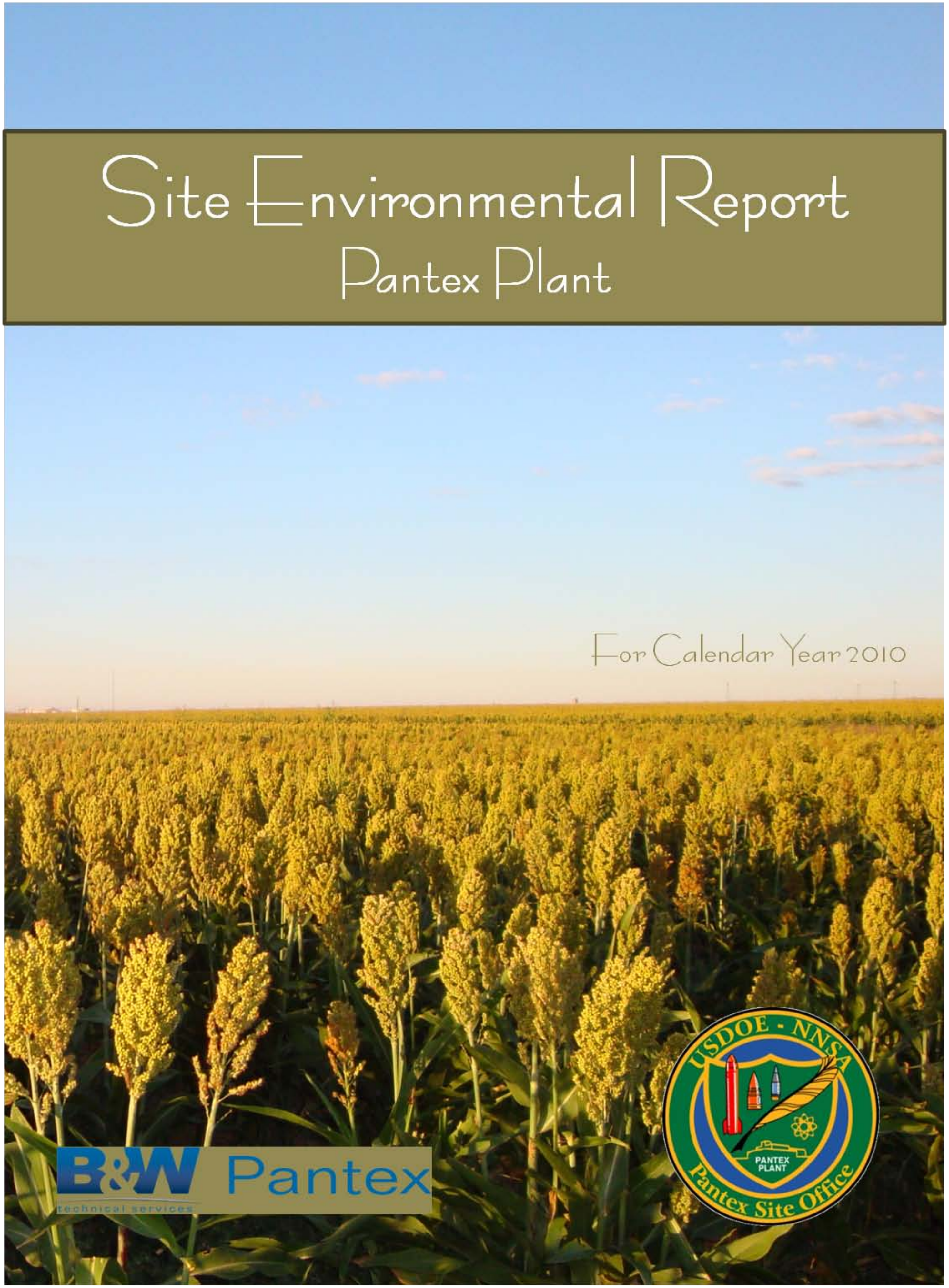
Site Environmental Report
Pantex Plant

For Calendar Year 2010



Site Environmental Report Pantex Plant 2010

September 2011

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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

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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. Please tear out this page and mail or fax it to:

Kim Bush, B&W Pantex/12-132
P.O. Box 30020, Amarillo, TX 79120-0200
Phone: (806) 477-4435; Fax: (806) 477-6623.

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

Kim Bush
B&W Pantex/12-132
P.O. Box 30020
Amarillo, TX 79120-0200

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CHEMICALS AND UNITS OF MEASURE

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
DNX	hexahydro-1,3-Dinitroso-5-Nitro 1,3,5-triazine
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
gpd	gallons per day
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
MNX	hexahydro-1-Nitroso-3,5-Dinitro-1,3,5-triazine
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
NOx	nitrogen oxides
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

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

ABBREVIATIONS AND ACRONYMS

AEC	Atomic Energy Commission
AFV	Alternative Fuel Vehicle
AISD	Amarillo Independent School District
AQMR	Air Quality Management Requirement
ARC	Acquisition Review Committee
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
CAP	Corrective Action Plan
CAR	Corrective Action Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMS/FS	Corrective Measures Study/Feasibility Study
COC	Chain of Custody
COC	Contaminants of Concern
COD	Chemical Oxygen Demand
COPC	Contaminant of Potential Concern
CP	Compliance Plan
CRM	Cultural Resource Management
CWA	Clean Water Act
CY	Calendar Year
D&Z	Day and Zimmerman
DBP	Disinfectant By-Product
DCG	Derived Concentration Guide
DPA	Data Package Assessment
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
DOECAP	DOE Consolidated Audit Program
DQO	Data Quality Objective
EA	Environmental Assessment
EDD	Electronic Data Deliverable
EID	Environmental Information Document
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
ERDA	Energy Research and Development Administration
ESA	Endangered Species Act
ESD	Environmental Stewardship Department
ESTAR	Environmental Sustainability Award
FEC	Federal Electronics Challenge
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FM	Farm-to-Market Road
FS-4	Firing Site 4
FY	Fiscal Year (October 1 - September 30)

GAC	Granular Activated Carbon
GHG	Greenhouse Gas
GPS	Global Positioning Satellite
GWPS	Groundwater Protection Standard
HAA5	Haloacetic Acid
HAP	Hazardous Air Pollutant
HE	High Explosives
HEPA	High-Efficiency Particulate Air
HVAC	Heating-ventilation-air conditioning
IAG	Interagency Agreement
ICRP	International Commission of Radiological Protection
IEDB	Integrated Environmental Database
IRAR	Interim Remedial Action Report
ISB	In-situ Bioremediation
ISM	Interim Stabilization Measure
ISMS	Integrated Safety Management System
ISPM	In-Situ Performance Monitoring
ISO	International Standards Organization
IWQP	Inland Water Quality Parameter
LQAP	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
MHC	Mason and Hanger Corporation
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
NCR	Nonconformance Report
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
NIST	National Institute of Standards and Technology
NNSA	National Nuclear Security Administration
No.	Number
NPS	National Park Service
NRF	NEPA Review Form
NTNC-PWS	Non-Transient, Non-Community Public Water System
NWS	National Weather Service
O&M	Operation and Maintenance

ODS	Ozone Depleting Substance
ORP	Oxidation Reduction Potential
OSSF	On-Site Sewage Facility
P1PTS	Playa 1 Pump and Treat System
P2	Pollution Prevention
PA/CRMP	Programmatic Agreement/ Cultural Resources Management Plan
PBR	Permits-by-Rule
PE	Performance Evaluation
PGWCD	Panhandle Groundwater Conservation District
PIDAS	Perimeter Intrusion Detection and Surveillance
PM	Particulate Matter
PMU	Playa Management Unit
PPOA	Pollution Prevention Opportunity Assessment
PQL	Practical Quantitation Limit
PRCM	Pantex Radiation Control Manual
PREP	Pantex Renewable Energy Project
PST	Petroleum Storage Tank
PTE	Potential to Emit
PWS	Public Water System
PXSO	Pantex Site Office
QA	Quality Assurance
QC	Quality Control
Qtr	Quarter
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RER	Replicate Error Ratio
RFIR	RCRA Facility Investigation Report
ROD	Record of Decision
RRS	Risk Reduction Standard
RSD	Radiation Safety Department
S&A	Sampling and Analysis
SAR	Sodium Absorption Rate
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SE	Standard Exemption
SEISB	Southeast In-Situ Bioremediation
SEPTS	Southeast Pump and Treat System
SHPO	State Historic Preservation Office
SMP	Site Management Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
SPCC	Spill Prevention, Control, and Countermeasure
SSI	Statistically Significant Increase
Std Dev	Standard Deviation
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compound
SWEIS	Site-wide Environmental Impact Statement
SWMU	Solid Waste Management Unit
TAC	Texas Administrative Code

TCAA	Texas Clean Air Act
TCEQ	Texas Commission on Environmental Quality
TDSHS	Texas Department of State Health Services
TLAP	Texas Land Application Permit
TLD	Thermoluminescent Dosimeter
TNI	The NELAC Institute
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TRI	Toxic Chemical Release Inventory
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
THM	Total Trihalomethanes
TTRF	Texas Tech Research Farm
TYSP	Ten Year Site Plan
UCL	Upper Confidence Limit
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.

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 Department manager is Deborah R. Franklin.

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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 *2010 Site Environmental Report for Pantex Plant* was reviewed for classification and security issues; it was determined to be Unclassified.

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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 *2010 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 2010. This report is prepared in accordance with DOE Order 231.1A, *Environment, Safety and Health Reporting* (DOEg), and DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOEi). These orders and DOE Order 450.1A, *Environmental Protection Program* (DOEh), 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. xxxiv-xxxv) define the program that contains components of environmental management including, but not limited to, regulatory compliance, pollution prevention, and environmental monitoring.

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 2010 were routinely collected at diverse locations, and 27,088 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 DOE Information Repositories at the Amarillo Public Library Downtown Branch, in Amarillo, Texas and at the Carson County Library in Panhandle, 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 2010, the calculated annual radiation dose from releases to the atmosphere from Plant operations was 9.68×10^{-3} mrem (9.68×10^{-5} mSv) for a hypothetical, maximally exposed member of the public. (See footnote 2 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 2010 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 91.5 mrem for the year 2010. This is consistent with historical data. No unplanned radionuclide releases occurred at Pantex Plant in 2010. Ambient air monitoring results for 2010 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 2010 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. However, the explosive 2-nitrotoluene was detected in one playa sample, a first since sampling for this explosive began in 2004. Follow-up sampling could not be conducted due to declining water levels in the playa. Subsequent sampling, as water becomes available, will monitor for this analyte in the future.

Soil samples were collected and analyzed for metals, explosives, semi-volatile, and volatile organic compounds (VOCs). Onsite soil monitoring results for 2010 were, with one exception, 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. Initial sampling results for the explosive hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) was 1.9 mg/kg at sampling location BG-SS-C3. The established background concentration is 1.8 mg/kg for RDX at this location. The results from confirmation sampling, as provided for in Provision VI.F.1.a of Permit HW-50284, was 1.6 mg/kg for RDX, which is below the established background value at location BG-SS-C3. Because the confirmation sample result was below the established background value, no additional action is required.

Flora and fauna monitoring results indicated that there were no detrimental impacts from Plant operations in 2010. 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 2010 indicate that the main drinking water aquifer remains unaffected by natural migration of contaminants from soil and perched groundwater.

Pantex has completed investigations and soil cleanup of all solid waste management units, with the exception of units that remain in an active status. This allowed Pantex to transition to Long-Term Stewardship in 2009. A Record of Decision was issued in September 2008 that described the final remedial actions for all investigated units. During 2010 the final remedies were also incorporated into the Pantex Compliance Plan No. 50284 issued by the TCEQ in September 2010.

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. Pantex installed two types of remediation systems: two in-situ bioremediation (ISB) and two pump and treat systems. Although Pantex is in the early stage of its groundwater remedial action, monitoring results indicate that the groundwater systems 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.

The pump and treat systems operated near or above performance goals established for the systems. Those systems have been effective at remediating perched groundwater as declining water levels and contaminant concentrations have already been observed around the pump and treat systems. Additionally, the pump and treat systems removed about 1,000 lbs of high explosives and 174 lbs of hexavalent chromium from perched groundwater. Monitoring of the 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 being reduced at four close down-gradient wells.

Soil remedies were also inspected, maintained, or scheduled for maintenance during 2010. The soil vapor extraction (SVE) system continued to operate during 2010 and effectively removed 766 lbs of VOCs.

Regulatory Compliance and Permitting

During 2010, 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 No. WQ0003497000 by declaring the related application administratively complete. Similarly, the TCEQ declared the application to renew Permit No. WQ0002296000 administratively complete. The TCEQ conducted a Comprehensive Compliance Evaluation Investigation of both wastewater permits on June 9, 2010. No areas of concern or violations of terms, conditions, or requirements of the permits were identified.

On June 24, 2010 a comprehensive air compliance information package in response to an EPA *Clean Air Act* §114 information request was submitted. The response package established the baseline of how Pantex can demonstrate compliance with both the Flexible Air Permit Program, which is in dispute between EPA and the TCEQ, and the previously utilized New Source Review Permit Program.

The TCEQ conducted a Comprehensive Compliance Evaluation Investigation of Pantex Plant's Drinking Water System on July 7, 2010. 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. The TCEQ notified Pantex that its Public Water System would continue to receive a "Superior Rating." Organizations receiving the Superior Public Drinking Water System 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.

Pantex Plant continues to qualify for a reduction in oversight inspections from the State of Texas. The TCEQ performed an on-site audit of the Pantex EMS during the week of July 12, 2010. The TCEQ stated that recertification would be recommended and that Pantex exceeds expectations in regard to voluntary environmental initiatives.

On July 19-21, 2010, 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 16 consecutive years with no violations or areas of concern noted for the management of waste.

Pantex received an approved modification of Compliance Plan No. 50284 through TCEQ issuance September 21, 2010, which took 14 months. The TCEQ processing guidelines indicate that 14 months is the shortest timeframe that a Class 3 Modification, such as this one, can be achieved. No public comments were received during two separate review periods: one for the application submitted to TCEQ to initiate the modification and the other for evaluation of the modification proposed by TCEQ. This is a substantial achievement resulting from sound technical basis and supporting information, as well as concerted efforts to communicate appropriateness of the remedial actions and sufficiency of the Long-Term Monitoring Network.

The Pantex EMS provides the foundation to administer sound stewardship practices that protect natural and cultural resources while cost-effectively demonstrating compliance with environmental, public health and resource protection laws, regulations, and DOE requirements. Notable accomplishments in 2010 relating to the Pantex EMS include:

- Received the DOE EStar Award for exemplary environmental sustainability practices related to the EMS Aspects Review process.
- Continued to exceed groundwater remediation goals established in the Pantex Record of Decision and the Compliance Plan Permit with the TCEQ in operation of the Playa 1 and Southeast Pump and Treat Systems. Numerous improvements resulted in a 20% increase in the volume of water treated.
- Opened the Pantex Visitor Center in support of commitments made in the *Pantex Cultural Resource Management Plan/Programmatic Agreement.* The Visitor Center provides visitors and Plant personnel the opportunity to become absorbed in the history of the Pantex Plant and

world events during the years Pantex has been in existence. An additional accomplishment in support of the Agreement was completion of the onsite exhibit for several historic railroad cars.

- TCEQ approval of two Class 1 modifications to Hazardous Waste Permit HW-50284.
- Updated and submitted Pantex's Potential to Emit air compliance certification documentation.
- TCEQ approval of an Underground Injection Control application to add 20 additional injection wells.
- TCEQ concurrence with the notification of use of an air-quality permit by rule for drum cutting and crushing.
- Prepared and provided several major regulatory deliverables to state and/or federal regulators including:
  - A full revision and update to the Pantex Plant Spill Prevention, Control, and Countermeasures Plan and Resource Conservation and Recovery Act Contingency Plan.
  - Biennial Waste Management Report and Annual Burning Ground Monitoring Report.
  - Annual Affirmative Procurement Report.
  - Annual Toxic Reduction Inventory Report.
  - Annual Texas Land Application Compliance Report.

Pollution Prevention

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 2010, 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%.

In 2009, Executive Order 13514, Fe*deral Leadership in Environmental, Energy, and Economic Performance*, established Pollution Prevention (P2) and Sustainable Environmental Stewardship goals that are to be demonstrated by DOE sites through the integration of P2 into environmental management systems. 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 2010, 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.

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

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

Bulletin No: BLTN-924 Issue 002
Post: May 12, 2010
Remove: May 12, 2012

ENVIRONMENTAL MANAGEMENT SYSTEM

Date: September 16, 2010

From: John Woolery *John Woolery* Location: 12-69

To: B&W Pantex Employees

Subject: 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, natural resource management, pollution prevention, recycling, environmental remediation, and sustainability in all activities.

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

To Excel in:

- 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, recycling, and sustainability.
- Strict compliance with relevant regulations and requirements.
- Setting and reviewing environmental objectives and targets.
- Communication of this policy to all employees.
- Availability of the policy to the public.

ENERGY HOG

B&W Pantex

CLEAN TEXAS

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

<u>Policy Statement</u>: 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

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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 (PANTEXc).

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. At the end of 2010, just over 4000 people were employed at the Plant either as a contracted or subcontracted employee. 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.

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[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 "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)."

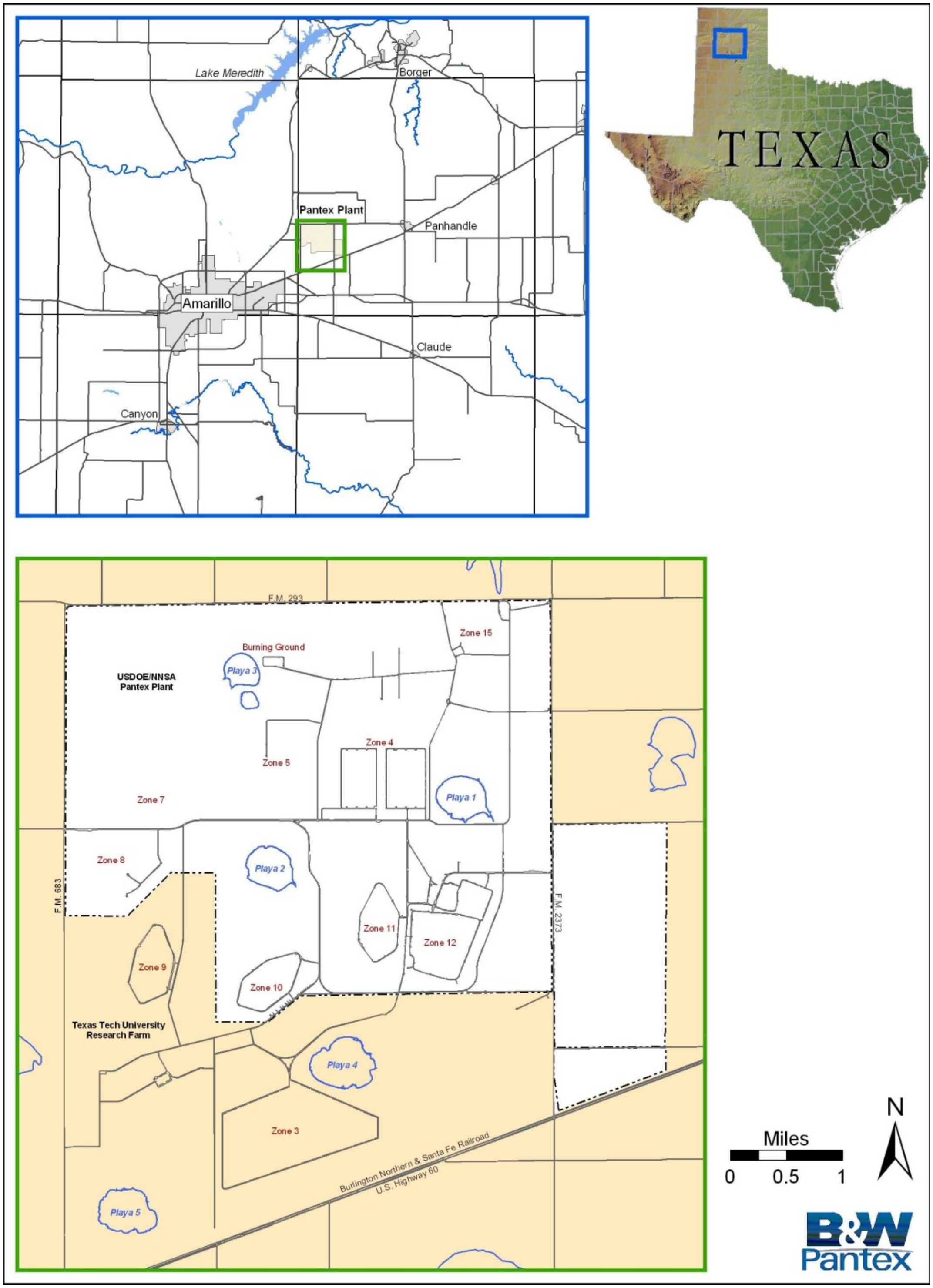

FIGURE 1.1 — *Pantex Plant Site Location*

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, and
- **Develop, fabricate, and test** chemical explosives and explosive components for nuclear weapons and to support DOE initiatives.

Weapon 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.

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.

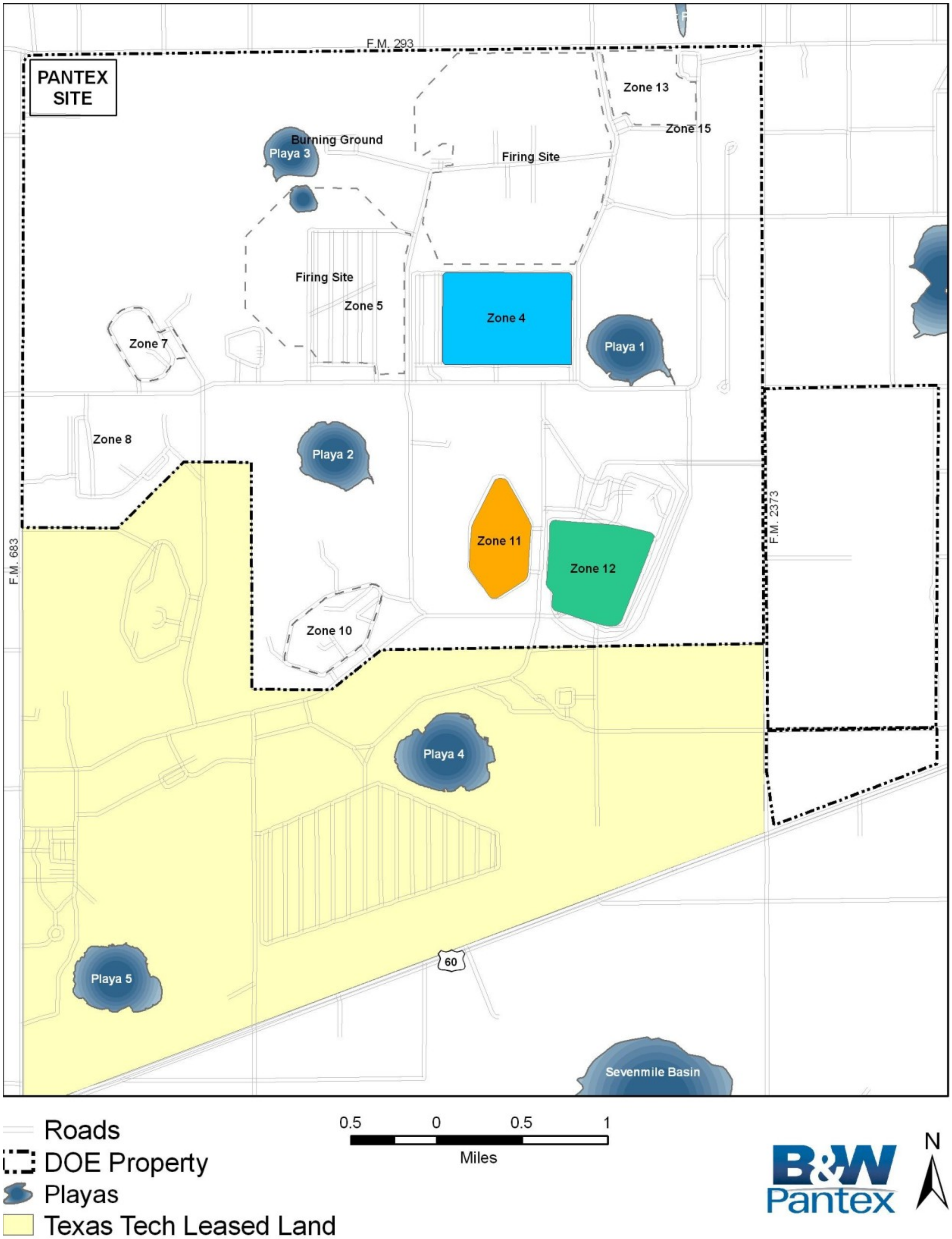

FIGURE 1.2 — ***Principal Features of the Pantex Plant Site***

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 (F) 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 tornadoes, convective wind events[2] and hail; an average of 17 tornadoes occurred each year in the 20 counties of the Texas Panhandle during the period between 1950 and 2008 (DOCb). (Due to increased population in the area, and increased public awareness of severe weather events, the Amarillo County Warning Area [which includes the same 20 counties and the adjacent 3 counties of the Oklahoma Panhandle] averaged 21.1 tornadoes per year during the period from 1980-2009 [DOCc]). While the threat of tornadoes is real, tornado occurrences in Amarillo are generally rare. Tornadoes are most common from April to June. There were 26 tornadoes reported in the Texas and Oklahoma Panhandles during 2010 (DOCd), close to the average, but less than half the number 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 2010 (14.6˚C [58.2˚F]) was only slightly above normal. The precipitation in the area of the Pantex Plant was 34 percent above the normal as the official NWS rain gauge recorded 67.4 cm (26.5 in) of precipitation.[3] A large portion of this rainfall (5.74 inches, a new July maximum daily rainfall record) occurred during a heavy rain and flooding event in the evening hours of Wednesday, July 7 through the early morning hours of Thursday, July 8. Other significant weather events in the Panhandle during the year included a major winter storm in January, tornadoes in April, May and June, and a strong thunderstorm affecting much of the area causing flooding problems, especially in Amarillo, which turned into a heavy snow event during November. 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.

The frequencies of wind direction and speed during 2010 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 Figure 1.3. Figure 1.3(a) indicates that, as in most previous years, a large

[2] High speed "straight-line" winds produced in the downdraft region of a thunderstorm.
[3] Precipitation includes the liquid water equivalent from snowfall.

percentage (nearly 50 percent) of the winds blew from the southeast through southwest during the year. Figure 1.3 also shows that wind direction and speed frequencies vary by season: Northwesterly winds are most frequent during the period from January 1 through March 31 (roughly corresponding to “winter”) (Figure 1.3[c]). Wind direction frequency is more bi-modal during the periods from April 1 through June 30 (Figure 1.3[d]) and from October 1 through December 31 (Figure 1.3[e]) (“spring” and “fall” respectively). The vast majority of winds are from the southern sector in “summer” (i.e., July 1 through September 30), including over 40 percent from the south and south-southwest directions (Figure 1.3[b]). In addition, wind speeds are highest in winter and spring and lowest in summer and autumn.

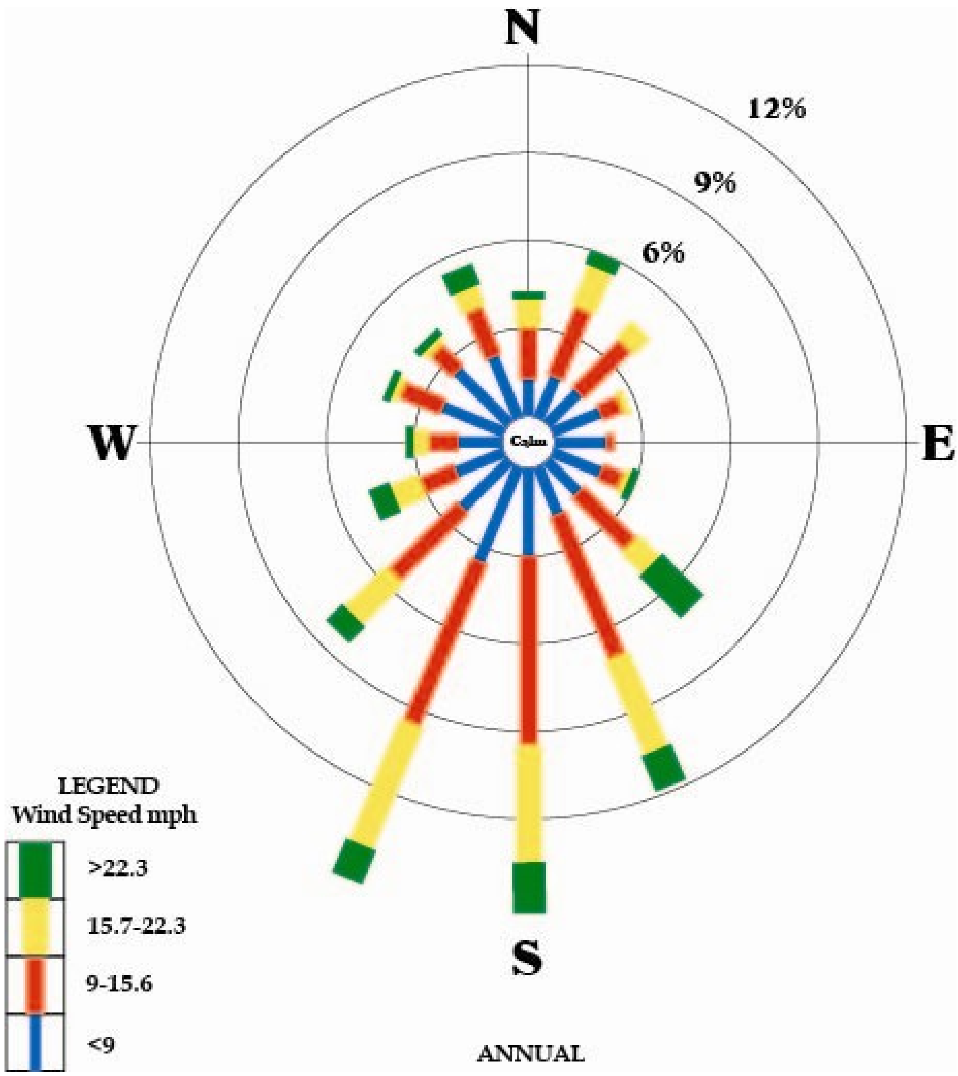

FIGURE 1.3(a) — *Pantex Plant Wind Roses for 2010 (a) Annual*

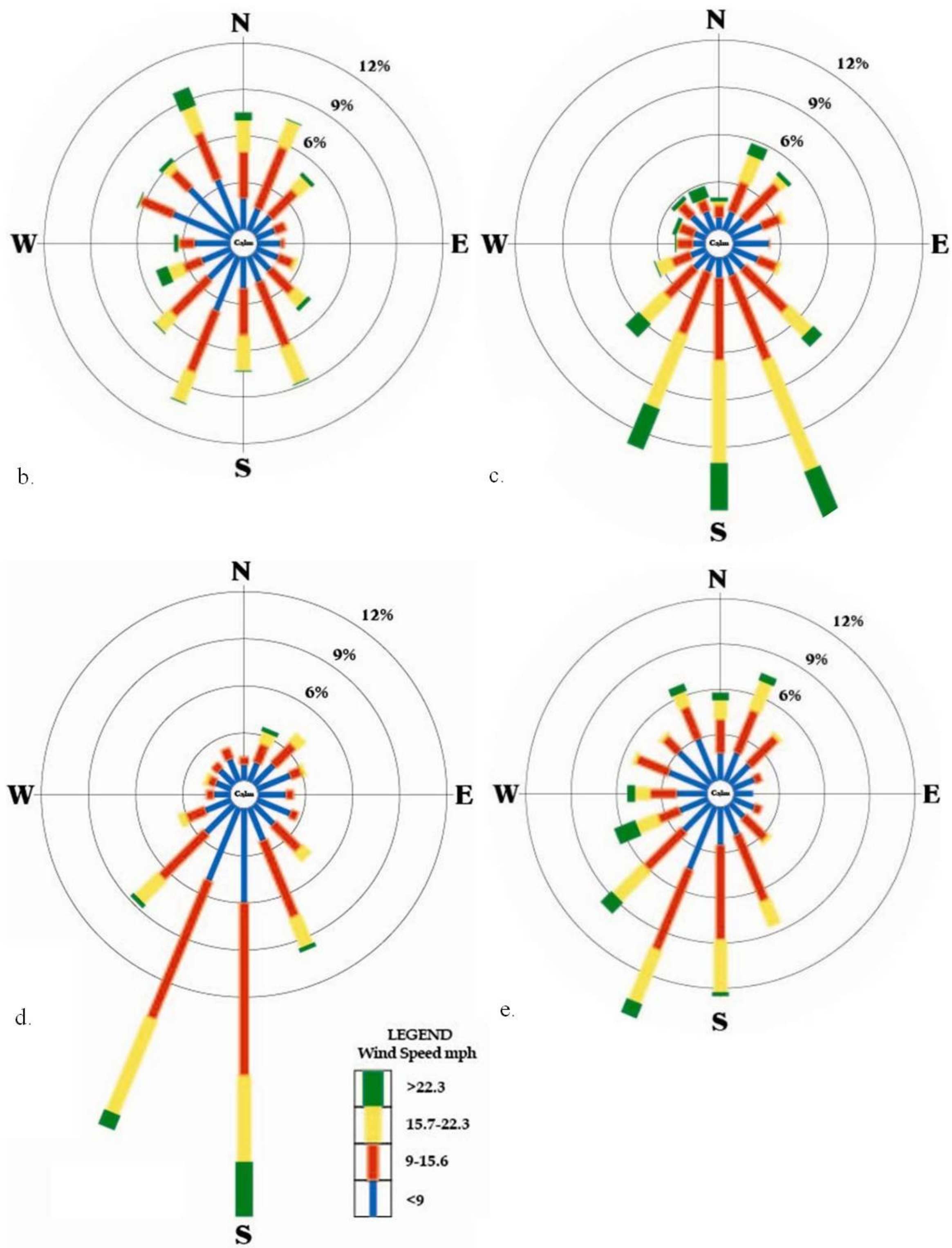

FIGURE 1.3(b-e) — ***Pantex Plant Wind Roses for 2010 (b) 1st Quarter; (c) 2nd Quarter; (d) 3rd Quarter; and (e) 4th Quarter***

Table 1.1 is a compilation of climatological data (temperature, relative humidity, precipitation [including the water equivalent of any snowfall] and wind speed) for 2010 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 Figures 1.4 and 1.5.

TABLE 1.1 — *Pantex 2010 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	19.8 (67.7)	-18.1 (0.6)	1.1 (34.0)	62	8.89 (0.35)	4.96 (10.9)	15.9 (35.3)
February	16.1 (61.0)	-13.7 (7.4)	0.0 (32.0)	76	22.61 (0.89)	4.8 (10.6)	26.3 (58.5)
March	29.6 (85.3)	-8.1 (17.5)	7.9 (46.2)	60	28.19 (1.11)	6.4 (14.2)	15.8 (35.1)
April	30.1 (86.2)	-2.7 (27.1)	13.8 (56.9)	54	74.42 (2.93)	7.2 (16.1)	18.1 (40.2)
May	33.1 (91.5)	2.6 (36.6)	17.7 (63.8)	58	83.57 (3.29)	6.4 (14.2)	20.1 (44.7)
June	36.2 (97.2)	14.8 (58.7)	25.4 (77.7)	55	37.08 (1.46)	6.8 (15.1)	15.3 (34.0)
July	34.8 (94.7)	16.1 (60.9)	24.6 (76.3)	66	10.16 (0.40)	5.7 (12.7)	15.7 (34.8)
August	36.2 (97.2)	10.9 (51.7)	25.8 (78.5)	53	2.79 (0.11)	5.1 (11.3)	21.6 (48.1)
September	37.1 (97.8)	8.6 (47.5)	22.5 (72.5)	58	37.85 (1.49)	5.6 (12.4)	27.3 (60.7)
October	28.4 (83.2)	-0.2 (31.7)	15.6 (60.1)	49	14.48 (0.57)	5.0 (11.2)	18.2 (40.4)
November	25.8 (78.4)	-8.3 (17.1)	7.7 (45.8)	10	51.8 (2.04)	5.8 (12.9)	13.9 (30.8)
December	23.8 (74.8)	-7.7 (18.1)	4.1 (39.4)	56	10.16 (0.40)	5.3 (11.7)	16.3 (36.3)
Annual[b]			13.9 (56.9)	55	382.02 (15.04)	5.8 (12.8)	

[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.

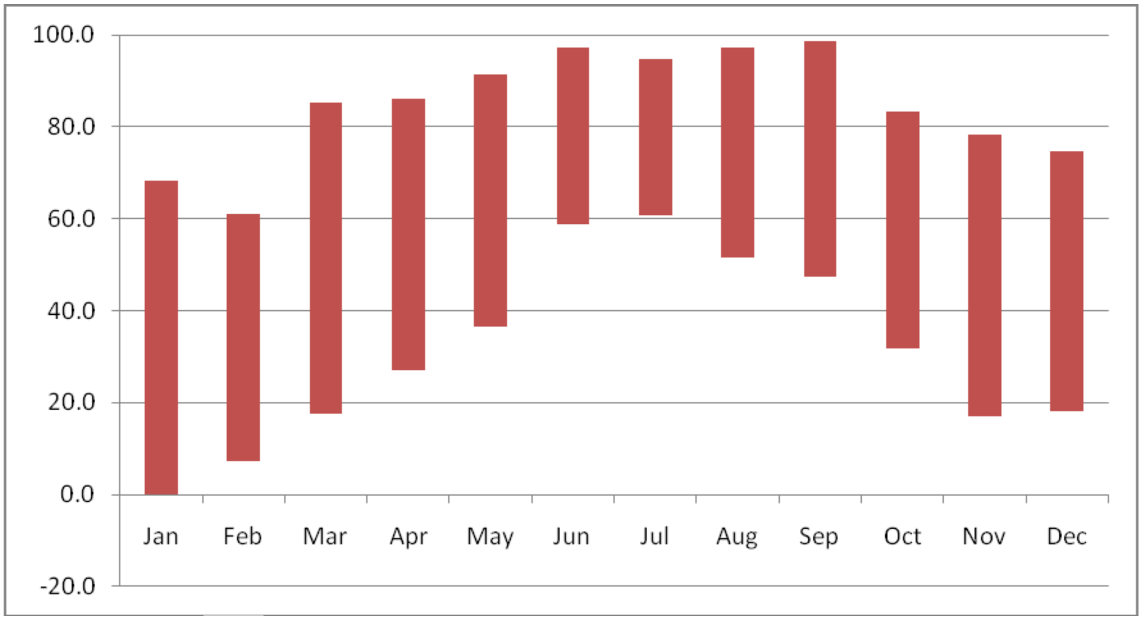

FIGURE 1.4 — ***Pantex Plant Monthly Temperature Range during 2010 (ºFahrenheit)***

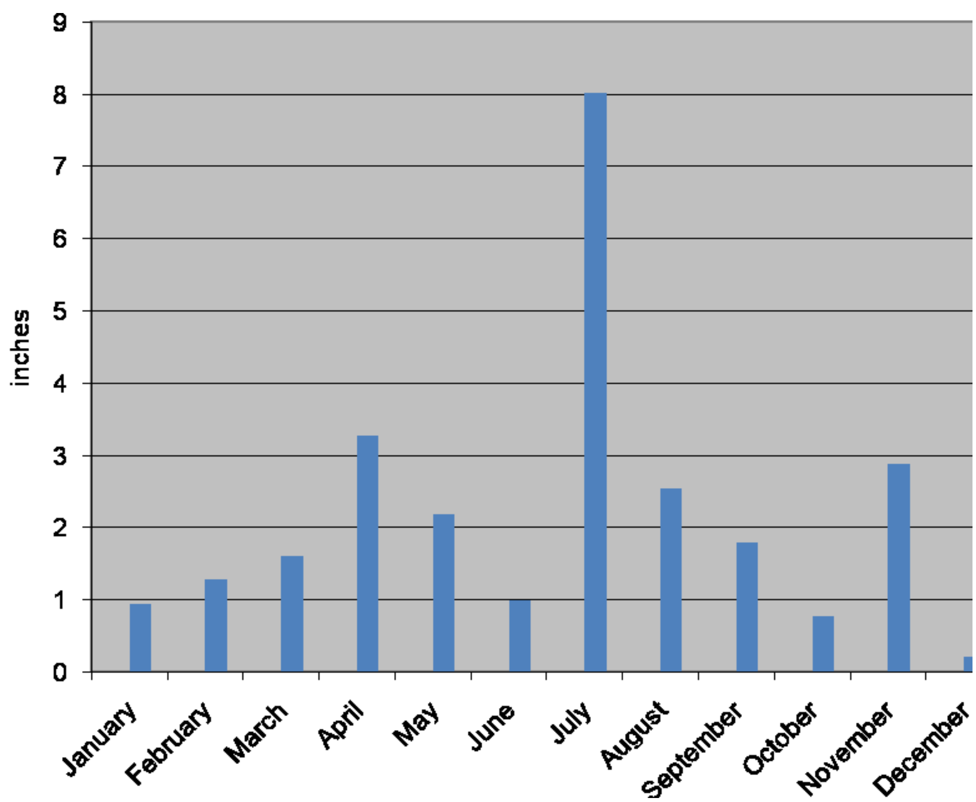

FIGURE 1.5 — ***Amarillo National Weather Service (NWS) Precipitation during 2010 (in inches)***

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 property (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)* (PANTEXc). 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) (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 2010, Pantex pumped approximately 406 million liters (107 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 (Bureau of Census 2000). The population within the 80 km (50 mi) circle is fairly evenly distributed at a density of about 5,916 people per square mile.

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. Hutchinson County (in which Borger is located) and Gray County (in which Pampa is located) are now classified as micropolitan statistical areas (DOCe). 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 2010 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.

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, plants, and animals.

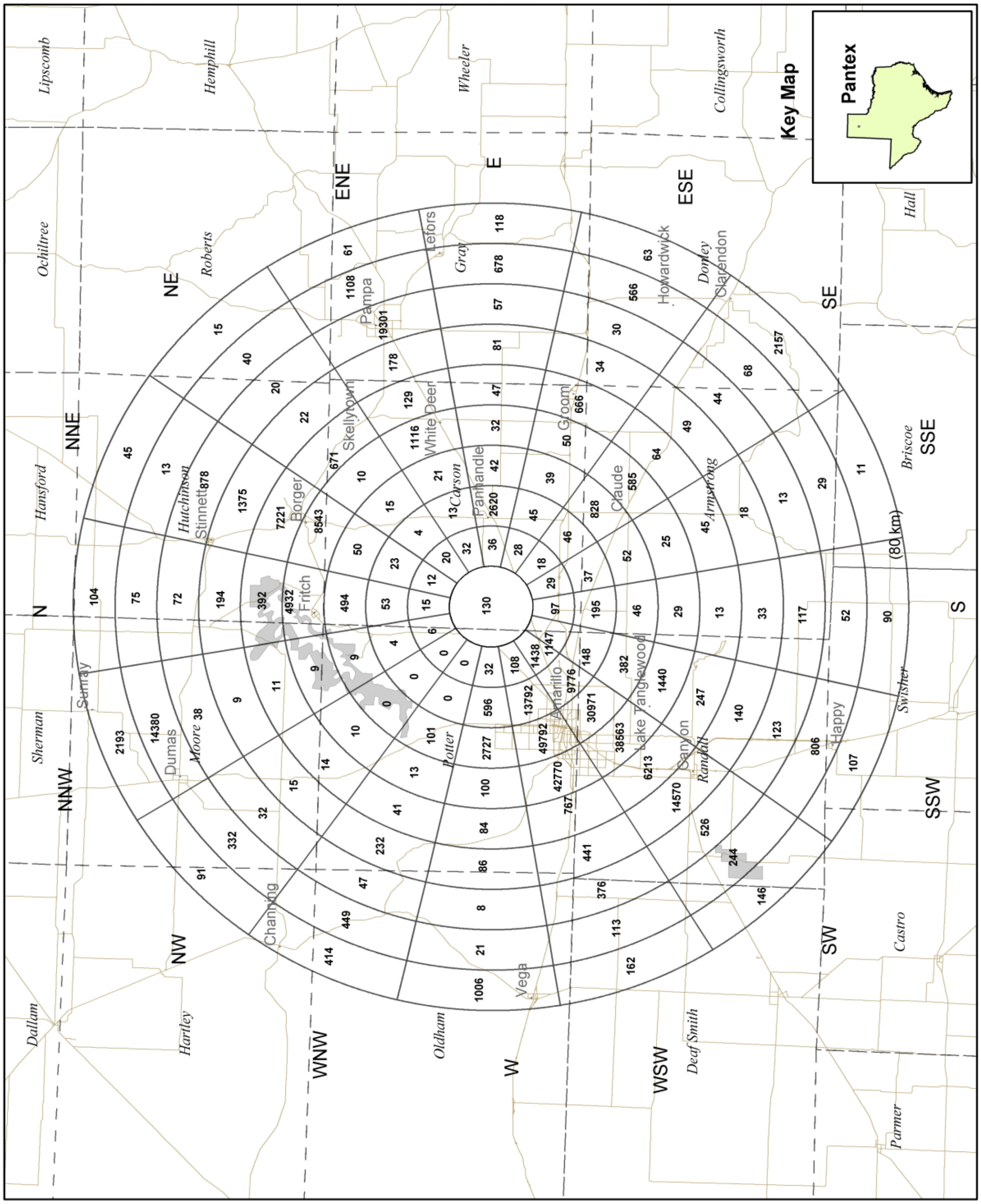

FIGURE 1.6 — *Population Distribution Within 50 Miles of Pantex Plant (2000)*

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 (if available) and nonradiological data for the 2010 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 2010 and a data validation summary.

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

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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 2010, Pantex demonstrated its commitment to maintaining full compliance with all applicable environmental requirements by: receiving no significant violations or adverse regulatory actions from environmental regulators; completing the 16th consecutive year without RCRA violations; receiving no violations during the drinking water inspection; the elimination of the use of chlorine gas; achieving no exceedances in the disposal of its treated wastewater; reducing the total amount of waste generated at the Plant; and applying for and obtaining renewals and amendments to existing permits. In addition to maintaining full compliance with all applicable environmental requirements, Pantex efforts to excel in its environmental management systems is exemplified by Pantex obtaining and maintaining Gold Level status in the TCEQ's Clean Texas Program.

2.1 Environmental Regulations

This chapter summarizes the compliance status of Pantex Plant for 2010. 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 (CFR), 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, control 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)	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 Pantex Site Office (PXSO) have signed an Interagency Agreement concerning the conduct of the remediation at

Regulatory Description	Authority	Codification	Status
CERCLA provides the regulatory framework for the remediation of releases of hazardous substances and cleanup of inactive hazardous substance disposal sites. Section 107 provides for the protection of natural resources on publicly owned property through designation of Natural Resource Trustees.			the Pantex Plant. A Record of Decision (ROD) was issued and approved in 2008 (DOEd) and Pantex was added to the Construction Completion List in 2010. Interested Co-Trustees have been involved in the planning and completion of the ecological risk assessment (ERA) for Pantex, 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 its wastewaters to 'Waters of the United States'. The Pantex Plant discharges its industrial wastewaters pursuant to Permits WQ0002296000, WQ0004397000, and UIC 5W2000017. The Plant has coverage under Texas Pollutant Discharge Elimination System (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 2010, two active projects had been registered with the TCEQ.

Regulatory Description	Authority	Codification	Status
			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: 49 CFR §173 State: 30 TAC §330.1010 and 25 TAC §1.131-§1.137	The Plant manages medical waste in accordance with applicable regulations.
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 National Environmental Protection Act (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 (2001) 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 2010, 8 Standard NEPA Review Forms, 41 Internal NEPA Review Forms, and 10 amendments were prepared. One Environmental Assessment (EA) was approved.
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	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 through the NEPA process, which considers impacts to all protected species.

Regulatory Description	Authority	Codification	Status
Code.			
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.
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. 0330007). In 2010, 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 polychlorinated biphenols (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 Environmental Protection Agency (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 40 CFR §61 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 2010. B&W Pantex has determined that the maximum effective dose equivalent that any member of the public received in 2010 was 9.68×10^{-3} mrem (9.68×10^{-5} 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 State 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 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 Quality Permits and Authorizations

Pantex continues to use a combination of an air quality permit issued under 30 TAC 116 and authorizations issued under 30 TAC §106 (Permits by Rule) to authorize operations conducted at the Plant.

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 (issued through the requirements of 30 TAC §116, Subchapter G) that includes an aggregate hourly and annual maximum emission rates for all emission points included in the Permit. On June 30, 2010, the EPA disapproved the flexible permit program that the TCEQ had submitted for inclusion in the Texas State Implementation Plan. As a result of that action, the Pantex Plant submitted an application to the TCEQ on December 20, 2010. This application requested that the

TCEQ amend Air Quality Permit 84802 to a permit that would be issued under an EPA-approved Texas State Implementation Plan.

2.2.6 Federal Operating Permit Program

The Title V Federal Operating Permit Program is administered and enforced by EPA Region 6 Office and the TCEQ. During 2010, Pantex maintained documentation demonstrating that it was not a major source, as defined by the Federal Operating Permit Program. Pantex currently operates under a Potential-to-Emit (PTE) Certification submitted on January 4, 2010.

2.2.7 Air Quality Inspection

During 2010, 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, as well as the site's Non-Major source status.

2.2.8 Emission Tracking and Calculation

2.2.8.1 Scope of the Pantex Plant Emission Tracking System

Pantex Plant 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 authorizations issued to the Pantex Plant.

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:[a]	Authorization Permit #	Standard Exemption	Permit By Rule
HE Synthesis Facility	Permit 84802		
HE Fabrication	Permit 84802		
Firing Site Activities	Permit 84802		
Boiler House	Permit 84802		
Stationary Standby Emergency Engines	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		

Process:[a]	Authorization Permit #	Standard Exemption	Permit By Rule
Epoxy Foam Production	Registration #43702		PBR 262
Component Sanitization	Registration #41577		PBR 261 & 262
Machining		SE 39, 41, 42	PBR 433 & 452
VMF Fueling Operations	Permit 84802		PBR 412
HWTF Liquid Processing Facility	Registration #48297		PBR 261
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 261, 262, & 512
Drum Management Operations	Registration 92876		PBR 533

[a] Authorization dates (the effective dates) can be found in Table 2.5.

2.2.8.2 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 criteria pollutants. Under this designation, a facility is not required to declare its emissions every year to the TCEQ; however, a certification of 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 and the EPA.

The Pantex Plant 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.

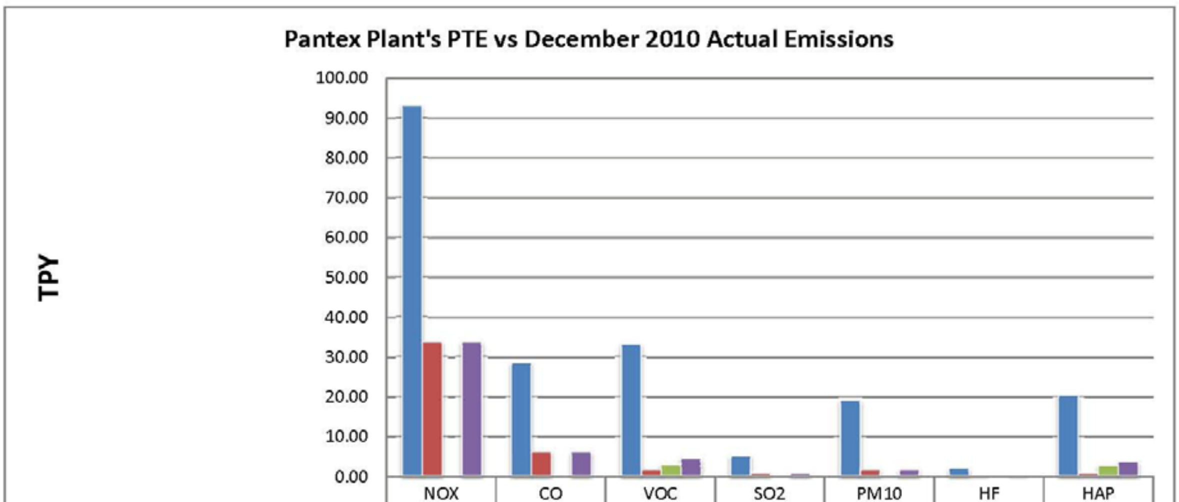
2.2.8.3 Types and Tracking of Emissions

During 2010, 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 HAPs. 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.

On August 10 through August 12, 2010, Pantex conducted a series of tests that demonstrated that the Type O Incinerator used to sanitize weapon components met the emission standards stated in 40 CFR §61, Subpart C (National Emission Standards for Beryllium).

2.2.8.4 Conclusions of Air Emission Tracking for 2010

Over the 12 months of air emission tracking for 2010, 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 presentation of the emission information gathered from January through December 2010, 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	SO2	PM10	HF	HAP
Cert. PTE-Jan 2010	93.08	28.53	33.16	5.14	19.14	2.00	20.36
Permit 84802 Emission Rates:	33.79	6.14	1.60	0.88	1.71	0.15	0.88
Exemption Authorization Emission Rates:	0.00	0.00	2.93	0.00	0.00	0.00	2.76
Plant Total Emission Rates:	33.79	6.14	4.54	0.88	1.72	0.15	3.64

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

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

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 2010, the Interim Remedial Action Report was submitted and approved. 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 2010	Federal Status	State Status
Birds				
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
Mammals				
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
Reptiles				
Texas horned lizard	*Phrynosoma cornutum*	[a]	Concern	Threatened

[a] Presence documented at Pantex Plant in 2010.
[b] Candidate, threatened.

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.

2.5 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) 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 FIFRA 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* (PANTEXg). 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 2010

Texas Tech Research Farm submitted 46 agricultural spray requests during the 2010 growing season. Although all 46 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. Table 2.4 shows the number of pesticide applications conducted at Pantex since 2003.

TABLE 2.4 — *Number 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
2010	44	55	36	135

2.5.2 Maintenance Department and Contractor Pesticide Use in 2010

The B&W Pantex Maintenance Department made 55 applications of pesticides during 2010. 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 36 applications that accounted for the remainder of pesticide use in 2010. The majority of the 36 contractor applications were herbicides applied as soil sterilants before roads or structures were built, weed control in rock landscaped areas, and prairie dog control.

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 but is subject to the requirements of the Texas Water Code. All discharges must be done in compliance with the requirements of the Texas Water Code and its implementing regulations.

During 2010, Pantex maintained three permits issued by the TCEQ that authorized the disposal of its industrial wastewaters. In 2010, Pantex disposed of all of its treated industrial wastewaters via a subsurface irrigation system. This system is authorized by Permit WQ0004397000 (also known as a Texas Land Application Permit) and Underground Injection Control (UIC) Authorization 5W2000017. Combined, these authorizations allow the operation of approximately 300 acres of subsurface irrigation.

Permit WQ0004397000 authorizes the disposal of treated wastewaters when the subsurface irrigation area is covered by vegetation. UIC Authorization 5W2000017 allows the application of limited quantities of treated wastewater to the irrigation area during periods when the agricultural fields are fallow. Pantex also maintains a Texas Water Quality Permit WQ0002296000 that authorizes the disposal of treated wastewater to an on-site playa. Together, through compliance with these three permits Pantex disposes of its treated effluent in a manner that protects the environment.

On May 17, 2010 the Pantex Plant submitted an application to renew and amend Permit WQ0004397000. In addition to requesting the renewal of Permit WQ0004397000, this application requested the addition of 100 acres of subsurface irrigation to the existing 300 acres and amendments to the reporting requirements of the permit. On July 7, 2010 the TCEQ declared Pantex's application to renew and amend Permit WQ0004397000 to be administratively complete. The public notice of the TCEQ's Receipt of Application and Intent to Obtain Water Quality Permit Amendment was made on July 22, 2010. As of December 31, 2010 the Pantex Plant was in negotiations with the TCEQ on the final terms of the proposed permit.

On May 17, 2010 the Pantex Plant submitted an application to renew and amend UIC Permit 5W2000017 to include the addition of 100 acres of subsurface irrigation to the existing 300 acres. On June 16, 2010, the TCEQ issued a renewal and amendment to UIC Permit 5W2000017.

On May 1, 2010 the Pantex Plant submitted an application to renew Permit WQ0002296000. On July 19, 2010 the TCEQ declared Pantex's application to renew Permit WQ0002296000 to be administratively complete. The public notice of the TCEQ's Receipt of Application and Intent to Obtain Water Quality Permit was made on August 5, 2010. As of December 31, 2010 the Pantex Plant was in negotiations with the TCEQ on the final terms of the proposed permit.

Pantex maintains a Texas Pollutant Discharge Elimination System (TPDES) Storm Water General Permit for Construction Activities (Permit TXR150000). Pursuant to permit, the Notice of Intent for individual projects that were filed or active in 2010 are listed in Table 2.5.

At seven of the more remote buildings, Pantex operates "On-site Sewage Facilities" (OSSFs) or septic tank systems, to dispose of domestic wastewaters from these buildings. Newer OSSFs have been approved by the TCEQ via permits. However, several of the systems were installed prior to the promulgation of applicable regulations and are not currently registered. As unregistered OSSF's are repaired or replaced, permits authorizing the upgrading or installation of the new system will be acquired from the TCEQ.

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	05/05/2010	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

Building or Activity	Permit Number	Issuing Agency	Effective Date	Expiration Date
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	06/24/2010	When the Application to Renew Permit WQ0002296000 is renewed (which would set a new expiration date) or denied.
Texas Land Application Permit	WQ0004397000	TCEQ	10/06/2003	When the Application to Renew Permit WQ0004397000 is renewed (which would set a new expiration date) or denied.
TPDES Multi-Sector (Industrial) Storm Water Permit	TXR05P506	TCEQ	11/14/2006	08/14/2011
TPDES Storm Water General Permit for Construction Activities Interior Gas Main Replacement High Pressure Fire Loop Replacement Project Irrigation System Upgrade/Expansion	TXR150000 TXR15PN86 TXR15OT07 TXR15QC95	TCEQ TCEQ TCEQ TCEQ	03/05/2010 04/28/2010 10/07/2009 06/16/2010	03/05/2013 05/02/2010 When completed. 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

During 2010, 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 No. WQ0003497000 by declaring the related application administratively complete. Similarly, the TCEQ declared the application to renew Permit No. WQ0002296000 administratively complete. The TCEQ conducted a Comprehensive Compliance Evaluation Investigation of both wastewater permits on June 9, 2010. No areas of concern or violations of terms, conditions, or requirements of the permits were identified.

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 applicable requirements.

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). *Implementation Guidance for DOE Policy on Documentation and Online Posting of Categorical Exclusion Determinations: NEPA Process Transparency and Openness*, October 16, 2009, mandates that all determinations for categorical exclusions involving classes of actions listed in Appendix B to Subpart D of the DOE's NEPA regulations, 10 CFR 1021 be published online.

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 2010, eight Standard NEPA Review Forms (Categorical Exclusion determinations), 41 Internal NEPA Review Forms, and 10 amendments were prepared and approved. Categorical Exclusion determinations for the 8 Standard NEPA Review Forms and 2 amendments were posted on the Pantex website. The Environmental Assessment for the Pantex Renewable Energy Project was completed and the Finding of No Significant Impact was signed on July 30, 2010. (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) (PANTEXi). 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, 52 projects were evaluated in 2010 under the PA/CRMP. Of these projects, 40 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 and 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 2010 are summarized in Table 2.6. Overall, the amount of waste generated in 2010 decreased 20.6 percent from 2009. 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 2010, Pantex Plant generated 541.4 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 36.4 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 2010, Pantex Plant generated 6,045.0 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 47.9 percent of the total non-hazardous waste generated during 2010. In addition, during the year, Pantex Plant generated 1,040.1 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	2007	2008	2009	2010	% Increase or (Decrease) from 1993	% Increase or (Decrease) from 2009
Non-hazardous Waste	10,885	5,751.5	22,934.93	7,962.7	6045.0	(44.5)	(24.1)
Sanitary Waste	612	1,377.04	1,465.56	1,230.1	1040.1	70.0	(15.4)
Hazardous Waste	369.6	561.9	411.9	506.6	541.4	46.5	6.9
Low-Level Waste	287	32.71	34.01	21.6	57.3	(80.0)	165.3
Mixed Waste	37.5	0.32	0.076	0.14	0.08	(99.8)	(42.9)
TSCA Waste	112.9	25.02	115.2	64.3	81.7	(27.6)	27.1
Universal Waste [a]	-	20.35	16.3	6.2	5.2	-	(16.1)
Total	12,304	7,768.85	24,977.98	9791.64	7770.8	(36.8)	(20.6)

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

Pantex Plant generated 81.7 m^3 of wastes regulated by TSCA, during 2010. 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 93.6 percent of the total TSCA waste generated. All TSCA wastes were shipped offsite for final treatment and disposal.

During 2010, Pantex Plant generated 5.2 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 1.5 percent of the total universal waste generated. These wastes are shipped offsite for final treatment, disposal, or, as applicable, recycling.

Pantex Plant generated 57.3 m^3 of low-level radioactive waste, during 2010. 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 2010, Pantex Plant generated 0.08 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 April 29, 2010 the Pantex Plant submitted an application to amend Hazardous Waste Permit HW-50284. This application updated the Pantex Plant’s Spill Prevention, Control, and Countermeasures (SPCC) and RCRA Contingency Plan. On July 26, 2010 the TCEQ amended Hazardous Waste Permit HW-50284 which incorporated the changes to the SPCC and RCRA Contingency Plan requested by the Pantex Plant.

2.10.3 Annual Resource Conservation and Recovery Act Inspection

From July 19 through July 21, 2010, the TCEQ conducted its annual RCRA inspection of the active solid waste management units at the Pantex Plant. After inspecting approximately 80 active waste management units; no violations or areas of concern were identified by the TCEQ. The results of the TCEQ’s inspection represent 16 consecutive years with no violations or areas of concern noted for the management of solid waste at the Pantex Plant.

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

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. This Compliance Plan (CP) permit modification became effective when it was issued September 16, 2010. (See Section 3.7 for additional information.)

Progress reports, required by Table VII of the Compliance Plan (TCEQ, 2010) and Article 16.4 of the Pantex Interagency Agreement, were submitted in 2010. The annual report contained a full reporting of all monitoring information for 2010. Quarterly progress reports were submitted in 2010 in accordance with the schedule in the approved Sampling and Analysis Plan, Long-Term Monitoring Design, and Table VII of CP-50284. Those reports focus on the continued operation of the remedies and on monitoring results from key wells.

2.10.5 Underground Storage Tanks

The Plant operated five regulated underground Petroleum Storage Tanks (PSTs) during 2010. Of the five regulated underground storage tanks at Pantex, two are used for emergency generator fuel storage. Three other PSTs 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 2010.

2.11 Safe Drinking Water Act

The Plant operates non-community, non-transient Public Drinking Water System No. 0330007, which is registered with the TCEQ. This category of systems identifies private systems that continuously supply water to a small group of people; i.e., schools and factories.

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 by electrolyzing salt and water to produce a mixture of hypochlorous acid, hypochlorite ion, and other chlor-oxygen species that behave like chlorine dioxide or ozone while offering a residual chlorine level. This method eliminated the storage and use of large amounts of chlorine gas at the Pantex Plant. The chlorinated water was 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 8, 2010, a TCEQ subcontractor conducted required sampling of the Drinking Water system. No problems were noted in the results from sampling. On July 7, 2010, 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 (PWS) 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 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 for chemical or microbiological quality parameters during the past two years. The system must have implemented a source water protection program, 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 the 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 by, 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 — *2010 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 2010.
Extremely Hazardous Substance Notification (SARA 304)	Yes	Two chemicals were stored at Pantex in quantities above the threshold planning quantities in 2010.
Material Safety Data Sheet/Chemical Inventory (SARA 311-312)	Yes	This requirement was satisfied by the Texas Tier Two Report.[a] Eleven chemicals were listed in the report for 2010.
Toxic Chemical Release Inventory Reporting (SARA 313)	Yes	A Toxic Chemical Release Inventory Report was required for calendar year 2010.

[a] 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 (USACE), Tulsa District, completed a floodplain delineation report in January 1995 (USACE, 1995), revising an earlier delineation. In calendar year 2010, 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 (DOEb) 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, and
- Cultural resource management.

Management of floodplains and protection of the wetlands is addressed in the *Integrated Plan for Playa Management at Pantex Plant* (PANTEXf). Two floodplain assessments were completed in 2010. The first was the Floodplain Assessment for the Irrigation System Upgrade project, with the resulting Floodplain Statement of Findings published on February 18, 2010. The second was the Floodplain Assessment for the Onsite Water Line Erosion Repairs project, with the resulting Floodplain Statement of Findings published on December 23, 2010.

Environmental Management Information

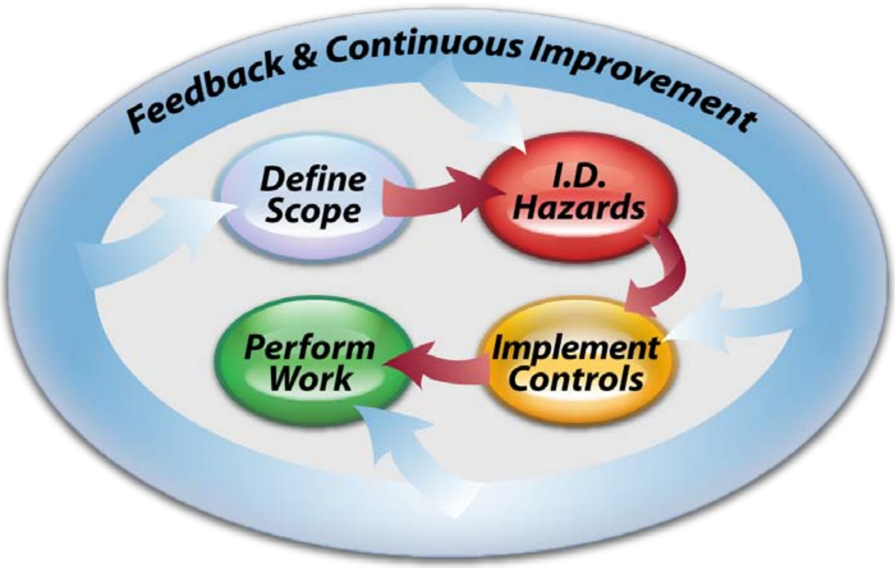
To implement sound stewardship practices that are protective of the air, water, land, and other natural and cultural resources impacted by U.S. Department of Energy (DOE) operations, a comprehensive Environmental Management System (EMS) has been developed. The Pantex EMS is a major component of the Integrated 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, including influence on wildlife, 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. Sustainability at Pantex is considered an opportunity to create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations. 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* (DOEj), and DOE Guidance 450.4-1B (Volumes 1&2), *Integrated Safety Management System Guide* (DOEf). This policy sets forth DOE's expectations of line management to ensure that operations are adequately implementing environmental, 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. 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).

On October 8, 2009, Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, became effective. The Order stipulates the use of formal environmental management systems that are appropriately implemented and maintained for the purpose of achieving performance necessary to meet the goals of the order. EO 13514 is intended to supplement EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, in providing a stable foundation for environmental sustainability. EO 13423, effective January 26, 2007, consolidated previous Executive Orders to better establish direction for environmental management by the federal government.

Pantex has an EMS that meets the requirements of DOE Order 450.1A, *Environmental Protection Program* (DOEh). (Please see the *Executive Summary*, pp. xxx and xxxi, for the official B&W Pantex and Pantex Site Office Environmental Policies.) It provides for systematic planning, integrated execution, and evaluation of programs for: 1) public health and environmental protection, 2) pollution prevention (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 as appropriate.



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*

The Plant's EMS is modeled on the International Organization for Standardization's (ISO) 14001, *Environmental Management Systems – Requirements with Guidance for Use, 2004* (ISO, 2004).

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 three objectives/targets to be pursued in 2010. The targets were met for all three items as scheduled. Table 3.1 represents the final status of Objectives and Targets for 2010.

TABLE 3.1 – *B&W Pantex Objectives and Targets for 2010*

Objective	Target(s)	Status/Comments
Reduce Plant's Consumption of Fossil Fuel	• Reduce gasoline (petroleum product) by an additional 5,000 gallons from the FY 2009 actual use.	Reduction exhibited >22,000 gallons conserved compared to FY 2009 actual use. TARGET MET
Enhance Environmentally Preferable Procurement Practice	• Implement Standing Order for Acquisition Review Committee (ARC) to provide review and clarification of subject matter specifics regarding procurement	TARGET MET

Objective	Target(s)	Status/Comments
	activities prior to final submission for purchase.	
Regulatory Satisfaction with State	• Receive three year renewal of Gold level participation in the Texas Commission on Environmental Quality (TCEQ) "Clean Texas" Program.	TCEQ renewed participation by letter dated September 30, 2010. TARGET MET

EMS Accomplishments for 2010

- From NNSA/DOE: In 2010 the Pantex EMS received a Pollution Prevention "***Best-in-Class***" Award in the Environmental Management Systems Category for strategies developed and implemented regarding "*Aspects Analysis to Performance Success*". (Figure 3.2)

- From DOE: In 2010 the Pantex EMS was recognized with the Environmental Sustainability Award (ESTAR) for strategies developed and implemented regarding "*Aspects Analysis to Performance Success*". Representatives from Pantex were present in Washington D.C. to receive this honor.

- "Clean Texas"- The Texas Commission on Environmental Quality has a voluntary environmental leadership program to protect air, water, and land resources in Texas. Clean Texas recognizes organizations for creative approaches in resolving environmental challenges and setting goals that exceed compliance levels under existing regulations. In 2010 Pantex applied with the TCEQ and received a three year (3) renewal of "Gold Level" of participation in this program. This level of participation places Pantex as one of the elite environmentally protective organizations in the State.

- Regularly scheduled building surveillances (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.

- On an annual basis, a team of Pantexans reviews the potential of impacts to the environment from the activities performed at the plant. The annual aspects review process began in May 2010 and resulted in five Objectives with specific Targets that were approved as FY 2011 goals for environmental improvement. Prior to performing these annual aspects reviews, each Department Manager submits a response to an EMS questionnaire (electronically). The aspects analysis team reviews responses to the questionnaires and then evaluates those activities (e.g., waste generation and management, storm water discharges, air emissions, etc.) to determine environmental impacts.

- Executive Order 13423 requires that federal facilities reduce the fleet's total consumption of petroleum products by 2 percent annually, using 2005 as a baseline, through the end of fiscal year 2015, while increasing the total fuel consumption that is non-petroleum-based by 10 percent annually. Pantex has reduced the use of gasoline by nearly 50% and increased the use of alternative fuel by greater than 200%.

FIGURE **3.2 –** ***DOE/NNSA EMS Awards***

3.1.1 Energy

Continued success is realized from energy savings activities performed at Pantex. Lighting up-grades, the use of more energy efficient equipment, including the use of Energy Star products, continuous building commissioning, and use of an energy management control system, 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. In 2010, Pantex Plant began an alternate work schedule (9X80s) which helps reduce energy consumption for a large number of administrative type personnel for at least two more days per month. The Plant is using more building setbacks to control building heating, ventilating, and air conditioning systems (HVACs) and provide more efficient lighting.

To date, Pantex Plant has been successful in reducing energy intensity compared to the FY 1985 baseline. From the early days of energy management, the Plant has reduced energy intensity at least 40 percent. 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 3.3). Total plant energy use continues to exhibit a downward trend as energy cost shows signs of stability (Figure 3.4). Presently the Plant maintains a 20 percent reduction in energy intensity from the 2003 baseline in anticipation of achieving the reduction goal.

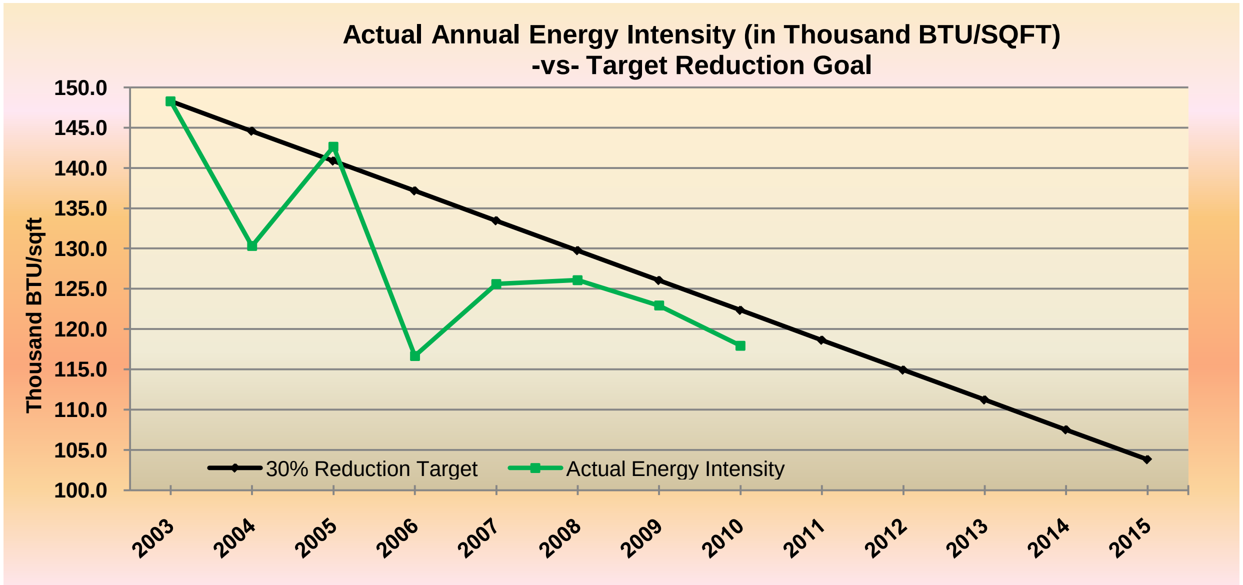


FIGURE **3.3 —** ***Energy Use versus Required Target Reduction Rate***

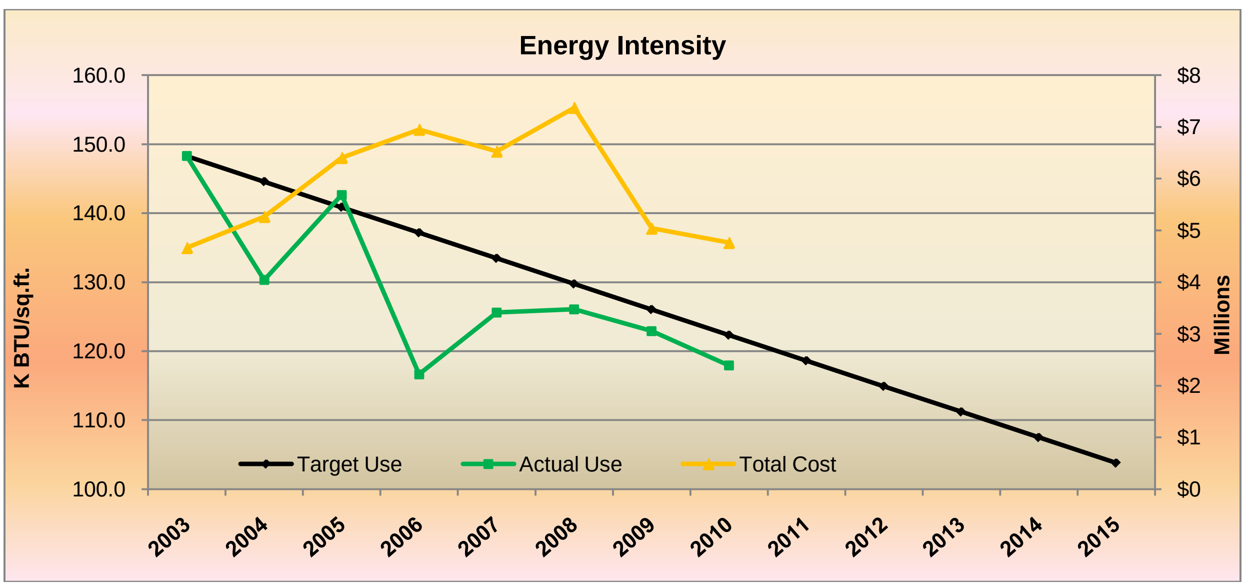


FIGURE **3.4 —** ***Energy Use versus Required Target Reduction Rate with Cost***

Greenhouse gases (GHGs) accredited to Pantex Plant by the Federal Energy Management Program (FEMP) in the FY 2008 inventory are primarily generated through the use of purchased energy for Plant operations. Of most significance are the gases from the purchase and use of electricity and natural gas. These combined actions apparently generated more than 89,268.6 mT CO_2e of GHG in 2008, and since Plant processes and energy use did not change significantly in the next two years, it is deduced that GHG generation in FY 2010 would be similar.

Pantex will continue to strive for reductions in energy use as a primary means to reduce GHG. Each energy efficiency project has the potential to reduce energy intensity and the consequent GHG.

Since petroleum fuel use also generates noticeable amounts of GHG, the Plant will continue to improve operations of the Pantex fleet by reducing petroleum fuel use, using more hybrid vehicles for better gas mileage or Alternative Fuel Vehicles (AFVs) and by ensuring the fleet is the right size for operations.

The actions above should help reduce Scope 1 (direct GHG emissions from Federally owned or controlled sources) and Scope 2 emissions (direct GHG emissions resulting from the generation of electricity, heat, or steam purchased by a Federal agency). Scope 3 emissions (GHG emissions from sources not directly owned or controlled by a Federal agency but related to agency activities) are being evaluated to determine the amount of GHG generated by travel, energy transportation and disposition loses, commuting, and other normal activities (Figure 3.5). Once better understood, actions are possible to attempt to reduce levels of Scope 3 generated GHG.

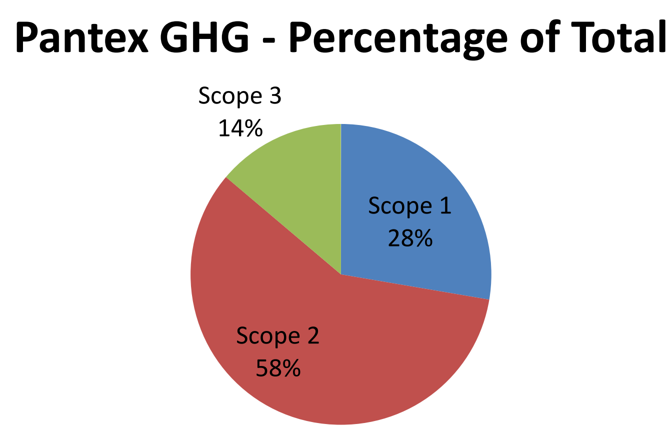
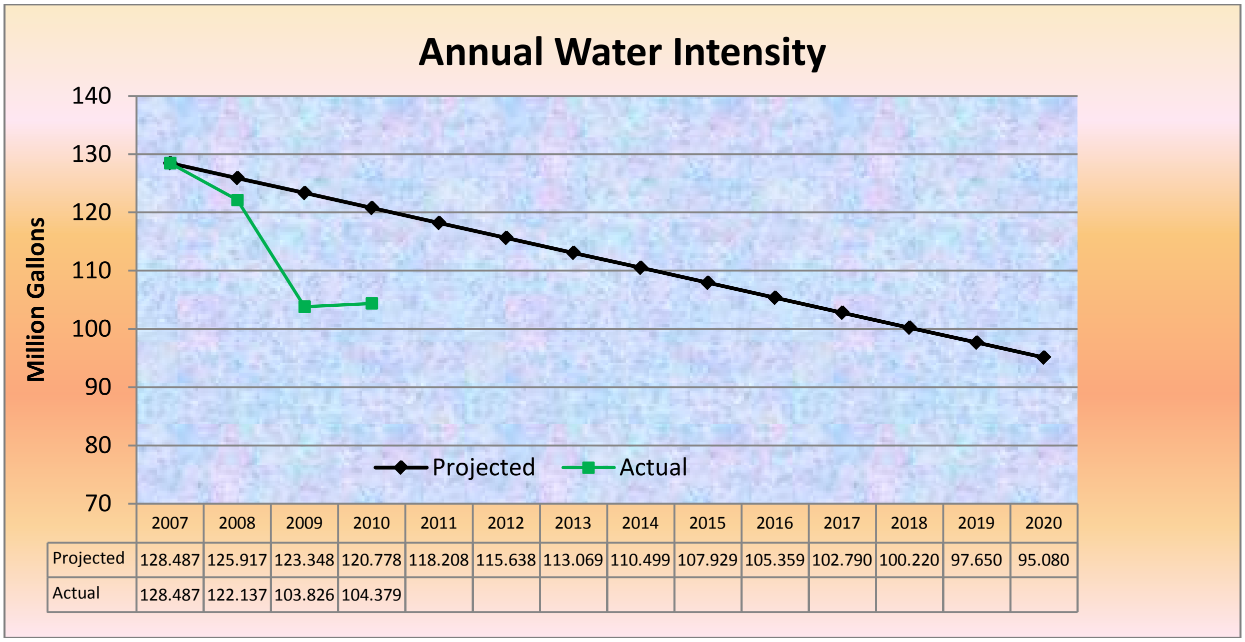


FIGURE **3.5 –** ***Scope Percentage of GHGs at Pantex***

3.1.2 Water

Benefits from issues addressed since the inception of the Pantex EMS include 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 in exceeding the reduction goal.

Executive Order 13423 required Pantex, beginning in FY 2008, to reduce water consumption intensity relative to the baseline of the agency’s water consumption in FY 2007. The challenge was to focus on awareness and life-cycle cost-effective measures to reduce annual use by 2 percent through the end of FY 2015 (16 percent). Executive Order 13514 (2009) progressively challenged facilities to increase the goal by reducing an additional 10 percent by 2020, equating to 26 percent. Pantex has currently reduced water consumption by approximately 19 percent and is engaged to meet the cumulative goal. (Figure 3.6)



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Projected	128.487	125.917	123.348	120.778	118.208	115.638	113.069	110.499	107.929	105.359	102.790	100.220	97.650	95.080
Actual	128.487	122.137	103.826	104.379										

FIGURE **3.6 -** ***Actual Water Use versus Required Target Reduction Rate***

3.1.3 Fuel

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

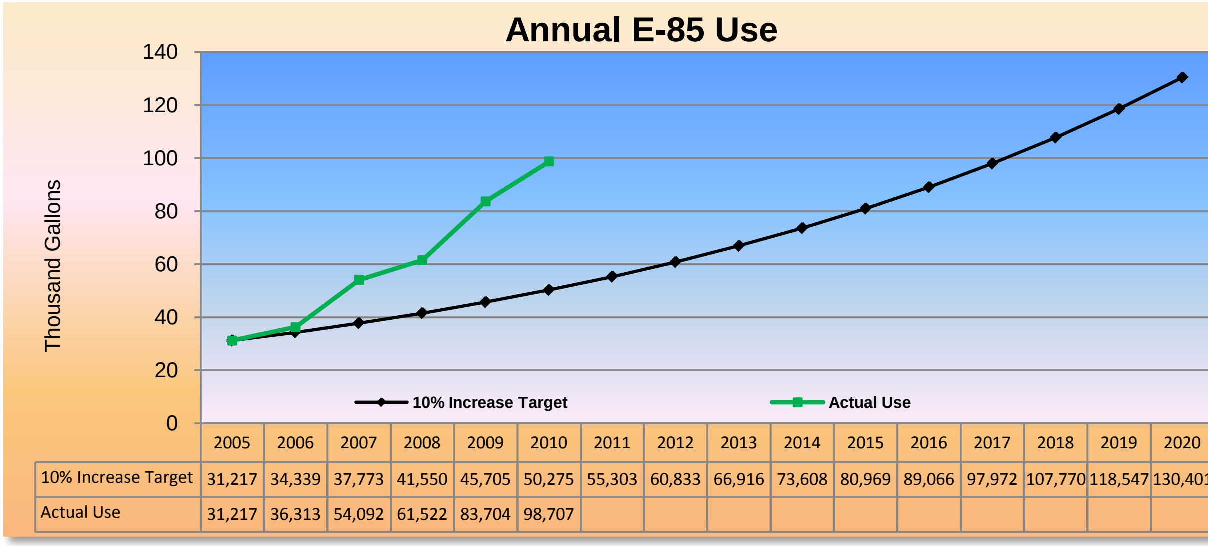
Relative to fiscal year 2005, Executive Order 13423 promotes the use of alternative fuels ("increases the total fuel consumption that is non-petroleum-based by 10 percent annually") (Figure 3.7), while reducing the use of petroleum products ("reduces the fleet's total consumption of petroleum products by 2 percent annually through the end of fiscal year 2015"). Executive Order 13514 extended the timeframe for reduction of petroleum product to fiscal year 2020 (Figure 3.8). Pantex Plant continues to successfully meet and exceed these goals.

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 2010 are discussed in Chapter 2 of this document.

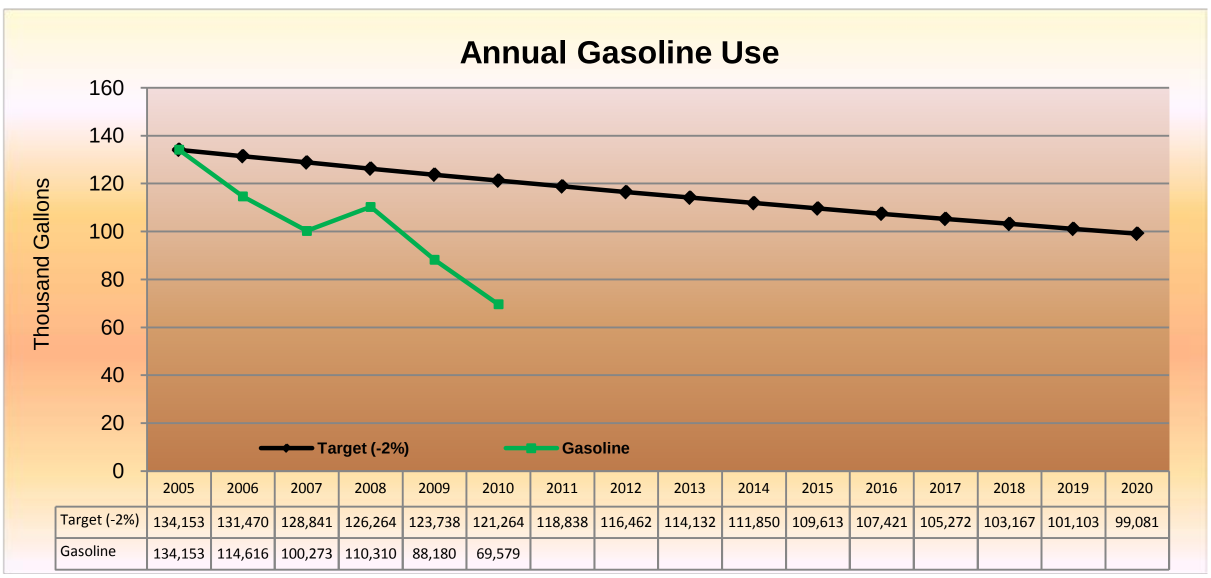
State of Texas. The results of compliance inspections conducted by various state agencies in 2010 are discussed in Chapter 2 of this document. An additional oversight mechanism was initiated in 1989 when the Secretary of Energy invited the host state of each DOE facility to oversee the evaluation of 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, 2005 and 2010. The current agreement is effective until September 30, 2015. 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.



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
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	89,066	97,972	107,770	118,547	130,401
Actual Use	31,217	36,313	54,092	61,522	83,704	98,707										

FIGURE 3.7 - *Alternative Fuel Use versus Target Increase Rate*



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Target (-2%)	134,153	131,470	128,841	126,264	123,738	121,264	118,838	116,462	114,132	111,850	109,613	107,421	105,272	103,167	101,103	99,081
Gasoline	134,153	114,616	100,273	110,310	88,180	69,579										

FIGURE 3.8 - *Gasoline Use versus Target Reduction Rate*

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 2010; 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 2010, 13 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 2010, the Plant population and workload increased as the focus of the Plant's mission changed from weapons assembly during the Cold War to primarily dismantlement. Even with these increases, the Pollution Prevention (P2) Program's efforts were successful in reducing the generation of hazardous waste by more than 99%.

In 2009, Executive Order 13514, Fe*deral Leadership in Environmental, Energy, and Economic Performance,* established P2 and Sustainable Environmental Stewardship goals that are to be demonstrated by DOE sites through the integration of P2 into environmental management systems. Goals set by Executive Order 13514 include promoting pollution prevention and eliminating waste by:

- Minimizing the generation of waste and pollutants through source reduction;
- Diverting at least 50 percent of non-hazardous solid waste, excluding construction and demolition debris by the end of FY 2015;
- Diverting at least 50 percent of construction and demolition materials and debris by the end of FY 2015;
- Reducing printing paper use and acquiring uncoated printing and writing paper containing at least 30 percent postconsumer fiber;
- Reducing and minimizing the quantity of toxic and hazardous chemicals and materials acquired, used, or disposed of;
- Increasing diversion of compostable and organic material from the waste stream;

- Implementing integrated pest management and other appropriate landscape management techniques;
- Increasing agency use of acceptable alternative chemicals and processes in keeping with the agency's procurement policies; and
- Decreasing agency use of chemicals where such decrease will assist the agency in achieving greenhouse gas reduction with the requirements of Sections 301 through 313 of the Emergency Planning and Community Right-to-Know Act of 1986.

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 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 2010 are shown in Table 3.2.

TABLE 3.2 — *Pantex Plant Sitewide Recycling for 2010*

Recycled Material	2010 Totals	
	Pounds	Kilograms
Non-Suspension Scrap Metals	469,643	213,026
Office and Mixed Paper	168,290	76,335
Corrugated Cardboard	157,750	71,554
Batteries	76,641	34,764
Activated Carbon	50,108	22,729
Tires/Scrap Rubber	45,897	20,819
Engine Oils	38,580	17,500
Computers & Other Electronics	36,577	16,591
Newspapers/Magazines	20,941	9,499
Aluminum Cans	17,862	8,102
Plastic	10,260	4,654
Fluorescent Bulbs	2,397	1,087
Oil Filters	900	408
Total	**1,095,846**	**497,067**

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 reused/recycled a total of 36,577 pounds of electronics during 2010.

In 2010, NNSA recognized Pantex Plant's groundwater management strategy with a Pollution Prevention and a DOE EStar for initiatives associated with implementation of its EMS (Figure 3.9). 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 wastewater treatment plant. These pumps were better configured to match flow with need and considered for pump replacement 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 approximately 9 million gallons per year.

FIGURE 3.9— ***2010 DOE EStar Award Pantex***

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. 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 (PANTEXb). 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. In September 2010 a new plant species for Pantex Plant was discovered west of Playa 2 that was not identified in the Floristic Surveys conducted in 1993 and 1995 (Johnston and Williams, 1993; Johnston, 1995). Arizona Cottontop (*Digitaria californica*), see Figure 3.10, also known as cottontop, cotton-top, Arizona cottongrass, cotton grass, punt blanca, or California cottontop was documented on the edge of a cultivated field planted to grain sorghum in 2010. This species is good for grazing and grows rapidly following late spring and summer rains. It reproduces from seed and will continue to do well if good seed production is achieved.

FIGURE 3.10 — ***Arizona Cottontop, a New Plant Species at Pantex Plant, September 2010***

<u>Fauna (Mammals).</u> At least 13 species (Table 3.3) of mammals were recorded at Pantex Plant in 2010 during field activities, nuisance animal responses, and fall spotlight surveys. The all-time mammal list for Pantex includes 45 species.

In 2010, 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 141.6 hectares (350 acres) at the Plant and Pantex Lake. Figures 3.11 and 3.12 show the locations of prairie dog colonies on the Plant site. Areas of operational concern were treated in 2010 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. 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 2010 were black-tailed jackrabbits (*Lepus californicus*), bobcats (*Lynx rufus*), cottontails (*Sylvilagus spp.*), coyotes (*Canis latrans*), striped skunks (*Mephitis mephitis*), mule deer (*Odocoileus hemionus*), and white-tailed deer (*O. virginianus*). Newly installed trail cameras revealed bobcats, cottontails, coyotes, mule deer, raccoons (*Procyon lotor*), striped skunks, Virginia opossums (*Didelphis virginiana*), and white-tailed deer. All these species are commonly observed at Pantex. See two common Pantex residents in Figure 3.13 and Figure 3.14.

TABLE 3.3 — *Mammals Identified at Pantex Plant During 2010*

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
Black-tailed prairie dog	*Cynomys ludovicianus*		X	X	X		X
Bobcat	*Lynx rufus*	X	X	X	X	X	X
Cottontail	*Sylvilagus spp.**	X	X		X		X
Coyote	*Canis latrans*		X			X	X
Feral hog	*Sus scrofa*						X
Mule deer	*Odocoileus hemionus*					X	X
Pronghorn	*Antilocapra americana*					X	
Raccoon	*Procyon lotor*					X	X
Striped skunk	*Mephitis mephitis*		X		X	X	X
Virginia opossum	*Didelphis virginiana*				X	X	X
White-tailed deer	*Odocoileus virginianus*					X	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 13 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* (PANTEXf) provides for monitoring of birds at the playas. The all-time bird list for Pantex includes 197 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.

Eighty-nine species of birds were recorded on the Plant during 2010 (Appendix B). Observations of black-and-white warbler (*Mniotilta varia*), broad-tailed hummingbird (*Cynanthus latirostris)*, chimney swift (*Chaeturura pelagica*), Harris hawk (*Parabuteo unicinctus*), and greater white-fronted goose (*Anser albifrons*) were all first sightings at Pantex. The number of species observed on or near playas in 2010 was 52, compared to 43 in 2009. Ample rainfall occurred in the summers of 2009 and 2010, resulting in good range conditions and wet playas. Extraordinary numbers of shorebirds were observed at Pantex following rains that fell. 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, more trips were made to Pantex Lake in 2010 and the playa and floodplain were flooded for extensive periods providing habitat for waterfowl, wading birds, and shorebirds. Goals remain to continue to try to increase sampling/observation efforts in the Playa 3 PMU, as well as Pantex Lake, and tree and shrub habitats.

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. In October 2010, in honor of National Raptor Month, Southwestern Public Service Company/Xcel Energy recognized Pantex for this action through a media release.

Staff members continue to promote bird conservation through public outreach, such as presentations, and the Purple Martin Outreach Program. In 2010, 339 nestling purple martins (*Progne subis*) were banded at four residences in two communities in the Texas Panhandle. A manuscript, *Natal Dispersal of Eastern Purple Martins (Progne subis subis) on the Western Periphery of Their Range*, was prepared and will be updated with 2011 results, and then, will be submitted for publication in the Purple Martin Conservation Association's, **Purple Martin Update**.

Fauna (Reptiles and Amphibians). Nineteen species of reptiles and amphibians were recorded at Pantex in 2010 during field activities, research projects, and nuisance animal responses (Table 3.4). None of the species documented were new to the Panhandle, but the documentation of two red-eared sliders represented a Pantex species record. The all-time list of amphibians and reptiles at Pantex includes 28 species.

Cooperative Contract Studies with Universities. Subcontracts were secured with WTAMU for FY03-FY06 and FY08-FY10 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.

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. Lastly, 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 and 2010 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 ungrazed/unmowed native vegetation utilized as escape cover. Monitoring horned lizards for mortality has shown that Pantex can be successful in reducing roadkill mortality on these two-tracks.

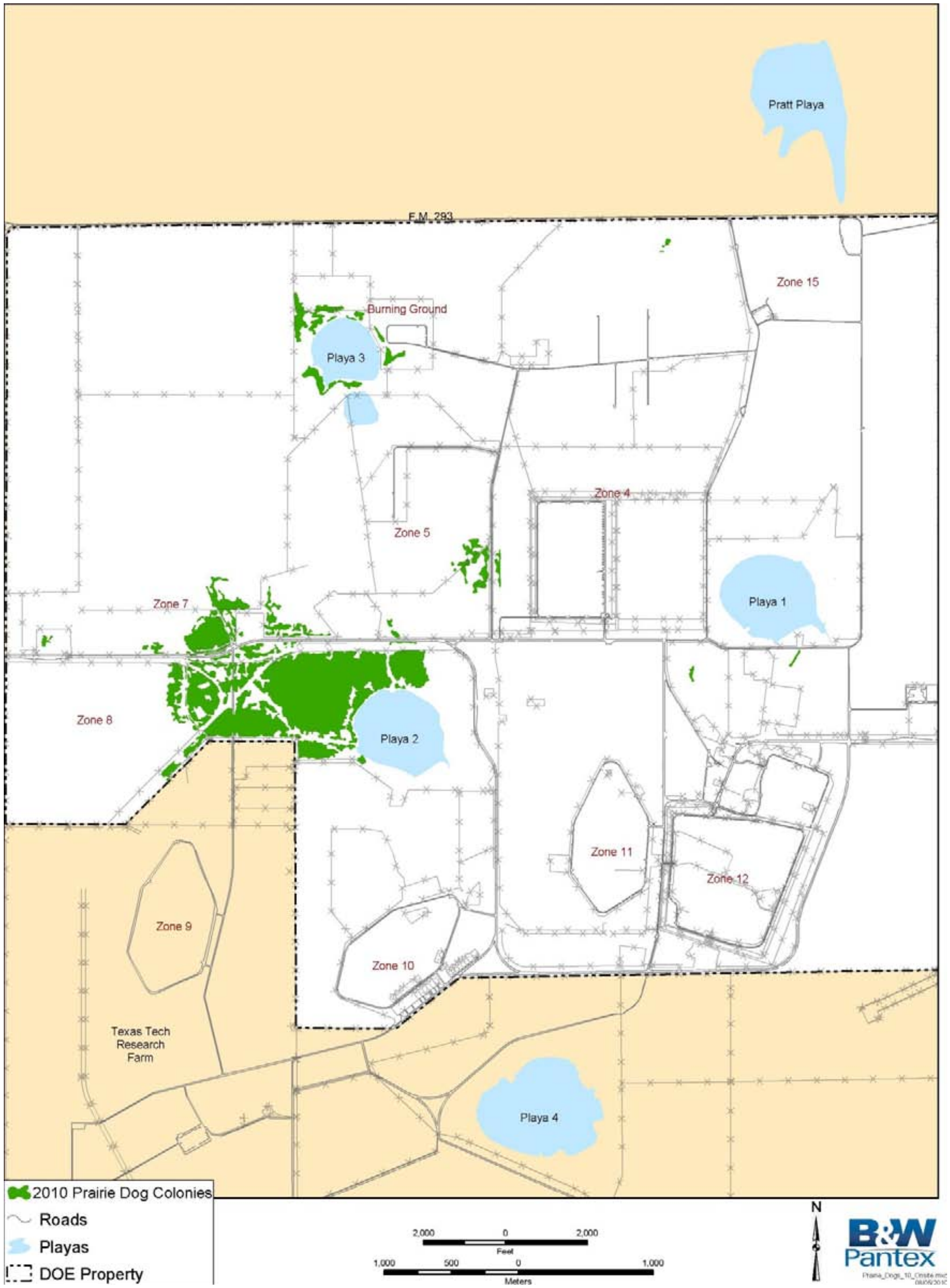


FIGURE 3.11 — ***Locations of Prairie Dog Colonies at Pantex Plant***

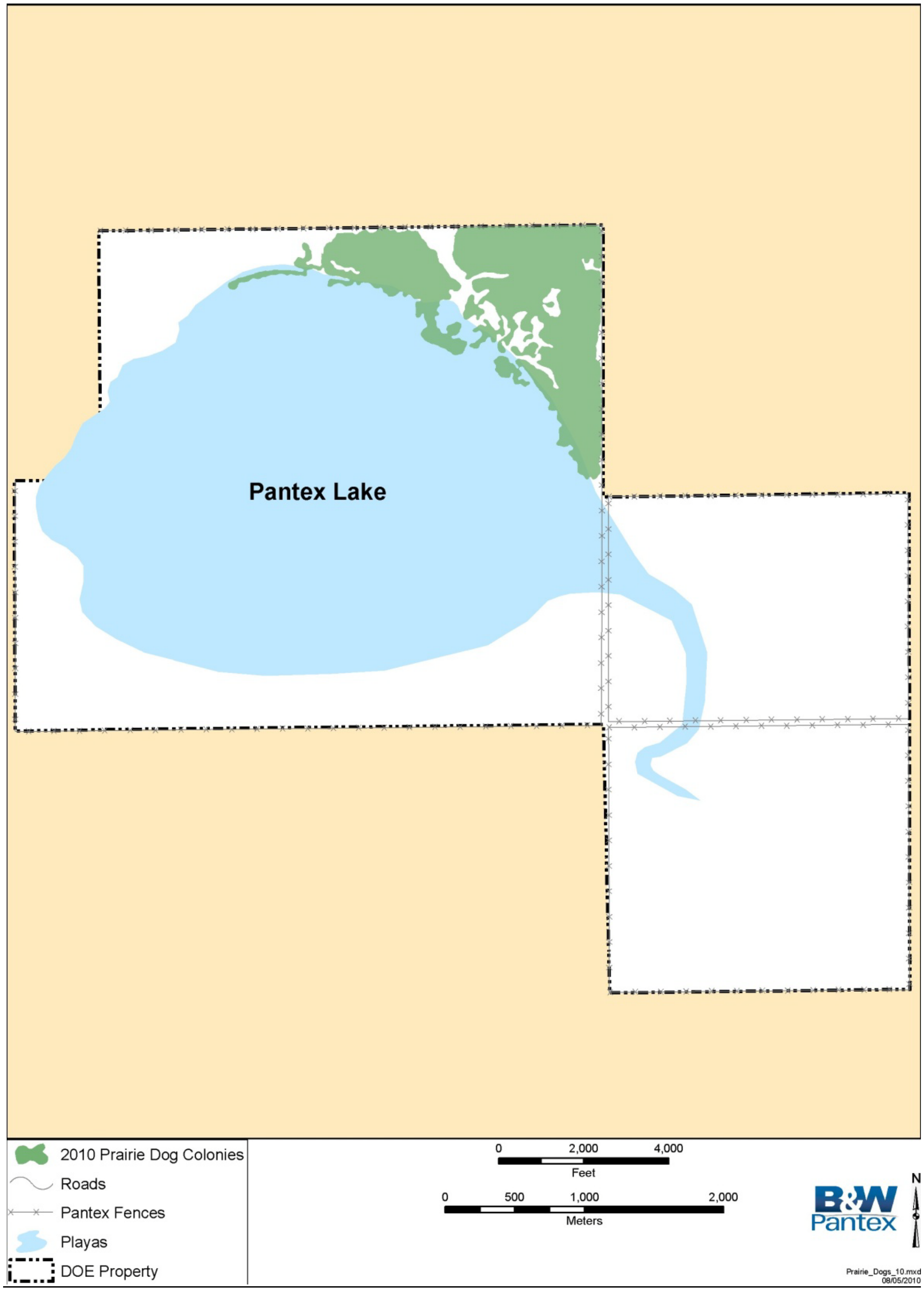


FIGURE 3.12 — *Location of the Prairie Dog Colonies at Pantex Lake*

FIGURE 3.13 — ***Marked/Eastside Female Bobcat Photographed by Trailcam***

FIGURE 3.14 — ***Preparing a Texas Horned Lizard for Powder-tracking***

TABLE 3.4 — *Reptiles and Amphibians Identified at Pantex Plant During 2010*

Common Name	Scientific Name	Playa 1	Playa 2	Playa 3	Pantex Lake	East Property	Other Area
Barred tiger salamander	*Ambystoma tigrinum mavortium*	X				X	X
Bullsnake	*Pituophis melanoleucus sayi*		X			X	X
Central Plains milk snake	*Lampropeltis triangulum gentilis*						X
Checkered garter snake	*Thamnophis marcianus marcianus*	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
Lined snake	*Tropidoclonion lineatum*					X	X
New Mexico spadefoot	*Scaphiopus multiplicatus*		X				
Plains leopard frog	*Rana blairi*	X	X				
Plains spadefoot	*Scaphiopus bombifrons*	X	X		X	X	X
Prairie rattlesnake	*Crotalus viridis viridis*	X	X		X	X	X
Red-eared slider	*Trachemys scripta elegans*	X					X
Spotted chorus frog	*Pseudacris clarkii*	X	X		X	X	X
Texas horned lizard	*Phrynosoma cornutum*	X	X				X
Western coachwhip snake	*Masticophis flagellum testaces*					X	X
Woodhouse's toad	*Bufo woodhouseii woodhouseii*	X	X			X	X
Yellow mud turtle	*Kinosternon flavescens flavescens*						X

WTAMU continued to concentrate on capturing and powder-tracking Texas horned lizards, as well as determination of diet through analysis of fecal samples. These samples (2003-2010) are consistent with those collected in the Canadian River basin, indicating that small ant species are consumed more than harvester ants here in the Panhandle. Information on this project was presented at the 46th Annual Meeting of the Texas Chapter of the Wildlife Society, Galveston, TX, and at Muleshoe National Wildlife Refuge's 75th Anniversary Diamond Celebration (December). The focus on horned lizard use of two-tracks will continue in 2011, and the evaluation of effects of prescribed burning on horned lizards will be initiated. Six areas are approved for prescribed burns planned for the winter of 2010 and 2011 (section 5.4.1.1).

Biological and Nuisance Aspects of Bobcats at Pantex - West Texas A&M University (Raymond Matlack). A subcontract was secured with WTAMU for FY08-FY11 to evaluate biological and nuisance aspects of bobcats at Pantex. 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.

WTAMU provides traps and supplies, as well as support with sedating, marking, and data collection/interpretation, while B&W Pantex staff conducts the trapping of the bobcats. Captured cats are ear-tagged to facilitate recognition of individuals, and adults are equipped with G.P.S. satellite-collars to map home ranges. In 2010, three cats were captured including the recapture of the "Eastside Female," and a new 27-pound male and new 16-pound female. The three home ranges are shown in Figure 3.15.

The “Westside” female was found as a roadkill on Hwy. 60 on January 18, 2010. Her final home range size was 53 square miles. Her home range size was influenced by activity to the north and to the east, only after she apparently lost her kittens. The home range sizes of the “Eastside” female and the Heck female (named for the landowner on whose property the bobcat was first located) were much smaller (19 and 26 square miles, respectfully), and their home ranges were defined soon after collaring. However, the “Eastside” female eventually extended her west boundary south and west, once the “Westside” Female’s area became available. Females clearly avoid each other’s home ranges, but may readily “fill in” with the loss of an adjoining female. The 2010 male’s home range encompassed 28 square mile, including the entire home range of the “Eastside” female.

Both females demonstrated denning behavior[1] and fidelity to a den site in 2010. The “Eastside” female was observed with as many as three kittens, but one became a victim of roadkill, and the litter may have dwindled to one, and then to zero as the summer progressed. The Heck female was observed on several occasions with one kitten, including as recently as November.

Information on this project was presented at Muleshoe National Wildlife Refuge’s 75th Anniversary Diamond Celebration (December).

Beginning in FY11, DNA will be taken from any cat trapped or found as mortality, to determine parental relationships. Trail cams will also be utilized at scent stations and other locations as a tool to determine presence of marked and unmarked cats that do not carry radio-collars.

Information gained from this study will be reported in annual reports of this Plan, and in other Pantex documents. At the conclusion of the contract, information will be incorporated into a revision of this Plan. Marking, including satellite marking of adults, is recommended as an annual management action for this species for the foreseeable future.

Assess Impacts of Wind Turbine Generators to Wildlife and Habitat at Pantex Plant - West Texas A&M University (Raymond Matlack). A subcontract was secured with WTAMU for FY09-FY14 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, 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.

Raptor surveys were conducted during the spring, and surveys for other birds and their nests were conducted during spring and summer. In general, the primary bird species counted within bird survey plots included grasshopper sparrows (*Ammodramus savannarum*), western meadowlarks (*Sturnella neglecta*), mourning doves (*Zenaida macroura*), and red-winged blackbirds (*Agelaius phoeniceus*). As expected, horned larks (*Eremophila alpestris*) are observed frequently within plots dominated by shorter grass and more open ground, a cover type commonly associated with prairie dog colonies. Dickcissels (*Spiza americana*) were frequently observed during point-counts, as well, but appeared to prefer thistle-dominated plots. Nests found as a result of walking between avian point-count locations included those of mourning doves, western meadowlarks, and mallards (*Anas platyrhynchos*).
Carcass searches under a neighbor’s wind turbines were conducted periodically using a double spiraling-rope method. No carcasses were observed. Motion-sensitive trail cameras aimed at bird carcasses were

[1] Sudden fidelity to a single site consisting of significant structure, and lasting for several weeks. In one case, kittens were subsequently confirmed at the location.

installed under the turbines revealed carcasses being taken by coyotes, and placed carcasses disappeared within 24-48 hours. Cams were approved (Technical Security) for placement on Pantex (non-turbine sites as controls, bobcat den sites, etc.).

Due to a number of active Swainson's hawk (*Buteo swainsoni*) nests observed near the proposed Pantex field and existing neighbors' turbine fields, a new objective was secured to pre- and post-monitor nesting pairs for habitat use and productivity (in relation to the PREP).

Information on this project was presented at Muleshoe National Wildlife Refuge's 75th Anniversary Diamond Celebration (December).

Nuisance Animal Management. Nuisance wildlife problems in the areas of health, safety, and interferences with operations continued at Pantex Plant in 2010. Nineteen species were documented in nuisance situations. The primary species causing problems were the striped skunk and the feral cat, but active migratory bird nests played a role in the delay of a demolition project at Cockrell homestead.

Nuisance feral cats 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 2010, eleven feral cats were captured and transported to the City of Amarillo Animal Control Facility. Six striped-skunks were captured and euthanized, and a number of snakes, Virginia opossums, and raccoons 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 2010, none were controlled, because Security adopted additional training requirements for those involved in this activity. Control is planned to continue on an as-needed basis once these requirements are accomplished.

Feral 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. Swallows are protected by the Migratory Bird Treaty Act, as are their nests, eggs, and young. However, United States Fish and Wildlife Service policy allows removal of nests that do not contain eggs or young. In 2010, no pigeons were controlled, because Security adopted additional training requirements for those involved in this activity. Control of feral pigeons is planned to continue once these requirements are accomplished.

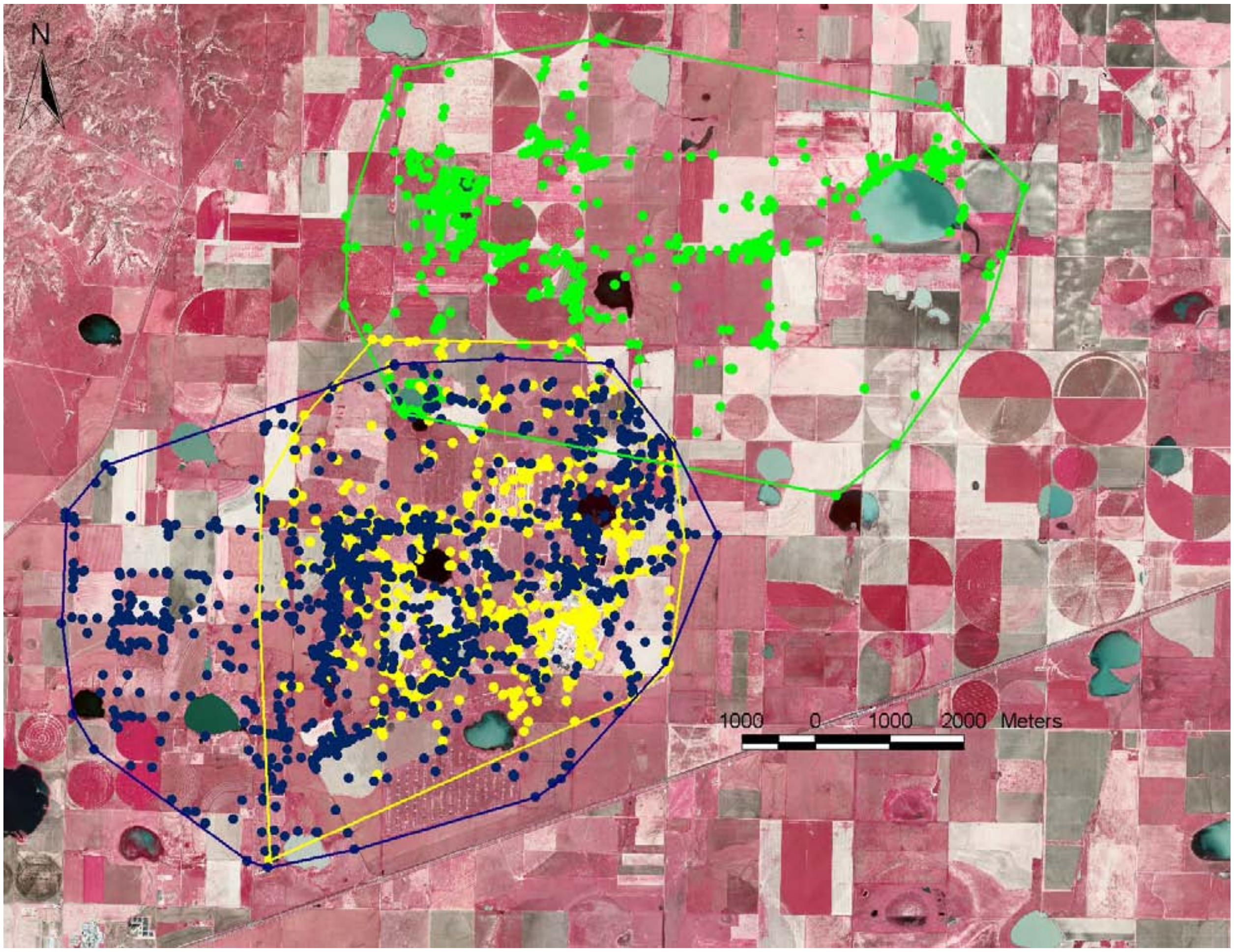


FIGURE 3.15 — *Locations and Home Ranges of Two Adult Female Bobcats (green, yellow) and One Adult Male Bobcat Tracked at Pantex*

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) (PANTEXi). 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, and Cold War era properties, objects, artifacts and records. 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 2010.

Archeology. The Pantex Plant lies within the southern Great Plains archeological province, and specifically, in that part that lies within the High Plains Ecological Region of the Texas Panhandle. Approximately half of the DOE-owned and -leased land at Pantex Plant has been systematically surveyed for archeological resources and based on surveys 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 Native American prehistoric sites represented by lithic scatters of animal 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. All archeological reports, records, photographs, maps and artifacts will archive at the Plant in accordance with 36 CFR 79. In addition, 22 prehistoric sites are protected within playa management units surrounding the four DOE-owned playas.

In the 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 archeologist. Today the bison bones from a bison kill site used by prehistoric nomadic Indians have been placed in a permanent exhibit within the new Pantex visitor center.

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. The World War II era buildings and structures have been preserved to some extent through survey documentation, photographs, individual site forms, and oral histories.

Additional preservation activities include a completed historical display in the new Visitor Center (Figure 3.16) located in Bldg. 16-12. The World War II exhibit includes world events from the beginning of the fundamental activities for tactical and thermonuclear weapons that were developed and proved, to the creation of physical infrastructure to the nuclear weapon complex that lead to the growth of the stockpile and its impact on Pantex. Recent upgrades in 2010 include an interactive multimedia audio and touch screen display. The upgrades feature computer-driven exhibits that enhance the Visitor Center's capacity and introduce the voices and faces of "real" people. This simple reliable mechanism allows visitors to reach out, touch the screen, and select and listen to the oral histories of former World War II Pantex employees. Included in the multi-media exhibit are a collection of scanned newsletters, containing vintage World War II history. Published in 1942 and 1943, the collection documents the stories, photographs, and the work performed. The newsletters provide a framework of the everyday events at the Pantex Ordnance Plant while recognizing the efforts of the employees.

FIGURE 3.16 — *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" (National Park Service [NPS] Bulletin 15, 1991). 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. 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 date 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 Cultural Resource Management Program is now focused on implementing the PA/CRMP and completing the range of preservation activities. The activities continue to expand as funding is obtained. This year, an exhibit preserving historically important railcars was completed. Another preservation project included the conversion of oral histories to DVD. The Cultural Resource Management Program initiatives are continuing to be integrated within other Plant objectives. The FY 2012 to FY 2021 Ten Year Site Plan (TYSP) continues to implement and incorporate historical preservation goals.

Under the Cold War directive, six Cold War railcars were preserved and an exhibit has been developed to interpret the significance of the railcars and the role they played in the Cold War. The railcars were significant for their role in the transportation of weapons on and offsite. The 2010 completion of the railcar exhibit features illustrations and photos of the train in action and of the loading process (Figure 3.17).

FIGURE 3.17 —*Train Exhibit*

A major portion of the Visitor 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. The Visitor Center exhibits portray the historical influences that have shaped the operations at the site. The Pantex operations contributed, and continue to contribute, to the U.S. defense system.

Phase II of the Visitor Center has been completed. A high level multimedia center includes actual Pantex oral histories and other visual-related information, a conference table, and a drop-down screen for presentations. The room serves as a 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 and presentations and serves as a great venue for other events and conferences. The Center will be available for use by other programs that do not want to interrupt Plant operations and assists as a welcome center with the prime use of the facility for background information about the Plant's history and today's mission. Incoming visitors are 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. The goal of Phase II of the Visitor Center is to make learning about Pantex a more tactile hands-on experience. This was accomplished by combining audio, video and historic artifacts. The Visitor Center experience will bring visitors closer to the events than ever before.

Reformatting the oral histories onto DVD R media has enhanced the preservation of the audio material. The conversion safely stores the data and utilizes high performance technology, which extends the media archive life to ensure the reliability of the data. The transfer of the media was used to create the oral histories that were used in the new multi-media Visitor Center displays (Figure 3.18).

FIGURE 3.18 — *Multimedia Exhibits*

3.6 Educational Resources and Outreach Opportunities at Pantex Plant

Educational Outreach is an important part of B&W Pantex's community outreach program. B&W Pantex sponsors more than 25 educational programs from elementary school through graduate school. In 2001, B&W Pantex funded a $300,000 technical scholarship program for area college students. This fund continues awarding scholarships every year. B&W Pantex also supports an Amarillo Independent School District (AISD) tutoring program to help students improve their reading and math skills. Pantex scientists donate their time and talent to area schools by speaking to students about science careers and helping stimulate student interest in science, math and engineering.

The P2 Team has continued its efforts in public outreach and pollution prevention education during 2010. 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. B&W Pantex has 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 seventh 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 2010" with Xcel Energy and Wildcat Bluff (Figure 3.19). Personnel from across the Plant, along with other volunteers, contributed their time and efforts to make the event a huge success. Activities included Frisbee toss, basketball throw, ring toss, Earth Day *Jeopardy*, bird feeders, energy conservation quiz, and other Earth Day games. This event provided more than 1,800 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 3.19 – *Frisbee Toss at Earth Fest 2010*

B&W Pantex has sponsored Science Bowl competitions for middle schools and high schools throughout the Panhandle for a number of years. Science Bowl is a scientific competition developed by DOE in 1990, which was created to recognize outstanding students and motivate them to higher learning in science and math. B&W Pantex employees organize and staff these competitions each year. B&W Pantex was recognized by Secretary of Energy Chu at the National Science Bowl this Spring for being a 20-year sponsor of the competition.

The Middle School Fuel Cell Car Race, held each spring, challenges students to design and build a vehicle to complete a race in the shortest possible time. Some cars can run the 10-meter track in 4 seconds. This project gives students a chance to participate in a hands-on engineering design competition. 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, which is held every four years.

Pantex staff provided several presentations to school, community, and professional groups on a variety of topics including backyard wildlife, horned lizards, bobcats, and wildlife management and research at Pantex. In addition, staff members banded Purple Martins through the Purple Martin Outreach Program and provided outreach at four locations in two communities in the Panhandle. A total of 339 nestlings were banded during 2010.

3.7 Environmental Restoration

Environmental Restoration at Pantex is conducted in accordance with CERCLA and RCRA, as discussed in Chapter 2. During 2010 Pantex continued operation and maintenance of remedial actions. A summary of that information is included in this section.

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 in unlined pits and sumps, and disposal of high explosive (HE) wastewater and industrial wastes in 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 necessary to protect human health and the environment. Figure 3.20 depicts the location and status of the 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 and Sapere, 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.

Soil areas requiring continued maintenance are depicted with the Solid Waste Management Unit (SWMUs) in Figure 3.20.

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

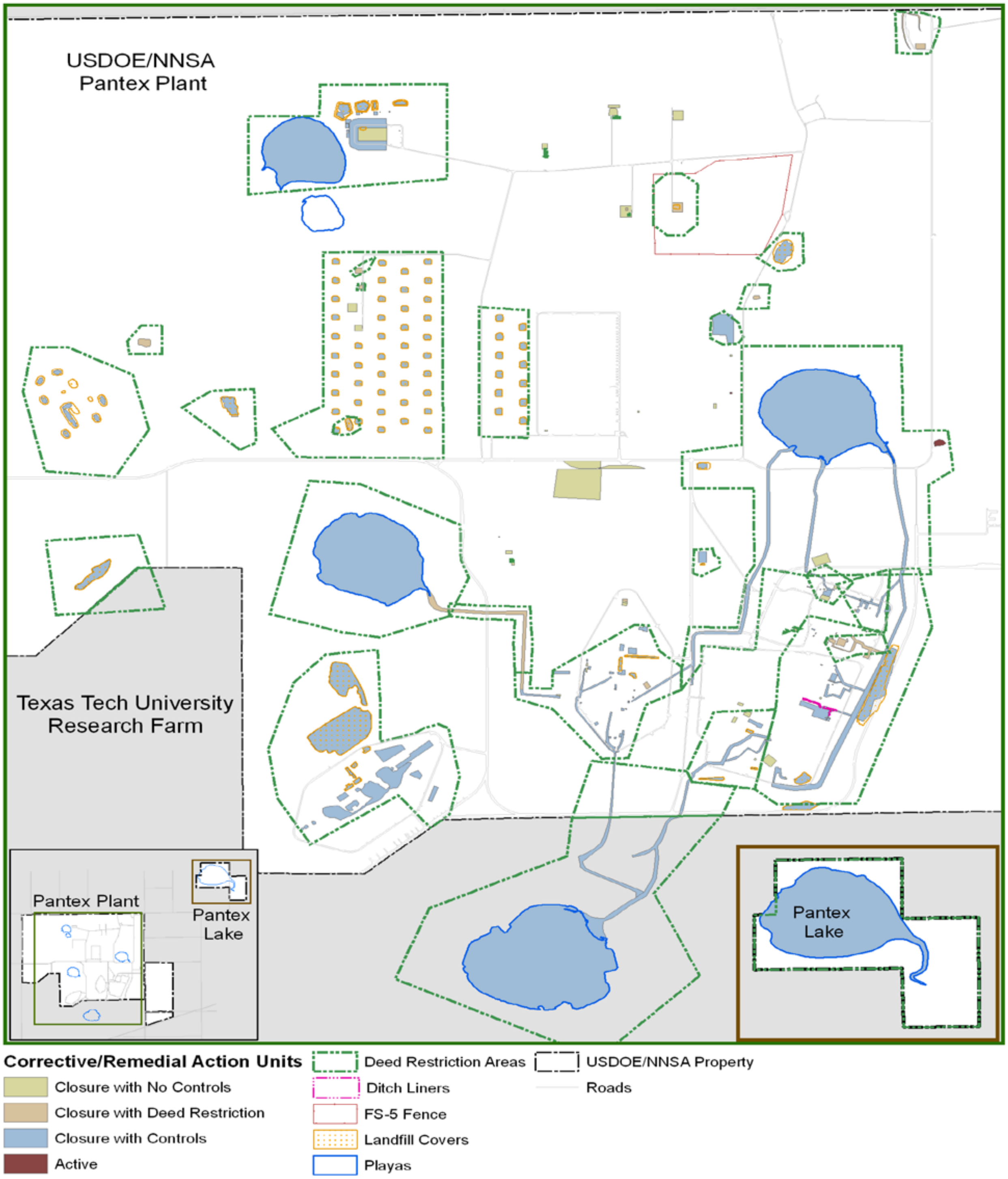


FIGURE **3.20 —*Location and Status of Solid Waste Management Units***

> Environmental Restoration
> 2010 Milestones
>
> - Continued operation of Remedial Actions
> - Issuance of Pantex Compliance Plan 50284 in September 2010 (TCEQ, 2010) to include final Remedial Actions and LTM Groundwater Network
> - Approval of Interim Remedial Action Report

Environmental Restoration Milestones. During 2010 Pantex completed several milestones under the continued long-term stewardship of environmental units. 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. Although the long-term monitoring (LTM) network was set up through the ROD and subsequent reports in accordance with CERCLA, the Remedial Action and final LTM network had not been incorporated into the Compliance Plan, pursuant to RCRA regulation, until its issuance in 2010. The approval of the Interim Remedial Action Report (IRAR) marked the final document required under CERCLA to document the final installation and operation of the Remedial Actions. The milestones for the Remedial Action Systems are discussed below.

Remedial Action Systems. The remediation systems at Pantex are depicted in Figures 3.20 and 3.21. All systems were installed by the end of 2009. Major milestones for 2010 were:

- Pump and Treat systems were operated as planned, and upgrade projects for the wellheads at the Southeast Pump and Treat were started.
- An irrigation system upgrade was initiated to provide an additional 100-acre tract for beneficial use of treated water.
- Zone 11 and Southeast ISB received a second amendment injection.
- Burning Ground Soil Vapor Extraction System was operated as planned.
- Landfill covers and SWMUs inspected, maintained, or scheduled for maintenance.
- Three LTM groundwater wells were plugged and abandoned and replaced.

<u>Pump and Treat Systems.</u> 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 the remediation goals, 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 use, 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 was 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.

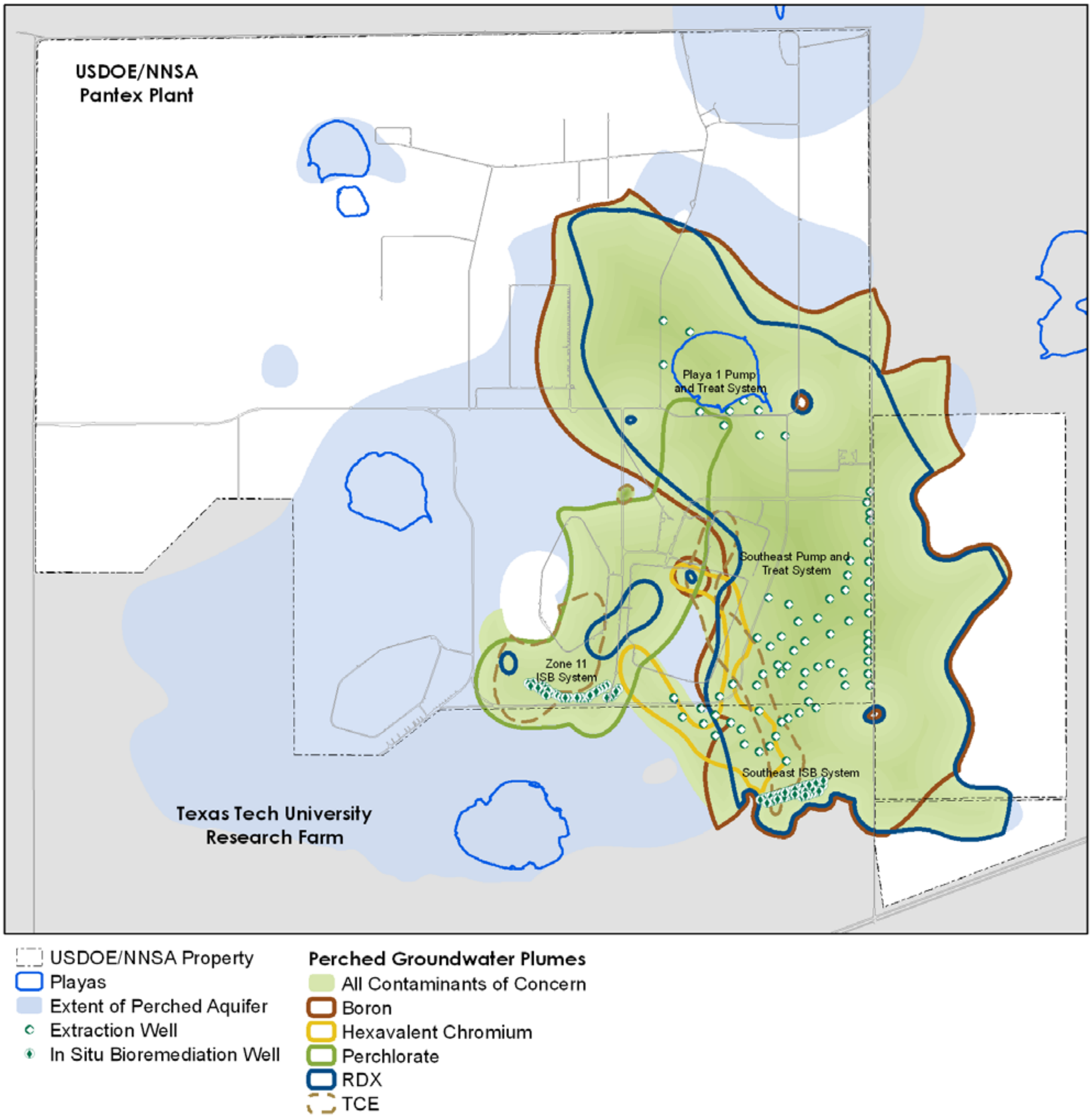


FIGURE **3.21 -** ***Perched Groundwater Plumes and Treatment Systems***

Each of the systems is evaluated in annual and quarterly progress reports that can be found on the Pantex website (http://www.pantex.com/about/environment/erDocs/index.htm). The evaluation of the systems operations is summarized below.

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 2010 is depicted in Figure 3.22. The SEPTS exceeded the operational and treatment goal for 2010 by operating 98% of the time and treated an average of 393,468 gallons per day (gpd) (91% of capacity) of impacted perched groundwater. The P1PTS operated 94% of the time and treated an average of 281,974 gpd (78% of capacity) during 2010. As depicted in Figure 3.22, system treatment performance was continuous at the SEPTS, but treatment declined at P1PTS in the last half of 2010. The decline in performance was due to the upgrade to the irrigation system which required the WWTF and portions of the irrigation system to be shut down for short periods of time.

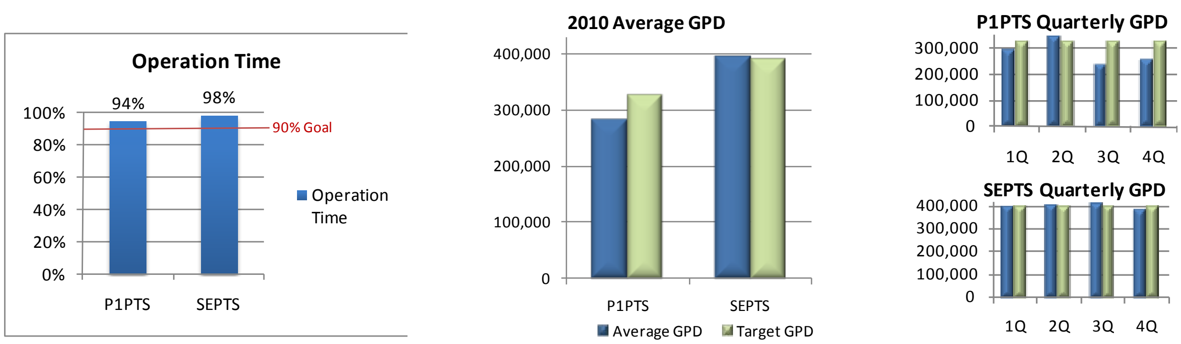
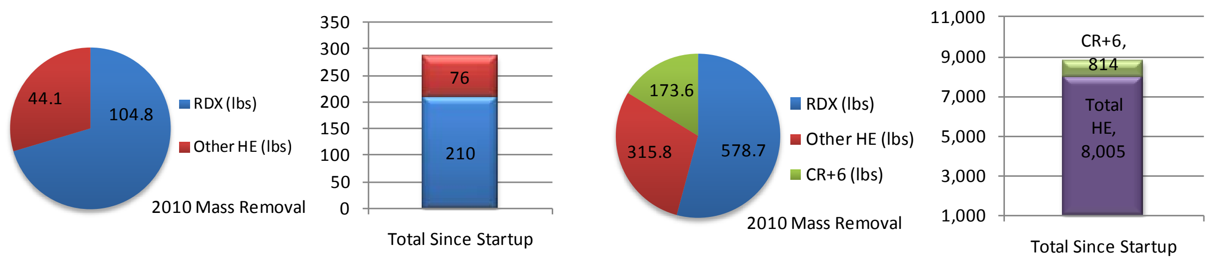


FIGURE 3.22 – *Pump and Treat Systems Performance*

The P1PTS 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. The SEPTS was able to operate continuously because this system has the capability to inject the treated water back into the perched aquifer. 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. However, the eventual goal for the SEPTS and P1PTS is to only beneficially use treated water rather than inject. The primary goal of the systems is to remove water from the perched aquifer so 2011 operation will be guided by the amount of treated water that can be beneficially used until the irrigation system upgrade is complete. Performance at both systems is expected to meet goals after 2011 as the extra irrigation tract will allow more treated water to be beneficially used.

In addition to removing impacted water from the perched aquifer, the pump and treat systems remove contaminant mass from the groundwater that is extracted from the aquifer. The P1PTS primarily removes the high explosive RDX and the SEPTS primarily removes RDX and hexavalent chromium (Cr^{+6}). Figure 3.23 provides the mass removal for HEs and chromium for 2010, as well as totals since startup of the systems. The SEPTS has been operating longer, and the greatest concentrations of HEs are found in the SEPTS extraction well field, so mass removal is much higher at that system.



P1PTS Mass Removal **SEPTS Mass Removal**

FIGURE 3.23 – *Pump and Treat Systems Mass Removal*

As demonstrated in Figures 3.22 and 3.23, the systems have been effective in removing and treating perched groundwater. Evaluation of the contaminants of concern (COC) concentration trends and water levels is included in Chapter 6.

ISB Systems. Two ISB systems (Zone 11 ISB and Southeast ISB) are in operation at Pantex (see Figure 3.21). 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 Texas Tech University property south of Zone 11 or where the area is sensitive to vertical migration of 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. The amendment provides a food source for naturally occurring bacteria that break down the COCs. Monitoring wells were installed down-gradient of the groundwater flow from the treatment systems to monitor whether the system is effectively degrading the COCs. Injection of amendment is anticipated every twelve to eighteen months for both systems. The effectiveness of the treatment zone and down-gradient performance monitoring well information is included in Chapter 6.

As part of the O&M of the ISB systems, both systems received amendment injections during 2010. Based on results of sampling, the food source at both systems was declining. Injection was completed at the Southeast ISB during April 2010 and by the end of September 2010 at the Zone 11 ISB. The Southeast ISB treatment zone had also started showing signs of loss of reduction potential; however, results of sampling following injection indicated the reduction potential returned to expected conditions and COCs were continuing to be treated.

Burning Ground SVE. A soil vapor extraction (SVE) system was installed and has been 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 current SVE system is intermittently operated and is also down during granular activated carbon (GAC) drum change-out and for maintenance and repairs. Mass removal calculated for 2010 is presented in Figure 3.24. Mass removal is calculated for VOCs contributing more than 1% of the total VOCs. A decline in tetrahydrofuran (THF) concentrations has been evident during 2010 indicating this VOC may be depleting and may no longer be used in mass removal calculations. Effluent PID readings indicate that no VOCs were present after treatment with the exception of three readings. These concentrations are significantly lower than allowed by the permit by rule for any single VOC. The GAC drums were replaced after the positive readings were obtained.

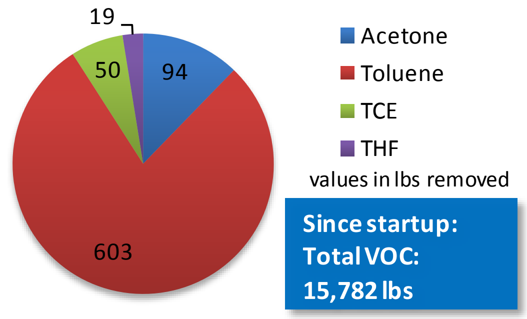


FIGURE 3.24—*Burning Ground SVE Mass Removal*

Soil Remedies and Institutional Controls. Institutional controls are required as part of the long-term stewardship of soil remedial action units at Pantex. Deed restrictions have been placed on all soil units with the exception of the active units depicted in Figure 3.20. 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 to 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.

In addition to quarterly inspections of the landfills in 2010, Pantex conducted inspections after rainfall events of greater than 0.5 inch. Inspections were also conducted for the ditch liner. 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 managed appropriately during execution of the work. In 2010, six work requests for construction projects in or near remedial action units were approved. Of the six, two were completed and the others are ongoing, have been cancelled, or the permit expired and will have to be reissued before work commences. Two approved ongoing projects from 2009 also continued into 2010.

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 and SWMU signs missing at FS-5 fence.	Internal work order generated and waiting for work to be planned and implemented by the Maintenance Dept.
Prairie dogs present in landfills near Zone 4 supplemental verification site (SVS 7a and 7b) and Landfill 15.	Prairie dogs controlled out of landfills.
Sediment collecting in ditch liner. Gravel used to keep liner in place is collecting sediment and allowing plant growth. Tears have also been noted in the headwall of the liner.	Attempts to flush sediment out of gravel were not effective. Pantex is planning a project to contract for gravel and sediment to be removed and replaced with cylindrical ballasts, as well as repair tears in the liner. This project is planned for 2011, and will be implemented based on availability of funding.

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 monitoring information collected is evaluated and 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 and at source areas
- 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 the influence of treatment systems

During 2010, three monitoring wells (one Ogallala and two perched) were plugged and abandoned and replaced by new wells or existing wells in the same area. The Ogallala well had low-level detections of high explosives. This was determined to be due to a leaking well casing annulus that contributed perched groundwater to the Ogallala well. The well was properly plugged and abandoned and a new well was installed to replace the well. No high explosives have been detected in the new Ogallala well. The two perched wells were determined to have problems that required the well to be replaced to ensure representative sampling of the perched groundwater. Both wells were plugged and abandoned properly. One well was replaced with a new well, the other well was replaced by an existing nearby well that was not being used in the LTM network.

3.8 Environmental Monitoring

Prior to the release of DOE Order 450.1A, "Environmental Protection Program"[2] 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 plans for 2010 monitoring were implemented using a consistent system for collecting, assessing, and documenting environmental data of known and documented quality in order to: detect,

[2] This order will itself be superseded by DOE Order 436.1 "Departmental Sustainability" during calendar year 2011. The new order combines the requirements of the aforementioned DOE Order 450.1A and those of DOE Order 430.2B, "Departmental Energy, Renewable Energy and Transportation Management".

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 3.25.

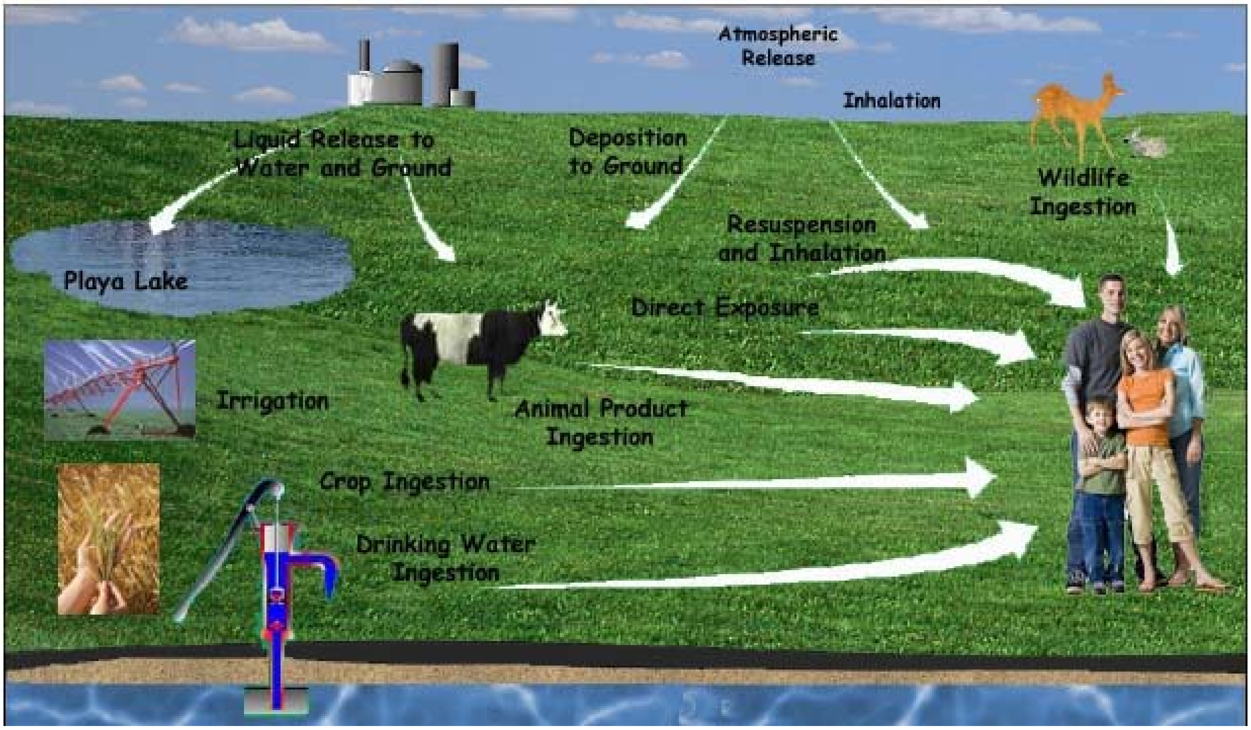


FIGURE 3.25— ***Potential Pathways for Environmental Transport of Contaminants***

The monitoring plans described 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. Each 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 Texas AgriLife Bush Research Farm[3] located 56 kilometers (35 miles) from the Plant. Control samples for the faunal 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.

[3] In December 2009, sampling equipment formerly located on U.S. Department of Agriculture property was removed. In October, 2010, the re-located equipment was activated approximately 1 mile north on property leased from the Bush Research Farm during CY 2010.

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 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 2010, 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 2010*

Media	Onsite	Offsite
Air[a]	4	14
Ambient External Radiation (TLDs[b])[a]	5	10
Drinking Water	32	0
Fauna[c]	10	1
Groundwater	154	52
Soil/Sediment	14	0
Surface Water	12	0
Vegetation (crops, native species)	23	11
Wastewater	2	0
Total	377	48

[a] Includes fence line.
[b] Thermoluminescent dosimeters.
[c] Onsite number includes one sampling location at Pantex Lake.

Environmental Radiological Program

A minor change to the control location for the environmental thermoluminescent dosimeters was accomplished in 2010. However, monitoring results of environmental pathways in 2010 indicated levels below relevant standards and similar to background conditions as well as those from previous years.

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 2010, Pantex Plant's environmental radiological monitoring program was conducted according to U.S. Department of Energy (DOE) Orders 450.1A, *Environmental Protection Program* (DOEh)[1] and 5400.5, *Radiation Protection of the Public and the Environment* (DOEi)[2]. 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, flora, and fauna samples (see Chapters 5, 6, 7, 9, 11, and 12). The radionuclides ^{234}U, ^{238}U, and ^{239}Pu emit primarily alpha particles.[3] Tritium emits beta particles. Gamma radiation emissions from these radionuclides were also monitored and evaluated.

Based on the 2010 operational data, Pantex emitted a dose to the maximally exposed member of the general public of 9.68×10^{-3} 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 2010.

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, etc.). For example:

- Individual doses from airborne emissions of radionuclides and from gamma radiation are reported

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[1] DOE Order 436.1 "Departmental Sustainability" was promulgated on May 2, 2011. The new order combines the requirements of the aforementioned DOE Order 450.1A and those of DOE Order 430.2B, "Departmental Energy, Renewable Energy and Transportation Management". However, as of December 31, 2010, the new order had not been finalized, and DOE Order 450.1A was still the enforceable order containing requirements for an environmental protection program.

[2] DOE Order 458.1 "Radiation Protection of the Public and the Environment" was promulgated on February 11, 2011. This order supersedes DOE Order 5400.5 and refines and explicitly states requirements to protect the public and the environment against risks associated with radiological activities conducted by the DOE. However, as of December 31, 2010, the new order had not been finalized, and DOE Order 5400.5 was the relevant order.

[3] 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 cannot 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 $^{239/240}Pu$). Equivalent to be determined for $^{235/236}U$.

- in millirem per year (mrem/yr)[4] or millisievert per year (mSv/yr).[5]
- Population dose[6] 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 (National Council on Radiation Protection and Measurements [NCRPa]) 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.[7] The potential environmental pathways for radioactive material released from Pantex Plant are illustrated in Figure 3.25.

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 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 in 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

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[4] 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 x 10^{-3} mrem, as 1.25 x 10^{-6} rem, or even as 1.25 μrem. Additionally, 1.25 x 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.

[5] 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.

[6] 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.

[7] 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 (See ICRP, 2007) and used by the EPA, the Nuclear Regulatory Commission, and DOE in establishing standards for radiological protection.

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 (EPAb).

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[8] 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 (5.0E-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.[9] 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]
3.32E-02 (1.23E+09)	8.34E-10 (3.09E+01)	None	8.35E-10 (3.09E+01)	None

[a] Total Uranium (grams) = 2.26E-03
[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 2010 (located approximately 5230 meters [3.25 miles] north [N] of Building 12-42) would have received a dose of 9.68 $\times 10^{-3}$ mrem (9.68 $\times 10^{-5}$ mSv). This dose equivalent is 9.68 $\times 10^{-3}$ percent of the DOE Public Dose Limit for all pathways, is 9.68 $\times 10^{-2}$ percent of the effective dose equivalent standard specified in 40 CFR 61, Subpart H, and is also less than 1 percent of the level requiring emission monitoring (itself set at 1 percent of the aforementioned 40 CFR 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 1.14 $\times 10^{-5}$ person-rem/year (1.14×10^{-7} person-sievert/year) in 2010. The majority of this collective population dose equivalent is contributed by ^{3}H.

The dose equivalent received by the maximally exposed individual during 2010, the 2010 collective population dose, and the 2010 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.

[8] See the definition of this term in the glossary.
[9] The overwhelming majority (99.9%) 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.

TABLE 4.2 — *Pantex Radiological Doses in 2010*

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)
9.68×10^{-3}	9.68×10^{-5}	9.68×10^{-3}	1.14×10^{-5}	1.14×10^{-7}	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* (DOEa), 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 2010 to 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 would not be exceeded 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 would not be exceeded 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 2.72×10^{-3} and 2.04×10^{-5} 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.

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.

TABLE 4.3a — *Evaluation of Dose to Aquatic Biota in 2010*

Nuclide	Water Concentration (pCi/L)	BCG (Water) (pCi/L)	Partial Fraction (Water)	Sediment Concentration (pCi/g)[a]	BCG (Sediment) (pCi/g)	Partial Fraction (Sediment)	Sum of Fractions (Water & Sediment)
Hydrogen-3	58.90	2.65E+08	2.22 E-07	5.89 E-05	3.74 E+05	1.57 E-10	2.22 E-07
Uranium-234	0.12	2.02E+02	5.95 E-04	6.20 E-03	5.27 E+03	1.18 E-06	5.96 E-04
Uranium-238	0.46	2.23E+02	2.06 E-03	2.30 E-02	2.49 E+03	9.24 E-06	2.07 E-03
Plutonium-239	0.01	1.87E+02	5.36 E-05	1.73 E-02	5.86 E+03	2.95 E-06	5.65 E-05
Sum of Fractions			2.71 E-03			1.34 E-05	2.72 E-03

[a] In both Table 4.3a and 4.3b, the sediment/soil concentration values for all isotopes (nuclides) are estimated and are 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 2010*

Nuclide	Water Concentration (pCi/L)	BCG (Water) (pCi/L)	Partial Fraction (Water)	Soil Concentration (pCi/g)[a]	BCG (Soil) (pCi/g)	Partial Fraction (Soil)	Sum of Fractions (Water & Soil)
Hydrogen-3	58.90	2.31 E+08	2.55 E-07	5.89 E-05	1.71 E+05	3.45 E-10	2.55 E-07
Uranium-234	0.12	4.04 E+05	2.97 E-07	6.20 E-03	5.13 E+03	1.21 E-06	1.51 E-06
Uranium-238	0.46	4.06E+05	1.13 E-06	2.30 E-02	1.58 E+03	1.46 E-05	1.57 E-05
Plutonium-239	0.01	2.00 E+05	4.99 E-08	1.73 E-02	6.12 E+03	2.83 E-06	2.88 E-06
Sum of Fractions			1.74 E-06			1.86 E-05	2.04 E-05

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.)[10]. The estimated total average annual effective dose equivalent to any individual member of the U.S. population from ubiquitous[11] background (formerly known as natural background) sources is 3.11 mSv[12] (311mrem)

[10] A detailed report on exposures from these and other types of radiation sources can be found in NCRP Report No. 160 "Ionizing Radiation Exposure of the Population of the United States" (NCRPb).

[11] 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).

[12] This includes 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.

(NCRPb). A comparison of the dose rates from several sources is illustrated at Figure 4.1. The Pantex doses are several orders of magnitude smaller than the smallest doses illustrated.

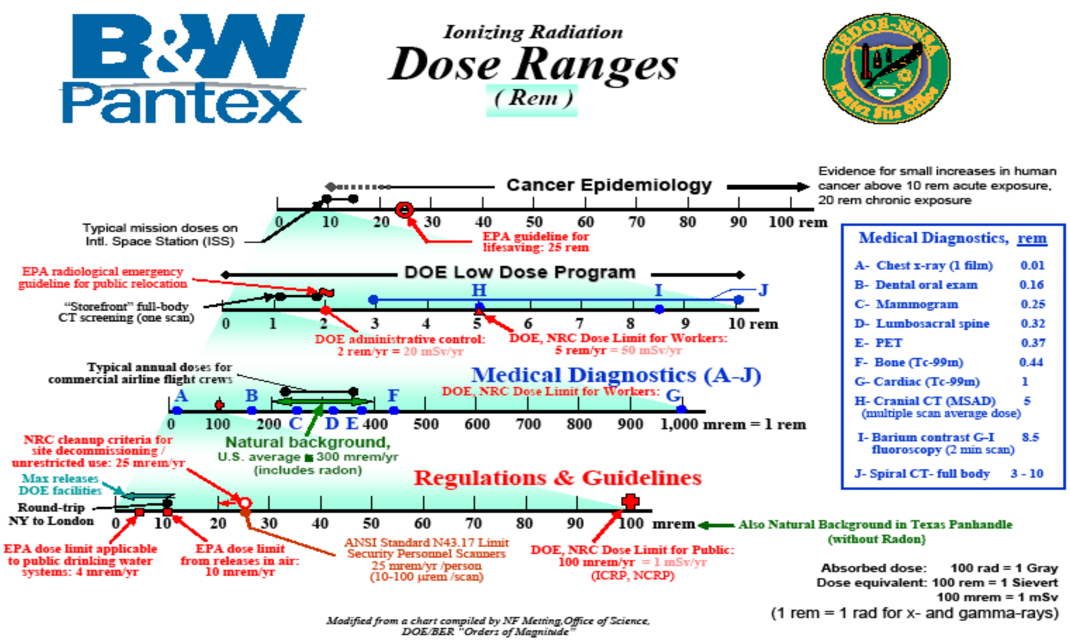

FIGURE 4.1 – *Comparison of Ionizing Dose Ranges*

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.[13] The order distinguishes real property (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.

[13] As previously mentioned, DOE Order 458.1 superseded DOE Order 5400.5 on February 11, 2011. It provides additional detailed guidance for radiological property release and waste management not included in the older order.

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) (PANTEXj), 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; and/or
- 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 2010 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 2010.

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 2010, 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 4.2 shows the locations of the Plant's dosimeters during 2010. 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 2010 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 2010 was approximately 19.1 mrem. The equivalent average annual dose is 76.3 mrem/year (0.76 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 20.6 mrem (equivalent to 82.5 mrem/year or 0.82 mSv/year), while the quarterly dose at upwind locations (those locations which are located in the direction opposite to the predominant wind direction) averaged 21.0 mrem (equivalent to 84.1 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 no location exceeded the quarterly average dose of 22.9 mrem (equivalent to 91.5 mrem/year or 0.92 mSv/year) measured at the background or control location at Bushland, Texas[14], 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.[15]

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 2010 continued to indicate evidence of seasonality between the several quarterly measurements as the measurements taken 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 2010.

[14] An "Interagency Agreement" (IA) between USDA and USDOE/NNSA that allowed access to the Bushland site expired in December 2009. In early 2010, a "Land Use Agreement" was negotiated between B&W-Pantex and Texas AgriLife Research to allow access to a new Control site located on James Bush Farms approximately 2 miles north of the previous site. The location of both sites is indicated on Figure 4.2.

[15] Although on the average, these sources are of approximately equal magnitude, soil concentrations of the principal sources of terrestrial radiation are variable (NCRPb). 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).

TABLE 4.5 — *Environmental Doses Measured by Thermoluminescent Dosimeters in 2010, in millirem*[16]

Location	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Avg. Qtrly
Onsite					
PD-02	19.5	18.0	19.0	18.0	18.6
PD-03	17.5	17.0	18.0	19.0	17.9
PD-04	22.5	20.0	21.0	22.0	21.4
PD-06 [a]	18.5	17.0	19.0	18.0	18.1
PD-07	19.5	19.0	20.0	19.0	19.4
Upwind					
FD-10 [a]	23.5	19.0	21.0	22.0	21.4
FD-12 [a]	21.5	22.0	22.0	20.0	21.4
FD-16B [a]	19.5	19.0	20.0	20.0	19.6
FD-17[a]	21.5	22.0	22.0	22.0	21.9
OD-06	21.5	20.0	22.0	20.0	20.9
Downwind					
FD-05 [a]	21.5	19.0	21.0	22.0	20.9
FD-06 [a]	23.5	22.0	22.0	22.0	22.4
FD-07 [a]	21.5	19.0	20.0	19.0	19.9
OD-02	19.5	19.0	20.0	18.0	19.1
OD-04 [a]	22.5	19.0	21.0	19.0	20.4
OD-05	21.5	20.0	21.0	22.0	21.1
Control					
OD-13B	23.5	22.0	22.0	24.0	22.9
Blank Correction	2.5	2.0	0.0	2.0	

[a] Locations co-sampled with TDSHS. Results for the TDSHS monitoring program during 2010 at the indicated co-sampling locations were not available at the time this document was prepared.

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.

[16] 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.

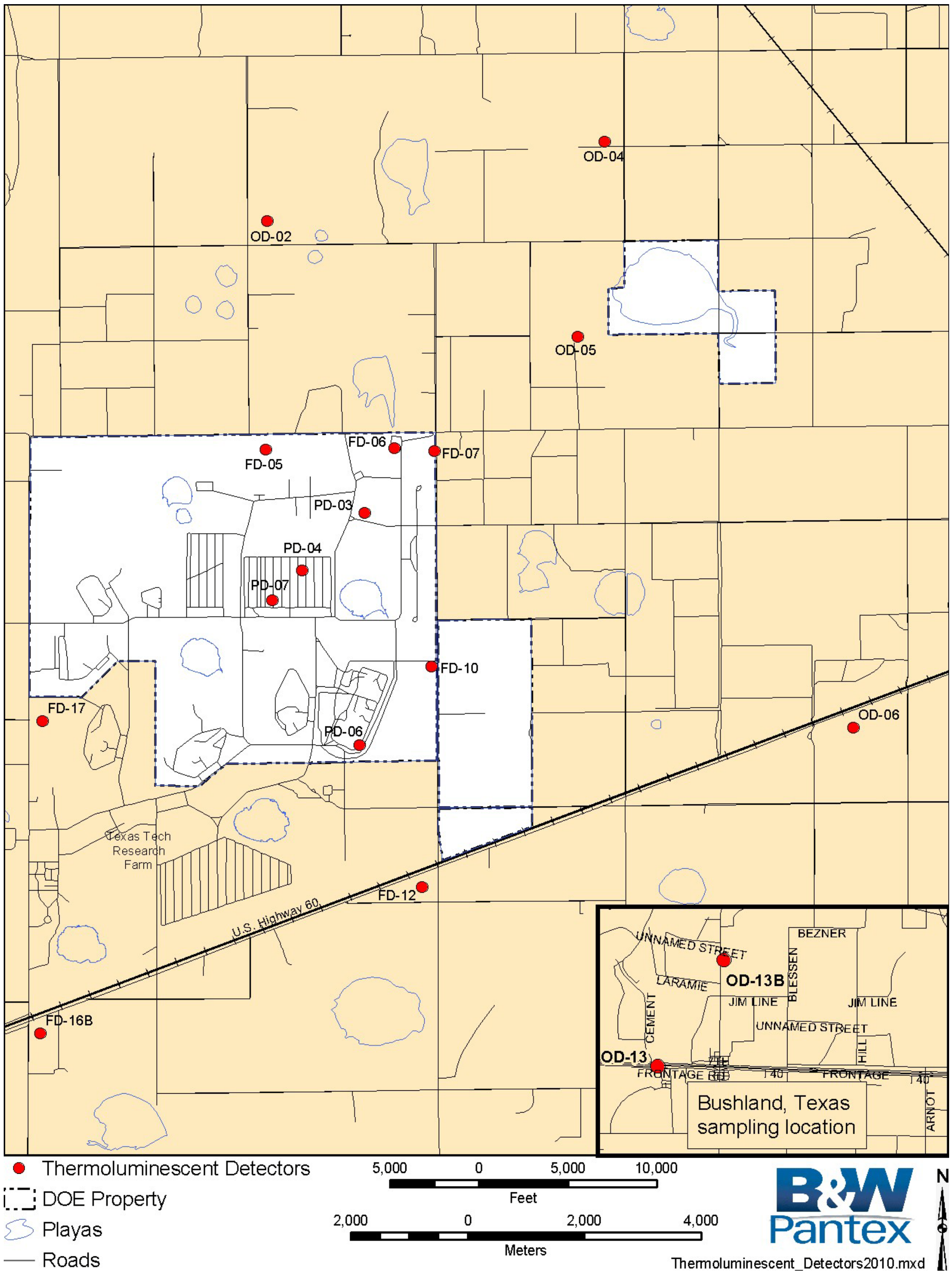

FIGURE 4.2 — *Locations of Pantex Plant Thermoluminescent Dosimeters*

Air Monitoring

Effluent monitoring was conducted for an incinerator located at 12-13 which demonstrated conformance with Beryllium emission standards. Radiological monitoring commenced at a new "control" location established at the James Bush Farms near Bushland, Texas during 2010. This site replaced the similar location formerly operated at the USDA's Agricultural Research Service Conservation and Production Research Laboratory approximately 2 miles south of the new site. All radiological monitoring indicated results that were not distinguishable from background.

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* [PANTEXc]). 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* (PANTEXc).

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 2010, the Plant had two 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. In August, 2010 three VEEs were conducted.

These VEEs were conducted concurrently with effluent ("stack") monitoring conducted by an independent subcontractor to confirm the values of emission factors for Beryllium (Be) associated with the operation of a Type O incinerator used to sanitize weapon components located in Building 12-13. The results of the monitoring demonstrated that the incinerator met the emission standards stated in 40 CFR

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[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.

§61, Subpart C (National Emission Standards for Beryllium).

5.3 Routine Radiological Air Monitoring

5.3.1 Collection of Samples

During 2010 the air monitors were operated according to the schedule shown in Table 5.1 wherein several monitors were operated continuously (the four onsite locations as well as the control location), others operated less frequently, and a few were not operated at all during the year. A total of 18 air monitoring stations were used to monitor for radionuclides in air in 2010. 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). Stations PA-AR-03 and PA-AR-04 are located around the firing sites to monitor areas contaminated with depleted uranium that was released during test firing of uranium containing components, 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.

Ten of the sixteen available fenceline radiological monitoring stations, designated as FL-AR-XX (for fence line), along the Plant perimeter provided coverage for 2010 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-13B, is a control station and is located upwind at Bushland, Texas[6]. A total of four offsite stations (including the control station) were used in monitoring activities in 2010.

The air monitoring schedule shown in Table 5.1 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[7]. Several fence line monitoring stations (those designated as FL-AR-04, -05, -06, and -08 in addition to those designated as OA-AR-04, and -05) 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 would

[6] An "Interagency Agreement" (IAG) between USDA and USDOE/NNSA that allowed access to the USDA's Agricultural Research Service Conservation and Production Research Laboratory site near Bushland, Texas expired in December 2009. In early 2010, a "Land Use Agreement" was negotiated between B&W-Pantex and Texas AgriLife Research to allow access to a new control site located on James Bush Farms approximately 2 miles north of the previous site. This site was constructed during CY 2010 and became operational in late October. (The location of both sites is indicated on Figure 5.2.)

[7] This schedule is modified annually in a manner to ensure that each location other than the four onsite locations and the control location, is scheduled for sample collection at least once every three years.

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, -10, -11, -14, -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.)

TABLE 5.1 — *2010 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												
FL-AR-03												
FL-AR-04		X		X		X	X		X		X	
FL-AR-05			X		X	X		X	X			X
FL-AR-06	X	X		X			X			X	X	
FL-AR-07												
FL-AR-08		X	X			X			X		X	X
FL-AR-09												
FL-AR-10		X			X			X			X	
FL-AR-11			X			X			X			X
FL-AR-12B[a]												
FL-AR-13												
FL-AR-14			X			X			X			X
FL-AR-15												
FL-AR-16		X			X			X			X	
FL-AR-17			X			X			X			X
Offsite												
OA-AR-02												
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-13B	X	X	X	X	X	X	X	X	X	X	X	X

[a] Due to highway construction beginning in 2008 operation of the monitoring equipment at the location designated as FL-AR-12 was discontinued. A new location to replace the former FL-AR-12 has not yet been selected.

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 thermoluminescent dosimeters (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.

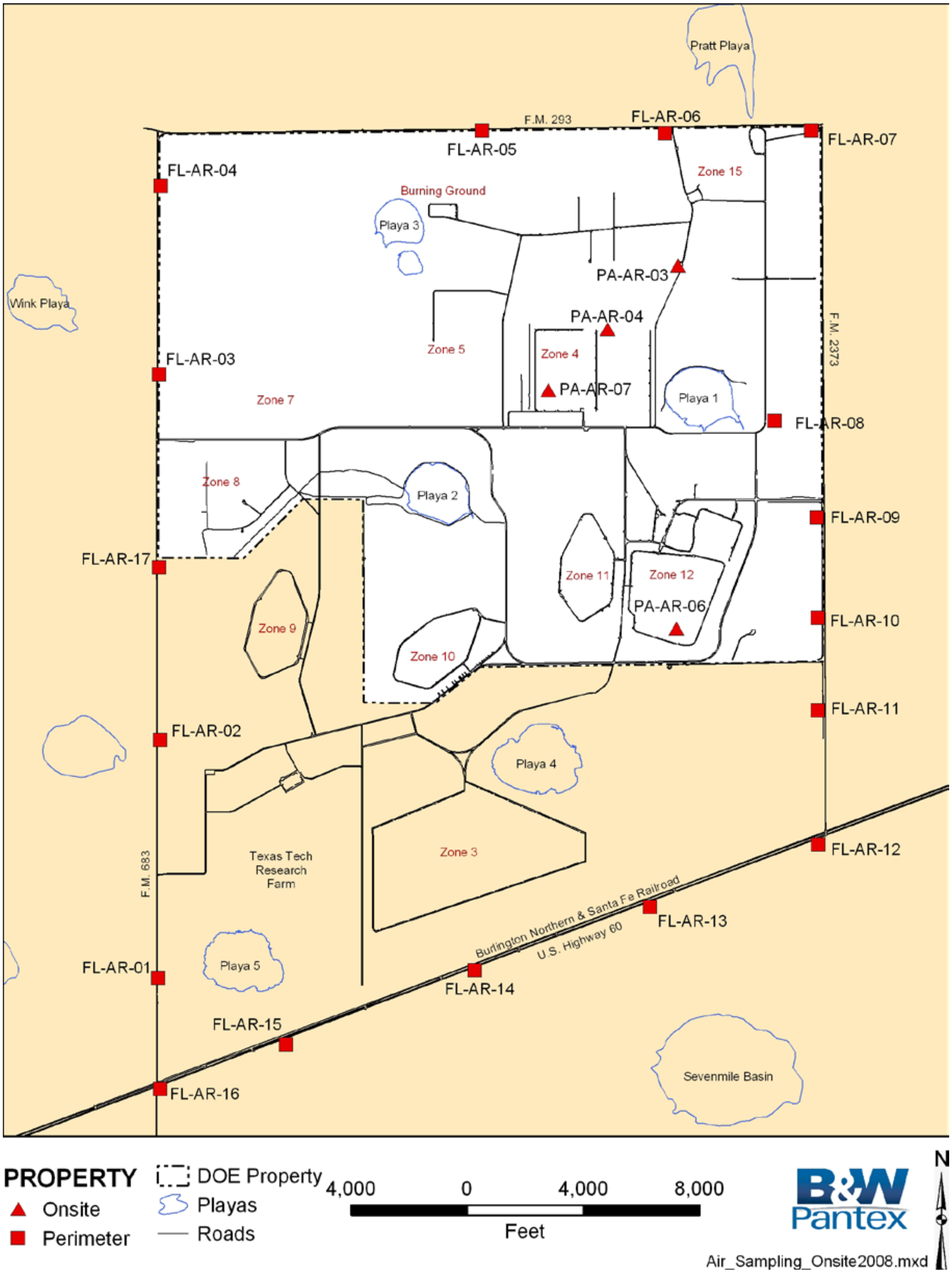

FIGURE 5.1 — ***Locations of Onsite and Fence Line Air Monitoring Stations***

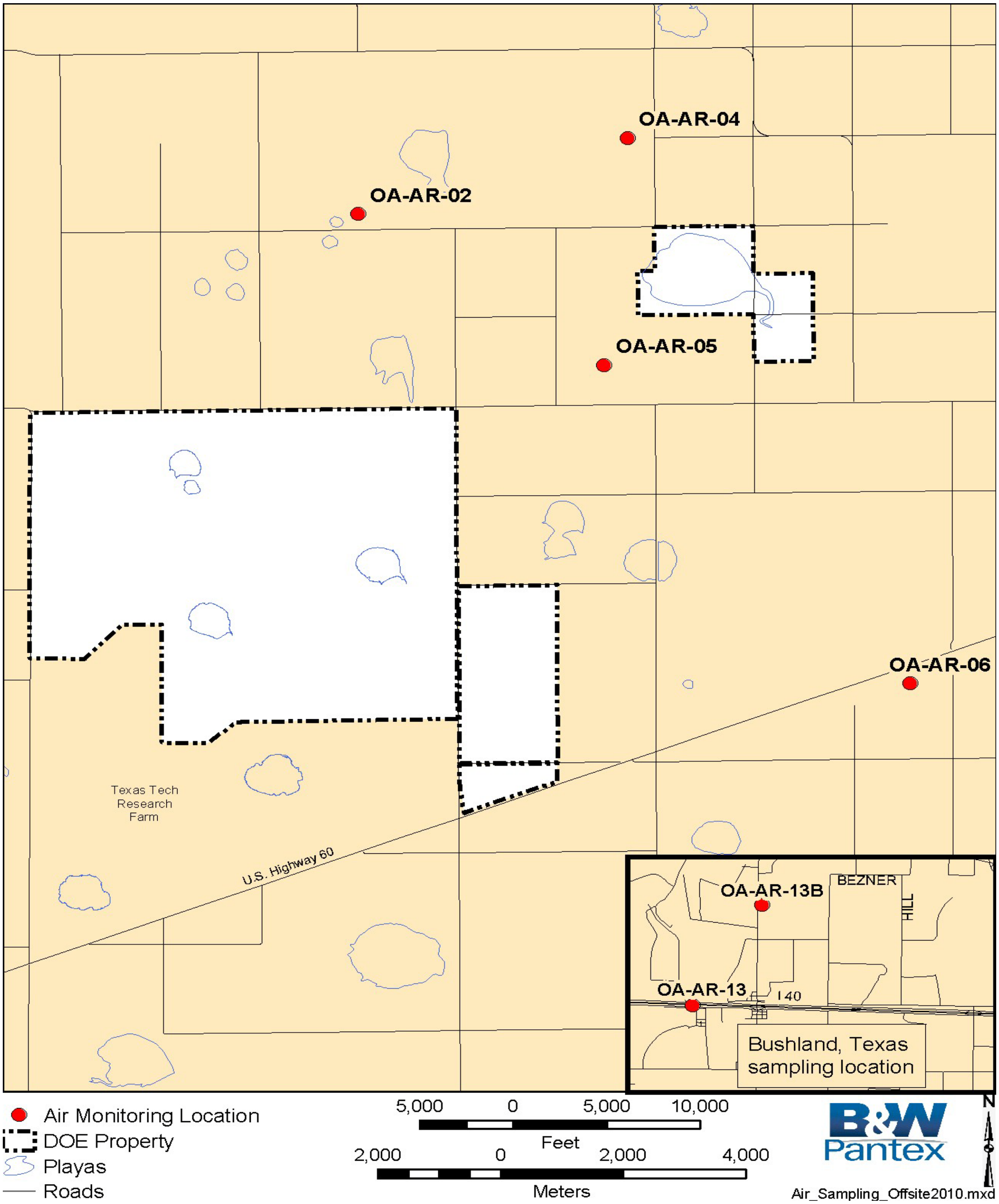

FIGURE 5.2— *Offsite Air Sampling Stations*

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.

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 5.2a through 5.2d 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[8]; and the Derived Concentration Guide (DCG) for comparison.

B&W Pantex collected approximately 89 percent of the planned samples at onsite locations, 88 percent at upwind locations, and 89 percent at downwind locations. Resource constraints, intermittent power losses, low "moisture content" for tritium samples during the summer months, and laboratory errors accounted for the majority of the "missing" samples. However, as shown in Table 5.2d, due to the approximately 10-month period between the removal of the monitors from the USDA site and the initiation of operations at the James Bush Farms site, less than 20 percent of the planned samples were collected at either of the Bushland control locations during 2010. This limited number of obtained samples affects the value of some of the statistical parameters used to compare the results from the control location to the results from the onsite, upwind, and downwind locations[9]. Accordingly, all of the data from the USDA site collected during the period from 2007 through 2009 and reported in the ASERs for those several years (Pantex Plant, 2008; Pantex Plant, 2009; Pantex Plant, 2010) were also used in data comparisons.

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[8] This parameter is the upper confidence limit (UCL) for a population consisting of all data for the specified radionuclide from the control location during the period from 2007-2009. UCL = x-bar + sK, where x-bar is the mean of the population, s is the standard deviation and K is a statistical parameter (approximately equal to 3) tabulated for specific numbers of samples, and the % confidence that a user of the data is willing to accept (usually 95%) for statistical conclusions drawn from the data. When used to derive an "historical background", a user will have 95% confidence that any single analysis result from a non-control location which is greater than the derived value is "different than background". (See discussions of this topic in statistical texts such as Gilbert [Gilbert, 1987]).

[9] When comparing several similar "populations" (such as those from on-site monitoring locations, those from neighboring locations, and those from a control location), the values of x-bar, s (see footnote 8) from each population are used in addition to other statistical parameters. (See discussions of this topic in statistical texts such as Gilbert [Gilbert, 1987]).

FIGURE 5.3 – ***Typical Air Monitoring Site***

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

TABLE 5.2 —*Concentrations of Radionuclides in Air[a] for 2010 at (a) Onsite Locations; (b) Upwind Locations; (c) Downwind Locations; and (d) Background Location*

a.

Radionuclide	Number of Samples Collected/Planned[b]	Mean ±Std. Dev.	Max ±Counting Error	Hist. Bkgd.	DCG
^{3}H	183/208	6.77 ± 19.62	144.10 ± 15.48	13.20	1,000,000
$^{233/234}$U	44/48	21.10 ± 8.38	42.90 ± 3.12	108.50	90,000
^{238}U	44/48	19.80 ± 9.00	44.82 ± 3.12	106.30	100,000
$^{239/240}$Pu	44/48	0.19± 0.22	0.79 ± 0.71	0.71	20,000

b.

Radionuclide	Number of Samples Collected/Planned[b]	Mean ±Std. Dev.	Max ±Counting Error	Hist. Bkgd	DCG
^{3}H	105/121	3.26 ± 9.54	84.01 ± 17.91	13.20	1,000,000
$^{233/234}$U	25/28	18.99 ± 7.41	37.17 ± 2.66	108.50	90,000
^{238}U	25/28	19.55 ± 8.28	47.81 ± 6.82	106.30	100,000
$^{239/240}$Pu	25/28	0.31 ± 0.53	0.32 ± 0.50	0.71	20,000

c.

Radionuclide	Number of Samples Collected/Planned[b]	Mean ±Std. Dev.	Max ±Counting Error	Hist. Bkgd	DCG
^{3}H	138/158	2.15 ± 5.11	16.03 ± 10.20	12.30	1,000,000
$^{233/234}$U	33/36	20.78 ± 9.41	46.97 ± 6.71	108.50	90,000
^{238}U	33/36	20.09 ± 10.34	47.81 ± 6.82	106.30	100,000
$^{239/240}$Pu	33/36	0.21 ± 0.26	1.07 ± 0.82	0.71	20,000

d.

Radionuclide	Number of Samples Collected/Planned[b]	Mean ±Std. Dev.	Max ±Counting Error	Hist. Bkgd	DCG
^{3}H	9/52	3.09 ± 2.47	7.48 ± 4.03	12.30	1,000,000
$^{233/234}$U	2/12	17.66 ± 4.34	20.73 ± 3.99	108.50	90,000
^{238}U	2/12	17.50 ± 4.98	21.02 ± 4.09	106.30	100,000
$^{239/240}$Pu	2/12	0.20 ± 0.18	0.32 ± 0.49	0.71	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.

5.3.3. Data Interpretation

As in previous years, relatively high values of tritium at PA-AR-06 during 2010 occurred during periods of rapid changes in barometric pressure with the highest value (14.41 ± 1.54 pCi/mL) recorded on May 20, 2010. These measurements likely result from continued off-gassing from soils near Cell 1 (the location of the unplanned release of tritium which occurred in 1989) 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 2010 exceeded the applicable DCG for the radiological materials analyzed. Comparisons of the data collected from the James Bush Farms control location during the period it was operational (late October through December 2010) was similar to data collected from the geographically similar USDA control location during the same periods of 2007 through 2009. Comparisons of the 2010 population and the data used to calculate the historical means in each of the three non-control categories of monitoring stations, as well as comparisons of the 2010 data population for individual locations to the 2007-2009 historical data from the control 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.

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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. Monitoring wells in the perched groundwater are 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.

Groundwater data collected in 2010 demonstrated that current remedial actions continue to operate as expected. The pump and treat systems are affecting both water levels and COC plumes within their zone of influence, which should expand as the systems continue to reduce saturated thickness in key areas of the perched aquifer. The Southeast ISB system is reducing COC concentrations in downgradient monitoring wells while the Zone 11 ISB is not expected to demonstrate effectiveness until 2012 or later. Unexpected analytical results in the High Plains Aquifer were likely due to background variability or analytical method and none exceeded the groundwater protection standard.

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).

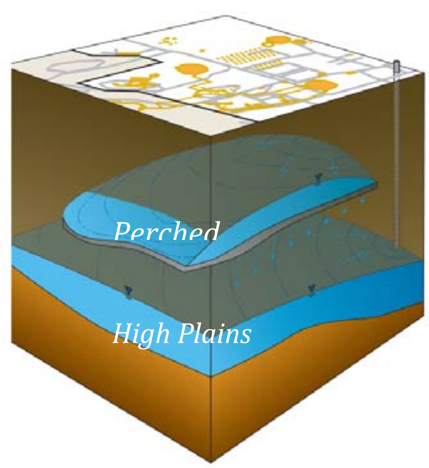


FIGURE 6.1 – *Groundwater Beneath Pantex*

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 of the High Plains Aquifer 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.

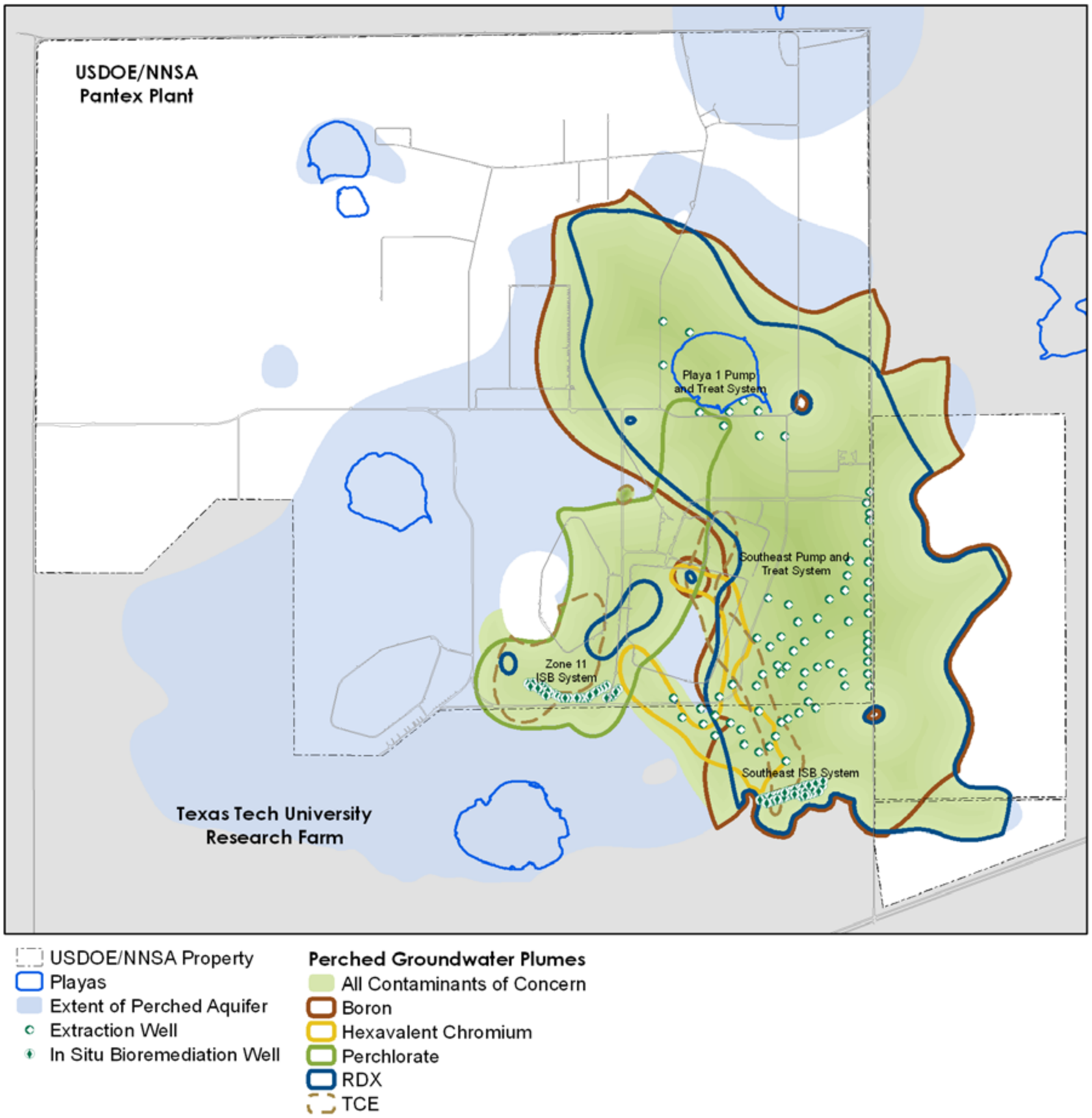


FIGURE 6.2 — *Perched Groundwater Plumes and Remediation Systems*

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* (PANTEXh) and a *Sampling and Analysis Plan* (PANTEXl) 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 September 16, 2010) (TCEQ, 2010) 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 2010 by function currently used in monitoring of the remedial actions and the total number of analytes assessed.

TABLE 6.1 — *Summary of Well Monitoring in 2010*

Well Type	Drinking Water Aquifer		Perched Groundwater	
	# Wells	# Analytes Assessed	# Wells	# Analytes Assessed
Long-Term Monitoring Well	31	1745	90	6002
Parked Wells (water level monitoring)	5	--	58	--
Pump & Treat Extraction Well	--	--	66	1026
***In Situ* Bioremediation Injection Well**	--	--	19	2023
Total	36	1745	233	9051

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 remedies 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 its saturated thickness to lessen the potential for impacted perched groundwater to migrate to the drinking water aquifer below it. 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 this injection capability will remain available 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 and system treatment goals for 2010. The Playa 1 Pump and Treat System (P1PTS), which was in its second full year of operation, exceeded operation time goals every month in 2010, with the exception of July due to extremely heavy rainfall. The system throughput was affected by both the heavy rainfall in July and WWTF limitations due to system upgrades and expansion. However, the average flow rate for 2010 was over 90% of the operational goal and should improve when the WWTF and irrigation system upgrades are complete.

During the long operational history of the SEPTS, much of the treated water has been injected back into the perched zone, as the system was not originally designed to meet the remedial goal of reducing saturated thickness in the perched aquifer. 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 down gradient of the pump and treat systems, with declines of up to 1 ft/yr in most wells that demonstrate a decreasing trend as depicted in Figure 6.3. A greater decline in water levels was observed south of Playa 1 and along the eastern fence line. 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, with the following exceptions:

- PTX06-1005 exhibited an increasing trend in ground water level. This trend is likely due to injection at PTX06-INJ-12A, which is located approximately 325-feet to the west. Over 26 million gallons of treated water were injected at this injection well during 2010.
- PTX06-1098, PTX06-1100, and PTX06-1101, which are all located on Texas Tech property northwest of the Southeast ISB (SEISB) system down gradient of the SEPTS, indicated increasing trends in water levels. However, the two closest extraction wells to this area, PTX06-EW-40 and PTX06-EW-41, removed extremely limited volumes (<50,000 gallons) during 2010 and several other up gradient wells removed a total volume of less than 1 million gallons during 2010.
- Four wells north of Playa 1 exhibited increasing trends in water levels. These increasing trends may have been caused by recharge in the area due to historic rainfall events and episodes of flooding. In addition, three of these wells are under the influence of the P1PTS and likely have variable water levels.

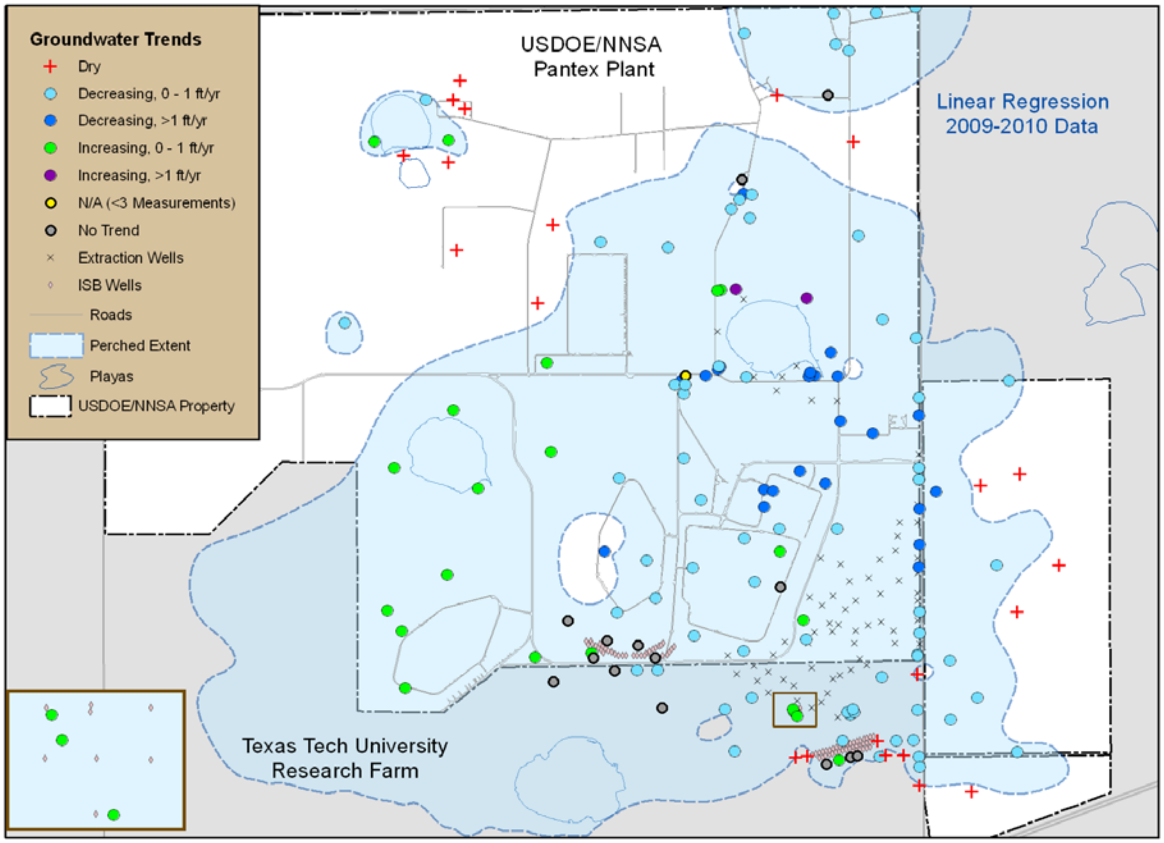


FIGURE **6.3 –** ***Water Level Trends in the Perched Aquifer***

Plume stability is also evaluated to determine if the center of mass is still moving in the perched groundwater. Major perched aquifer COCs (RDX, hexavalent chromium, TCE, and perchlorate) were included in this evaluation. Because the RDX plume has expanded to the perched extent, the entire plume was not evaluated, but rather the two 1000-ug/L plume "hot spots" associated with the two source areas and affected by the remedial actions were evaluated. As depicted in Figure 6.4, the COC plumes had the same general shape from 2009 to 2010, with the following notable exceptions:

- The perchlorate plume has slightly expanded to the east due to increasing concentrations at the monitoring and extraction wells that define the eastern boundary.
- The northeastern lobe of the hexavalent chromium plume extended further to the west. This plume movement is due to the hexavalent chromium detection at PTX08-1007. It is believed this concentration is due to historic SEPTS injection before implementation of irrigation, which pushed the plume boundary to the west. Since this well had not been sampled since 2003, it is likely this well has been affected for some time. It is expected this concentration will eventually decrease as injection near this well has stopped and the groundwater flow returns to its general southeastern gradient.
- All plumes exhibit slight variations at their boundaries, likely due to minor variations in concentration over time and the low values defining the plume boundaries. In addition, some plume expansion is likely due to advection, dispersion and groundwater gradients.
- The hexavalent chromium, RDX, and TCE plumes appear to be contracting in the SEPTS well

field. However, concentrations tend to be variable in this area, so additional data are needed to confirm this plume movement.

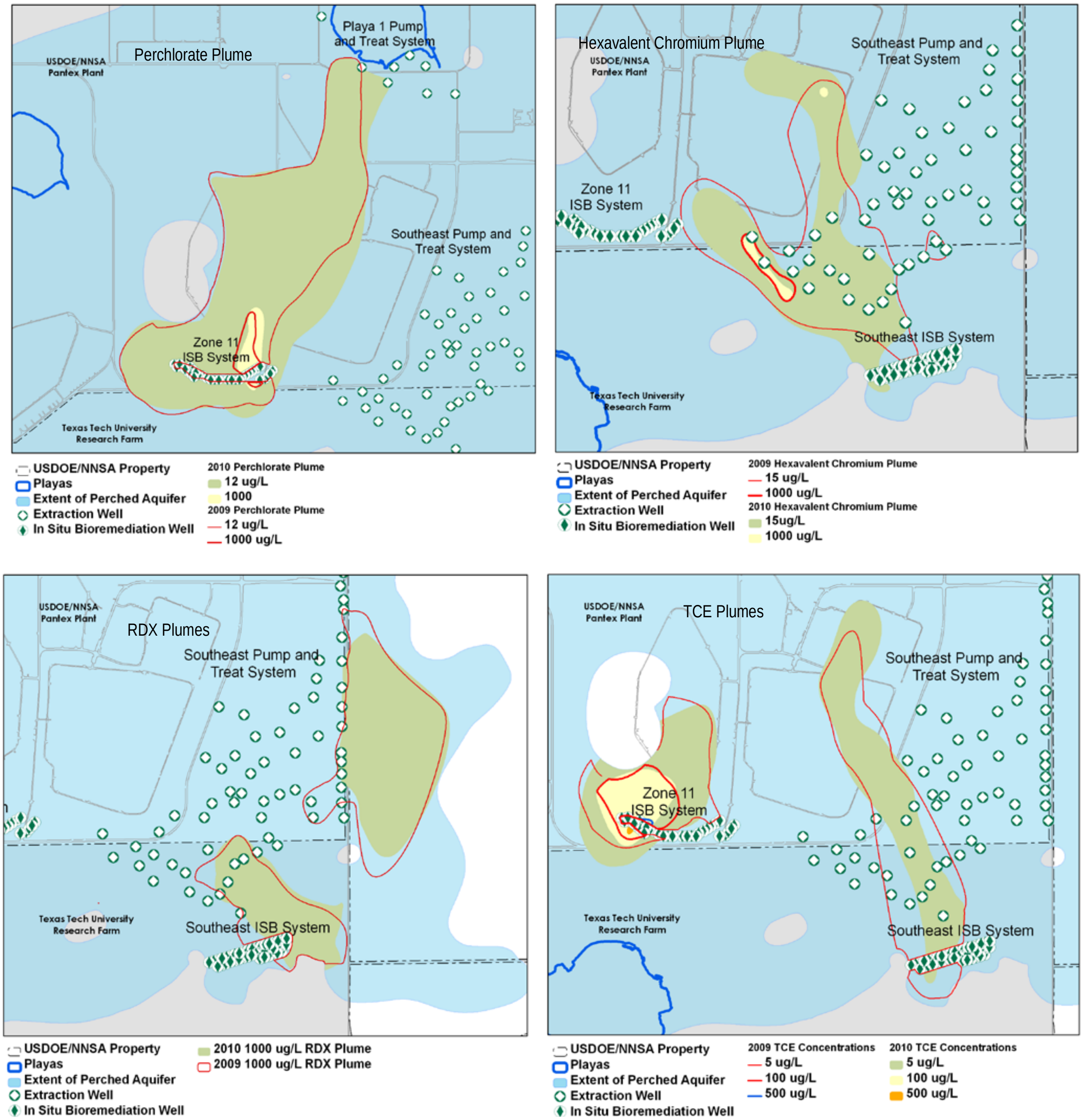


FIGURE **6.4 –** ***2009-2010 Plume Movement - Perchlorate, Hexavalent Chromium, RDX, and TCE***

Concentration trends of individual monitoring points are also evaluated to assess the remedial action effectiveness and plume stability. To represent the current impact of the remedial action systems on concentrations, the RDX trends were calculated using the last 4 measurements. Evaluation of RDX concentration trends 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. One well (PTX06-1002A) is exhibiting increasing trends in RDX near a source area, but this increasing trend is likely due to plume movement caused by radial flow from Playa 1 rather than an increase in mass flux from the source area. 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 potentially more sensitive to vertical migration to the deeper drinking water aquifer.

Overall, four monitoring wells exhibited increasing trends in RDX using data from the last four measurements, as depicted in Figure 6.5. However, PTX06-1034 is located in the far southeastern lobe of the perched aquifer and PTX06-1006 is located on the western edge of Zone 12, which are areas that are not under the influence of any remedial action at this time. The other two wells exhibiting increasing RDX trends (PTX06-1015 and PTX06-1102) are located on the northwest corner of TTU property south of the SEPTS well field. These two wells may be within the influence of the SEPTS. However, limited saturated thickness, hydraulic conductivity, and groundwater flow reduce SEPTS effectiveness in this area. In fact, PTX06-1102 and PTX06-1108 were originally installed as SEPTS extraction wells and were converted to monitoring wells due to limited productivity.

Concentration trends for the remaining major COCs (perchlorate, TCE, and hexavalent chromium) are discussed in the 2010 Annual Compliance Report (PANTEXa). Areas outside the influence of the remedial action systems are also monitored for HE and TCE breakdown products to gather data regarding natural attenuation and will be evaluated over time to determine the rate of these processes.

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 mild to strong reducing conditions found are expected for each ISB treatment zone. However, stronger reducing conditions may be required for the complete breakdown or reduction of TCE.

The Southeast ISB was installed in 2007, with injection complete by March 2008. A second amendment injection was completed during second quarter 2010. The system was installed with 42 treatment zone wells and six performance monitoring wells. Pantex monitors eight treatment zone wells and five in-situ performance monitoring (ISPM) wells (see Figure 6.6 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.

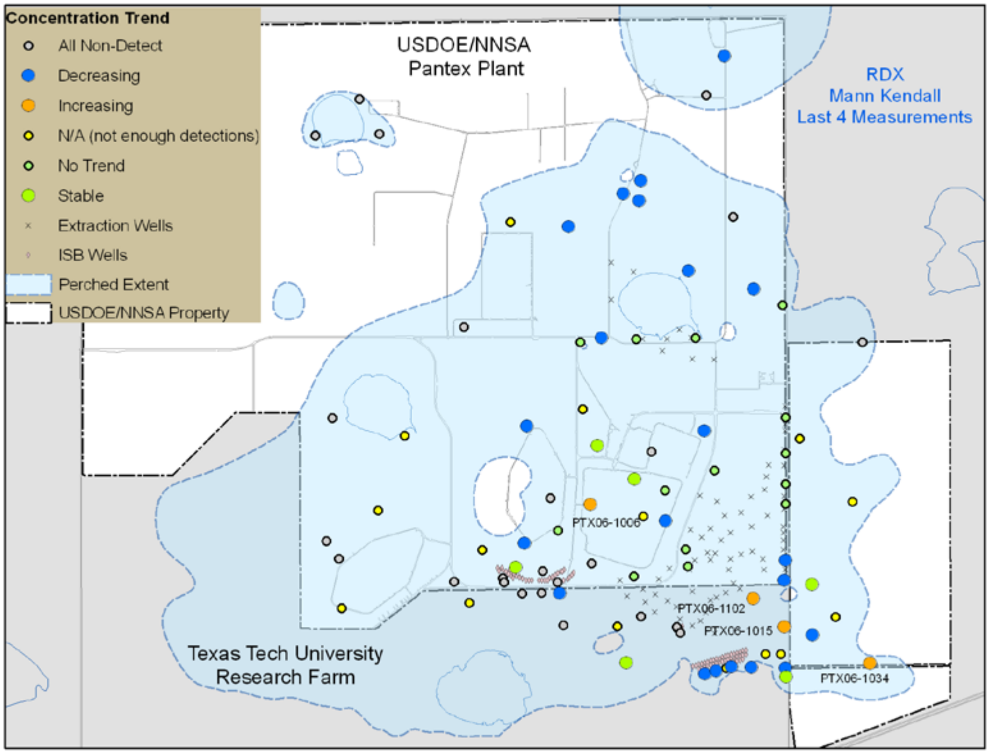


FIGURE 6.5 –*RDX Concentration Trends in the Perched Aquifer*

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 to Strong	Increasing	No[1]	No[1]
Southeast ISB	Strong	Increasing	Yes	Yes

Mild conditions = 0 to -50 mV

Strong Conditions = ORP < -50 mV and sulfate and nitrate reduced, indicating conditions are present for methanogenesis

[1] Downgradient wells are not expected to demonstrate reducing conditions for up to 5 years after the treatment zone is established. Initial injection into treatment zone wells was completed June 2009. Injection into new wells was completed in November 2009.

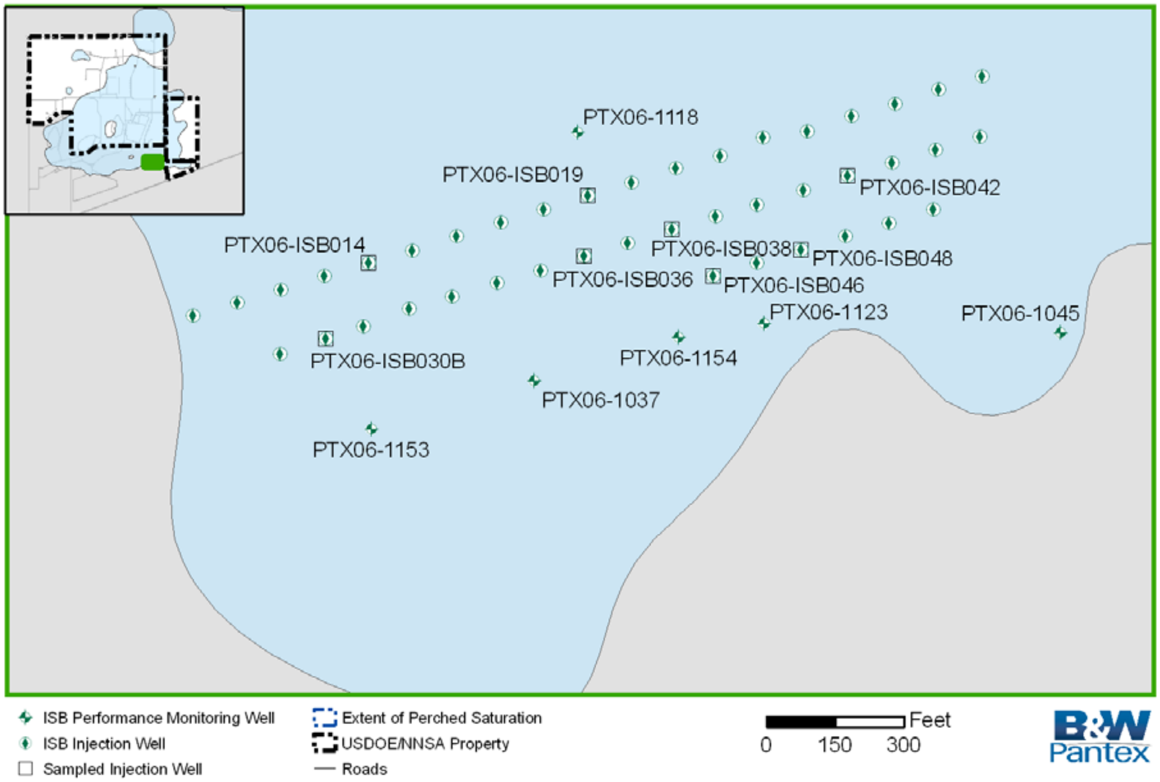


FIGURE **6.6 –** ***Wells Sampled at Southeast ISB***

Four of the 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. The 2010 results are much lower than the typical baseline values reported for down gradient wells. In addition, PTX06-1154, which is in the zone of highest groundwater velocity in the ISB treatment zone, had the first measured concentrations below the GWPS in 2010. The remaining down gradient ISPM wells are expected to exhibit decreasing RDX trends that will eventually stabilize below the GWPS as the treated water reaches the wells. Although the hexavalent chromium (Cr^6) plume is primarily upgradient of the ISB, concentrations in the closest downgradient performance monitoring wells are below the GWPS established in the Compliance Plan and ROD. The downgradient performance monitoring well information is included in Table 6.3.

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 (hexahydro-1-Nitroso-3,5-Dinitro-1,3,5-triazine [MNX], hexahydro-1,3-Dinitroso-5-Nitro-1,3,5-triazine [DNX], and hexahydro-1,3,5-Trinitroso-1,3,5-triazine [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 6.7, TNX concentrations are high relative to the GWPS of 2 ug/L in the Southeast ISB area; however, initial RDX concentrations were high compared to TNX concentrations, and all wells are exhibiting downward trends in both RDX and TNX. These trends are expected to continue as biodegradation continues.

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

Well ID	Cr^6 Baseline	Cr^6 1Q2010	Cr^6 2Q2010	Cr^6 3Q2010	Cr^6 4Q2010	RDX Baseline	RDX 1Q2010	RDX 2Q2010	RDX 3Q2010	RDX 4Q2010
PTX06-1037	37.75		<15		<15	1700		74		11
PTX06-1123	--		<15	<15	<15	3320		130	47	35
PTX06-1153	--	<15	24	<15	19	--	260	320	100	200
PTX06-1154	--	<15	<15	<15	<15	--	490	630	<0.2	R

Concentrations provided in ug/L.
Highlighted cells indicate concentrations less than the GWPS.
Blank spaces indicate no samples were collected.
Data from ISPM Wells PTX06-1045 and PTX06-1118 were not included in this table. PTX06-1045 is the furthest down gradient ISPM well that may have little to no hydraulic connection to the SEISB treatment zone. In addition, this well went dry in the second half of 2010. PTX06-1118 is upgradient to the ISB system and is used to monitor the influent COC concentrations and was dry throughout 2010. This well may not demonstrate decreasing concentrations unless it is affected by the treatment zone inadvertently.
The "--" symbol indicates that no baseline data are available.
R – Data rejected

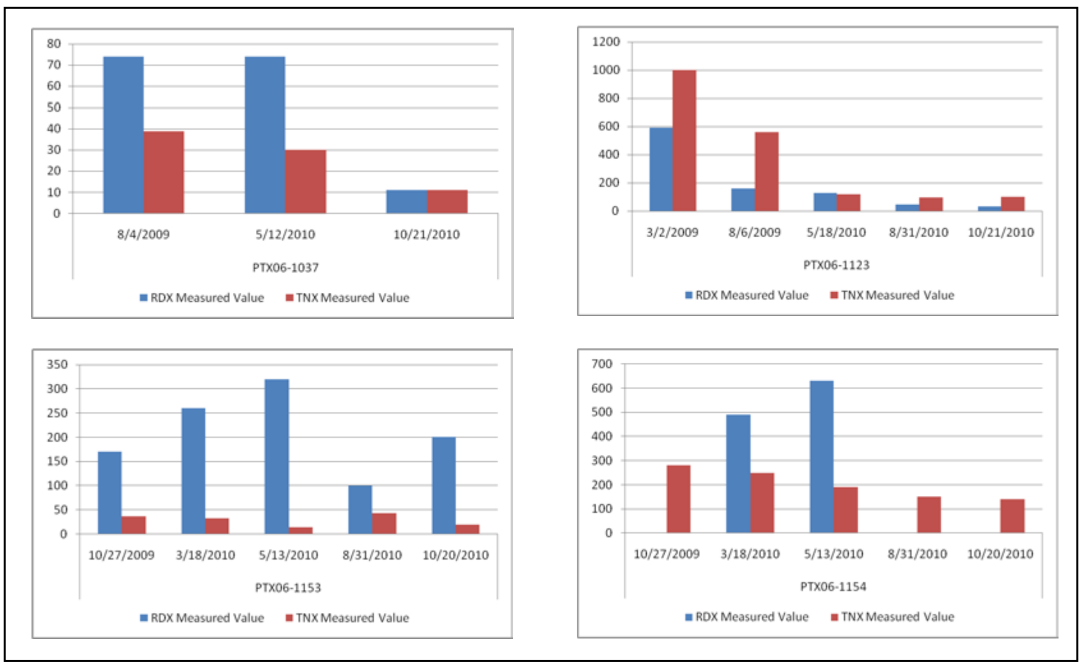


FIGURE 6.7 – *RDX and TNX Concentrations in Parts per Billion (ppb) from Southeast ISB Downgradient Performance Monitoring Wells*

The Zone 11 ISB system was installed by early 2009 with injection completed in the original 23 wells by June 2009. An additional nine wells were installed during 2009 to better treat the perchlorate plume on the eastern side and the TCE plume on the western side of the ISB system. Injection was completed in the new wells in November 2009. A second injection was completed in all wells in third quarter 2010 and data in this report reflect post-injection results. Eleven treatment zone wells and three downgradient ISPM wells are used to evaluate the Zone 11 ISB system (Figure 6.8).

Data collected in 2010 indicate that a mild-to-strong reducing zone has been established and maintained over time. Conditions favorable for reductive dechlorination (important for TCE reduction) are present as nitrate and sulfate concentrations have declined. Evaluation of COC data collected in the treatment zone (Table 6-4) indicate that COC concentrations are below the GWPS and most are non-detect with the exception of perchlorate at two wells during the fourth quarter. Those two wells (PTX06-ISB078 and PTX06-ISB081) were affected by a drop in pH which likely temporarily reduced the biological activity. The pH is rebounding and reducing conditions are expected to be reestablished. Future results should be below the GWPS. Treatment zone conditions will continue to be monitored over time to determine when a third injection is required.

As shown in Table 6-4, downgradient monitoring wells do not yet reflect reduced COC concentrations from the ISB. Concentrations are not expected to decline in the downgradient monitoring wells until late 2012 or later based on the estimated rate of groundwater flow in the Zone 11 area.

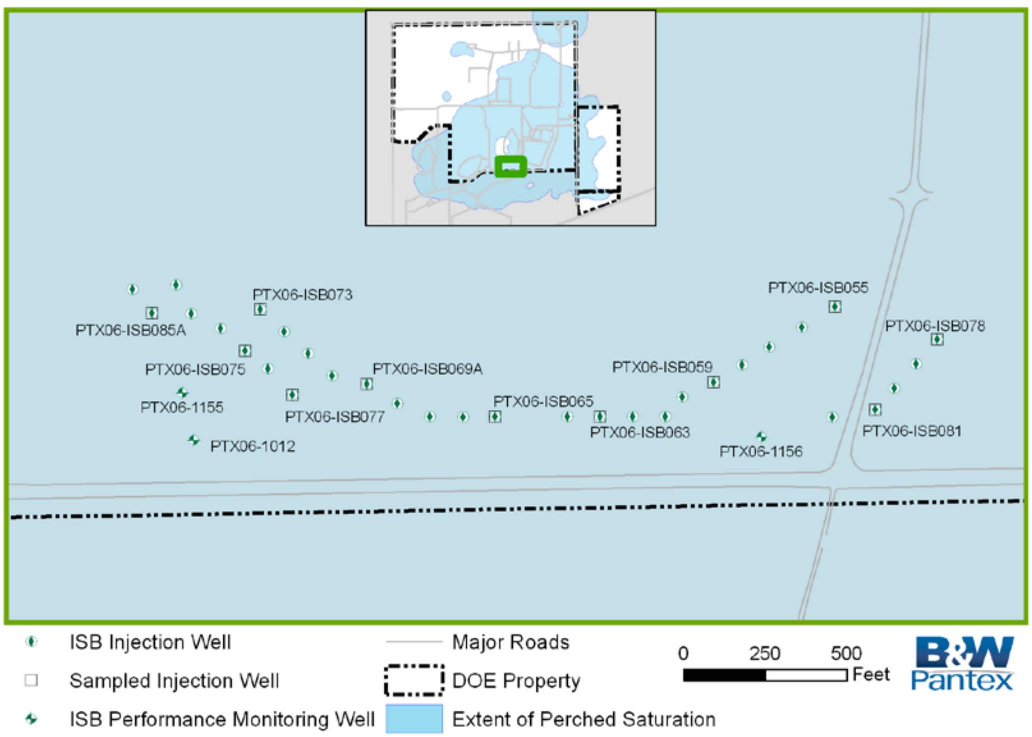


FIGURE **6.8 –** ***Wells Sampled at Zone 11 ISB***

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.

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

Well ID	Perchlorate (1Q2010)	Perchlorate (2Q2010)	Perchlorate (3Q2010)	Perchlorate (4Q2010)	TCE (1Q2010)	TCE (2Q2010)	TCE (3Q2010)	TCE (4Q2010)
In Situ Bioremediation Wells								
PTX06-ISB055	<20	<20	<20	<20	<3	<3	<3	<3
PTX06-ISB059	<20	<20	<20	<20	<3	<3	<3	<3
PTX06-ISB063	<20	<20	<20	<20	<3	0.75	<3	<3
PTX06-ISB065	<20	<20	<20	<20	<3	<3	<3	<3
PTX06-ISB069A	<20	<20	<20	<20	<3	<3	1	<3
PTX06-ISB073	<20	<20	<20	<20	<3	<3	0.91	<3
PTX06-ISB075	<20	<20	<20	<20	<3	<3	0.83	<3
PTX06-ISB077	<20	<20	<20	<20	<3	<3	<3	<3
PTX06-ISB078	<20	<20	<20	38.9	<3	<3	<3	<3
PTX06-ISB081	<20	<20	<20	47.9	<3	<3	<3	<3
PTX06-ISB085A	<20	<20	<20	<20	<3	<3	<3	<3
In Situ Performance Monitoring Wells								
PTX06-1012		341		305		190		300
PTX06-1155	487	415	389	454	540	470	610	580
PTX06-1156	2140	1570	1590	1990	3.5	2.7	4.5	4.5

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

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 more comprehensive list of constituents will be sampled to specifically evaluate those wells. Figure 6.9 depicts the perched and High Plains aquifer wells used in this evaluation for 2010. A total of 47 wells were evaluated for unexpected conditions. Because of the differing frequency of sampling, all available data for these wells are used in this evaluation.

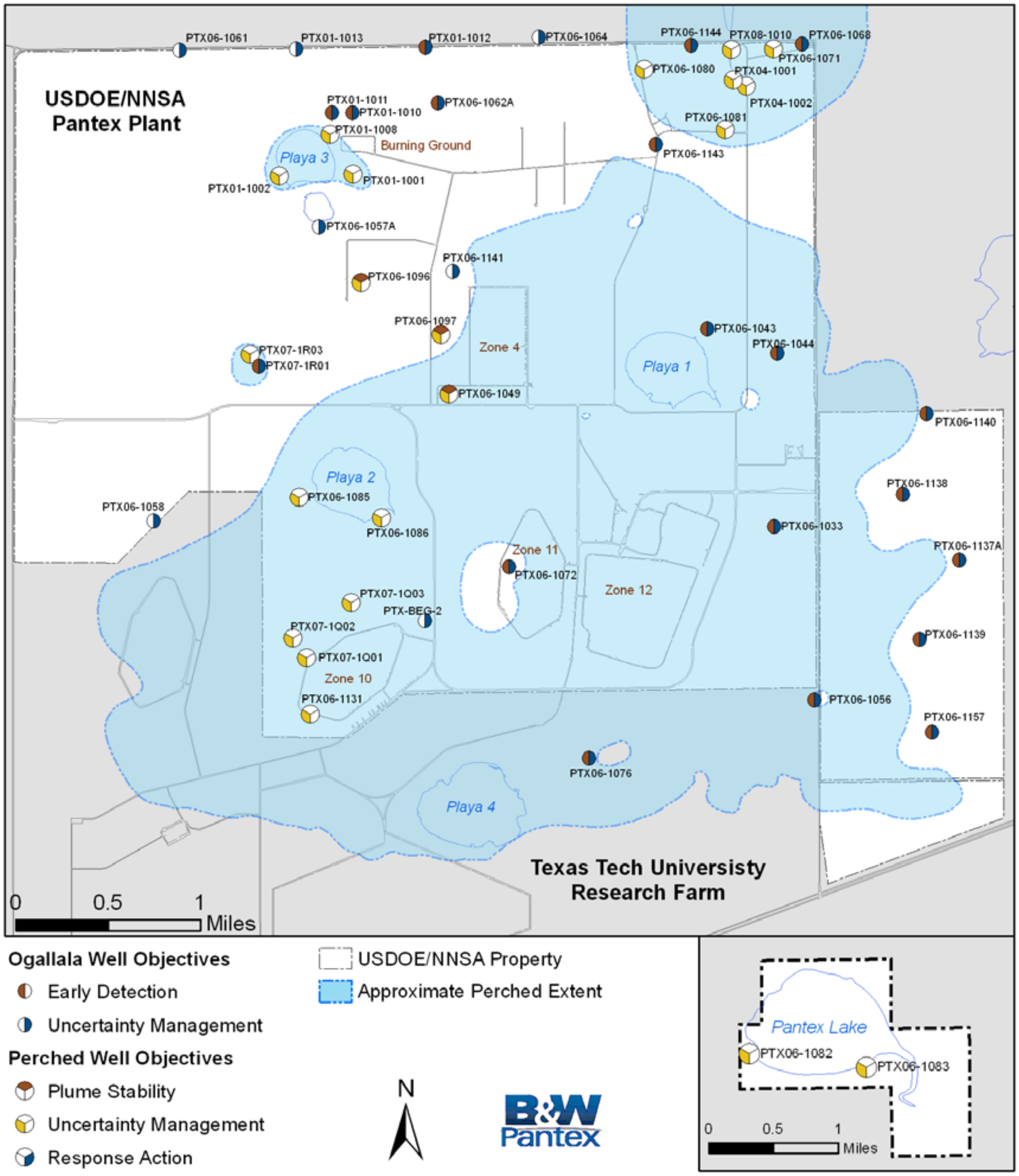


FIGURE **6.9 – *Uncertainty Management and Early Detection Wells***

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* (PANTEXl) 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 monitoring 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	4/29/2010	Trichloroethene	0.552	N	3	N	5	Y[1]
PTX01-1001	10/25/2010	Trichloroethene	0.34	N	3	N	5	Y[1]
PTX04-1002	7/26/2010	RDX	0.181	N	1	N	2	Y[1]
PTX04-1002	7/26/2010	HMX	0.76	N	1	N	360	Y[1]
PTX04-1002	7/26/2010	Chloroform	0.35	N	3	N	80	Y[1]
PTX04-1002	7/26/2010	Trichloroethene	0.83	N	3	N	5	Y[1]
PTX06-1049	**4/29/2010**	**Trichloroethene**	**0.779**	**N**	**3**	**N**	**5**	**N**[2]
PTX06-1081	7/26/2010	Trichloroethene	0.84	N	3	N	5	Y[3]
PTX06-1131	**7/15/2010**	**RDX**	**0.347**	**N**	**1**	**N**	**2**	**N**[4]

BKG = background value for naturally occurring constituents from the *Risk Reduction Rule Guidance to the Pantex RFI* (DOEc, PANTEXk).
PQL = Practical quantitation limit from the *Sampling and Analysis Plan* (PANTEXl).
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]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.
[3]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.
[4]PTX06-1131 was resampled in October 2010, and the detection was not confirmed.

Five perched monitoring wells had detections of COCs in 2010. Three of those conditions were expected, as those wells had previous detections of the COCs, but at higher concentrations. These wells will be tracked to ensure that concentrations continue to decline.

PTX06-1049 exhibited a detection of TCE below the PQL and the GWPS. This well is near the southwest corner of Zone 4, west of Playa 1. This well previously exhibited TCE detections in 2006 and more recently in 2009. The recent impacts observed in this well appear 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.

PTX06-1131 had a first-time detection of RDX below the PQL and the GWPS in July 2010. This well, which is near the southwest corner of Zone 10, was installed in 2008 and first sampled in 2009. The well was resampled in October 2010 and the July detection was not confirmed. Therefore, this detection may be a false positive due to sample handling or laboratory errors. This well will continue to be monitored over time.

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. Fourteen High Plains Aquifer (Ogallala/Dockum) wells had detections in 2010. Thirteen of those wells had unexpected conditions and are discussed below. Wells with expected conditions are footnoted with explanations in Table 6.6.

Several wells, including PTX06-1044, PTX06-1062A, PTX06-1064, PTX06-1139, and PTX-BEG-2 had boron detections slightly above the background value of 194 ppb. Because the boron concentrations at these wells are very close to background and observed boron concentrations tend to be considerably variable, it appears that these concentrations also represent background for these wells. Evaluation of historic boron data in these wells does not indicate increasing trends. The measured concentrations are well below the GWPS of 7,300 ppb. Pantex will continue to monitor these wells according to the Sampling and Analysis Plan (SAP). PTX06-1056 and PTX06-1157 also exhibited boron concentrations above background values. PTX06-1056 and PTX06-1033, which are installed into the deeper zone of the High Plains Aquifer, have consistently demonstrated boron concentrations above background. The higher boron concentrations in these deeper wells are possibly due to influence of the lower Dockum formation. This Dockum formation influence is supported by the fact that boron concentrations increased with depth in PTX06-1157, as well as several other multi-level wells.

Hexavalent chromium was detected in newly installed well PTX06-1157 at a depth of 517 ft. It was not detected in the two higher sampling depths. This well is cross-gradient and distant from the hexavalent chromium plume in the perched groundwater. The detection is below the laboratory PQL. Additionally, the colorimetric method used for hexavalent chromium can produce false positives below the PQL. This well was installed to replace PTX06-1032 which had low-level detections of high explosives believed to be a result of a leaking casing annulus. No HEs were detected in PTX06-1157 at any sampling depth. Because the hexavalent chromium detection is below the PQL and the well is not down gradient of the perched groundwater plume, the detection is considered as a false positive, and the well will continue to be monitored in a manner similar to all other wells equipped with multiple screened intervals using the monitoring lists and sampling frequencies previously assigned to PTX06-1032.

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?
			High Plains Aquifer Wells					
PTX06-1033	3/30/2010	Boron	202	Y	194	N	7300	Y[1]
PTX06-1033	7/19/2010	Boron	212	Y	194	N	7300	Y[1]

Well ID	Sample Date	Analyte	Measured Value (ug/L)	Above BKG or PQL?	BKG/ PQL (ug/L)	Above GWPS?	GWPS	Expected Condition?
PTX06-1044	**3/22/2010**	**Boron**	**197**	**Y**	**194**	**N**	7300	**N**
PTX06-1056	3/10/2010	Boron	258	Y	194	N	7300	Y[1]
PTX06-1056	8/4/2010	Boron	208	Y	194	N	7300	Y[1]
PTX06-1062A	**1/25/2010**	**Boron**	**215**	**Y**	**194**	**N**	**7300**	**N**
PTX06-1064	**3/22/2010**	**Boron**	**195**	**Y**	**194**	**N**	**7300**	**N**
PTX06-1068	**3/2/2010**	**Boron**	**247**	**Y**	**194**	**N**	**7300**	**N**
PTX06-1139	**5/4/2010**	**Boron**	**200**	**Y**	**194**	**N**	**7300**	**N**
PTX06-1139	**10/12/2010**	**Boron**	**211**	**Y**	**194**	**N**	**7300**	**N**
PTX06-1157-467	6/15/2010	Boron	207	Y	194	N	7300	Y[2]
PTX06-1157-517	6/16/2010	Boron	212	Y	194	N	7300	Y[2]
PTX06-1157-517	**6/16/2010**	**Chromium, Hexavalent**	**5**	**N**	**15**	**N**	**100**	**N**
PTX-BEG-2	**7/14/2010**	**Boron**	**196**	**Y**	**194**	**N**	**7300**	**N**

BKG = background value for naturally occurring constituents from the *Risk Reduction Rule Guidance to the Pantex RFI* (PANTEXk).
PQL = Practical quantitation limit from the *Sampling and Analysis Plan* (PANTEXl).
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) from which the sample was taken.
Wells with unexpected conditions are in bold.
[1] Wells are installed in deeper segments of the High Plains Aquifer, have consistently demonstrated boron concentrations above background established for the High Plains Aquifer, and are believed to be influenced by the lower Dockum formation.
[2] PTX06-1033 and 1056 are installed in deeper segments of the High Plains Aquifer, have consistently demonstrated boron concentrations above background established for the High Plains Aquifer, and are believed to be influenced by the lower Dockum formation. The background for the High Plains Aquifer of 194 ppb was set based on samples collected across the entire saturated thickness and may not be representative of samples collected at discrete intervals. Because of this, boron concentrations slightly above background are expected in deeper segments of the High Plains Aquifer.

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

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

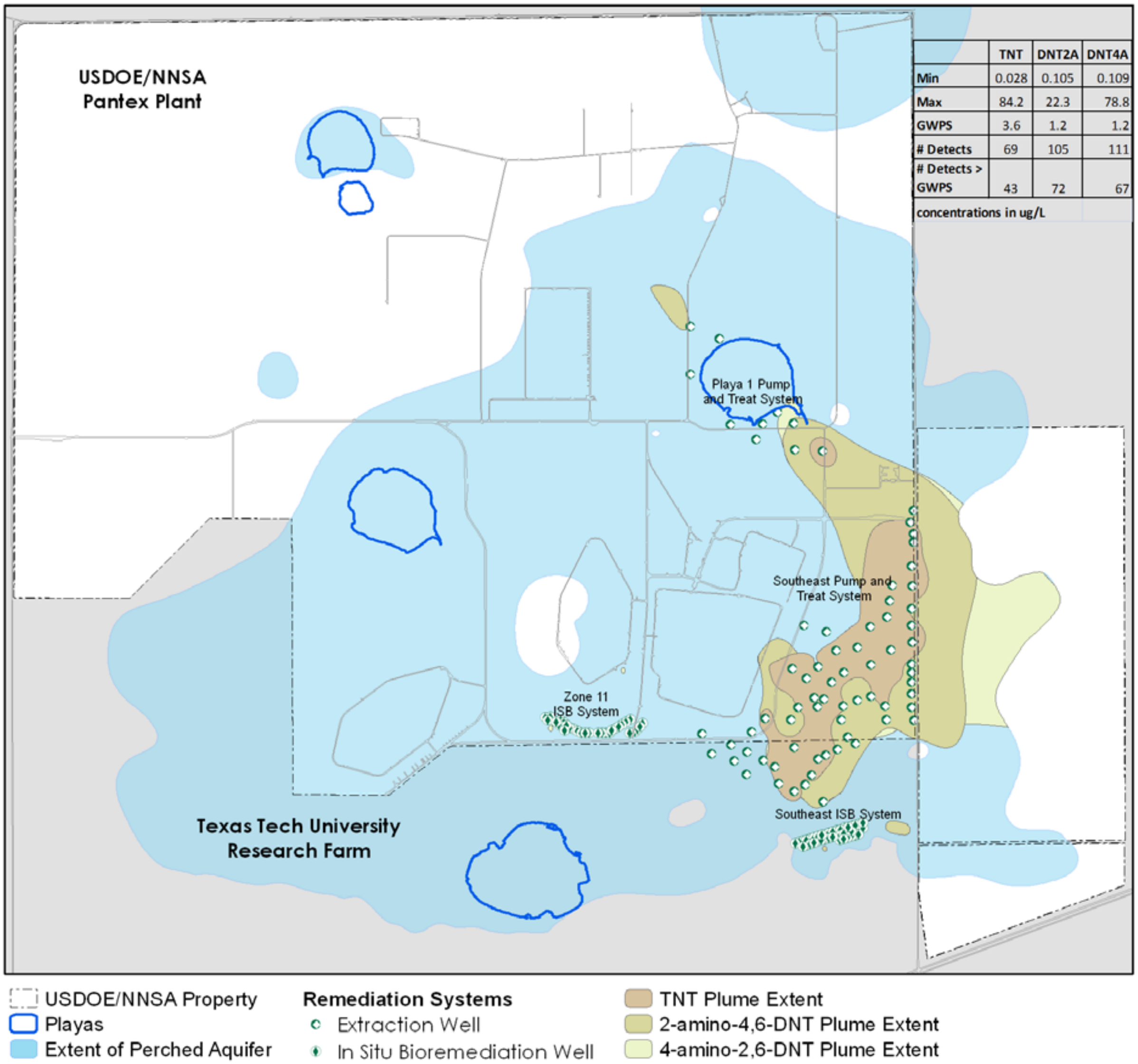
wells by July 2009 after testing analytical methods to ensure they could reliably detect and quantify those products. Because analytical methods are readily available, Pantex has monitored for degradation products of TNT and TCE in the past and continues to monitor for those in key areas.

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 6.10). 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 plume for the final breakdown product, 4-amino-2,6-DNT, extends to the eastern edge 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 6.10.

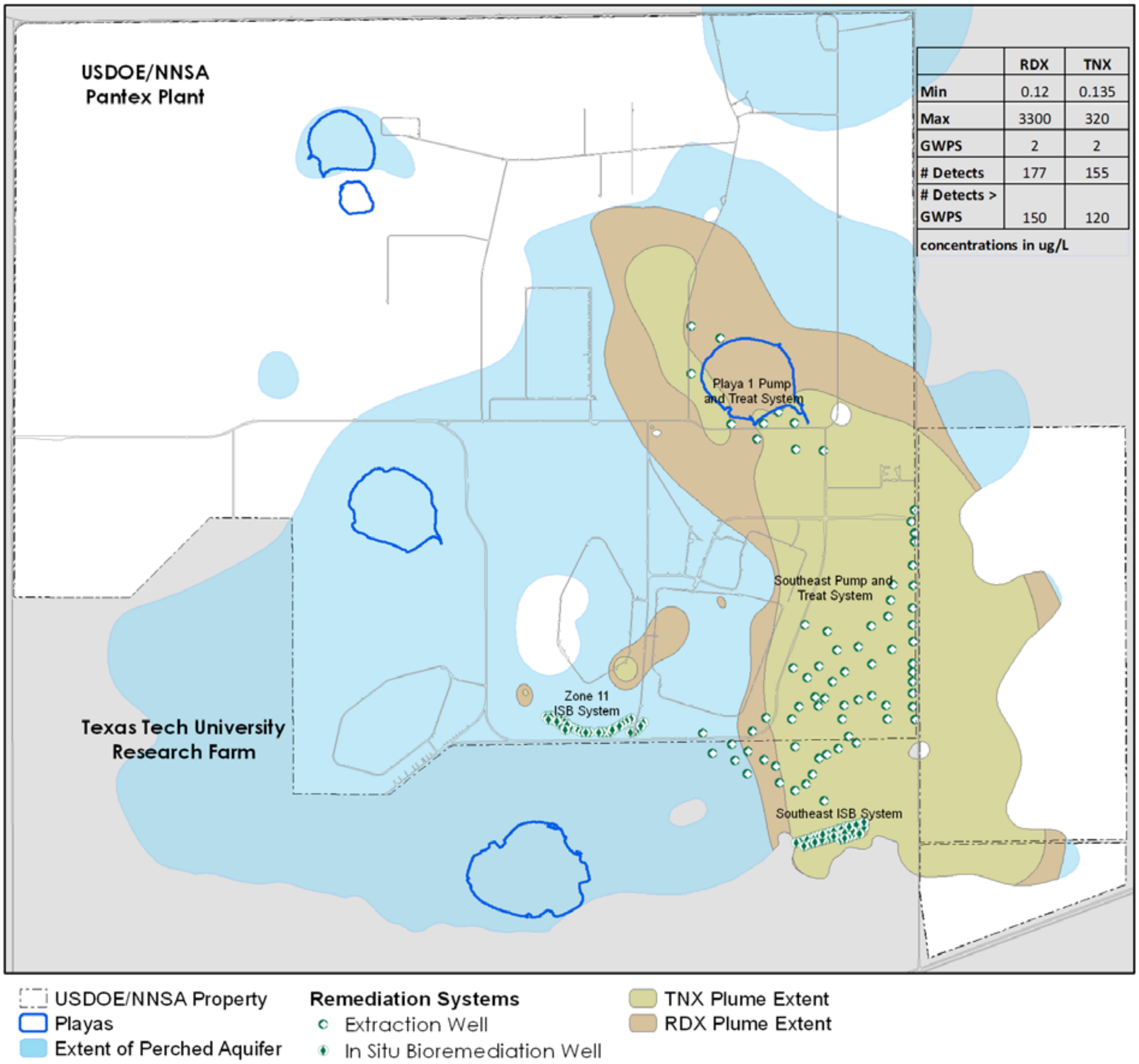
Perched groundwater sampling results for RDX and breakdown products (MNX, DNX, and TNX) indicate that the breakdown products are present throughout most of the RDX plume, with TNX being the most widespread. TNX, the final degradation product, is a better indicator of degradation because the other intermediate 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. As depicted in Figure 6.11, the TNX plume is similar in size and extent to the RDX plume, but at much lower concentrations. 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 breakdown products 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	0.028	0.105	0.109
Max	84.2	22.3	78.8
GWPS	3.6	1.2	1.2
# Detects	69	105	111
# Detects > GWPS	43	72	67
concentrations in ug/L			

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



	RDX	TNX
Min	0.12	0.135
Max	3300	320
GWPS	2	2
# Detects	177	155
# Detects > GWPS	150	120

FIGURE **6.11 –** ***RDX and Degradation Product Plumes***

Drinking Water

Results from routine drinking water compliance monitoring in 2010 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, and adequate levels of disinfectant were maintained in the distribution system. The Pantex Public Water System continues to be recognized by the Texas Commission on Environmental Quality as a "Superior" supply system.

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 (NTNC-PWS) system under 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 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 and its implementing regulations (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 2010 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

Although there are proposed rules that will affect Public Water Systems in the State of Texas, no new regulations affecting the water system at Pantex Plant were promulgated during 2010.

7.3 Water Production and Use

In 2010, Pantex Plant pumped approximately 406 million liters (107 million gallons) from the Ogallala Aquifer. This is an increase of 32 million liters (8.2 million gallons) compared to water produced in 2009. This increase was due, in part, to the draining and refilling of a 2.5 million gallon water storage tank following scheduled maintenance.

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.

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.

7.4 Sampling Locations

Routine drinking water samples were collected at 32 locations during 2010. 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[1]" code because the sampling locations are periodically changed to assure adequate Plant coverage.

7.5 Results

In general, results for drinking water and production well monitoring in 2010 were similar to those reported for 2009. 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.

7.5.1 Radiological Monitoring *(30 TAC §290.108)*

Radiological monitoring is not required for a NTNC-PWS; however, as a best management practice, Pantex Plant routinely monitors for these contaminants. Radiological monitoring results for 2010 documented compliance with 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), additional testing (i.e., isotopic analysis) would be conducted to determine the specific radionuclide involved. All detected radiological constituents for 2010 were below the MCL.

7.5.2 Chemical Monitoring *(30 TAC §290.107)*

Chemical monitoring and 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.

Constituent concentrations in routine samples in 2010 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.

[1] "DR" Indicates an historic designation for drinking water monitoring locations.

TABLE 7.1 — *Drinking Water and Production Well Sampling Locations, 2010*

Description	Location
Chemical and Radiological Sampling	
DR-43	Firing Site 1
DR-115	Building 15-27
Biological and Disinfectant Level Sampling	
DR-116	Building 12-103
DR-117	Building 18-1
DR-118	Building 12-6
DR-119	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.

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 2010	*Typical Source*
Inorganics:						
Antimony	ppm	0.006	NS	NS	< 0.003	Discharge from petroleum refineries, fire retardants, ceramics, electronics, solder
Arsenic	ppm	0.05	0.003	NS	< 0.005	Erosion of natural deposits, discharge from semiconductor mfg., petroleum refineries,
Barium	ppm	2	0.158	0.146	0.108	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	0.182	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	NS	NS	<0.010	Erosion of natural deposits, discharge from steel and/or pulp mills, plating operations
Fluoride	ppm	4	0.97	3.00	< 0.00106	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 Level	BMP samples collected	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 2010	*Typical Source*
Nitrate	ppm	10	1.17	1.45	1.46	Runoff from feedlots and the use of fertilizer, leaching from septic systems, erosion of natural deposits
Nitrite	ppm	1	< 0.01	NS	< 0.04	Runoff from feedlots and the use of fertilizer, leaching from septic systems, erosion of natural deposits
Selenium	ppm	0.05	0.0048	NS	0.0035	Discharge from petroleum refineries, erosion of natural deposits, discharge from mining
Thallium	ppm	0.002	NS	NS	< 0.001	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	6.1	6.1	6.09	Naturally occurring elements found in the soil, manmade materials
Gross Beta photon emitters**	pCi/L	50	8.4	8.4	6.96	Naturally occurring elements found in the soil, manmade materials
Total Radium	pCi/L	5	0.09	0.09	NS	Naturally occurring elements found in the soil, manmade materials
Tritium	pCi/L	20,000	NS	NS	-24.60	Naturally occurring elements found in the soil, manmade materials
Secondary Contaminants:						
Chloride	ppm	300	NS	123	12.96	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 2010	*Typical Source*
Corrosivity	mm/year	Noncorrosive	NS	NS	0.4	A secondary parameter (non-health related) indicating the aggressiveness of water to corrode piping
Iron	ppm	0.3	NS	0.071	0.107	Naturally occurring elements found in the soil
Manganese	ppm	0.05	NS	NS	< 0.005	Naturally occurring elements found in the soil
Total Trihalomethanes: samples taken at DR-43						
Chloroform	ppm	- -	0.0011	0.0041	0.0025	By-Product of Chlorination
Bromodichloromethane	ppm	- -	0.0038	0.0081	0.0029	By-Product of Chlorination
Chlorodibromomethane	ppm	- -	0.0072	0.0128	0.0034	By-Product of Chlorination
Bromoform	ppm	- -	0.0047	0.0064	0.0019	By-Product of Chlorination
Sum of all TTHMs	ppm	**0.08**	**0.022**	**0.044**	**0.011**	By-Products of Chlorination
Total Haloacetic Acids: samples taken at DR-43						
Monochloroacetic Acid	ppm	- -	0.0013	NS	<0.003	By-Product of Chlorination
Monobromoacetic Acid	ppm	- -	0.0024	NS	0.0008	By-Product of Chlorination
Trichloroacetic Acid	ppm	- -	0.0012	NS	0.0005	By-Product of Chlorination
Dibromoacetic Acid	ppm	- -	0.0053	NS	0.0011	By-Product of Chlorination
Dichloroacetic Acid	ppm	- -	0.0019	NS	0.0022	By-Products of Chlorination
Sum of all HA Acids:	ppm	**0.06**	**0.015**	**0.0019**	**0.0046**	By-Products of Chlorination
Water Quality Constituents:						
Alkalinity	ppm	- -	NS	189.2	219	Naturally occurring elements found in the soil
Calcium Hardness	ppm	- -	NS	246	183	Naturally occurring elements found in the soil
Chloride	ppm	- -	NS	123	12.96	Naturally occurring elements found in the soil
Chlorine	ppm	0.2 min. 4.0 max.	0.2 min 2.4 max	0.02 min. 2.2 max.	0.82 min. 2.13 max.	Liquid chlorine used as a disinfectant

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 2010	*Typical Source*
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)						

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[2] 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.

Two samples were slightly above the Action Level of 0.015 mg/L for lead. This is likely due to aging plumbing materials such as solder, or insufficient water consumption/usage at the sampling location. The two elevated results were 0.061 and 0.017 mg/L. Corrective measures to replace a waterline are underway.

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 drinking water at Pantex is chlorinated, prior to entry into the distribution system. The results are provided in Table 7.2.

[2] 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.

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: Total trihalomethanes (TTHMs) and Haloacetic Acids (HAA5). TTHMs 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 Inspections

As a cooperative effort between B&W Pantex and the TCEQ, a TCEQ contractor collected samples for residual chlorine and nitrite from the drinking water supply system in September 2010. In July, the TCEQ Region 1 office conducted a Comprehensive Compliance Inspection of the Pantex Public Drinking Water system. Results of this testing demonstrates that Pantex Plant meets or exceeds the related requirements of the Safe Drinking Water Act for Public Water Supplies.

Wastewater

B&W Pantex 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 collected in the sanitary sewer, managed in the WWTF, and are either disposed through a permitted outfall[1] to an underground irrigation system or discharged to an onsite playa lake through the permitted outfall. The playa is an ephemeral lake and is not connected to any other lakes, rivers, or streams (Figure 8.1).

FIGURE 8.1 — *Playa 1*

The WWTF (Figure 8.2) 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 8.3).

[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 Treatment Facility, Facultative Lagoon*

FIGURE 8.3 — *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. Below the surface and above the bottom of the lagoon, 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 2010, Pantex had three authorizations for wastewater disposal. These authorizations require analytical monitoring and periodic reporting to the TCEQ. Firstly, Pantex is permitted to dispose of treated wastewater by means of a subsurface irrigation system into agricultural fields for beneficial reuse. This permit is referred to as a Texas Land Application Permit (TLAP, WQ0004397000). Secondly, 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 authorizations, 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[2]. This irrigation system consists of more than 700 miles of piping, tubing, and pressure-compensating drip emitters. The irrigation area consists 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 2010, B&W Pantex beneficially applied approximately 221.7 million gallons of treated wastewater and perched groundwater to crops managed by TTU. This is an increase of 10 million gallons compared to operations during 2009. This 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 700 million gallons of all treated wastewater (i.e., domestic, industrial and treated water from Environmental Restoration activities) for crop production. During 2010, corn, opportunity wheat and winter wheat were grown. Table 8.1 shows the volume of water applied for each irrigation tract.

[2] Pantex is currently in the process of adding an additional 100-acre tract of irrigated land. It is anticipated that this will be operational in 2011.

TABLE 8.1— *Annual Irrigation Summary, 2010*

Irrigation Tract	Irrigation Area (acres)	Volume Applied (gallons)	Volume Applied (acre ft./ac)
101	100.86	80,724,841	2.46
201	100.5	43,102,581	1.32
301	98.75	97,854,565	3.04

8.3 Sampling Locations

Sampling was conducted at the incoming weir of the lagoon system (before treatment) and at the permitted discharge points: (a) for the subsurface irrigation system, Outfall 031, or (b) for the surface water discharge, Outfall 001. Monitoring the water quality at the incoming weir was done to determine the effectiveness of the wastewater treatment system. Results of these efforts showed that the treatment system adequately treats the wastewater to comply with all effluent limitations. 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 2010, there was no discharge through, and thus no sampling at, Outfall 001.

8.4 Analytical Results

Sampling was routinely conducted at permitted Outfall 031. Permit-required analyses were reported to the TCEQ in December 2010. There were no exceedances under either permit. A summary of the results from 2010 is shown in Table 8.2.

Approximately 439 water 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 36 samples were collected from the influent weir and 12 samples for miscellaneous (non-permitted) constituents. These efforts provide information on the treatment capability and efficiency of the wastewater treatment system. Results from soil monitoring in the irrigation application area are provided in Chapter 10 of this report.

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 2009, and during previous years.

TABLE 8.2 — *Water Quality Results from Outfall 031, 2010*

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	0.001	< 0.003	< 0.003	0/0	100
Arsenic	0.3	0.002	< 0.007	< 0.004	0/0	100
Beryllium	Report	0.0001	< 0.0005	< 0.0005	0/0	100
Cadmium	0.2	< 0.001	< 0.001	< 0.001	0/0	100
Chromium	5.0	0.001	0.003	0.002	0/0	100
Cobalt	Report	< 0.005	< 0.005	< 0.005	0/0	100
Copper	2.0	0.004	0.095	0.028	0/0	100
Lead	1.5	0.001	0.004	0.001	0/0	100
Manganese	3.0	0.013	0.049	0.024	0/0	100
Mercury	0.01	< 0.0002	< 0.0002	< 0.0002	0/0	100
Molybdenum	Report	0.004	< 0.010	< 0.010	0/0	100
Nickel	3.0	0.002	0.003	0.002	0/0	100
Selenium	0.2	0.001	< 0.005	< 0.005	0/0	100
Silver	0.2	0.001	< 0.005	< 0.005	0/0	100
Thallium	Report	0.0003	0.0006	0.0004	0/0	100
Titanium	Report	0.002	0.012	0.005	0/0	100
Zinc	6.0	0.005	0.040	0.013	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

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	< 0.11	0.98	0.31	0/0	100
BOD	Report	9.9	32.9	16.88	0/0	100
COD	Report	21.0	74.0	42.13	0/0	100
NO2/NO3	Report	0.06	0.49	0.22	0/0	100
Oil/Grease	Report	1.5	4.8	2.5	0/0	100
PH	6.0 Min. 10.0 Max.	8.1	9.1	8.4	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.

Surface Water

Data from the surface water program during 2010 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. No significant changes were made to the surface water sampling program in 2010. None of the sampling results obtained indicate any new impacts to the environment.

9.1 The Scope of the Program

Pantex Plant is located in a region of relatively flat topography and with a semi-arid climate. 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 of these 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 playas. 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 — *Surface Water Sampling at Playa 1*

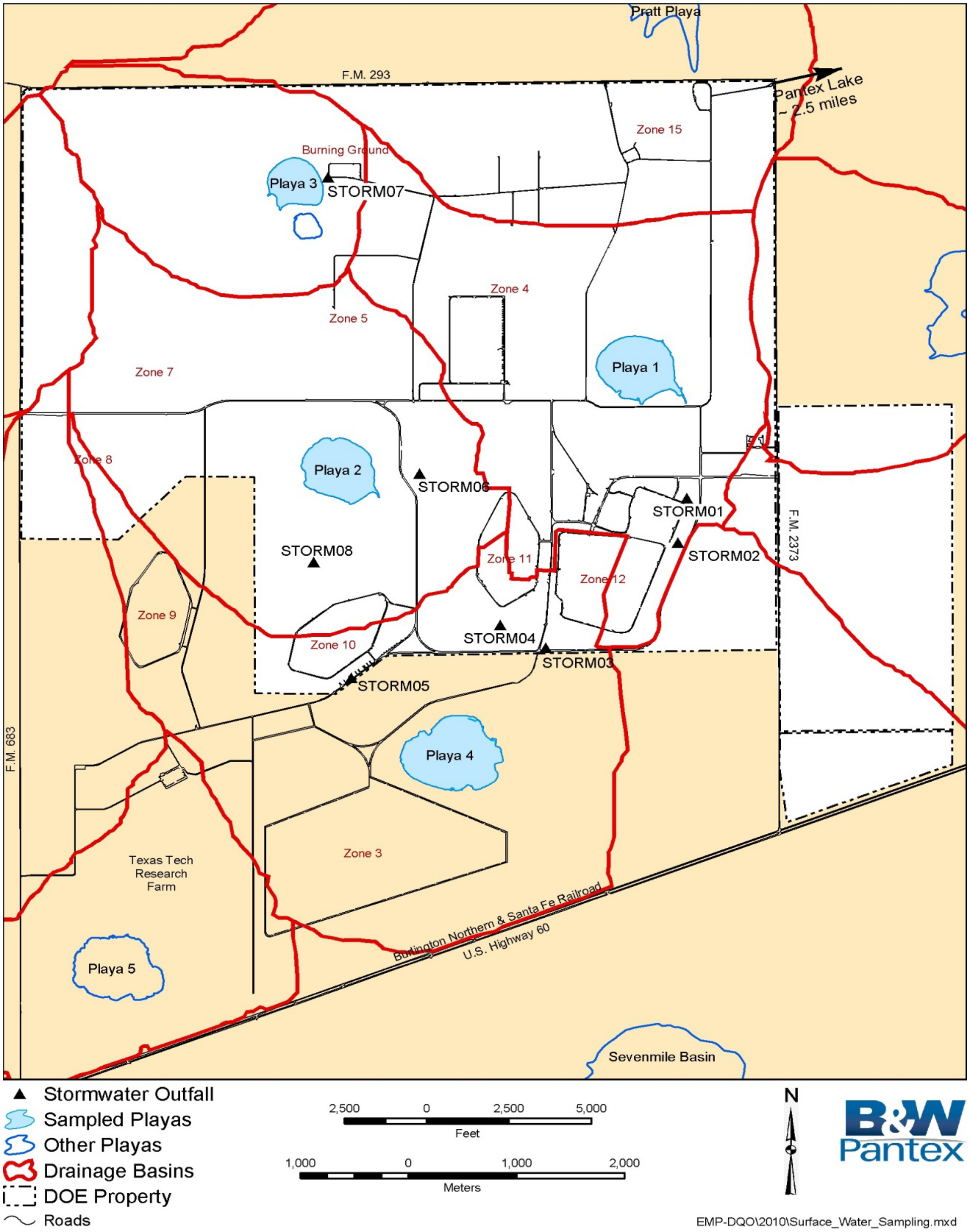


FIGURE 9.2 — *Drainage Basins, Playas, and Storm Water Outfalls at Pantex Plant*

Effluent from the Wastewater Treatment Facility (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 2010, storm water and playa sampling were conducted in accordance with permits issued by the Texas Commission on Environmental Quality (TCEQ) and Data Quality Objectives developed by B&W Pantex media scientists.

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*

The State of Texas was delegated permitting authority for construction storm water from the U.S. Environmental Protection Agency. Therefore, the TCEQ developed a 5-year general permit (TPDES General Permit No TXR 150000, Relating to Storm Water Discharges Associated with Construction Activites) for construction storm water which expires in March 2013. Under this permit, two TPDES general permits relating to storm water discharges associated with construction activities at Pantex were in effect at the end of 2010. 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. 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 2010 at designated sampling locations in accordance with permit requirements. Environmental surveillance monitoring was also conducted at selected locations as a best management practice. Appendix A lists the 2010 surface water analytes. 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 2010, sampling was conducted at all 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 2010 was above normal with approximately 67.4 cm for the year (26.54 inches). The annual average amount each year is typically 50.1 cm (19.71 inches). A record rainfall event occurred at the Site during the evening of July 7, 2010. Approximately 25 cm (10 inches) of rain resulted in significant flooding at the Pantex site.

Storm water monitoring required by the TPDES MSGP in 2010 consisted of both visual monitoring and analytical monitoring. Both are required each year of the duration of the MSGP. 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 2010 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 2010. Sector-specific analytes are compared to benchmarks listed in the General Permit. All eight storm water outfalls had sufficient flow for sampling during 2010. Sampling is weather-dependent and was conducted quarterly as storm events occurred. Because of the size of the Pantex site, some outfalls have sufficient flow while others across the Plant will not receive enough flow for sampling. Table 9.1 lists the metal analyte results from the storm water outfalls in 2010 and compares them with the IWQPs.

Environmental surveillance sampling was conducted at the four onsite 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 2010 included a dozen different metals, approximately 60 different volatile organic compounds (VOCs), 60 semi-volatile organic compounds (SVOCs), and a suite of 15 different 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 were 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.

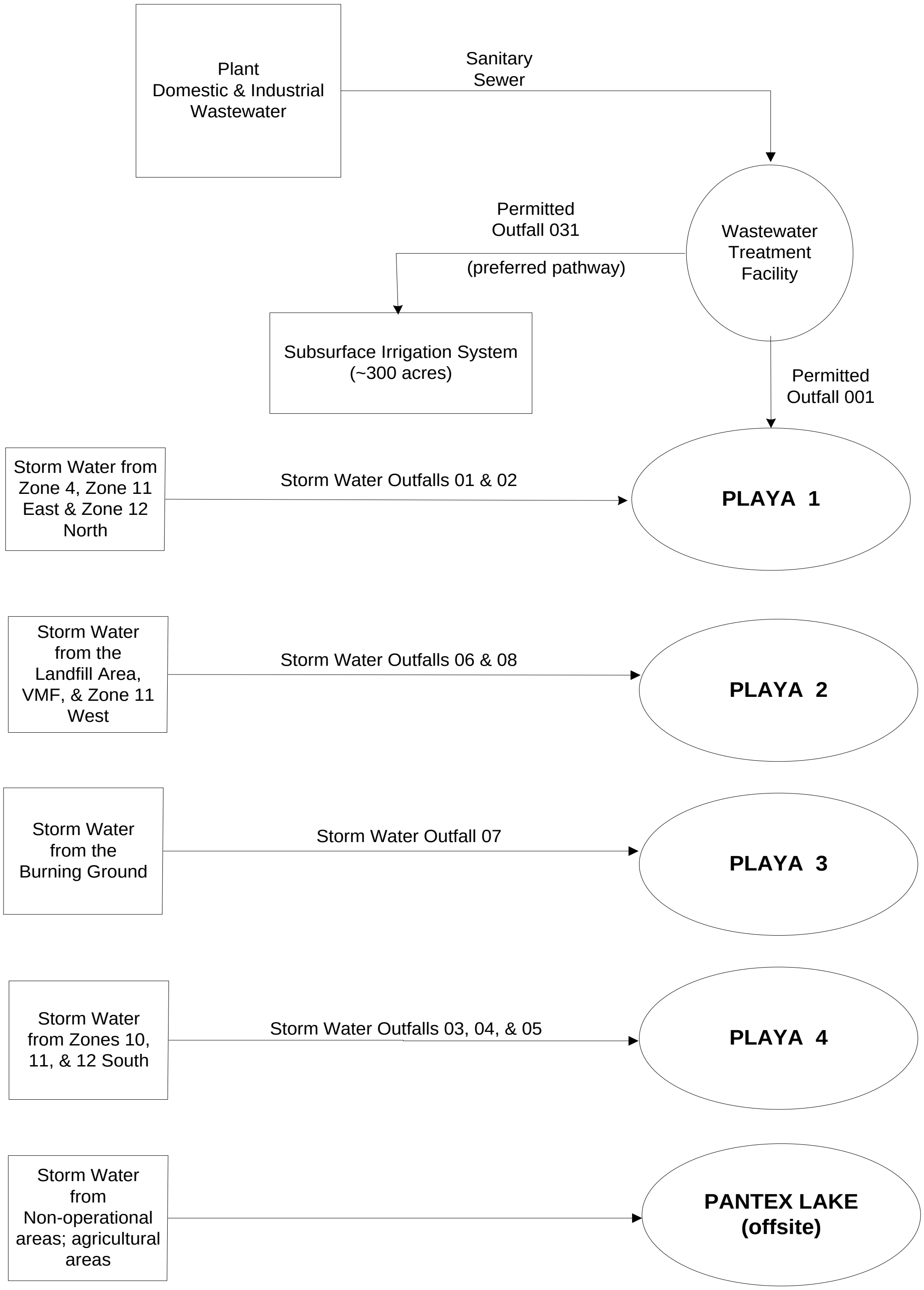


FIGURE 9.4 — *Pantex Surface Water Schematic, 2010*

TABLE 9.1 — *Annual Storm Water Results (metals), 2010 (mg/L)*

	Outfall STORM01	Outfall STORM02	Outfall STORM03	Outfall STORM04	Outfall STORM05	Outfall STORM06	Outfall STORM07	Outfall STORM08	IWQP
Arsenic	0.00177	0.00183 <0.010 <0.010	<0.005 0.0035 <0.010	<0.005 <0.010 <0.010	<0.005	0.003	<0.005	0.003 0.004	**0.3**
Barium	0.144	0.101 0.188 0.0778	0.0871 0.236 0.0789	0.088 0.031 0.031	0.063	0.174	0.217	0.119 0.121	**4.0**
Cadmium	0.00036	<0.001 0.188 0.0778	<0.001 0.00037 <0.0005	0.0004 <0.0005 <0.0005	0.0001	0.0002	0.0002	0.0002 0.0001	**0.2**
Chromium	0.00277	<0.010 0.0091 0.0086	<0.010 0.0141 0.0104	0.003 0.008 0.009	<0.01	<0.01	<0.01	0.004 0.004	**5.0**
Copper	0.00958	0.00302 0.00370 0.0024	0.00268 0.0101 0.0029	0.005 0.002 0.002	0.004	0.004	0.003	0.005 0.006	**2.0**
Lead	0.00288	0.00130 0.00250 0.0014	0.00113 0.0086 0.0013	0.002 0.0007 0.0006	<0.002	0.001	0.0008	0.002 0.002	**1.5**
Manganese	0.0549	0.0298 0.0458 0.0292	0.0315 0.142 0.0277	0.055 0.016 0.013	0.025	0.187	0.019	0.050 0.054	**3.0**
Mercury	<0.0002	<0.0002	<0.0002	<0.0002 <0.0002 0.00007	<0.0002	<0.0002	<0.0002	<0.0002 <0.0002	**0.01**
Nickel	0.00369	0.0016 0.0034 0.0024	0.00155 0.0093 0.0026	0.004 0.002 0.002	0.002	0.004	0.002	0.004 0.004	**3.0**
Selenium	0.00114	<0.005 0.0012 0.00069	<0.005 0.00075 0.00085	<0.005 0.0008 0.0006	<0.005	<0.005	0.001	<0.005 <0.005	**0.2**
Silver	<0.001	<0.001 0.0013 0.00024	<0.001 0.0013 0.00024	0.0003 <0.002 <0.002	<0.001	<0.001	<0.001	<0.001 <0.001	**0.2**
Zinc	0.0699	0.023 0.0222 0.0166	0.0155 0.0712 0.0182	0.045 0.012 0.008	0.005	0.009	0.007	0.014 0.016	**6.0**

IWQP= Inland Water Quality Parameter limits, 30 TAC §319.22

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 originates from some of the operational areas of Zone 12 North.

The western edge of Playa 1 receives storm water runoff from the Zone 4 area. Two additional drainages transport storm water runoff from agricultural areas that are north of the playa. In 2010, 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 second and third quarters during 2010 for metals, VOCs, SVOCs, explosives, and radionuclides (Figure 9.5). Metals analyses in 2010 at Playa 1 were all consistent with historic levels found at the playa and all were below the IWQPs. VOCs and SVOCs were below their respective PQLs. Radiological sampling conducted at Playa 1 during 2010 involved co-sampling with the TDSHS during the month of April and again in July. Tritium was below the MCL for drinking water. Isotopic radiological analyses for uranium and plutonium were below the DCGs for ingested water.

During the second quarter, the explosives HMX and RDX were both detected at 0.001 mg/l, slightly above their PQLs (0.0005 mg/l). These explosive detections have occurred at similarly low levels at Playa 1 in past years.

FIGURE 9.5 — ***Sampling at Playa 1***

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 ditch and on northward, finally discharging into Playa 1. BN5A is the Pantex Plant designation for the parking lot located north of operational areas, south of Playa 1, and west of agricultural areas, along which the aforementioned ditch runs on the east side.

Permit-required monitoring at Storm Water Outfall 01 was conducted during all four quarters of 2010. 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

2010.

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 second, third, and fourth quarters of 2010. 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 2010.

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 2010, 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 of 2010 for metals, VOCs, SVOCs, explosives, and radionuclides. Metals analyses at Playa 2 were all consistent with historic levels found at the playa and all metals were below the IWQPs. VOCs and SVOCs were below their respective PQLs. Tritium was below the MCL for drinking water. Isotopic radiological analyses for uranium were below the DCGs for ingested water.

During the third quarter, the explosive 2-nitrotoluene was detected at Playa 2 at 0.001 mg/l (PQL, 0.0005 mg/l). The slight detection of this explosive was a first since sampling for 2-nitrotoluene began in 2004. Follow-up sampling could not be performed in 2010 due to dropping water levels in the playa. Subsequent sampling, as water becomes available, will monitor this analyte in the future.

Storm Water Outfall 06 —Vehicle Maintenance Facility (VMF). This outfall receives storm water runoff from an area that includes the VMF and 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 recently re-paved lot 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 2010. 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 in 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 2010.

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 second, third, and fourth quarters in 2010. 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 and iron (1.3 mg/l) on two instances; however, both were normal based on historical data. All metals at the outfall were below IWQPs in 2010.

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 quarter of 2010 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. Radiological sampling conducted at Playa 3 during 2010 included co-sampling with the TDSHS during the month of July. Tritium was below the MCL 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).

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

Permit-required monitoring at Storm Water Outfall 07 was conducted during the third quarter of 2010. 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 2010.

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 primarily from pasture areas but does receive 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 2010, 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 second and third quarters during 2010 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. Radiological sampling conducted at Playa 4 during 2010 included co-sampling with the TDSHS during the month of July. Tritium was below the MCL 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 the second, third, and fourth quarters of 2010. 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 2010.

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 (Figure 9.7). Storm water from this area discharges southward to Playa 4. There are no industrial effluents discharged through this outfall.

Permit-required monitoring at Storm Water Outfall 04 was conducted during the second and third quarters of 2010. 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 2010.

Storm Water Outfall 05—Zone 10 South. Surface 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. Some of the laydown yards contain overhead storage tanks for re-fueling vehicles and heavy equipment. Waste staging, primarily scrap metal, is conducted in the area as well as container staging. Drainage in this vicinity is very flat. There are no industrial effluents discharged through this outfall.

FIGURE 9.7 — *Monitoring Equipment at STORM 04*

Permit-required monitoring at Storm Water Outfall 05 was conducted during all four quarters of 2010. 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 2010.

9.2.5 Pantex Lake

Pantex Lake is the largest playa controlled by the DOE and B&W Pantex and is approximately 136 hectares (337 acres). 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. Since there are no Plant operations within the Pantex Lake watershed and a significant amount of historical data has been collected, monitoring at Pantex Lake was discontinued in 2004.

9.3 Historical Comparisons

Sampling results from storm water outfalls during 2010 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 2010 were very similar with past monitoring results.

Metals, explosives, VOCs, SVOCs, and radionuclides remain relatively unchanged at the playas. This information continues to support the conclusion 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. 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.

Soils

Results of permit required soil monitoring are reported in this chapter. Results of soil monitoring conducted at the Burning Ground in 2010 were, with one exception, within established background comparison values. Results of soil monitoring conducted at the subsurface irrigation site were consistent with previous year's results and indicate operations are having no negative impact to the environment.

10.1 The Scope of the Program

This chapter presents the results of soil sampling at Pantex Plant during 2010. Surface 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). Subsurface soil samples were also collected onsite and analyzed for parameters in accordance with Provision V.I of the Pantex Plant Texas Land Application Permit (TLAP WQ0004397000). All samples were analyzed by offsite contract laboratories that meet U.S. Environmental Protection Agency requirements as discussed in Chapter 13, Quality Assurance. Specific analytes are listed in Appendix A.

10.2 Burning Ground Surface Soil Sampling and Analysis

In 2010, surface 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 2010, soil was sampled at five onsite locations, representing three upland and two playa sampling areas associated with the Burning Ground.

10.2.1 Surface Soil Data Comparisons

The background comparison levels were determined by obtaining samples during three consecutive calendar quarters in 2006 for each monitoring parameter indicated in Table VI.D.2.b of Permit HW-50284. If all 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 less than 50 percent of the analytical results 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.

The complete Burning Ground soil sampling results are reported to the Texas Commission on Environmental Quality in an Annual Burning Ground Monitoring Report. Assessment of the contaminant risk and remediation of the Burning Ground, if appropriate, is part of the B&W Pantex Environmental Restoration

Program.

10.2.2 Surface Soil Analytical Results

Analytical results are summarized in the following sections. Results for metals are reported in section 10.2.3 and explosive compounds are reported in section 10.2.4.

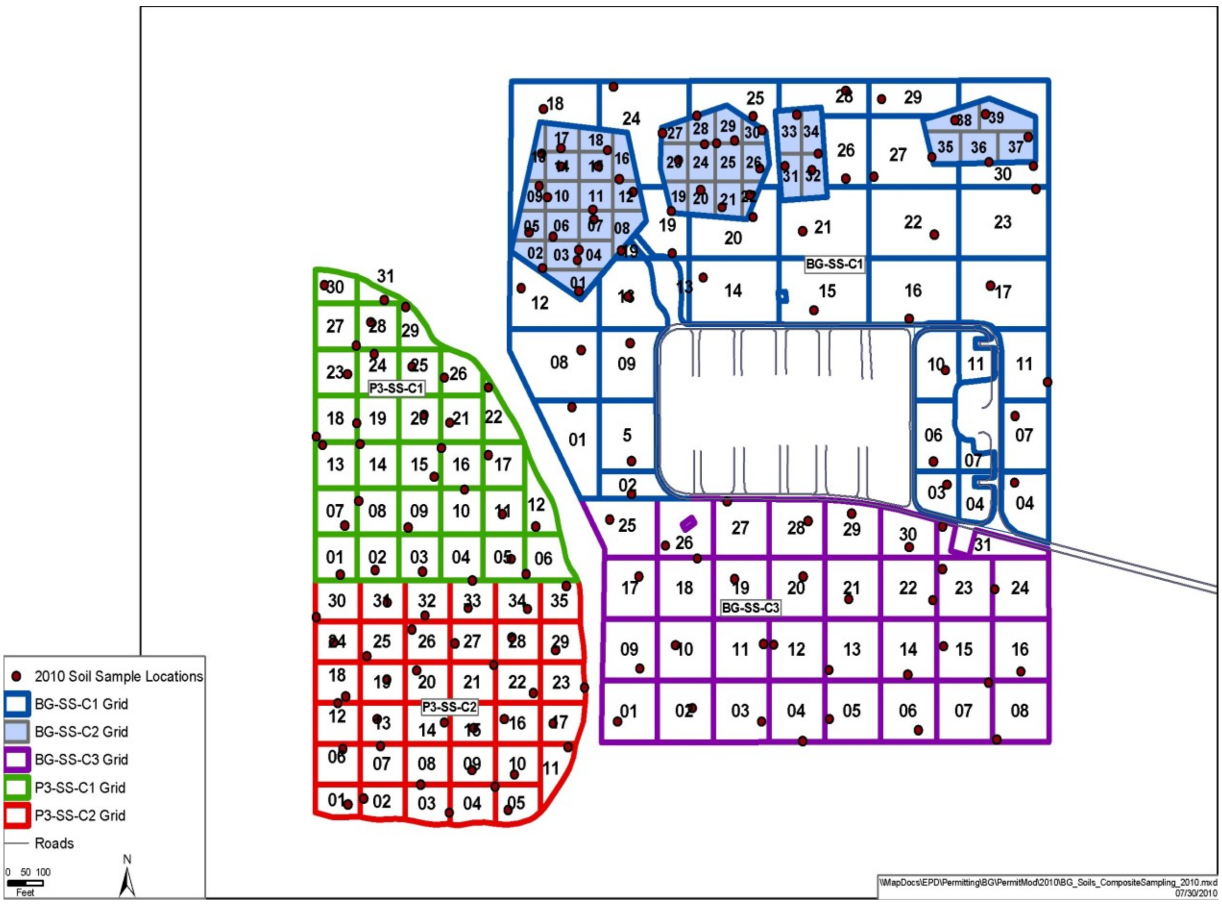


FIGURE 10.1 — *Burning Ground Multi-Incremental Soil Sampling Locations for 2010*

10.2.3 Surface Soil Metals Analysis

Soil samples collected from the Burning Ground and Playa 3 were analyzed for 10 metals (See the "BG Soil" column in Appendix A). All of the metal concentrations observed in 2010 were below the established permit background concentrations.

10.2.4 Surface Soil Explosives Analysis

Soil samples collected from the Burning Ground and Playa 3 were analyzed for eight explosive compounds (Appendix A). With the exception of RDX at sampling location BG-SS-C3, all sampling results for explosives in 2010 were below the established permit background concentrations. The initial sampling results indicated a potential statistically significant increase (SSI) for RDX (1.9 mg/kg). The established background concentration is 1.8 mg/kg for RDX at this location. The result from confirmation sampling, as provided for in Provision VI.F.1.a of Permit HW-50284, was 1.6 mg/kg for RDX, which is below the established background value at location BG-SS-C3.

10.3 Subsurface Drip Irrigation System Soil Sampling and Analysis

In 2010, the annual TLAP subsurface drip irrigation system soil samples were collected from three locations, Tract 101, Tract 201, and Tract 301, with each tract representing no more than 100 acres. Samples were collected individually at zones of 0-6, 6-18, and 18-30 inches, with each composite sample consisting of 18 subsamples. These composite samples were analyzed for agricultural parameters, high explosives (HE), metals, reactivity, herbicides, pesticides, semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs). See the TLAP Soil column in Appendix A for specific analytes.

10.3.1 Subsurface Drip Irrigation System Soil Sampling Results

The 2010 subsurface soil sampling results for HE, SVOCs, VOCs, reactivity, herbicides, and pesticides, with the exception of the pesticide heptachlor-epoxide from the 6-inch composites at Tracts 101 (0.00056 mg/kg) and 201 (0.0004 mg/kg), were all non-detects. Heptachlor-epoxide is a by-product of the pesticide heptachlor mixing with oxygen in the environment. The commercial sale of heptachlor in the United States was banned in 1988, and its use is currently restricted to controlling fire ants in power transformers. Heptachlor is known to stay in soil for long periods of time. Any heptachlor-epoxide in the soils would be from past practices (prior to 1988), and no changes in pesticide management practices at the Plant would be required.

The results of the agricultural parameters (nutrient parameters analyzed on a plant available or extractable basis) and metals are presented in Tables 10-1 through 10-3.

The TLAP subsurface soil sampling results are reported annually to the Texas Commission on Environmental Quality as report only information, with no comparison values. The agricultural parameters are also used for decision making regarding the addition of nutrient amendments to the agricultural soils.

10.4 Conclusions

With the exception noted for the initial RDX results, onsite Burning Ground surface soil monitoring results for 2010 were within the concentration ranges of the established background levels.

TABLE 10.1 — *TLAP Soil Results from Tract 101*

Analyte	6-Inch Depth Measured Value	18-Inch Depth Measured Value	30-Inch Depth Measured Value	Unit of Measurement
Agricultural Parameters[1]				
pH (1:1 ratio soil pH)	6.9	7.7	7.9	pH Units
Conductivity (S Salts 1:1)	0.59	0.54	0.52	MMHOS/CM
Nitrate (as Nitrogen)	13.6	7.3	4.6	MG/KG
Ortho Phosphate	15.0	3.0	2.0	MG/KG
Potassium	687.0	428.0	381.0	MG/KG
Sulfur	16.0	15.0	16.0	MG/KG
Calcium	3,083.0	4,671.0	5,897.0	MG/KG
Magnesium	573.0	787.0	950.0	MG/KG
Sodium	38.0	100.0	173.0	MG/KG
Boron	0.63	0.29	0.37	MG/KG
Total Nitrogen	1,162.0	1,092.0	504.0	MG/KG
Sodium Absorption Ratio (SAR)	0.60	1.2	1.9	
Metals[2]				
Arsenic	3.15	3.60	3.64	MG/KG
Barium	126.0	135.0	488.0	MG/KG
Cadmium	0.49	0.40	0.42	MG/KG
Chromium	16.3	17.1	16.2	MG/KG
Lead	13.6	13.7	12.8	MG/KG
Mercury	0.02	0.01	0.02	MG/KG
Silver	0.34	0.46	0.34	MG/KG
Selenium	< 1.16	< 1.18	< 1.20	MG/KG

[1] Nutrient parameters analyzed on a plant available or extractable basis, and used decision making regarding the addition of nutrient amendments to the agricultural soils.
[2] Results reported annually to the Texas Commission on Environmental Quality as report only information.

TABLE 10.2 — *TLAP Soil Results from Tract 201*

Analyte	6-Inch Depth Measured Value	18-Inch Depth Measured Value	30-Inch Depth Measured Value	Unit of Measurement
Agricultural Parameters				
pH (1:1 ratio soil pH)	6.7	7.8	8.1	pH Units
Conductivity (S Salts 1:1)	0.45	0.58	0.66	MMHOS/CM
Nitrate (as Nitrogen)	3.3	1.5	1.4	MG/KG
Ortho Phosphate	6.0	2.0	2.0	MG/KG
Potassium	613.0	378.0	353.0	MG/KG
Sulfur	12.0	14.00	19.0	MG/KG
Calcium	2,674.0	5,006.0	5,841.0	MG/KG
Magnesium	513.0	807.0	903.0	MG/KG
Sodium	64.0	172.0	216.0	MG/KG
Boron	0.49	0.20	0.33	MG/KG
Total Nitrogen	1,015.0	668.0	504.0	MG/KG
Sodium Absorption Ratio (SAR)	0.9	1.9	2.2	
Metals				
Arsenic	3.49	3.88	3.69	MG/KG
Barium	134.0	154.0	337.0	MG/KG
Cadmium	0.47	0.40	0.35	MG/KG
Chromium	19.7	22.1	20.7	MG/KG
Lead	14.2	13.1	12.2	MG/KG
Mercury	0.01	< 0.01	< 0.01	MG/KG
Silver	0.17	< 0.55	0.17	MG/KG
Selenium	1.00	< 1.23	< 1.19	MG/KG

TABLE 10.3 — *TLAP Soil Results from Tract 301*

Analyte	6-Inch Depth Measured Value	18-Inch Depth Measured Value	30-Inch Depth Measured Value	Unit of Measurement
Agricultural Parameters				
pH (1:1 ratio soil pH)	7.0	7.7	8.1	pH Units
Conductivity (S Salts 1:1)	1.15	0.7	0.62	MMHOS/CM
Nitrate (as Nitrogen)	2.2	2.6	2.6	MG/KG
Ortho Phosphate	9.0	3.0	2.0	MG/KG
Potassium	565.0	405.0	378.0	MG/KG
Sulfur	125.0	33.0	22.0	MG/KG
Calcium	3,950.0	5,408.0	5,932.0	MG/KG
Magnesium	541.0	817.0	902.0	MG/KG
Sodium	74.0	158.0	192.0	MG/KG
Boron	0.21	0.20	0.35	MG/KG
Total Nitrogen	841.0	650.0	579.0	MG/KG
Sodium Absorption Ratio (SAR)	0.7	1.5	2.2	
Metals				
Arsenic	2.75	3.49	3.19	MG/KG
Barium	118.0	156.0	138.0	MG/KG
Cadmium	0.45	0.42	0.41	MG/KG
Chromium	14.5	17.7	20.4	MG/KG
Lead	13.0	13.5	12.7	MG/KG
Mercury	0.02	0.01	0.03	MG/KG
Silver	0.48	0.63	0.43	MG/KG
Selenium	< 1.14	< 1.19	< 1.17	MG/KG

Fauna

No changes in the faunal monitoring program were made for 2010. Radionuclide concentrations in faunal samples (black-tailed prairie dogs and cottontail rabbits) were compared to historical values and values observed in samples from control locations. Comparisons indicated no detrimental impacts from Plant operations in 2010.

11.1 The Scope of the Program

Faunal surveillance is complementary to air, flora, and water 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 had an impact on them. Prairie dogs and cottontail rabbits were the species selected for sampling because they interact with both primary (air, water) and secondary (vegetation) environmental media also 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. Cottontail rabbits were sampled for radionuclides, because the rabbits are present across the Plant, including around work areas in Zones 4 and 12. The results of faunal sampling are summarized in Sections 11.2 and 11.3.

11.2 Radiological Surveillance in Fauna

Radionuclide surveillance of fauna at Pantex was scheduled semi-annually at nine onsite locations and one control location. 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. However, no prairie dogs or cottontails were available for sampling at the FS-4 and 12-36 sites in 2010. Control samples are collected at Buffalo Lake National Wildlife Refuge near Umbarger, Texas (Randall County). 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 2010 faunal sampling are presented in Table 11.1 (prairie dogs) and 11.2 (cottontails), as are the historical means (1997-2000) for prairie dogs. Eighteen prairie dogs and five cottontails were sampled. Although historic means are not established for cottontails, which have just been sampled during the previous three years, or for prairie dogs collected at the site west of Zone 4, all 2010 results (maximum values or means) for cottontail and prairie dog samples were below minimum detection activity (MDA) levels or were similar to or less than historic data.

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 for cause-of-death analysis should an outbreak be suspected or indicated.

TABLE 11.1 — *Tritium, $^{233/234}$U, and ^{238}U in Prairie Dogs in 2010, in pCi/g Dry Weight*

Location	No. of Samples (# ≤ MDA)	Maximum[a]	Minimum[a]	Mean ± Std.[b]	No. of Samples in 1997-2000	1997-2000 Mean ± Std
Tritium						
Zone 4 (W)	2 (2)	-0.264[c] ± 0.706	-0.470 ± 0.712	-0.367 ± 0.146	--	--
Zone 8	2 (2)	0.063 ± 0.282	-0.040 ± 0.280	0.011 ± 0.073	14	0.017 ± 0.065
Playa 2	2 (2)	0.100 ± 0.282	0.088 ± 0.267	0.094 ± 0.008	14	0.055 ± 0.136
Burning Ground	4 (4)	0.027 ± 0.730	-0.665 ± 0.763	-0.191 ± 0.320	11	0.152 ± 0.300
Playa 3	4 (4)	0.482 ± 0.767	-0.630 ± 0.637	0.014 ± 0.468	14	0.019 ± 0.070
FS-4[d]	--	--	--	--	--	--
12-36[d]	--	--	--	--	--	--
Buffalo Lake[e]	4 (4)	0.371 ± 0.759	-0.084 ± 0.262	0.164 ± 0.206	14	0.015 ± 0.055
$^{233/234}$Uranium						
Zone 4 (W)	2 (0)	0.022 ± 0.011	0.007 ± 0.005	0.015 ± 0.010	--	--
Zone 8	2 (2)	0.006 ± 0.009	0.003 ± 0.010	0.004 ± 0.002	11	0.012 ± 0.019
Playa 2	2 (2)	0.007 ± 0.010	0.005 ± 0.009	0.006 ± 0.002	11	0.013 ± 0.022
Burning Ground	4 (2)	0.128 ± 0.028	0.006 ± 0.005	0.041 ± 0.058	9	0.018 ± 0.040
Playa 3	4 (2)	0.037 ± 0.012	0.009 ± 0.009	0.023 ± 0.012	11	0.020 ± 0.022
FS-4	--	--	--	--	--	--
12-36	--	--	--	--	--	--
Buffalo Lake	4 (2)	0.029 ± 0.012	0.004 ± 0.012	0.014 ± 0.012	11	0.017 ± 0.025
^{238}Uranium						
Zone 4 (W)	2 (1)	0.011 ± 0.008	0.006 ± 0.006	0.008 ± 0.004	--	--
Zone 8	2 (2)	0.015 ± 0.011	0.003 ± 0.007	0.009 ± 0.009	11	0.010 ± 0.021
Playa 2	2 (2)	0.004 ± 0.004	0.001 ± 0.006	0.002 ± 0.002	11	0.009 ± 0.009
Burning Ground	4 (2)	0.016 ± 0.008	0.004 ± 0.004	0.008 ± 0.006	9	0.013 ± 0.026
Playa 3	4 (2)	0.039 ± 0.013	0.005 ± 0.009	0.016 ± 0.016	11	0.011 ± 0.015
FS-4	--	--	--	--	--	--
12-36	--	--	--	--	--	--
Buffalo Lake	4 (2)	0.026 ± 0.010	0.003 ± 0.010	0.015 ± 0.014	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 No prairie dogs available.
e Control location.

TABLE 11.2 — *Tritium, $^{233/234}U$, and ^{238}U in Cottontail Rabbits in 2010, in pCi/g Dry Weight*

Location	No. of Samples (# ≤ mda)	Maximum[a]	Minimum[a]	Mean Std.[b]
Tritium				
Zone 4	2 (2)	0.000 ± 0.758	-0.198[c] ± 0.758	-0.099 ± 0.140
Zone 12 South	3 (3)	0.453 ± 0.309	0.071 ± 0.770	0.280 ± 0.193
Buffalo Lake[d,e]	--	--	--	--
$^{233/234}$Uranium				
Zone 4	2 (1)	0.016 ± 0.009	0.013 ± 0.007	0.014 ± 0.002
Zone 12 South	3 (2)	0.017 ± 0.009	0.000 ± 0.135	0.009 ± 0.009
Buffalo Lake	--	--	--	--
^{238}Uranium				
Zone 4	2 (2)	0.006 ± 0.007	0.001 ± 0.004	0.004 ± 0.004
Zone 12 South	3 (2)	0.009 ± 0.006	-0.001 ± 0.005	0.004 ± 0.005
Buffalo Lake	--	--	--	--

[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.
[e] No cottontails obtained.

Twenty-four prairie dogs (from Pantex and Buffalo Lake) were collected in 2010 and tested for diseases that might impact human or animal populations, including eastern and western equine encephalitis, tularemia, plague, and pseudorabies. 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.

Herpesvirus testing has been continued despite it not being a factor in human health (Mock, 2004). 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. Evidence of the virus was detected at both Pantex and the control site. Thirteen of 24 (54%) individuals analyzed in 2010 tested positive for herpesvirus or titers of herpesvirus, down from 12 of 12 (100 percent) in 2009. No other antibodies or diseases were detected.

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 2010. Sampling results indicated that prairie dogs on-site are not harboring any diseases of concern to Plant workers or neighboring landowners.

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 adverse impacts from Plant operations in 2010. Additionally, there were no significant changes in analytical results between 2009 and 2010.

12.1 The Scope of the Program

Flora surveillance is complementary to air, fauna, and water 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 2010 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.

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 six-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, 10 onsite, and 10 offsite locations (Figures 12.1 and 12.2).

12.2.2 Native Vegetation

Samples were collected during the growing season, no more frequently than once per month at any location, in 2010. 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.

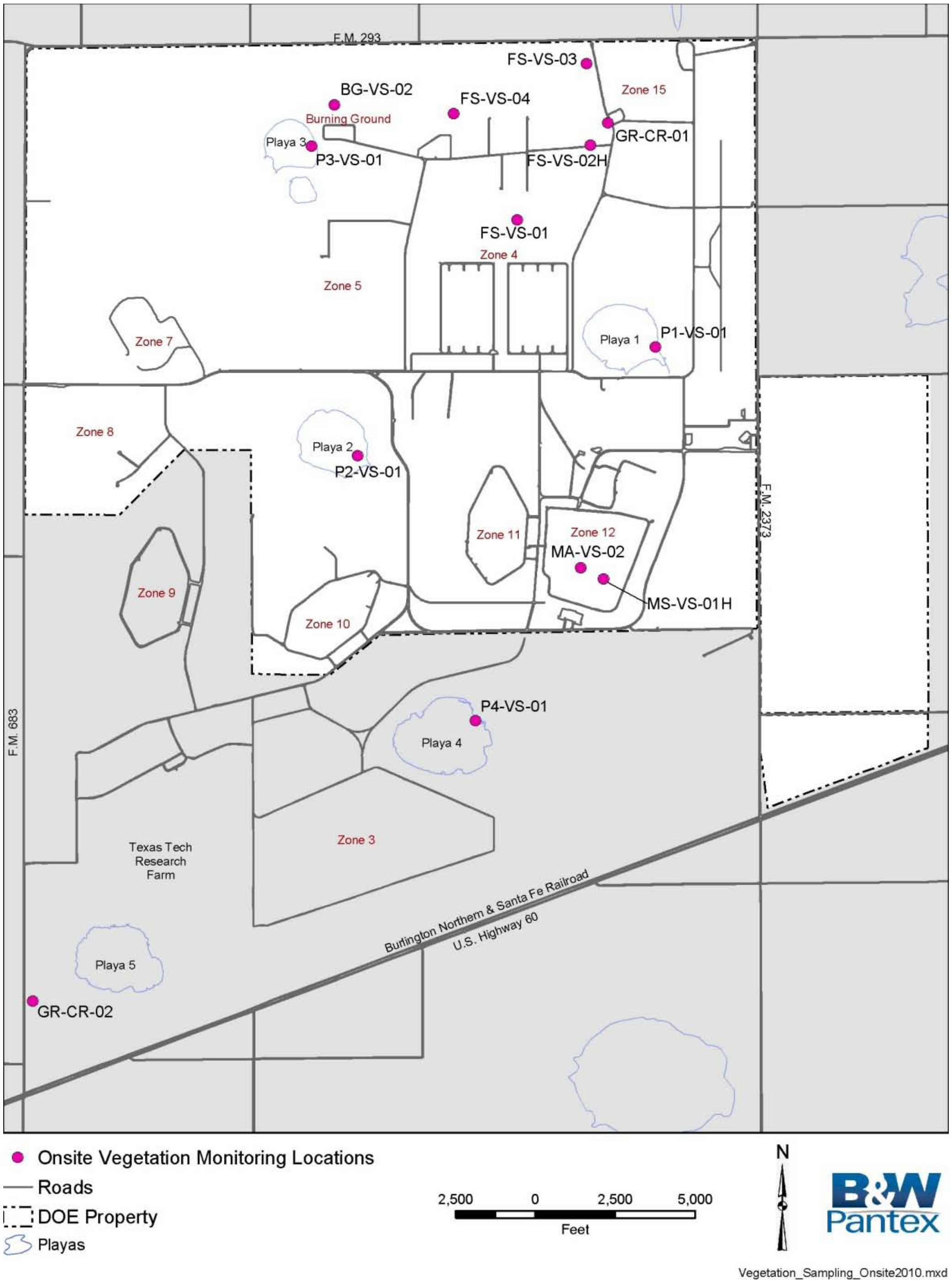


FIGURE 12.1 — ***Onsite Vegetation Monitoring Locations***

NOTE: On Figures 12.1 and 12.2, note the following designations: B- Bushland, CR- crops GR- garden produce, O- offsite, P- playa, V-vegetation, and WW- winter wheat. Any sample location with H behind it is historical and is not currently being sampled.

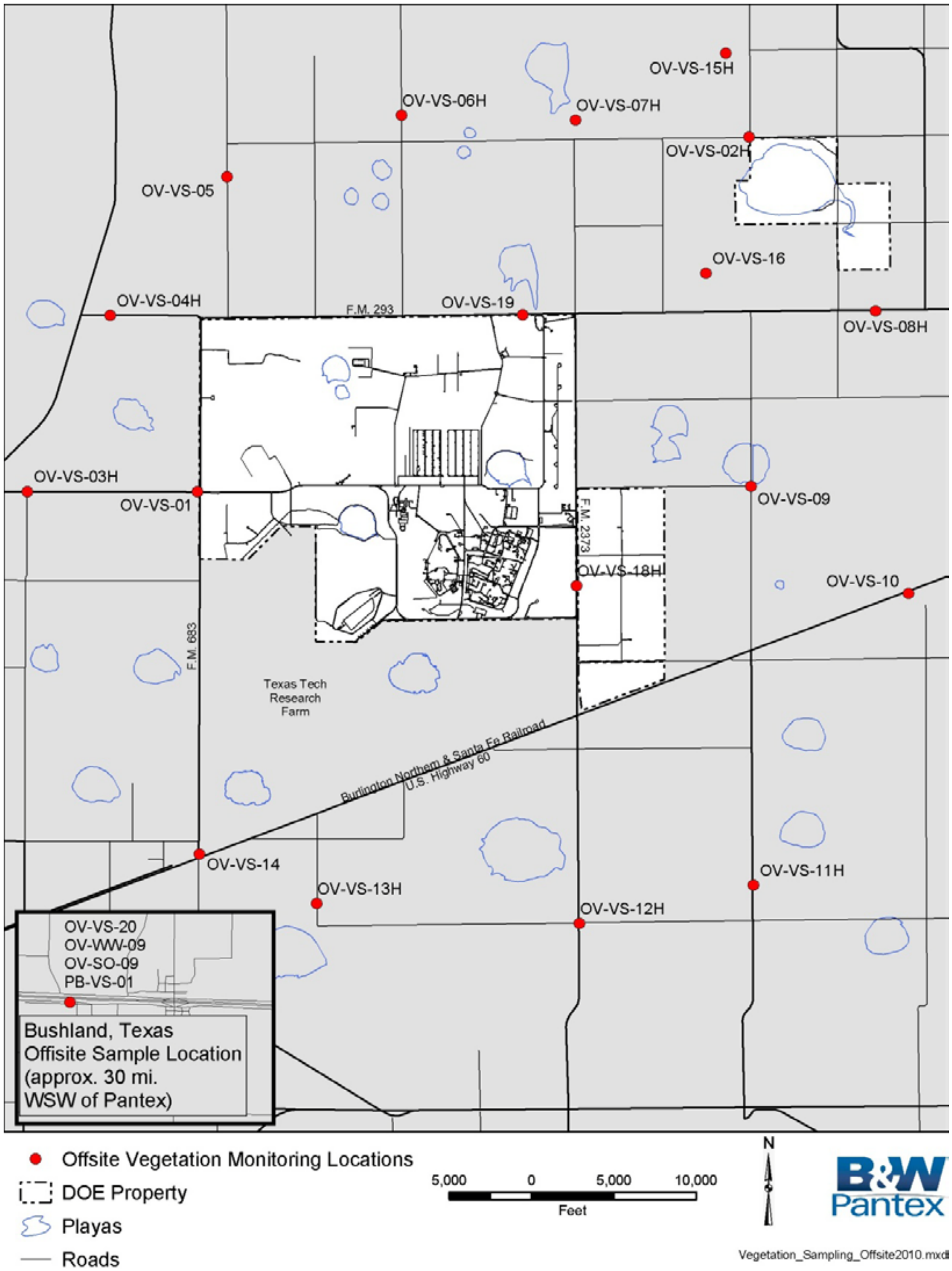


FIGURE 12.2 — ***Offsite Vegetation Monitoring Locations***

Tritium results from 88 percent of onsite and offsite sample locations were at or below minimum detectable activity 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 July at P3-VS-01 and OV-VS-05 resulted in a higher measured value for tritium than any of the results from the control location during the year. However, the analytical results for these locations were not greater than the historical mean of results from the control location. Sample results for P3-VS-01 earlier and later in the year were not elevated and were comparable to the control location. Sample results for OV-VS-05 earlier and later in the year were not elevated and were comparable to the control location. Results for all other onsite and offsite locations were consistent with those found in previous years. Concentrations of tritium in native vegetation indicate that no uptake of tritium into vascular plants has occurred.

The percentage of vegetation samples at or below the MDA level for $^{233/234}U$ and ^{238}U in all vegetation were 93 and 91 percent, respectively. These percentages are higher than most years. Usually the MDA level is near 50% and may be attributed to the fact that area soils have naturally occurring uranium. The vegetation samples are not washed and may contain some dirt and dust. Only one sample was higher than the offsite control location for 2010 data. The measured value for ^{238}U was an all time high at OV-VS-09. This location is east of Pantex, and earlier samples results were not elevated and were comparable to the control location. This sample was collected mid September, and by the time results were received from the laboratory a killing frost prevented additional sampling. Measured values for $^{233/234}U$ and ^{238}U at all onsite and other offsite locations during 2010 were similar to the values obtained at the control location.

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). Six winter wheat samples and a duplicate from onsite were collected in April 2010, and one control sample was collected from Bushland. The majority of onsite winter wheat and grain sorghum sampling locations were near the Burning Ground, with the remainder evenly distributed across the Plant. Six onsite samples and a duplicate sample of grain sorghum plus one control sample from Bushland were collected in September 2010.

Fruits and leaves from garden plants were sampled in July 2010. 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 2010 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 2010 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 adverse impacts from Plant operations in 2010.

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 (QA) and quality control (QC) requirements. A quality plan was implemented in 2010 to guide the environmental monitoring program to achieve its quality goals and to make certain that highly reliable data are consistently produced. Of the 27,088 individual results obtained from all laboratory analyses during 2010, the results determined to be useable amounted to 98.0 percent.

13.1 The Scope of the Program

Pantex Plant has an established 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 2010, 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 Data Collection Planning and Implementation

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 uses 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* (EPAa). 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 2010, 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 Quality Planning and Implementation

The B&W Pantex Sampling and Analysis (S&A) Department implemented the *Pantex Plant Environmental Monitoring Program Management and Quality Plan, QPLAN-0010*, (PANTEXd) to establish the QA and QC requirements for environmental monitoring activities. The plan has two main objectives: 1) to maintain a program for evaluating, monitoring, and facilitating continuous improvement of field sampling, analytical laboratory performance, and data quality, and 2) to maintain a technical assessment and programmatic laboratory auditing capability.

The plan contains requirements including, but not limited to, the following:

Field and Laboratory Assessments

Annual internal assessments are conducted on representative field and laboratory operations. The assessments on field operations are performed on both liquid and solid sampling methods. These assessments are used to assure the reliability and defensibility of analytical data acquired to support environmental monitoring programs. They are also a tool for continuous improvement of sampling operations, administrative functions, and quality systems. Activities reviewed in the field assessment may include calibration and documentation for field equipment, proper field sampling procedures, provisions for minimization of potential sample contamination, compliance with Chain of Custody (COC) procedures, sample documentation, and sample transfer to the laboratory. Activities reviewed for laboratory operations may include quality systems, sample receiving, handling, COC, and storage procedures, documentation for laboratory procedures such as run logs, data reduction, standard operating procedures (SOPs), condition and calibration of analytical instruments, and sample disposal.

External assessments, including management and independent assessments, are also conducted. They are scheduled based on risk assessment models provided by the B&W Pantex Quality and Performance Assurance Division.

Most assessments are performed using checklists developed by the B&W Pantex S&A Department with specific criteria for each procedure observed. Checklists from the United States Department of Energy Consolidated Audit Program (DOECAP) are be used as guidance in developing the checklists for the assessments.

An exit meeting is conducted at the end of an audit to discuss the findings. The findings are summarized in a report, and a Corrective Action Plan (CAP) is submitted by the laboratory for all the findings, that include the root cause, corrective action, personnel responsible for the corrective action implementation, and projected date for completion of the corrective action. A nonconformance report (NCR) is generated when a departure from documented requirements such as procedures, sampling plans, and QC criteria occurs. A formal Corrective Action Report (CAR) may be necessary depending on the severity, repetitiveness, and impact to reported data. Corrective actions are required to be implemented in a timely manner by the appropriate personnel who are knowledgeable about the work.

Co-verifications

Data verification is performed on 100% of the laboratory data. Five percent of all data packages undergo co-verification on an annual basis. Historically, the co-verification of data packages has helped to identify areas that can be interpreted in different ways and has helped data validators come to an agreement on how data should be reviewed. This was the only requirement of QPLAN-0010 not implemented in 2010 because of staff turnover in the B&W Pantex S&A Department. The majority of data verification for 2010 was performed by a specialized technical subcontractor.

Quarterly, a random selection of at least 10% of manual entries into the Integrated Environmental Database (IEDB) is verified and documented by a second party. Transcription errors can occur when hand entering data into the IEDB, and a second party check of the manual entries provides assurance that the data are correct.

Quarterly, a random selection of at least 5% of all reported data from hardcopy Certificates of Analyses is compared by a second party to the data uploaded from subcontract laboratory Electronic Data Deliverables (EDDs) into the IEDB. EDDs provide an easy way for analytical laboratories to deliver their data to the customers, and they allow different laboratories to provide consistent reporting parameters. Errors can be caused by miscommunication of the desired format or data elements. A second party check of the data uploaded into the IEDB from EDDs provides assurance that all data are correct.

Data Management Systems Audit

An audit of the data management systems, primarily the IEDB, is performed at least annually to document oversight activities. Areas audited will include IEDB security, verification that software programs accurately perform their intended functions, tracking changes to electronic records, and manual entries.

Annual Review of all Operations

An annual review of the sampling operations, administrative functions, and quality systems is conducted by the B&W Pantex S&A Department to assure their continued effectiveness. The items reviewed include the suitability of policies and procedures, outcome of internal and external assessments, trending of NCRs and CARs, client complaints, changes in volume of work, staffing, and resources.

Recordkeeping

All records and documents under the control of the B&W Pantex S&A Department are issued, revised, controlled, stored, and archived in accordance with Pantex Plant requirements.

13.3.1 Quality Plan Requirements for Subcontract Laboratories

Subcontract laboratories shall be accredited by The NELAC Institute (TNI) and in accordance with Texas Administrative Code Title 30 Part 1 Chapter 25 for all parameters within the scope of work provided by Pantex Plant. Exceptions might be made when TNI accreditation is not available.

Each subcontract laboratory must be qualified by the B&W Pantex S&A Department prior to sending samples for analysis. The prequalification process includes a review of the technical proposal submitted by the prospective laboratory, successful analysis of Performance Evaluation (PE) samples, and a systems audit performed by DOECAP, National Nuclear Security Administration (NNSA) Analytical Management Program, or Pantex Supplier Quality Department.

In addition to the initial systems audit, all subcontract laboratories must submit to annual systems audits in order to maintain status as a qualified subcontract laboratory. These audits are technical and programmatic and performed by DOECAP. Their purpose is to ensure that all existing subcontract laboratories are qualified to provide high quality analytical laboratory services.

A Data Package Assessment (DPA) will be conducted annually at subcontract laboratories. In this type of assessment, random analytical deliverables are selected, and all the supporting documentation such as calibration records, method detection limit, and QA/QC reports are reviewed.

The subcontract laboratory shall conduct internal audits at least annually to assure they are compliant with the laboratory's quality systems and with the *Pantex Statement of Work (SOW) for Analytical Laboratories* (PANTEXm).

Qualified subcontract laboratories must successfully analyze PE samples semi-annually in order to maintain qualified status, and they may be subject to submission of PE samples from Pantex Plant at any time.

PE sample analyses are designed to evaluate normal laboratory operations, and evaluation of the PE sample results must consider factors such as identification of false positives, false negatives, large analytical errors, and indications of calibration or dilution errors.

If the subcontract laboratory performs any combination of inorganic, organic, and radiological testing, participation in two semi-annual inter-laboratory comparison PE programs is required. One program must be the Mixed Analyte Performance Evaluation Program (MAPEP), and the other program should be from a vendor accredited by National Institute of Standards and Technology (NIST) under TNI Proficiency Test Standards. Participation in additional inter-laboratory comparison PE programs is necessary if the laboratory provides other unique services such as asbestos or lead in paint.

Nonconformance reports shall be submitted by the laboratory if unacceptable PE results are reported. PE sample requirements may be waived for any analysis in which a PE sample is not available.

Sample shipments to a subcontract laboratory may be suspended if it is determined that the laboratory is not capable of meeting the analytical, quality assurance, and deliverable requirements of the SOW.

13.4 Laboratory Quality Assurance

During 2010, the Pantex Laboratory Quality Assurance Program (LQAP) continued to provide qualified laboratory auditors to participate in DOECAP. The primary function of DOECAP is to evaluate laboratory quality assurance systems and verify that they are effective. Pantex Plant supports this resource-sharing approach to laboratory quality assurance.

During 2010, all of the requirements for the subcontract laboratories in QPLAN-0010 were met. All of the subcontract laboratories had the proper certifications for analyzing environmental samples from Pantex Plant. They performed the necessary internal audits, and participated in the appropriate PE programs. DOECAP audits and DPAs were also conducted.

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.

13.4.1 Data Review and 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 are 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 that caused data to be rejected during the verification process 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 rejected.

- 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 B&W Pantex media scientist was alerted to any limitations in the use of the data, based on the DQO requirements. Of the *27,088* individual results obtained in 2010 from all laboratory analyses, 98.0 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 2.0 percent of data rejected.

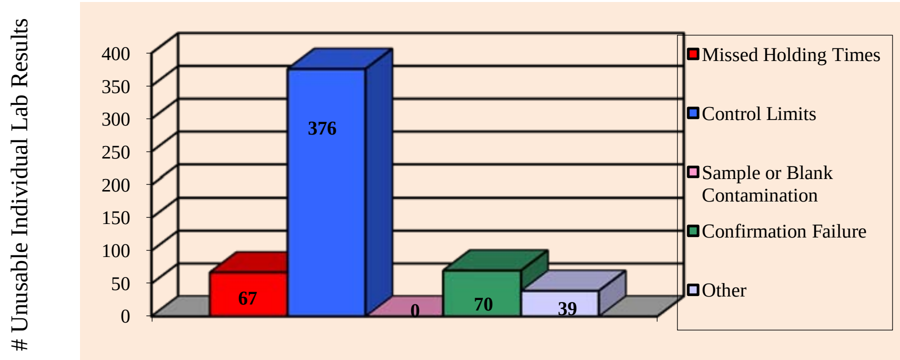


FIGURE 13.1 — *2010 Data Rejection Summary*

13.4.2 Laboratory Technical Performance

All subcontract laboratories were required to participate in inter-laboratory comparison studies administered by DOE and EPA. In 2010, Pantex Plant offsite subcontract laboratories participated in MAPEP PE sample analysis, sponsored by the DOE/Idaho Operations Office.

The MAPEP samples include radiological, inorganic, and organic compounds in matrices including water, soil, air filters, and vegetation. Under MAPEP, the DOE Idaho Operations Office publishes evaluation reports, rating the analyses from each participating laboratory. MAPEP results, particularly the results for MAPEP Series 22 and 23, for all participating subcontract laboratories used by Pantex Plant in 2010 (GEL, TestAmerica, and Southwest Research Institute) are presented in Figure 13.2. After September 2010, Pantex Plant did not have a contract with Southwest Research Institute. For this laboratory, the results shown are for the MAPEP Series 22 only.

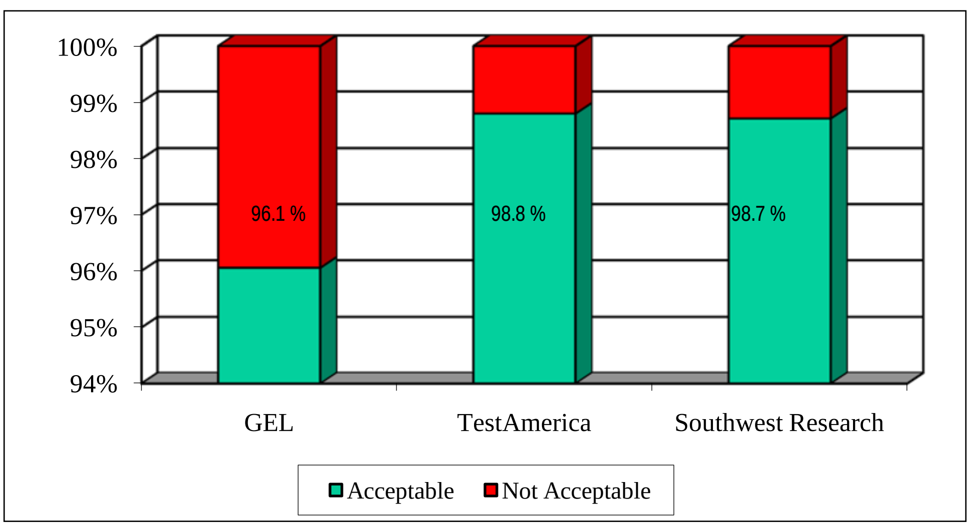


FIGURE 13.2 — *2010 MAPEP Results*

GEL had a Priority I Finding from the MAPEP samples for Plutonium-238 in a water matrix. GEL failed to achieve acceptable results on this analysis in two consecutive rounds of MAPEP samples.

GEL also had three Priority II Findings from the MAPEP samples for Plutonium-238 in a soil matrix, Americium-241 in a filter matrix, and Americium-241 in a vegetation matrix. GEL failed to achieve acceptable results on these analyses in two consecutive rounds of MAPEP samples.

Per the Quality Systems for Analytical Services (DOEe), the laboratory may not receive samples for analysis by the failed method until an acceptable remedial MAPEP PE sample score has been achieved. The decision to withhold sample shipments will be at the discretion of the individual DOE contract holder.

Pantex Plant does not require testing for Americium-241 in any matrix, but the Plant does require testing for Plutonium-238. The actions that GEL conducted upon realizing the error provide assurance that their analytical process is in control. The laboratory quickly began the corrective action process and identified the root cause. They ordered a PE sample from a commercial provider and a MAPEP PE sample, and the results for their analysis on Plutonium-238 in water were within the acceptance limits. Pantex S&A personnel believe it is acceptable to continue to send GEL this type of samples while the Priority I and II findings are in place.

All other subcontract laboratories had acceptable MAPEP results.

The primary purpose of the PE programs is to measure a laboratory's implementation of methods to obtain accurate results and serve as a comparison between laboratories. The SOW and DOECAP have requirements that all labs shall participate in several PE's, including the potable and non-potable water programs (EPA Supply and Water Pollution), and MAPEP.

13.5 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.

13.5.1 Duplicate and Replicate Analyses

During 2010, Pantex Plant 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 and continuous air monitoring equipment, 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 one indicates that the replicates are comparable within the 95 percent confidence interval. For 2010, the average RER for vegetation data value was 0.320, with an associated standard deviation of 0.201. The 2010 vegetation sample RER analysis indicated that field replicate sample precision accurately reflects the actual sample value.

13.5.2 Blanks and Rinsates

During 2010, 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 flag detects found in sample values. The detects found were used to flag 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 2010. These compounds are indicative of common laboratory solvents and materials associated with the sampling containers. The frequency of detection was 0.97 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.

13.6 Onsite Analytical Laboratories

A limited number of samples were analyzed onsite during 2010, using approved EPA or standard industry methods:

- Industrial Hygiene Laboratory performed analysis of samples for chemical oxygen demand, biochemical oxygen demand, and ferrous iron; and

- Materials and Analytical Services Laboratory performed 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 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, Oxidation Reduction Potential (ORP), and pH.

13.7 Continuous Improvement

During 2010, 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 were executed. 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 15 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.

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.

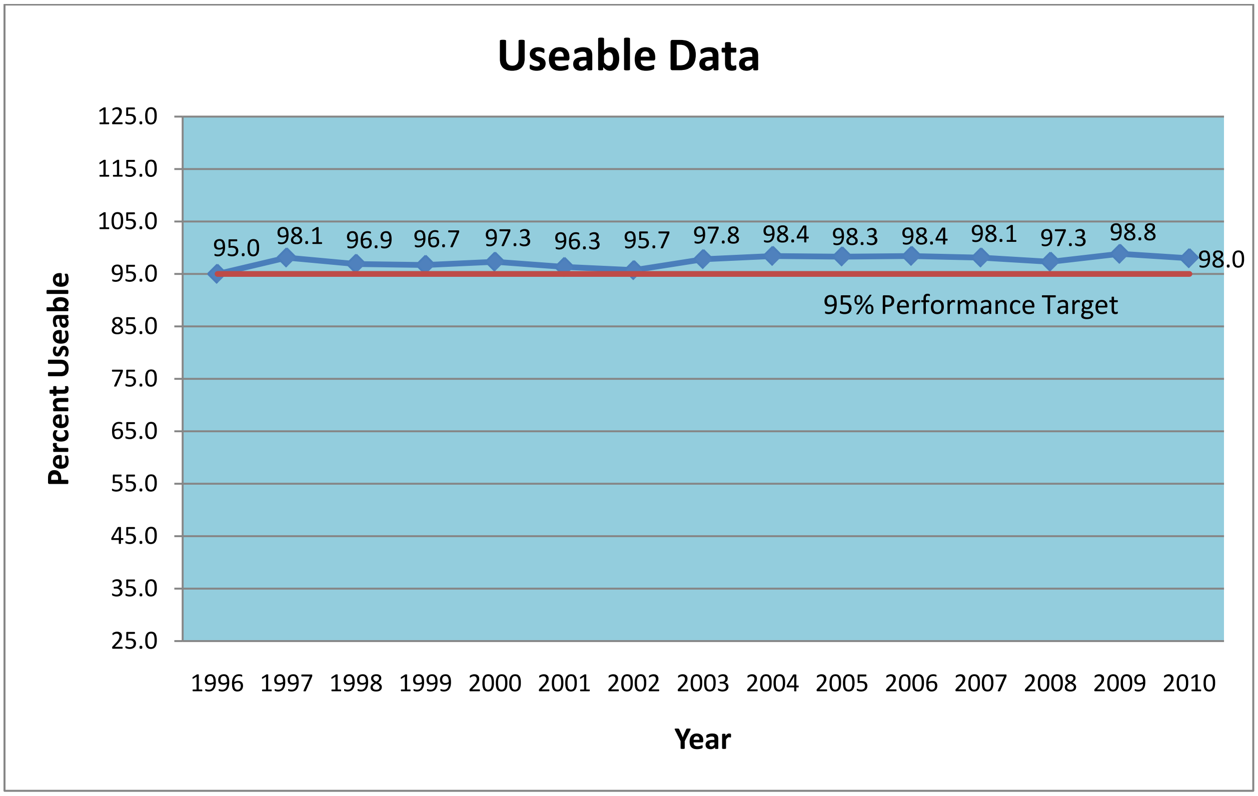


FIGURE 13.3 — *History of Useable Results Data*

Appendix A Analytes Monitored in 2010

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	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	-	■	■	■	■	■	■[9]	-	-
Cadmium	7440-43-9	-	-	■	■	■	■	■	-	-
Calcium	7440-70-2	-	■	-	-	-	-	■[9]	-	-
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]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
Iron	7439-89-6	-	■	■	■	-	-	-	-	-
Ferrous Iron	1345-25-1	-	■	-	-	-	-	-	-	-
Lead	7439-92-1	-	-	■	■	■	■	■	-	-
Magnesium	7439-95-4	-	■	-	-	-	-	■[9]	-	-
Manganese	7439-96-5	-	■	■	■	■	-	-	-	-
Mercury	7439-97-6	-	-	■	■	■	■	■	-	-
Molybdenum	7439-98-7	-	■	-	-	■	-	-	-	-
Nickel	7440-02-0	-	■	-	■	■	■	-	-	-
Potassium	7440-09-7	-	~	-	-	-	-	■[9]	-	-
Selenium	7782-49-2	-	-	■	■	■	-	■	-	-
Silver	7440-22-4	-	-	■	■	■	■	■	-	-
Sodium	7440-23-5	-	■	-	-	-	-	■[9]	-	-
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]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	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	-	■	■	■	■	■	-	-	-
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	-	-	■	-	-	-	-	-	-
Aroclor 1254	11091-69-1	-	-	■	-	-	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
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]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	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	-	■	-	-	-	-	-	-	-
Electrical Conductivity (S Salts 1:1)	NA	-	-	-	-	-	-	■	-	-
Fluoride	7782-41-4	-	■	■	-	-	-	-	-	-
Foaming agents (surfactants)	NA	-	-	■	-	-	-	-	-	-
Ignitability	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	-	-	-	-	■	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
Ortho Phosphate	14265-44-2	-	-	-	-	-	-	■[9]	-	-
Perchlorate	14797-73-0	-	■	~	-	-	-	-	-	-
pH	10-29-7	-	■	■	■	■	-	-	-	-
pH (1:1 ratio soil pH)	NA	-	-	-	-	-	-	■	-	-
Phosphorus, Total (As P)	7723-14-0	-	■	-	-	-	-	-	-	-
Reactivity	NA	-	-	-	-	-	-	■	-	-
Sodium Adsorption Ratio	NA	-	-	-	-	-	-	■	-	-
Specific conductance	10-34-4	-	-	■	-	-	-	-	-	-
Sulfate	14808-79-8	-	■	■	-	-	-	-	-	-
Sulfide	18496-25-8	-	■	-	-	-	-	-	-	-
Sulfur	NA	-	-	-	-	-	-	■[9]	-	-
Temperature	NA	-	■	■	■	■	-	-	-	-
Total dissolved solids	10-33-3	-	■	■	-	-	-	-	-	-
Total hardness (as $CaCO_3$)	11-02-9	-	■	■	-	-	-	-	-	-
Total Kjeldahl Nitrogen	NA	-	-	-	-	-	-	■	-	-
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	-	-	■	■	-	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
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	-	-	■	-	-	-	-	-	-
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	-	-	■	■	-	-	■	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
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	-	-	-	■	-	-	-	-	-
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	-	■	■	■	-	-	■	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
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	-	-	-	■	-	-	-	-	-
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	-	~	■	■	-	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
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	-	-	-	■	-	-	-	-	-
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	-	-	-	■	-	-	■	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
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	-	-	-	■	-	-	-	-	-
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	-	-	■	■	-	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
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	-	-	■	■	-	-	-	-	-
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	-	-	-	■	-	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
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	-	-	-	■	-	-	-	-	-
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	-	-	-	-	-	-	-	-	■

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna
Tuleremia	NA	-	-	-	-	-	-	-	-	■
Volatile Fatty Acids[8]										
Acetic Acid	64-19-7	-	■	~	-	-	-	-	-	-
Butyric Acid	107-92-6	-	■	~	-	-	-	-	-	-
Hexanoic Acid	142-62-1	-	■	~	-	-	-	-	-	-
i-Hexanoic Acid	646-07-1	-	■	~	-	-	-	-	-	-
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[8]										
Ethane	74-84-0	-	■	~	-	-	-	-	-	-
Ethene	74-85-1	-	■	~	-	-	-	-	-	-
Methane	74-82-8	-	■	~	-	-	-	-	-	-

Analyte	CAS Number	Air	GW[1]	DW[2]	SW[3]	IW[4]	BG[5] Soil	TLAP Soil[6]	Veg.[7]	Fauna

[1] Groundwater.
[2] Drinking water & production wells.
[3] Storm water and playas.
[4] Irrigation Water.
[5] Burning Ground soils & sediment
[6] Texas Land Application Permit (TLAP) soils.
[7] Vegetation.
[8] Only applicable to ISB and ISPM wells to monitor performance of the ISB Systems.
[9] TLAP nutrient parameters analyzed on a plant available or extractable basis.
■ = Sampled for.
\- = Not sampled.
NA = Not available.

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Appendix B Birds Identified at Pantex

COMMON NAME	SCIENTIFIC NAME
Pied-billed grebe	*Podilymbus podiceps*
Cattle egret	*Bubulcus ibis*
Black-crowned night-heron	*Nycticorax nycticorax*
Great egret	*Casmerodius albus*
Great blue heron	*Ardea herodias*
White-faced ibis	*Plegadis chihi*
Sandhill crane	*Grus canadensis*
Greater white-fronted goose	*Anser albifrons*
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*
Blue-winged teal	*Anas discors*
Canvasback	*Aythya valisneria*
Ring-necked duck	*Aythya collaris*
Lesser scaup	*Aythya affinis*
Bufflehead	*Bucephala albeola*
American avocet	*Recurvirostra americana*
American coot	*Fulica americana*
Black-necked stilt	*Himantopus mexicanus*
Long-billed dowitcher	*Limnodromus scolopaceus*
Killdeer	*Charadrius vociferus*
Greater yellowlegs	*Tringa melanoleuca*
Long-billed curlew	*Numenius americanus*
Spotted sandpiper	*Actitis macularia*

COMMON NAME	SCIENTIFIC NAME
Wilson's phalarope	*Phalaropus tricolor*
Upland sandpiper	*Bartramia longicauda*
Ring-billed gull	*Larus delawarenis*
American kestrel	*Falco sparverius*
Prairie falcon	*Falco mexicanus*
Peregrine falcon	*Falco peregrines*
Red-tailed hawk	*Buteo jamaicensis*
Swainson's hawk	*Buteo swainsoni*
Rough-legged hawk	*Buteo lagopus*
Ferruginous hawk	*Buteo regalis*
Harris hawk	*Parabuteo unicinctus*
Northern harrier	*Circus cyaneus*
Cooper's hawk	*Accipiter cooperii*
Turkey vulture	*Cathartes aura*
Bald eagle	*Haliaeetus leucocephalus*
Scaled quail	*Callipepla squamata*
Ring-necked pheasant	*Phasianus colchicus*
Rock dove (feral pigeon)	*Columba livia*
Mourning dove	*Zenaida macroura*
Eurasian collared dove	*Streptopelia decaocto*
Greater roadrunner	*Geococcyx californianus*
Barn owl	*Tyto alba*
Short-eared owl	*Asio flammeus*
Burrowing owl	*Athene cunicularia hypugea*
Great horned owl	*Bubo virginianus*
Common nighthawk	*Chordeiles minor*
Chimney swift	*Chaetura pelagica*
Broad-tailed hummingbird	*Selasphorus platycercus*

Common Name	Scientific Name
Western kingbird	*Tyrannus verticalis*
Scissor-tailed flycatcher	*Tyrannus forficatus*
Say's phoebe	*Sayornis saya*
Horned lark	*Eremophila alpestris*
Barn swallow	*Hirundo rustica*
Cliff swallow	*Hirundo pyrrhonota*
American crow	*Corvus brachyrhynchos*
Chihuahuan raven	*Corvus cryptoleucus*
Common raven	*Corvus corax*
Mountain bluebird	*Sialia currucoides*
American robin	*Turdus migratorius*
Loggerhead shrike	*Lanius ludovicianus*
Northern mockingbird	*Mimus polyglottos*
Curve-billed thrasher	*Toxostoma curvirostre*
European starling	*Sturnus vulgaris*
Black-and-white warbler	*Mniotilta varia*
Northern cardinal	*Cardinalis cardinalis*
Grasshopper sparrow	*Ammodramus savannarum*
Lark sparrow	*Chondestes grammacus*
Cassin's sparrow	*Aimophila cassinii*
Chipping sparrow	*Spizella passerina*
White-crowned sparrow	*Zonotrichia leucophris*
Dickcissel	*Spiza americana*
Lark bunting	*Calamospiza melanocorys*
Eastern meadowlark	*Sturnella magna*
Western meadowlark	*Sturnella neglecta*
Red-winged blackbird	*Agelaius phoeniceus*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*

COMMON NAME	SCIENTIFIC NAME
Brewer's blackbird	*Euphagus cyanocephalus*
Great-tailed grackle	*Quiscalus mexicanus*
Common grackle	*Quiscalus quiscula*
House sparrow	*Passer domesticus*
House finch	*Carpodacus mexicanus*

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. 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.

DOCa. *Amarillo Climate Notes.* U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Amarillo Office, http://www.srh.noaa.gov/ama/?n=rec_norm_ama. (accessed 2 Mar 11).

DOCb. *Information Concerning Texas and Oklahoma Panhandles Tornado Stats*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Amarillo Office. http://www.srh.noaa.gov/ama/?n=tornado_stats. (accessed 2 Mar 11).

DOCc. *The Severe Convective Storm Climatology of the Texas and Oklahoma Panhandles*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Amarillo Office report. http://www/srh/noaa.gov/images/ama/amaclimo/ama_climo.pdf. (accessed 2 Mar 11).

DOCd. *Significant Weather Events in the Texas and Oklahoma Panhandles*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service Amarillo Office report. http://www.srh.noaa.gov/ama/?n=major_events. (accessed 2 Mar 11).

DOCe. *American FactFinder*. U.S. Census Bureau, Population Division. http://factfinder.census.gov/home/saff/main.html?_lang=en. (accessed 15 Aug 11).

DOEa. *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.

DOEb. *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.

DOEc. *Final Report*: *Risk Reduction Rule Guidance to the Pantex RCRA Facility Investigation.* U.S. Department of Energy, Pantex Plant, Amarillo, Texas. 2002.

DOEd. *Pantex Site-Wide Record of Decision (ROD).* U.S. Department of Energy, Washington, D.C. September 2008.

DOEe. *Quality Systems for Analytical Services*, Rev. 2.5. U.S. Department of Energy, Washington, D.C. November 2009.

DOEf. DOE Guidance 450.4-1B. *Integrated Safety Management System Guide.* U.S. Department of Energy, Washington, DC. 2001.

DOEg. DOE Order 231.1A. *Environment, Safety and Health Reporting.* U.S. Department of Energy, Washington, DC. 2004.

DOEh. DOE Order 450.1A. *Environmental Protection Program*. U.S. Department of Energy, Washington, DC. 2008.

DOEi. DOE Order 5400.5. *Radiological Protection of the Public and the Environment.* U.S. Department of Energy, Washington, DC. 1993.

DOEj. DOE Policy 450.4. Safety Management System Policy, U.S. Department of Energy, Washington, DC. 1996.

EPAa. *USEPA QA/G4 Guidance for Data Quality Objective Process* (EPA/600/R-96/055). September 1994.

EPAb. *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.

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.

Gilbert, Richard O. *Statistical Methods for Environmental Pollution Monitoring*. Van Nostrand Reinhold, New York. 1987.

ICRP. *2007 Recommendations of the International Commission of Radiological Protection (Users Edition)*. ICRP Publication 103 (Users Edition). Ann. ICRP 37 (2-4).

ISO. 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.

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.

NCRPa. *A Handbook of Radioactivity Measurement Procedures*. Report No. 58. National Council on Radiation Protection and Measurements, Bethesda, Maryland. 1985.

NCRPb. *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.

PANTEXa. Pantex Plant. *2010 Annual Progress Report*. Amarillo, Texas. June 2011.

PANTEXb. Pantex Plant. *Biological Assessment of the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components*. Battelle Pantex, Amarillo, Texas. 1996.

PANTEXc. Pantex Plant. *Environmental Information Document: In Support of the National Environmental Policy Act Documents for Pantex Plant*, PLN-20. Amarillo, Texas. 1998.

PANTEXe. Pantex Plant. *Environmental Monitoring Program Management and Quality Plan*. Iss. 1. Amarillo, Texas. 2010.

PANTEXf. Pantex Plant. *FY 2012 to FY 2021 Ten year Site plan (TYSP).* Amarillo, Texas. March 2011.

PANTEXg. Pantex Plant. *Integrated Plan for Playa Management at Pantex Plant*. Amarillo, Texas. 2010.

PANTEXh. Pantex Plant. *Land-Applied Chemical Use Plan for Pantex Plant*. Amarillo, Texas. March 2005.

PANTEXi. Pantex Plant. *Long-Term Monitoring System Design Report.* Prepared for the U.S. Department of Energy/National Nuclear Security Administration. April 2009.

PANTEXj. Pantex Plant. *Programmatic Agreement and Cultural Resource Management Plan for Pantex Plant*. Amarillo, Texas. October 2004.

PANTEXk. Pantex Plant, *Radiological Control Manual*. 2009.

PANTEXl. 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.

PANTEXm. Pantex Plant. *Sampling and Analysis Plan.* Prepared for the U.S. Department of Energy/National Nuclear Security Administration. April 2009.

PANTEXn. Pantex Plant. *Statement of Work (SOW) for Analytical Laboratories*, Rev. 4. Amarillo, Texas. 2010.

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.

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.

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*. September 21, 2010.

USACE. *Floodplain Delineation Report*. Prepared by U.S. Army Corps of Engineers, Tulsa District, Tulsa, Oklahoma, January 1995.

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