supports this resource-sharing approach to laboratory quality assurance.

To ensure that all subcontract laboratories provide high quality analytical services, an effective approach to laboratory quality assurance was implemented through the LQAP, which used three key processes to ensure overall quality of environmental monitoring data:

- Technical and programmatic laboratory auditing, performed at least annually, aided in selecting and retaining qualified laboratories and ensuring all existing subcontract laboratories are qualified to provide high quality analytical laboratory services for Pantex Plant under DOECAP.
- Data package assessments (DPAs) were performed annually. Technical specialists selected random analytical deliverables and reviewed all supporting documentation: worksheets, calibration records, method detection limit studies, and QA/QC reports. The review evaluated daily adherence to the quality requirements specified in the *Pantex Statement of Work (SOW) for Analytical Laboratories* (Pantex Plant, June 2005) and in the subcontract laboratory's QA/QC program.
- A technical and contractual verification of the laboratory deliverables, performed by staff scientists as analytical results were received from the laboratories, ensured that contractual deliverable specifications, technical content, and QC deliverables complied with SOW requirements consistent with industry standards.

13.3.2 Data Qualification

Historically, the vast majority of analytical results are usable unless there is a catastrophic QA/QC failure (such as no surrogate or radiotracer recovery) during the analytical process that causes the results to be rejected (declared unusable).

Sample results were qualified as usable by means of various data qualifier flags, based on industry standard conventions, to alert the end user to any limitations in using the result. This approach was taken to make use of as many sample results as possible without sacrificing quality. Sample results that were completely unusable were rejected. Several criteria were used during the verification process so that analytical results could be appropriately qualified. Some of the criteria used were:

- Missed Holding Times. The analysis was not initiated, or the sample was not extracted/prepared, within the time frame required by the EPA method and the SOW.

- Control Limits. A quality control parameter such as a surrogate, spike recovery, response factor, or tracer recovery associated with a sample failed to meet the limits of acceptability.

- Not Confirmed. Analytical methods for high explosives and perchlorate may employ enhanced confirmation techniques, such as mass spectral or diode array detectors. This information is used to qualify data obtained from traditional techniques, such as use of a second chromatographic column, which may be prone to matrix interference. Second column confirmation is especially susceptible to false positives when the constituent of interest is at or near the method detection limit.

- Sample or Blank Contamination. The sensitivity of modern analytical techniques makes it virtually impossible to have a blank sample that is truly analyte-free. This is especially true for inorganic parameters such as metals. When the laboratory either accidentally contaminated the actual sample or the lab blank contained parameters of interest above a control limit, the associated sample results may be qualified.

- Other. This category includes, but is not limited to, the following:

    - Broken Chain-of-Custody (COC). There was a failure to maintain proper custody of samples, as documented on chain-of-custody forms and laboratory sample log-in records.

    - Instrument Failure. Either the instrument failed to attain minimum method performance specifications or the instrument or a piece of equipment was not functioning.

    - Preservation Requirements. The requirements, as identified by the EPA or a specific method, were not met and/or properly documented.

    - Incorrect Test Method. The analysis was not performed according to a method contractually required by Pantex Plant.

    - Incorrect or Inadequate Detection or Reporting Limit. The laboratory is required to attain specific levels of sensitivity when reporting target analytes, unless matrix effects prevent adequate detection and quantitation of the compound of interest.

The end user was alerted to any limitations in the use of the data, based on the DQO requirements. Of the *23,679* individual results obtained in 2009 from all laboratory analyses, 98.8 percent were deemed to be of suitable quality for the intended end use of the data. Figure 13.1 graphically represents the causes for the 1.2 percent of data rejected.

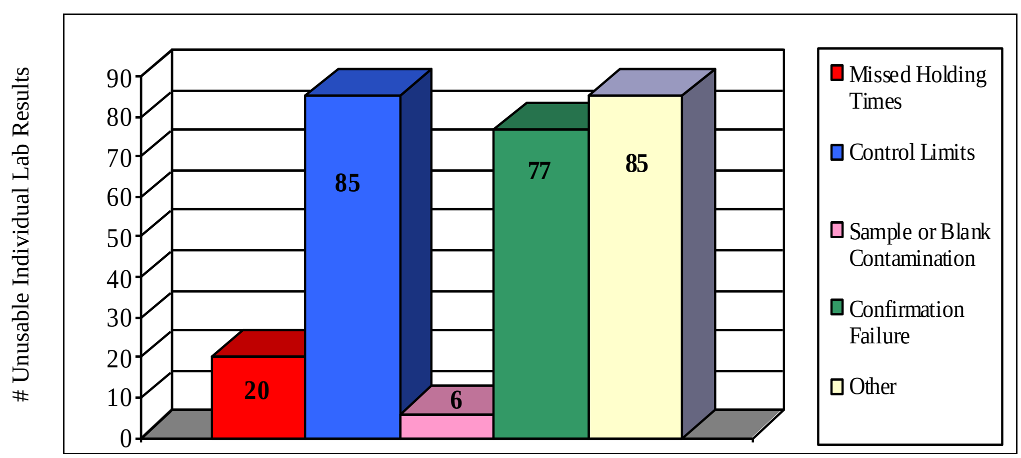


FIGURE 13.1 — *2009 Data Rejection Summary*

13.3.3 Laboratory Technical Performance

All subcontract laboratories were required to participate in inter-laboratory comparison studies administered by DOE and EPA. In 2009, Pantex Plant offsite subcontract laboratories participated in the Mixed Analyte Performance Evaluation Program (MAPEP), sponsored by the DOE/Idaho Operations Office.

The MAPEP includes radionuclides, inorganic, and organic parameters. Under MAPEP, the DOE Idaho Operations Office publishes evaluation reports, rating the analyses from each participating laboratory. MAPEP results for all participating subcontract laboratories used by Pantex Plant in 2009 (GEL, STL, and Southwest Research) are presented in Figure 13.2.

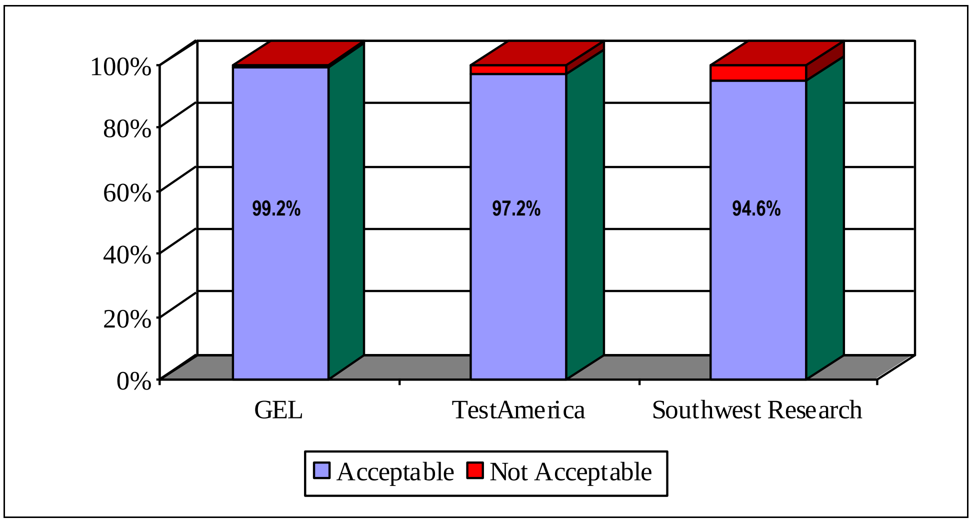


FIGURE 13.2 — *2009 MAPEP Results*

The SOW and DOECAP have requirements that all labs shall participate in several performance evaluations (PEs), including the potable and non-potable water programs (EPA Supply and Water Pollution), and MAPEP, and includes PE matrices such as air filters, soils, waters, and vegetation. MAPEP also has PE matrices containing inorganic, organic, and radioisotopic constituents to test the laboratory's processes of handling mixed-waste type samples.

The primary purpose of the PE programs is to measure a laboratory's implementation of methods to obtain accurate results, and as a comparison between laboratories. All subcontract laboratories used by Pantex Plant had acceptable MAPEP performance in 2009.

13.3.4 Field Operations Quality Assurance

Quality assurance samples, such as duplicates, replicates, blanks, and equipment rinsates, were collected at intervals specified in the DQOs. This was initiated to allow the media scientists to evaluate the data for potential bias or variability originating from either the sampling or the analytical process.

13.3.4.1 Duplicate and Replicate Analyses

During 2009, B&W Pantex continued to collect and analyze field duplicate and replicate samples to evaluate sampling procedures, as well as analytical precision (extraction procedures and analytical systems). A true field duplicate sample set consists of a thoroughly homogenized sample collected from one desired location; the sample has been split into two discrete samples, and labeled as representing two separate sampling locations. When the laboratory is not informed that the two samples are sub-samples from a single sampling location, these samples are referred to as "blind field duplicate samples." When samples are collected from the same site at the same time, the samples are considered field replicates. For comparison purposes, field duplicates and field replicates are evaluated by the same criteria. Random replicate samples were collected for all media, except air and fauna. These exceptions are based upon the uniqueness of the sample type and the inability to replicate the sample. For example, animals collected in a trap do not lend themselves well to duplicate analysis while monitors, which are used to collect air samples, are not duplicated at a particular site.

The vegetation program's radiochemical data were analyzed to compare actual sample values to field replicate values. This program was chosen for statistical analysis because of the relatively high number of replicates required during the sample collection process. The replicate error ratio (RER) was used to perform the replicate analysis. The ratio takes into account the sample and replicate uncertainty to determine data variability. The RER is given by:

$$RER = | S - R | / (\sigma_{95S} + \sigma_{95R})$$

Where:

RER = replicate error ratio
S = sample value (original)
R = replicate sample value
σ_{95S} = sample uncertainty (95%)
σ_{95R} = replicate uncertainty (95%)

An RER of less than or equal to 1 indicates that the replicates are comparable within the 95 percent confidence interval. For 2009, the average RER for vegetation data value was 0.291, with an associated standard deviation of 0.013. The 2009 vegetation sample RER analysis indicated that field replicate sample precision accurately reflects the actual sample value.

13.3.4.2 Blanks and Rinsates

During 2009, trip blanks, field blanks, and/or rinsate samples were collected for all media except fauna. Blank samples were used to evaluate contamination that may have occurred during sampling, sample shipment, or laboratory operations. Trip blank and field blank values were used to qualify detects found in sample values. These detects found were used to qualify sample detects as "U" (undetected).

- A rinsate (equipment) blank is a sample of analyte-free water poured over or through decontaminated sampling equipment. The rinse solution is collected to show that there is no contamination from the sampling tool, or cross contamination between samples.

- Field blanks are analyte-free water samples that are taken to the field and opened for the duration of the sampling event, and then closed and sent to the lab. Field blanks assess if airborne contamination exists at the sampling site.

- Trip blanks are provided for each shipping container (cooler) to evaluate potential contamination of the sample bottles during shipment from the manufacturer, storage of the bottles, shipment to the laboratories, or analysis at the laboratory. Volatile organic compounds such as methylene chloride, toluene, and acetone were detected in trip blanks in 2009. These compounds are indicative of common laboratory solvents and materials associated with the sampling containers. The frequency of detection was 3.2 percent. Other analytes detected in blanks were metals such as aluminum, calcium, chromium, magnesium and sodium, which may be present in trace amounts in ASTM Type II grade reagent water.

13.4 Onsite Analytical Laboratories

A limited number of samples were analyzed onsite during 2009, using approved EPA or standard industry methods:

- Safety and Industrial Hygiene Department laboratory analysis of samples for chemical oxygen demand, biochemical oxygen demand, nitrites, alkalinity, and total hardness; and

- Analytical Services laboratory analysis of samples for alkalinity, color, hardness, nitrates, nitrites, and hexavalent chromium.

These onsite laboratories followed an internal quality control program similar to the program outlined in the Pantex analytical laboratory SOW. The onsite laboratories were audited by the Plant's internal quality audit program. Sampling technicians performed field measurements of certain samples for residual chlorine, dissolved oxygen, turbidity, conductivity, hydrogen sulfide, temperature, and pH.

13.5 Continuous Improvement

During 2009, the DOE, Pantex Plant acquired analytical data to support several aspects of the environmental monitoring program as required by permits, regulations, and DOE Orders**.** The QA/QC program described in this chapter was implemented to ensure the programmatic and technical elements required to meet these criteria. In addition, this program functioned to provide cost efficient analytical data of known and defensible quality.

Overall programmatic data quality has remained consistent as a result of continuous improvement in analytical methods, quality control/assurance practices, and refinement of data quality objectives, which can be quantified by trending the amount of useable data acquired over the past 14 years (Figure 13.3). Using 1996 as the base year, a 95 percent lower performance target was established to trend data usability. As with any data collection process, improvements are continually being made in defining technical specifications and improving sample collection methodology, laboratory instrumentation, and quality control practices. It is important to remember that any viable quality system undergoes continuous improvement by the very nature of the quality elements employed. This is the QA/QC program perspective used to review data critically for the annual site environmental report.

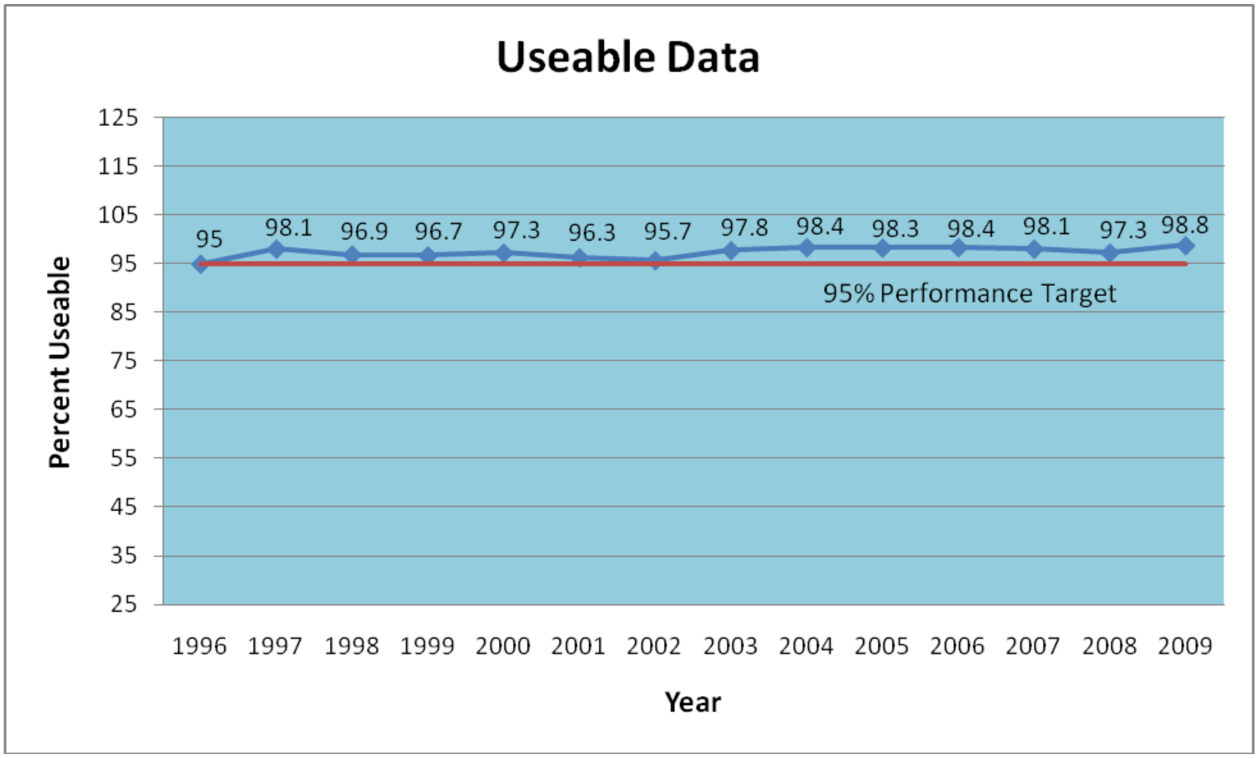


FIGURE 13.3 — *History of Useable Results Data*

A well-established quality framework exists at Pantex that supports the environmental monitoring program. The acquisition and review of analytical data is based on procedurally controlled sampling, analysis, data management (validation) and standardized technical specifications governing analytical measurements. The integration of each of these elements ensures environmental data collection and monitoring requirements are achieved meeting all site and stakeholder requirements for quality and reliability.

This page intentionally left blank.

Appendix A Analytes Monitored in 2009

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Radionuclides									
Gross alpha, total	12587-46-1	-	-	■	-	-	-	-	-
Gross beta, total	12587-47-2	-	-	■	-	-	-	-	-
^{238}Plutonium	12059-95-9	-	-	-	■	-	-	-	-
$^{239/240}$Plutonium	10-12-8	■	-	-	~	-	-	-	-
Tritium	10028-17-8	■	-	■	■	-	-	■	■
$^{233/234}$Uranium	11-08-5	■	-	-	■	-	-	■	■
$^{235/236}$Uranium	15117-96-1	-	-	-	■	-	-	-	-
^{238}Uranium	7440-61-1	■	-	-	■	-	-	■	■
Metals									
Aluminum	7429-90-5	-	■	■	-	-	-	-	-
Antimony	7440-36-0	-	-	■	-	■	-	-	-
Arsenic	7440-38-2	-	■	■	■	■	■	-	-
Barium	7440-39-3	-	■	■	■	-	■	-	-
Beryllium	7440-41-7	-	-	■	-	■	-	-	-
Boron	7440-42-8	-	■	■	■	-	■	-	-
Cadmium	7440-43-9	-	-	■	■	■	■	-	-
Calcium	7440-70-2	-	■	-	-	-	■	-	-
Chromium	7440-47-3	-	■	■	■	■	■	-	-
Chromium (hexavalent)	18540-29-9	-	■	-	-	-	-	-	-
Cobalt	7440-48-4	-	-	-	-	■	■	-	-
Copper	7440-50-8	-	-	■	■	■	■	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Iron	7439-89-6	-	■	■	■	-	-	-	-
Ferrous Iron	1345-25-1	-	■	-	-	-	-	-	-
Lead	7439-92-1	-	-	■	■	■	■	-	-
Magnesium	7439-95-4	-	■	-	-	-	■	-	-
Manganese	7439-96-5	-	■	■	■	■	-	-	-
Mercury	7439-97-6	-	-	■	■	■	■	-	-
Molybdenum	7439-98-7	-	■	-	-	■	-	-	-
Nickel	7440-02-0	-	■	-	■	■	■	-	-
Potassium	7440-09-7	-	~	-	-	-	■	-	-
Selenium	7782-49-2	-	-	■	■	■	■	-	-
Silver	7440-22-4	-	-	■	■	■	■	-	-
Sodium	7440-23-5	-	■	-	-	-	■	-	-
Strontium	7440-24-6	-	-	-	-	-	-	-	-
Thallium	7440-28-0	-	-	■	-	■	-	-	-
Titanium	7440-32-6	-	-	-	-	■	-	-	-
Vanadium	7440-62-2	-	■	-	-	~	-	-	-
Zinc	7440-66-6	-	-	■	■	■	■	-	-
Explosives									
1,3-dinitrobenzene	99-65-0	-	■		■	-	-	-	-
1,3,5-trinitrobenzene	99-35-4	-	■	-	■	-	■	-	-
2-amino-4,6-dinitrotoluene	35572-78-2	-	■	-	■	-	-	-	-
2-nitrotoluene	88-72-2	-	-	-	■	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
2,4-dinitrotoluene	121-14-2	-	■	-	■	-	■	-	-
2,6-dinitrotoluene	606-20-2	-	■	-	■	-	■	-	-
3-nitrotoluene	99-08-1	-	-	-	■	-	-	-	-
4-amino-2,6-dinitrotoluene	1946-51-0	-	■	-	■	-	-	-	-
4-nitrotoluene	99-99-0	-	-	-	■	-	-	-	-
HMX	2691-41-0	-	■	■	■	■	■	-	-
Nitrobenzene	98-95-3	-	-	-	■	-	~	-	-
PETN	78-11-5	-	-	■	■	■	■	-	-
RDX	121-82-4	-	■	■	■	■	■	-	-
TATB	3058-38-6	-	-	-	-	-	■	-	-
Tetryl	479-45-8	-	-	-	■	-	-	-	-
TNT	118-96-7	-	■	■	■	■	■	-	-
MDNA	NA	-	■	-	-	-	-	-	-
MNX	5755-27-1	-	■	-	-	-	-	-	-
DNX	80251-29-2	-	■	-	-	-	-	-	-
TNX	13980-04-6	-	■	-	-	-	-	-	-
Polychlorinated Biphenyls (PCBs)									
Aroclor 1016	12674-11-2	-	-	■	-	-	-	-	-
Aroclor 1221	1104-28-2	-	-	■	-	-	-	-	-
Aroclor 1232	11141-16-5	-	-	■	-	-	-	-	-
Aroclor 1242	53469-21-9	-	-	■	-	-	-	-	-
Aroclor 1248	12672-29-6	-	-	■	-	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Aroclor 1254	11091-69-1	-	-	■	-	-	-	-	-
Aroclor 1260	11096-82-5	-	-	■	-	-	-	-	-
Pesticides									
Alachlor	15972-60-8	-	-	■	-	-	-	-	-
Aldrin	309-00-2	-	-	■	-	-	-	-	-
Atrazine	1912-24-9	-	-	■	-	-	-	-	-
Bromacil	314-40-9	-	-	■	-	-	-	-	-
Chlordane	57-74-9	-	-	■	-	-	-	-	-
Dieldrin	60-57-1	-	-	■	-	-	-	-	-
Endrin	72-20-8	-	-	■	-	-	-	-	-
Heptachlor	76-44-8	-	-	■	-	-	■	-	-
Heptachlor epoxide	1024-57-3	-	-	■	-	-	■	-	-
Lindane (gamma-BHC)	58-89-9	-	-	■	-	-	■	-	-
Methoxychlor	72-43-5	-	-	■	-	-	■	-	-
Methyl n,n-dimethyl-n-{(methlycarbamoyl)oxy}-1	23135-22-0	-	-	■	-	-	-	-	-
s-Methyl-n-((Methylcarb amoyl)-oxy)-thioacetimidate	16752-77-5	-	-	■	-	-	-	-	-
Metribuzin	21087-64-9	-	-	■	-	-	-	-	-
Prometon	1610-18-0	-	-	■	-	-	-	-	-
Propachlor	1918-16-7	-	-	■	-	-	-	-	-
Sevin (carbaryl)	63-25-2	-	-	■	-	-	-	-	-
Simazine	122-34-9	-	-	■	-	-	-	-	-
Herbicides									
2,4-D	94-75-7	-	-	-	-	-	■	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Miscellaneous									
Alkalinity	T-005	-	■	■	-	-	-	-	-
Ammonia (as N)	7664-41-7	-	-	-	-	■	-	-	-
Biochemical oxygen demand	10-26-3	-	-	-	-	■	-	-	-
Bromide	24959-67-9	-	■	-	-	-	-	-	-
Chemical oxygen demand	C-004	-	-	-	-	■	-	-	-
Chlorate	14866-68-3	-	■	-	-	-	-	-	-
Chloride	16887-00-6	-	■	■	-	-	-	-	-
Chlorine residual	7782-50-5	-	-	■	-	-	-	-	-
Color	M-002	-	-	■	-	-	-	-	-
Corrosivity	10-37-7	-	-	■	-	-	-	-	-
Cyanide, free	10-71-9	-	-	■	-	-	-	-	-
Cyanide, total	57-12-5	-	-	■	-	■	-	-	-
Dissolved Organic Carbon	11-59-6	-	■	-	-	-	-	-	-
Dissolved Oxygen	NA	-	■	-	-	-	-	-	-
Fluoride	7782-41-4	-	■	■	-	-	-	-	-
Foaming agents (surfactants)	NA	-	-	■	-	-	-	-	-
Nitrate (as N)	14797-55-8	-	■	■	-	-	■	-	-
Nitrate/nitrite (as N)	1-005	-	-	-	-	■	-	-	-
Nitrite (as N)	14797-65-0	-	■	■	-	-	-	-	-
Oil and grease	10-30-0	-	-	-	-	■	-	-	-
Perchlorate	14797-73-0	-	■	~	-	-	-	-	-
pH	10-29-7	-	■	■	■	■	■	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Phosphorus, Total (As P)	7723-14-0	-	■	-	-	-	-	-	-
Specific conductance	10-34-4	-	-	■	-	-	-	-	-
Sulfate	14808-79-8	-	■	■	-	-	-	-	-
Sulfide	18496-25-8	-	■	-	-	-	-	-	-
Temperature	NA	-	■	■	■	■	-	-	-
Total dissolved solids	10-33-3	-	■	■	-	-	-	-	-
Total hardness (as $CaCO_3$)	11-02-9	-	■	■	-	-	-	-	-
Total organic carbon	C-012	-	■	■	-	-	-	-	-
Total petroleum hydrocarbons	10-90-2	-	-	-	■	-	-	-	-
Turbidity	G-019	-	■	■	-	-	-	-	-
Volatile Organics									
1,1,1,2-tetrachloroethane	630-20-6	-	-	■	■	-	-	-	-
1,1,2,2-tetrachloroethane	79-34-5	-	-	■	■	-	-	-	-
1,1,1-trichloroethane	71-55-6	-	-	■	■	-	-	-	-
1,1,2-trichloroethane	79-00-5	-	-	■	■	-	-	-	-
1,2,3-tricholorobenzene	87-61-6	-	-	■	-	-	-	-	-
1,2,3-trichloropropane	96-18-4	-	-	■	■	-	-	-	-
1,2,4-trimethylbenzene	95-63-6	-	-	■	-	-	-	-	-
1,3,5-trimethylbenzene	108-67-8	-	-	■	-	-	-	-	-
1,1-dichloroethane	75-34-3	-	-	■	■	-	-	-	-
1,1-dichloroethene	75-35-4	-	-	■	■	-	■	-	-
1,1-dichloropropene	563-58-6	-	-	■	-	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
1,2-dibromo-3-chloropropane	96-12-8	-	-	■	■	-	-	-	-
1,2-dibromoethane	106-93-4	-	-	■	■	-	-	-	-
1,2-dichlorobenzene	95-50-1	-	-	■	■	-	-	-	-
1,2-dichloroethane	107-06-2	-	■	■	■	-	■	-	-
1,2-dichloroethene	156-60-5	-	-	-	■	-	-	-	-
cis-1,2-dichloroethene	156-59-2	-	■	■	■	-	-	-	-
trans-1,2-dichloroethene	156-60-5	-	■	■	■	-	-	-	-
1,2-dichloropropane	78-87-5	-	-	■	■	-	-	-	-
1,3-dichlorobenzene	541-73-1	-	-	■	■	-	-	-	-
1,3-dichloropropane	142-28-9	-	-	■	-	-	-	-	-
cis-1,3-dichloropropene	10061-01-5	-	-	■	■	-	-	-	-
trans-1,3-dichloropropene	10061-02-6	-	-	■	■	-	-	-	-
trans-1,4-dichloro-2-butene	110-57-6	-	-	-	■	-	-	-	-
1,4-dichlorobenzene	106-46-7	-	-	■	-	-	■	-	-
2,2-dichloropropane	594-20-7	-	-	■	-	-	-	-	-
2-butanone (methyl ethyl ketone)	78-93-3	-	-	■	■	-	■	-	-
2-chloro-1,3-butadiene	126-99-8	-	-	-	■	-	-	-	-
2-chlorotoluene	95-49-8	-	-	■	-	-	-	-	-
2-hexanone	591-78-6	-	-	■	■	-	-	-	-
4-chlorotoluene	106-43-4	-	-	■	-	-	-	-	-
4-isopropyltoluene	99-87-6	-	-	■	-	-	-	-	-
Acetone	67-64-1	-	-	■	■	-	-	-	-
Acetonitrile	75-05-8	-	-	-	■	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Acrolein	107-02-8	-	-	-	■	-	-	-	-
Acrylonitrile	107-13-1	-	-	■	■	-	-	-	-
Allyl Chloride	107-05-1	-	-	-	■	-	-	-	-
Benzene	71-43-2	-	-	■	■	-	■	-	-
Bromobenzene	108-86-1	-	-	■	-	-	-	-	-
Bromochloromethane	74-97-5	-	-	■	-	-	-	-	-
Bromodichloromethane	75-27-4	-	-	■	■	-	-	-	-
Bromoform	75-25-2	-	-	■	■	-	-	-	-
Bromomethane	74-83-9	-	-	■	■	-	-	-	-
sec-Butylbenzene	135-98-8	-	-	■	-	-	-	-	-
tert-Butylbenzene	98-06-6	-	-	■	-	-	-	-	-
Carbon disulfide	75-15-0	-	-	■	■	-	-	-	-
Carbon tetrachloride	56-23-5	-	-	■	■	-	■	-	-
Chlorobenzene	108-90-7	-	-	■	■	-	■	-	-
Chloroethane	75-00-3	-	-	■	■	-	-	-	-
Chloroform	67-66-3	-	■	■	■	-	■	-	-
Chloromethane	74-87-3	-	-	■	■	-	-	-	-
Dibromochloromethane	124-48-1	-	-	■	■	-	-	-	-
Dibromomethane	74-95-3	-	-	■	■	-	-	-	-
Dichlorodifluoromethane	75-71-8	-	-	■	■	-	-	-	-
Ethylbenzene	100-41-4	-	-	■	■	-	-	-	-
Ethyl methacrylate	97-63-2	-	-	■	■	-	-	-	-
Freon 113	76-13-1	-	-	-	■	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Iodomethane	74-88-4	-	-	■	■	-	-	-	-
Isobutyl alcohol	78-83-1	-	-	-	■	-	-	-	-
Isopropylbenzene	98-82-8	-	-	■	-	-	-	-	-
Methylacrylonitrile	126-98-7	-	-	-	■	-	-	-	-
Methylene chloride	75-09-2	-	-	■	■	-	-	-	-
Methyl isobutyl ketone	108-10-1	-	-	■	■	-	-	-	-
Methyl methacrylate	80-62-6	-	-	■	■	-	-	-	-
n-Butylbenzene	104-51-8	-	-	■	-	-	-	-	-
n-Propylbenzene	103-65-1	-	-	■	-	-	-	-	-
Pentachloroethane	76-01-7	-	-	-	■	-	-	-	-
Propionitrile	107-12-0	-	-	-	■	-	-	-	-
Styrene	100-42-5	-	-	■	■	-	-	-	-
tert-Butyl methyl ether	1634-04-4	-	-	■	-	-	-	-	-
Tetrachloroethylene	127-18-4	-	■	■	■	-	■	-	-
Tetrahydrofuran	109-99-9	-	-	■	-	-	-	-	-
Toluene	108-88-3	-	■	■	■	-	-	-	-
Trichloroethene (Trichloroethylene)	79-01-6	-	■	■	■	-	■	-	-
Trichlorofluoromethane	75-69-4	-	-	■	■	-	-	-	-
Vinyl acetate	108-05-4	-	-	■	■	-	-	-	-
Vinyl chloride	75-01-4	-	■	■	■	-	■	-	-
Xylene, m	108-38-3	-	-	■	■	-	-	-	-
Xylene, o	95-47-6	-	-	■	■	-	-	-	-
Xylene, p	106-42-3	-	-	-	■	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Semi Volatile Organic Compounds									
1,2,4,5-tetrachlorobenzene	95-94-3	-	-	-	■	-	-	-	-
1,2,4-trichlorobenzene	120-82-1	-	-	■	■	-	-	-	-
1,4-dioxane	123-91-1	-	■	-	~	-	-	-	-
1,4-naphthoquinone	130-15-4	-	-	-	■	-	-	-	-
2,3,4,6-tetrachlorophenol	58-90-2	-	-	-	■	-	-	-	-
2,4,5-trichlorophenol	95-95-4	-	-	-	■	-	■	-	-
2,4,6-trichlorophenol	88-06-2	-	-	-	■	-	■	-	-
2,4-dichlorophenol	120-83-2	-	-	-	■	-	-	-	-
2,4-dimethylphenol	105-67-9	-	-	-	■	-	-	-	-
2,4-dinitrophenol	51-28-5	-	-	-	■	-	-	-	-
2-chloronaphthalene	91-58-7	-	-	-	■	-	-	-	-
2-chlorophenol	95-57-8	-	■	-	■	-	-	-	-
2-methylnaphthalene	91-57-6	-	-	-	■	-	-	-	-
2-methylphenol (o-Cresol)	96-48-7	-	-	-	■	-	-	-	-
4,6-dinitro-2-methylphenol	534-52-1	-	-	-	■	-	-	-	-
4-chloroaniline	106-47-8	-	■	-	■	-	-	-	-
4-chlorophenyl phenyl ether	7005-72-3	-	-	-	■	-	-	-	-
4-methylphenol (p-Cresol)	106-44-5	-	-	-	■	-	-	-	-
Acenaphthene	83-32-9	-	-	■	■	-	-	-	-
Acenaphthylene	208-96-8	-	-	■	■	-	-	-	-
Acetophenone	98-86-2	-	-	-	■	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Anthracene	120-12-7	-	-	■	■	-	-	-	-
Benzidine	92-87-5	-	-	-	■	-	-	-	-
Benzo[*a*]anthracene	56-55-3	-	-	■	■	-	-	-	-
Benzo[*a*]pyrene	50-32-8	-	-	■	■	-	-	-	-
Benzo[*b*]fluoranthene	205-99-2	-	-	■	■	-	-	-	-
Benzo[*g,h,i*]perylene	191-24-2	-	-	■	■	-	-	-	-
Benzo[*k*]fluoranthene	207-08-9	-	-	■	■	-	-	-	-
Benzoic acid	65-85-0	-	-	-	■	-	-	-	-
Benzyl alcohol	100-51-6	-	-	-	■	-	-	-	-
bis(2-chloroethyl) ether	111-44-4	-	-	-	■	-	-	-	-
bis(2-chloroisopropyl) ether	39638-32-9	-	-	-	■	-	-	-	-
bis(2-ethylhexyl) phthalate	117-81-7	-	-	■	■	-	-	-	-
Butyl benzyl phthalate	85-68-7	-	-	■	■	-	-	-	-
Carbazole	86-74-8	-	-	-	■	-	-	-	-
Cresol, m	108-39-4	-	-	-	-	-	■	-	-
Chrysene	218-01-9	-	-	■	■	-	-	-	-
Dibenz[*a,h*]anthracene	53-70-3	-	-	■	■	-	-	-	-
Dibenzofuran	132-64-9	-	-	-	■	-	-	-	-
Dibromoacetic acid	631-64-1	-	-	■	-	-	-	-	-
Dichloroacetic acid	79-43-6	-	-	■	-	-	-	-	-
Diethyl phthalate	84-66-2	-	-	■	■	-	-	-	-
Dimethyl phthalate	131-11-3	-	-	■	-	-	-	-	-
Di-n-butyl phthalate	84-74-2	-	-	■	■	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Di-n-octyl phthalate	117-84-0	-	-	-	■	-	-	-	-
Diphenylamine	122-39-4	-	-	-	■	-	-	-	-
Fluoranthene	206-44-0	-	-	-	■	-	-	-	-
Fluorene	86-73-7	-	-	■	■	-	-	-	-
Hexachlorobenzene	118-74-1	-	-	■	-	-	■	-	-
Hexachlorobutadiene	87-68-3	-	-	■	■	-	■	-	-
Hexachlorocyclopentadiene	77-47-4	-	-	■	-	-	-	-	-
Hexachloroethane	67-72-1	-	-	-	■	-	■	-	-
Indeno(1,2,3-c,d)pyrene	193-39-5	-	-	■	■	-	-	-	-
Isophorone	78-59-1	-	-	-	■	-	-	-	-
Monobromoacetic acid	79-08-3	-	-	■	-	-	-	-	-
Monochloroacetic acid	79-11-8	-	-	■	-	-	-	-	-
Naphthalene	91-20-3	-	-	■	■	-	-	-	-
N-nitrosodiethylamine	55-18-5	-	-	-	■	-	-	-	-
N-nitrosodimethylamine	62-75-9	-	-	-	■	-	-	-	-
N-nitrosodiphenylamine	86-30-6	-	-	-	■	-	-	-	-
N-nitrosodi-n-propylamine	621-64-7	-	-	-	■	-	-	-	-
N-nitrosopyrrolidine	930-55-2	-	-	-	■	-	-	-	-
Parathion, ethyl	56-38-2	-	-	■	-	-	-	-	-
Parathion, methyl	298-00-0	-	-	■	-	-	-	-	-
Pentachlorophenol	87-86-5	-	-	-	■	-	■	-	-
Phenanthrene	85-01-8	-	-	■	■	-	-	-	-
Phenol	108-95-2	-	-	-	■	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
Pronamide	23950-58-5	-	-	-	■	-	-	-	-
Pyrene	129-00-0	-	-	■	■	-	-	-	-
Pyridine	110-86-1	-	-	-	-	-	■	-	-
Trichloroacetic acid	76-03-9	-	-	■	-	-	-	-	-
Biological									
Complete blood count	NA	-	-	-	-	-	-	-	■
Histopathology	NA	-	-	-	-	-	-	-	■
Necropsy	NA	-	-	-	-	-	-	-	■
Total coliform bacteria	10-46-8	-	-	■	-	-	-	-	-
Escherichia coli	NA	-	-	■	-	-	-	-	-
Eastern encephalitis	NA	-	-	-	-	-	-	-	■
Western encephalitis	NA	-	-	-	-	-	-	-	■
Hanta virus	NA	-	-	-	-	-	-	-	■
Plague bacteria	NA	-	-	-	-	-	-	-	■
Pseudorabies	NA	-	-	-	-	-	-	-	■
Tuleremia	NA	-	-	-	-	-	-	-	■
Volatile Fatty Acids[6]									
Acetic Acid	64-19-7	-	-	■	-	-	-	-	-
Butyric Acid	107-92-6	-	-	■	-	-	-	-	-
Hexanoic Acid	142-62-1	-	-	■	-	-	-	-	-
i-Hexanoic Acid	646-07-1	-	-	■	-	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	Soil	Veg.[5]	Fauna
i-Pentanoic Acid	503-74-2	-	-	■	-	-	-	-	-
Lactic Acid and HIBA	50-21-5	-	-	■	-	-	-	-	-
Pentanoic Acid	109-52-4	-	-	■	-	-	-	-	-
Propionic Acid	79-09-4	-	-	■	-	-	-	-	-
Pyruvic Acid	127-17-3	-	-	■	-	-	-	-	-
Dissolved Gases[6]									
Ethane	74-84-0	-	-	■	-	-	-	-	-
Ethene	74-85-1	-	-	■	-	-	-	-	-
Methane	74-82-8	-	-	■	-	-	-	-	-

1 Groundwater.
2 Drinking water & production wells.
3 Storm water and playas.
4 Irrigation Water.
5 Vegetation.
6 Only applicable to ISB and ISPM wells to monitor performance of the ISB Systems.
■ = Sampled for.
\- = Not sampled.
NA = Not available.

COMMON NAME	SCIENTIFIC NAME
Pied-billed grebe	*Podilymbus podiceps*
Double-crested cormorant	*Phalacrocorax auritus*
Cattle egret	*Bubulcus ibis*
Snowy egret	*Egretta thula*
Great egret	*Casmerodius albus*
Great blue heron	*Ardea herodias*
White-faced ibis	*Plegadis chihi*
Sandhill crane	*Grus canadensis*
Snow goose	*Chen caerulescens*
Ross' goose	*Chen rossii*
Canada goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Green-winged teal	*Anas crecca*
American wigeon	*Anas americana*
Northern pintail	*Anas acuta*
Northern shoveler	*Anas clypeata*
Redhead	*Aythya americana*
Greater scaup	*Aythya marila*
Lesser scaup	*Aythya affinis*
Common goldeneye	*Bucephala clangula*
American avocet	*Recurvirostra americana*
American coot	*Fulica americana*
Long-billed dowitcher	*Limnodromus scolopaceus*
Killdeer	*Charadrius vociferus*
Greater yellowlegs	*Tringa melanoleuca*
Solitary sandpiper	*Tringa solitaria*
Wilson's phalarope	*Phalaropus tricolor*

COMMON NAME	SCIENTIFIC NAME
Upland sandpiper	*Bartramia longicauda*
Ring-billed gull	*Larus delawarenis*
Black tern	*Childonias niger*
Osprey	*Pandion haliaetus*
American kestrel	*Falco sparverius*
Prairie falcon	*Falco mexicanus*
Red-tailed hawk	*Buteo jamaicensis*
Swainson's hawk	*Buteo swainsoni*
Ferruginous hawk	*Buteo regalis*
Northern harrier	*Circus cyaneus*
Sharp-shinned hawk	*Accipiter striatus*
Turkey vulture	*Cathartes aura*
Golden eagle	*Aquila chrysaetos*
Bald eagle	*Haliaeetus leucocephalus*
Scaled quail	*Callipepla squamata*
Northern Bobwhite	*Colinus virginianus*
Ring-necked pheasant	*Phasianus colchicus*
Rock dove (feral pigeon)	*Columba livia*
Mourning dove	*Zenaida macroura*
White-winged dove	*Zenaida asiatica*
Eurasian collared dove	*Streptopelia decaocto*
Barn owl	*Tyto alba*
Burrowing owl	*Athene cunicularia hypugea*
Great horned owl	*Bubo virginianus*
Black-chinned hummingbird	*Archilochus alexandri*
Northern flicker	*Colaptes auratus collaris*
Eastern kingbird	*Tyrannus tyrannus*
Western kingbird	*Tyrannus verticalis*

COMMON NAME	SCIENTIFIC NAME
Scissor-tailed flycatcher	*Tyrannus forficatus*
Say's phoebe	*Sayornis saya*
Horned lark	*Eremophila alpestris*
Barn swallow	*Hirundo rustica*
Cliff swallow	*Hirundo pyrrhonota*
Blue jay	*Cyanocitta cristata*
American crow	*Corvus brachyrhynchos*
Chihuahuan raven	*Corvus cryptoleucus*
Common raven	*Corvus corax*
American robin	*Turdus migratorius*
Loggerhead shrike	*Lanius ludovicianus*
Northern mockingbird	*Mimus polyglottos*
Sage thrasher	*Oreoscoptes montanus*
Brown thrasher	*Toxostoma rufum*
Curve-billed thrasher	*Toxostoma curvirostre*
European starling	*Sturnus vulgaris*
Orange-crowned warbler	*Vermivora celata*
Grasshopper sparrow	*Ammodramus savannarum*
Vesper sparrow	*Pooecetes gramineus*
Song sparrow	*Melospiza melodia*
Lark sparrow	*Chondestes grammacus*
Cassin's sparrow	*Aimophila cassinii*
Chipping sparrow	*Spizella passerina*
Clay-colored sparrow	*Spizella pallida*
Dark-eyed junco	*Junco hyemalis*
White-crowned sparrow	*Zonotrichia leucophris*
Lincoln's sparrow	*Melospiza lincolnii*
Lark bunting	*Calamospiza melanocorys*

COMMON NAME	*SCIENTIFIC NAME*
Bobolink	*Dolichonyx oryzivorus*
Eastern meadowlark	*Sturnella magna*
Western meadowlark	*Sturnella neglecta*
Red-winged blackbird	*Agelaius phoeniceus*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Brewer’s blackbird	*Euphagus cyanocephalus*
Brown-headed cowbird	*Molothrus ater*
Great-tailed grackle	*Quiscalus mexicanus*
Common grackle	*Quiscalus quiscula*
House sparrow	*Passer domesticus*
House finch	*Carpodacus mexicanus*

Anderson, R. L., M. Morrison, K. Sinclair, and M. D. Strickland. 1999. Studying wind energy-bird interactions: a guidance document. Prepared for avian subcommittee and National Wind Coordinating Committee. <http://www.nationalwind.org/publications/wildlife/avian99/Avian_booklet.pdf>. Accessed 10 June 2009.

Bomar, George W. Texas Weather – 2nd ed., University of Texas Press, Austin, 1995.

Brady, Ray. Water statistics: Telephone conversation and memo-to-file. February 2005.

Bureau of the Census. Internet. http:/www.census.gov/population/estimates/metro-city. U.S. Bureau of the Census. 2000.

Crowell, Amy. Telephone conversation and memo-to-file. Panhandle Groundwater Conservation District, Whitedeer, Texas, January 30, 2007.

DOC. U.S. Census Bureau, Population Division, 2007, Metropolitan and Metropolitan Statistical Areas, www.census.gov/population/estimates/metroarea.html.

DOCa, "NWS Amarillo Climate Description," U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Amarillo Office report, published on internet at http://www.srh.noaa.gov/ama/climate/climo_narrative.htm.

DOCb, "NWS Amarillo Tornadoes by County 1950-2009," U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Amarillo Office report, published on internet at http://www.srh.noaa.gov/ama/climate/tornadostats.htm.

DOCc, "2009 Weather Year in Review," U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Amarillo Office report, published on internet at http://www.srh.noaa.gov/ama/climate/2008wxreview.htm.

DOE. *Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components*. DOE/EIS-0225, U.S. Department of Energy, Washington, D.C., 1996.

DOE. *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota,* DOE-STD-1153-2002, U.S. Department of Energy. Washington, D.C. 2002.

DOE. *Final Report*: *Risk Reduction Rule Guidance to the Pantex RCRA Facility Investigation*. U.S. Department of Energy, Pantex Plant, Amarillo, Texas. 2002.

DOE. *Pantex Site-Wide Record of Decision (ROD),* U.S. Department of Energy, Washington, DC. September 2008.

DOE Guidance 450.4-1B. *Integrated Safety Management System Guide.* U.S. Department of Energy, Washington, DC. 2001.

DOE Order 231.1A. *Environment, Safety and Health Reporting.* U.S. Department of Energy, Washington, DC. 2004.

DOE Order 450.1A. *Environmental Protection Program*, U.S. Department of Energy, Washington, DC. 2008.

DOE Order 5400.5. *Radiological Protection of the Public and the Environment*. U.S. Department of Energy, Washington, DC. 1993.

DOE Policy 450.4. Safety Management System Policy, U.S. Department of Energy, Washington, DC. 1996.

EPA. *User's Guide for CAP88-PC, Version 1.0*. Report 402-B-92-001, U.S. Environmental Protection Agency, Office of Radiation Programs, Las Vegas, Nevada, 1992.

EPA. *USEPA QA/G4 Guidance for Data Quality Objective Process* (EPA/600/R-96/055), September 1994.

Gilbert, Richard O., *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York, 1987.

ICRP. International Commission on Radiological Protection (ICRP), ICRP Publication 26, Pergamon Press, New York, 1985.

ICRP. *Limits of the Intake of Radionuclides by Workers*, ICRP Publication 30, Pergamon Press, New York, 1991.

International Organization for Standardization (ISO), *Environmental Management Systems - Requirements with Guidance for Use (ISO 14001)*, Washington, DC. 2004.

Johnston, M.C. and J.K. Williams. *Floristic Survey of the Pantex Plant Site, Carson County, Texas*, Prepared for the U.S. Department of Energy, by Marshall C. Johnston, Austin, Texas. 1993.

Johnston, M.C. *Floristic Survey of the Pantex Plant Site, Carson County, Texas*, Prepared for the U.S. Department of Energy, by Marshall C. Johnston, Austin, Texas. 1995.

Kunz, T. H., E. B. Arnett, B. M. Cooper, W. P. Erickson, R. P. Larkin, T. Mabee, M. L. Morrison, M. D. Strickland, and J. M. Szewczak. 2007. Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document. Journal of Wildlife Management 71:2449-2486.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers in Ecology and the Environment 5:315-324.

Largent, F.B. *A Cultural Resources Survey of 2,400 Acres at the U.S. Department of Energy Pantex Plant, Carson County, Texas*, Mason & Hanger Corporation, Amarillo, Texas. 1995.

McGrath, D.A. *Fault Identification Study for the Pantex Plant*. DOE/AL/65030-9512, Mason & Hanger — Silas Mason Co., Inc., Amarillo, Texas. 1995.

Mock, Richard. Memo to file, Texas A&M Research Center, Amarillo, Texas, August 27, 2004.

NCRP. *A Handbook of Radioactivity Measurement Procedures*. Report No. 58, National Council on Radiation Protection and Measurements, Bethesda, Maryland. 1985.

NCRPa. *Ionizing Radiation Exposure of the Population of the United States.* Report No. 93, National Council on Radiation Protection and Measurements, Bethesda, Maryland. 1987.

NCRP. *Ionizing Radiation Exposure of the Population of the United States*, Report No. 160, National Council on Radiation Protection and Measurements, Bethesda, Maryland, 2009.

NPS Bulletin 15. "How to Apply the National Register Criteria for Evaluation." National Register Bulletin 15, National Park Service, Washington, D.C. 1991.

Pantex Plant. *Pantex Plant Comprehensive Natural Resources Management Strategy*. Battelle Pantex, Amarillo, Texas. 1998.

Pantex Plant *Environmental Information Document: In Support of the National Environmental Policy Act Documents for Pantex Plant,* PTX-PLN-20, Amarillo, Texas. 1998.

Pantex Plant. *Integrated Plan for Playa Management at Pantex Plant*. Amarillo, Texas. 2002.

Pantex Plant. *Statement of Work (SOW) for Analytical Laboratories*, Rev. 4., Amarillo, Texas. 2005.

Pantex Plant. *Risk Reduction Rule Guidance to the Pantex Plant RFI.* Prepared for the U.S. Department of Energy/National Nuclear Security Administration. Pantex Plant. April 2002, Revised March 2003.

Pantex Plant. *Groundwater Contingency Plan*, 2009.

Pantex Plant. *Programmatic Agreement and Cultural Resource Management Plan for Pantex Plant*. Amarillo, Texas. October 2004.

Pantex Plant. *Land-Applied Chemical Use Plan for Pantex Plant*, Amarillo, Texas. March 2005.

Pantex Plant and Sapere Consulting. *Record of Decision for Groundwater, Soil and Associated Media.* Prepared for the U.S. Department of Energy/National Nuclear Security Administration. September 2008.

Pantex Plant. *Long-Term Monitoring System Design Report.* Prepared for the U.S. Department of Energy/National Nuclear Security Administration. April 2009.

Pantex Plant, *Radiological Control Manual*, 2009.

Pantex Plant. *Sampling and Analysis Plan.* Prepared for the U.S. Department of Energy/National Nuclear Security Administration. April 2009.

Pantex Plant. *Environmental Monitoring Plan for 2009.* Amarillo, Texas. April 2009.

PGWCD. *Approximate Altitude of the Base of the Ogallala Formation*. Panhandle Ground Water Conservation District No. 3, White Deer, Texas. 1980.

Purtymun, W.D., and N. M. Becker. *Supplementary Documentation for an Environmental Impact Statement Regarding the Pantex Plant: Geohydrology*. LA-9445-PNTX-I, Los Alamos National Laboratory, Los Alamos, New Mexico. 1982.

Rajagopalan, S. T., Anderson, K., Rainwater, M., Ridley, L., Fahlquist, and Jackson, A. (2006). Widespread *Occurrence of Naturally Occurring Perchlorate in High Plains of Texas and New Mexico.* Environmental Science and Technology 40:3156-3162.

SERDP. *Microbial Degradation of RDX and HMX*. Final Report. SERDP Project CU1213. February 2004.

Seyffert, K.D. *Checklist of Birds, Pantex Plant Site, Carson County, Texas.* Prepared for the U.S. Department of Energy, Amarillo, Texas. 1994.

Texas Commission on Environmental Quality (TCEQ). *Compliance Plan - 50284,* March 15, 2004.

Tucker, Art. Sample Data Report: Telephone conversation and e-mail, June 2, 2010.

USACE. *Floodplain Delineation Report*, prepared by U.S. Army Corps of Engineers, Tulsa District, Tulsa, Oklahoma, January 1995.

Executive Order 13186. *Responsibilities of Federal Agencies to Protect Migratory Birds*. January 10, 2001.

Executive Order 13423. *Strengthening Federal Environmental, Energy, and Transportation Management* January 24, 2007.

Executive Order 13514. *Federal Leadership in Environmental, Energy, and Economic Performance.* October 5, 2009.

Helpful Information

Units of Radiation Measurement

Current System	*Systéme International*	Conversion
curie (Ci)	becquerel (Bq)	1 Ci = 3.7×10^{10} Bq
rad	gray (Gy)	1 rad = 0.01 Gy
rem	sievert (Sv)	1 rem = 0.01 Sv

Scientific Notation Used for Units

Multiple	Decimal Equivalent	Notation	Prefix	Symbol
1×10^{3}	1,000	E+03	kilo-	k
1×10^{-2}	0.01	E-02	centi-	c
1×10^{-3}	0.001	E-03	milli-	m
1×10^{-6}	0.000001	E-06	micro-	μ
1×10^{-9}	0.000000001	E-09	nano-	n
1×10^{-12}	0.000000000001	E-12	pico-	p
1×10^{-18}	0.000000000000000001	E-18	atto-	a

Metric Conversions

When you know	Multiply by	To Get	When you know	Multiply by	To Get
cm	0.39	in.	in.	2.54	cm
m	3.28	ft	ft	0.305	m
km	0.62	mi	mi	1.61	km
kg	2.21	lb	lb	0.45	kg
L	0.26	gal	gal	3.79	L
L	1.04	quart	quart	0.95	L
hectare	2.47	acre	acre	0.40	hectare
km^2	0.39	mi^2	mi^2	2.59	km^2
m^3	35.32	ft^3	ft^3	0.03	m^3
To convert the temperature in degrees Celsius (°C) to degrees Fahrenheit (°F), use °F = 1.8(°C) + 32°.					

Pantex Plant, Amarillo, Texas