



PANTEX QUARTERLY PROGRESS REPORT

Remedial Action Progress

Fourth Quarter 2023

In support of Hazardous Waste Permit #50284 and
Pantex Plant Interagency Agreement
March 2024

Pantex Plant
FM 2373 and U.S. Highway 60
P.O. Box 30030
Amarillo, TX 79120



CERTIFICATION STATEMENT

Fourth Quarter 2023 Remedial Action Progress Report
Pantex Plant, March 2024

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Jimmy C. Rogers
Senior Director, Environment, Safety and Health
Consolidated Nuclear Security, LLC

Date

**Remedial Action Progress Report
Fourth Quarter 2023
in Support of Hazardous Waste Permit #50284
and Pantex Plant Interagency Agreement
for the Pantex Plant, Amarillo, Texas
March 2024**

Prepared by
Consolidated Nuclear Security, LLC
Management and Operating Contractor
for the
Pantex Plant and Y-12 National Security Complex
under Contract No. DE-NA0001942
with the
U.S. Department of Energy
National Nuclear Security Administration

In accordance with 30 TAC §335.553 (g), this report has been prepared and sealed by an appropriately qualified licensed professional engineer or licensed professional geoscientist.

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Date

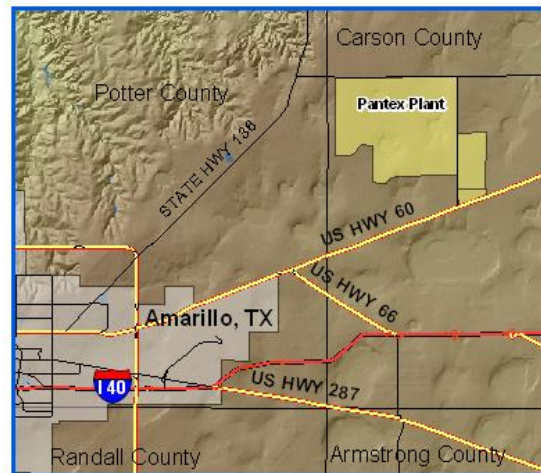
Project Team: Martin Amos
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LIST OF ACRONYMS

µg/L	micrograms per liter
CatOx	catalytic oxidation
COC	contaminant of concern
CP	Compliance Plan
Cr(VI)	hexavalent chromium
DCE	dichloroethene
DNT4A	4-amino-2,6-dinitrotoluene
EVO	emulsified vegetable oil
FGZ	fine-grained zone
GWPS	groundwater protection standard
HE	high explosive
ISB	<i>in situ</i> bioremediation
ISPM	<i>in situ</i> performance monitoring
Lbs	pounds
MEW	mobile extraction well
Mgal	million gallons
mV	millivolts
NAPL	non-aqueous phase liquid
ORP	oxidation-reduction potential
P1PTS	Playa 1 Pump and Treat System
ppmv	parts per million by volume
PQL	practical quantitation limit
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
REC	recirculation extraction well
SAP	Sampling and Analysis Plan
scfm	standard cubic feet per minute
SE ISB	Southeast <i>In Situ</i> Bioremediation
SE ISB EXT	Southeast <i>In Situ</i> Bioremediation Extension
SEPTS	Southeast Pump and Treat System
SVE	soil vapor extraction
TAC	Texas Administrative Code
TCE	trichloroethene
TZM	treatment zone monitoring
VOC	volatile organic compound
WWTF	wastewater treatment facility
Z11 ISB	Zone 11 <i>In Situ</i> Bioremediation

INTRODUCTION

The Pantex Plant, located in the Texas Panhandle 17 miles northeast of Amarillo, has implemented a response action to remediate perched groundwater and soils. Two types of systems have been installed for the groundwater response action: pump and treat systems in two areas and *in situ* bioremediation (ISB) systems in four areas. A soil vapor extraction (SVE) system has been installed to remediate volatile organic compounds (VOCs) in soils at the Burning Ground area. This quarterly report addresses progress achieved through implementation of the remedial actions for fourth quarter of 2023.



This report provides an intermediate data summary for response action systems throughout the year. More intensive data reporting is included in the annual progress reports. The quarterly progress reports address three of the five evaluations included in the annual progress reports: response action effectiveness, uncertainty management, and early detection. The reports provide information required by Hazardous Waste Permit #50284 CP Table VII and the Pantex Interagency Agreement.

Maps of the plumes, remedial action systems, sampling locations, and system wells are provided in Appendix A. Graphs of operation and flow rates for the pump and treat systems are provided in Appendix B. Graphs of important parameters for the ISB treatment zone and downgradient wells are provided in Appendix C.

RESPONSE ACTION EFFECTIVENESS

This quarterly progress report focuses on specific criteria for the pump and treat systems, ISB systems, and a small-scale SVE system. System operation, mass removal, and evaluation of effluent in reference to established operational goals are reported for the pump and treat systems. For the ISB systems, this report evaluates geochemical conditions and availability of food source in the treatment zone and reduction of concentrations of contaminants of concern (COCs) in downgradient performance monitoring wells to evaluate whether the treatment zone is working effectively. System operation, mass removal, and effluent photoionization detector readings are evaluated for the SVE system.

PUMP AND TREAT SYSTEMS

The groundwater remedial action at the Pantex Plant includes two pump and treat systems: Southeast Pump and Treat System (SEPTS) and Playa 1 Pump and Treat System (P1PTS). The pump and treat systems are designed to extract water and remove contaminant mass from the water before the effluent is beneficially used for irrigation, general Plant needs, and/or for amendment injections at the ISB systems. The systems were also designed to remove water from the perched aquifer to reduce saturated thickness. This reduction in saturated thickness reduces migration of contaminants both vertically and horizontally so that natural breakdown processes can occur over time. Reducing migration provides protection for the underlying High Plains Aquifer (also known as and referred to herein as the Ogallala Aquifer). SEPTS has the capability to inject the treated water back into the perched aquifer when beneficial use is not possible. Both systems now have the capability to release water to the new center pivot surface irrigation system. P1PTS can release water to the subsurface irrigation system directly or to the WWTF storage lagoons, which can discharge to Playa 1 and a subsurface drip irrigation system. Operational priorities for the pump and treat systems emphasize beneficial use of water.

The subsurface drip irrigation system was not utilized during the fourth quarter of 2023. Operation of the subsurface system is, and will continue to be, hindered by lowered lagoon storage capacity due to ongoing construction of repairs to the Plant’s WWTF storage lagoons. During periods the drip irrigation system is unavailable, Pantex continues to release WWTF water to Playa 1 as approved in the Texas Commission on Environmental Quality wastewater permit (WQ0002296000). However, the permit restricts the amount of water that can be released to the playa, so pump and treat throughput is reduced if other outlets are not available for use. Pantex finished installation of an irrigation alternative on the property east of FM 2373 in August 2023 to provide additional long-term use of the treatment system water. Installation of five irrigation pivots helps increase throughput for the pump and treat systems. The pivot system will be able to operate during warmer months (primarily March – November), decreasing water released to Playa 1. Operation of the pivot system will be limited during winter due to freezing temperatures.

During the fourth quarter, the SEPTS operated at a higher capacity using injection and release to Playa 1. P1PTS was operated during the fourth quarter, but was shutdown on December 7th due to

Pump and Treat System Fourth Quarter 2023 Operation	
<i>Playa 1 Pump and Treat System (P1PTS)</i>	
Days Operated	60
% Operation Time	60%
Volume Water Treated (Mgal)	19.0
HE Mass Removal (lbs)	4.5
Beneficial Use of Water	100%
<i>Southeast Pump and Treat System (SEPTS)</i>	
Days Operated	92
% Operation Time	99%
Volume Water Treated (Mgal)	33.8
HE Mass Removal (lbs)	92.4
Chromium Mass Removal (lbs)	19.3
Perchlorate Mass Removal (lbs)	40.2
Beneficial Use of Water	1.8%
<i>*Value below operational goals</i>	

a break at the pivot irrigation system’s wet well to prioritize operation of SEPTS. The wet well break was repaired in February 2024 allowing the pivot system to start spring growing operations on schedule which will utilize treated water from both pump and treat systems.

Graphs of monthly operation and throughput are included in Appendix B. The SEPTS wellfield had five wells that required repair during the fourth quarter due to electrical and equipment issues, while P1PTS had two wells in need of repair. Pantex has issued a contract to address these problems.

Together the systems treated about 53 million gallons (Mgal) during the fourth quarter. P1PTS

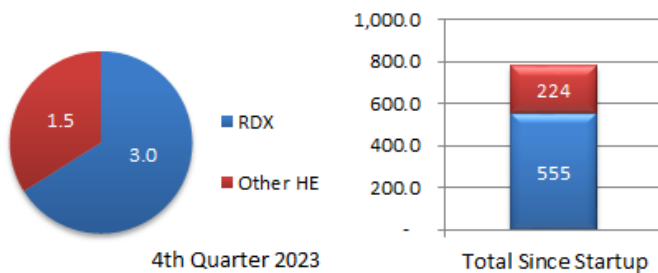


Figure 1. P1PTS Mass Removal

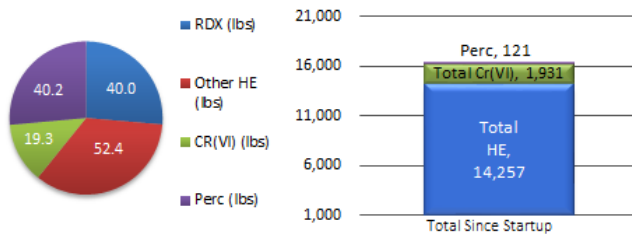


Figure 2. SEPTS Mass Removal

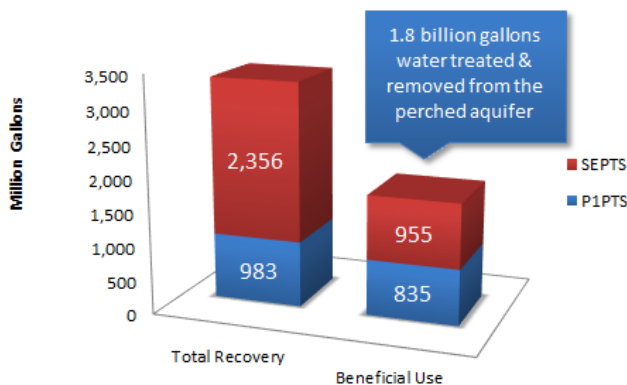


Figure 3. System Recovery and Use

primarily treats RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) and other high explosives (HEs), and SEPTS primarily treats RDX and other HEs, hexavalent chromium [Cr(VI)], and perchlorate. Figures 1 and 2 provide mass removal information for RDX and HEs, Cr(VI), and perchlorate for the fourth quarter, as well as totals since system startup.

Concentrations near Playa 1 are much lower due to declining source concentrations resulting in reduction of mass removal at P1PTS. Overall, the systems have removed over 17,080 pounds (lbs) of HEs, chromium, and perchlorate contaminants from perched groundwater since operations began.

The total recovery and treatment from both systems since startup has been calculated at about 3.3 billion gallons. Because SEPTS was originally designed to inject treated water, all of the treated water prior to 2005 was injected. However, a significant volume of treated water has been used beneficially since 2005, with a total of over 1.8 billion gallons of treated water beneficially used since startup of the irrigation system. The recovery and beneficial use totals are presented in Figure 3. All of P1PTS flow was used for irrigation purposes in the fourth quarter and were included in the beneficial use numbers. Evaluation of

effluent data from SEPTS and P1PTS indicates that all COCs were treated to levels below the groundwater protection standard (GWPS).

ISB SYSTEMS

Four ISB systems (Zone 11 ISB, Southeast ISB, Southeast ISB Extension, and Offsite ISB) were operating at Pantex during the fourth quarter of 2023. The systems are designed with closely spaced wells to set up a treatment zone in areas of the perched groundwater where pump and treat may not be as effective, or where the area is sensitive to vertical migration of COCs to the Ogallala Aquifer. Amendment is injected into these systems to establish treatment zones where COCs are degraded. Monitoring wells are installed downgradient of the treatment zone to monitor whether the system is effectively degrading the COCs (see maps in Appendix A). The primary COCs at the Zone 11 ISB are trichloroethene (TCE) and perchlorate. The primary COCs at the Southeast ISB are RDX and Cr(VI). The primary COC at the Southeast ISB Extension and the Offsite ISB is RDX.

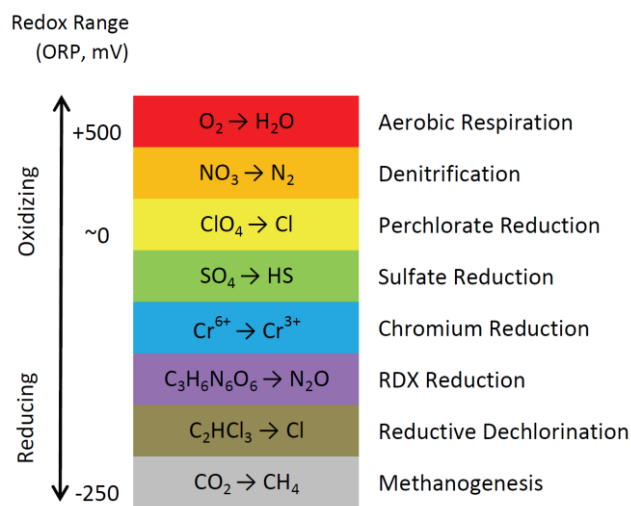


Figure 3. Redox Range for COCs

The following section provides an understanding of the expected conditions at the ISB systems and downgradient concentrations of COCs. For the treatment zone wells, this report evaluates whether the conditions are present, including oxidation-reduction (i.e. redox) potential (ORP) and the reduction of electron acceptors (i.e. dissolved oxygen and nitrate), to degrade the COCs in each area. The presence of gases, such as methane, can also be an indication of deeper reducing conditions. The presence of a continued food source (total organic carbon) for the microbial reduction of COCs is also evaluated. Strong reducing conditions (ORP below -50 millivolts (mV) to reduce RDX and

TCE and near 0 mV to reduce hexavalent chromium and perchlorate) are required to adequately reduce COCs. Figure 3 presents the redox ranges for the reduction of various COCs. Dissolved gases, redox potential, nitrate, and TOC are evaluated in the ISB treatment zone performance wells to determine if the treatment zone is rebounding to baseline conditions, thus requiring amendment injection.

Downgradient monitoring wells are evaluated to determine if the ISB systems are effective in degrading the COCs and any breakdown products of the COCs. Graphs of data from sampled treatment zone wells and downgradient *in situ* performance monitoring (ISPM) wells are included in Appendix C.

ISB INJECTION ACTIVITIES

Sampling of the ISB systems has been reduced to a semi-annual frequency. As a system's data is not always available for quarterly evaluation, only new and complete data sets for each system will be assessed during the current quarter. Over the third and fourth quarters, all systems were sampled completely. Table 1 summarizes the injection activities for 2023. Injection activities were continued at the Zone 11 ISB and the Offsite ISB in the fourth quarter.

Table 1. ISB Systems Activities

Month (2023)	SE ISB EXT	SE ISB	Z11 ISB	Offsite ISB ¹
January				
February		Sample		Maintenance
March	Sample	Sample	Maintenance	Injection
April	Sample		Sample	Injection
May			Sample/Injection	Sample/Injection
June			Injection	Sample/Injection
July	Sample/Maintenance		Injection	Injection
August	Injection	Sample	Injection	Injection
September	Injection	Sample	Injection	Injection
October			Injection	Sample/Injection
November	Sample	Sample	Sample/Injection	Sample/Injection
December			Sample/Injection	Sample/Injection

¹All sampled wells in the Offsite ISB are extraction wells (REC) and (MEW) and not injected; therefore, injection will not affect the sampling of the REC and MEW wells.

SE ISB EXT = Southeast ISB Extension

SE ISB = Southeast ISB

Z11 ISB = Zone 11 ISB

SOUTHEAST ISB REMEDIAL EFFECTIVENESS

The Southeast ISB was installed in 2007. Eight injection events have been completed at this system at the time of this report. The Southeast ISB continues to demonstrate declining water levels at the system; as a result, only 60% of the system was injected during the 2022 injection event. The inability to sample or inject into these wells is expected to persist with continued upgradient removal of water by the SEPTS. Pantex injected the system in early 2022 with molasses, as recommended in the *Fourth Quarter 2018 Progress Report*, but further injections may be limited or unnecessary.

Three injection wells and three downgradient ISPM wells were sampled at Southeast ISB between the third and fourth quarter. Three ISPM wells (PTX06-1118, PTX06-1045 and PTX06-1123) have gone dry or did not have sufficient water to be sampled. Analytical data indicate that reducing conditions continue at the treatment zone in all sampled ISB wells. All three wells have total organic carbon to allow continued treatment. Downgradient wells indicate that complete treatment is occurring at all but one well, PTX06-1153. PTX06-1153 indicates partial treatment, as the breakdown products of RDX are present; RDX continues to slowly decline at this location. Pantex has requested removal of PTX06-1153 from permit HW-50284 so the monitor well can be

used for injection. Pantex has also applied for use of this well under the underground injection control permit. Further recommendations will be made as injection occurs and more data are collected.

ZONE 11 REMEDIAL EFFECTIVENESS

Installation of the Zone 11 ISB remedial action was completed in 2009, and an expansion to the northwest of PTX06-ISB083 was completed in early 2015 and 2019 (see Appendix A maps). Another expansion was completed in late 2021 to address the southeast moving plume. Fifteen injection events have been completed at the time of this report, with the first injection event occurring in the expansion zone in 2015. Pantex has moved to the use of a more soluble carbon source, molasses, as studies conducted at the Zone 11 ISB in 2018 indicated that molasses distributed between widely-spaced injection wells at a much higher concentration than emulsified vegetable oil (EVO). More frequent injections are required for molasses and have been planned annually for the Zone 11 ISB to maintain reducing conditions. For the 2023 injection at Zone 11, injection on the west side of the system continues to use molasses as amendment. In an effort to further affect reducing conditions, a mixture of EVO and molasses is being used at selected wells on the east side of the system, which were recently installed with closer spacing. Pantex will continue to evaluate the system to ensure appropriate timing of injections and the most effective amendment.

The Zone 11 ISB has a well-established treatment zone in the original portion of the system, where injection has occurred since 2009. Portions of the northwest expansion area have received more than five injections, so deeper reducing conditions are likely established at the injection wells. Five injected wells, seven treatment zone monitoring (TZM) wells, and nine downgradient ISPM wells were sampled in the Zone 11 ISB system in the fourth quarter.

Reduction of nitrate and the measured ORP indicate whether conditions across the treatment zone are present for reductive dechlorination. Evaluation of data in the treatment zone indicates mild to strong reducing conditions, with ORP ranging from -114.5 to 49.2 mV across the Zone 11 ISB. Monitored conditions inside the treatment zone indicate nitrate was reduced at all sampled wells and negative ORP was measured in all but one treatment zone well, indicating deeper reducing conditions in most areas. Soluble metals (arsenic and manganese) increased and methane was measured in all treatment zone wells, indicating that deeper reducing conditions are established. TCE continues to be reduced to cis-1,2-dichloroethene (DCE), with TCE concentrations below GWPS in ten monitored wells inside of the treatment zone and cis-1,2-DCE present at concentrations below the GWPS in eleven of the twelve monitored wells. When greater amounts of TCE and cis-1,2-DCE are being degraded, ethene and vinyl chloride are expected to be detected. Vinyl chloride was detected in eight sampled wells inside the treatment zone, but ethene was not detected in any wells. These results could indicate that a portion of the TCE is being completely degraded in some areas of the treatment zone, while other areas have milder reducing conditions. Perchlorate was reduced in all wells across the treatment zone.

Pantex evaluates performance at nine downgradient ISPM wells for the Zone 11 ISB. Seven of nine ISPM wells exhibit perchlorate concentrations below the GWPS in the fourth quarter. TCE

concentrations are at or below the GWPS in six of nine ISPM wells. The first breakdown product of TCE, cis-1,2-DCE, was below the GWPS in all nine downgradient wells. Data indicate that due to treatment, concentrations of TCE and its breakdown products are very close to meeting the GWPS. Two downgradient wells, PTX06-1149 and PTX06-1150, historically did not demonstrate strong treatment. These wells were downgradient of a single row of injection wells. In lieu of installing a recirculation system in 2021, Pantex drilled a second row of closely spaced wells across the southern portion of the ISB to address higher concentrations of TCE moving into those areas. Wells that can no longer be injected were infilled with new wells, rather than replacing the old wells, so that injections can be more closely spaced. Current data at downgradient wells demonstrates that stronger treatment is beginning to occur.

SOUTHEAST ISB EXTENSION REMEDIAL EFFECTIVENESS

The Southeast ISB Extension was installed in 2017 as an extension of the chosen remedy for the southeast perched groundwater. Four additional wells were installed in late 2020 and an additional two in 2021 along the eastern property line in a north-south alignment to further encompass the plume (Appendix A). These new wells were injected for the first time in April 2021, with the exception of PTX06-ISB331, which was injected in August 2022. Two treatment zone monitoring (TZM) wells were also installed in late 2021. Overall, seven injection events have been completed at this system, with the most recent injection finishing in September 2023. Due to the success with distribution of a more soluble carbon (molasses), Pantex began injection at the Southeast ISB Extension using only soluble carbon (molasses), as recommended in the *Fourth Quarter 2018 Progress Report*. Pantex plans to continue injection at this system using only molasses to improve distribution and treatment. Because this system has not been treated with EVO, injections have been scheduled at approximately every nine months.

Four ISB wells, two TZM wells and two downgradient ISPM wells were sampled between the third and fourth quarter of 2023. Treatment zone data indicates very strong to mild reducing conditions are present for treatment of HEs. ORP was between -123.2 mV and -9.1 mV and nitrate was reduced in all sampled wells. Soluble metals (arsenic and manganese) increased, indicating that reducing conditions are established. Total organic carbon results indicate that a sufficient food source is available to support establishment of reducing conditions at the wells.

Downgradient wells demonstrated partial treatment during this quarter. TOC has slightly increased in downgradient wells since beginning of sampling in 2018. Monitoring results for the system indicate that RDX and breakdown products are present in downgradient performance monitoring wells and metals (i.e. arsenic and manganese) are starting to increase.

OFFSITE REMEDIAL EFFECTIVENESS

The installation of the first phase of wells for the Offsite ISB system was completed in 2020. The first phase of the installation focused on treatment at the leading edge of the plume. Infrastructure to support an injection event was completed in June 2021, with first injection of molasses completed in October 2021 at the leading edge of the plume. Three new ISB wells were installed on the neighboring property in late 2021 and were injected in 2022. The system was further expanded

in 2022 with nineteen new ISB wells, which were injected for the first time in 2023. The last phase of wells was installed in summer 2023, but will not be injected until spring 2024. Based on the use of molasses, injections are planned every six months at differing parts of the system. Injection plans will follow the schedule that was designed using fate and transport and optimization modeling.

All water used in the injection process must be withdrawn from beneath the offsite property, so downgradient ISB extraction wells were installed. These wells were installed at the very edge of the plume and assist in pulling the amendment towards the removal wells, providing an expanded zone for COC treatment. Six ISB extraction wells (labeled REC wells due to the recirculation they provide) were sampled in the fourth quarter 2023. Two TSM wells were also sampled. Evaluation of the baseline data from 2022 at these wells indicated very mild reducing conditions with ORP ranging from 19 to 281 mV. As of the fourth quarter 2023, reducing conditions improved and ORP ranged from -119.2 mV to 44.8. Concentrations of HEs remain low in the REC wells at the leading edge of the plume. Total organic carbon was also present at a higher concentration in all six REC wells. Treatment zone data for the two new TSM wells does not indicate an established treatment zone and portions of the plume are not expected to establish treatment until 2025 or later. Concentrations at the downgradient ISPM well PTX06-1215 indicate that all high explosives remain below the GWPS indicating that the system is arresting downgradient movement of the plume.

BURNING GROUND SVE

The Burning Ground SVE system began operation in 2002 as a large-scale catalytic oxidizer (CatOX) system. Due to a large reduction in VOC concentrations, a small CatOX system has been operating at the Burning Ground SVE system since April 2012. This small-scale system focused on treating residual non-aqueous phase liquid (NAPL) and soil gas at a single extraction well (SVE-S-20) near the source area. Overall, the system operated 32% of the quarter (~ 709 hours of operation). The system had been shutdown due to repairs, but became operational again in August 2023. The system ran until the end of October 2023 when a failure of the catalytic oxidizer shutdown the system. Figure 4 shows mass removal calculated for the fourth quarter and since startup for VOCs that historically contribute to the total VOC concentration.

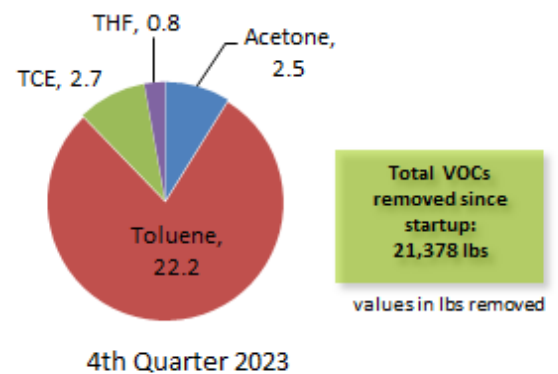


Figure 4. SVE Mass Removal

The system removed ~ 28 lbs of total VOCs during the fourth quarter, but has removed about 21,380 lbs of VOCs since startup. Based on PID data collected at the system effluent port, the overall average system destruction efficiency was 98%. Analytical data collected at startup indicate that the NAPL source is almost depleted, as reflected in the current mass removal values. Pantex submitted a closure report in August 2023 and requested closure of the system via the application for the renewal of the Hazardous Waste Permit. The SVE closure report was approved by EPA in October 2023 and TCEQ in December 2023.

UNCERTAINTY MANAGEMENT AND EARLY DETECTION

Uncertainty management and early detection wells are evaluated to determine if there are unexpected conditions in areas where previous groundwater contamination has not been detected or confirmed (Ogallala and perched aquifers), or in previous plume locations where concentrations have fallen below GWPS, background, and the practical quantitation limit (PQL) (e.g., perched wells at the Burning Ground and Old Sewage Treatment Plant areas). Indicator COCs are evaluated at the uncertainty management/early detection wells in the quarterly report. A map depicting the wells evaluated is included in Appendix A.

Review of the uncertainty management/early detection data collected during the fourth quarter indicates unexpected conditions at three Ogallala Aquifer wells: PTX06-1076, PTX06-1223 and PTX06-1229. Detections in these wells exceeded the respective PQLs. There were no unexpected conditions at perched uncertainty management wells in the fourth quarter.

4-amino-2,6-dinitrotoluene (DNT4A), a breakdown product of 2,4,6-trinitrotoluene (TNT), has been detected at PTX06-1076, with the initial detection occurring in June 2020. Sample results collected since that time have been variable, with values from May 2023 exceeding the PQL for the first time. As a result, a verification sample was completed at PTX06-1076 in August 2023. Results from the verification sample confirmed detections of DNT4A above the PQL. In accordance with the *Pantex Plant Ogallala Aquifer and Perched Groundwater Contingency Plan*, sampling was increased from semi-annual to monthly sampling for a three-month duration starting in October 2023. Results from this monthly sampling event are summarized below. Notification to regulators were sent in advance of sampling actions. Further actions will be determined based on future sampling results and in continued accordance with the *Pantex Plant Ogallala Aquifer and Perched Groundwater Contingency Plan*.

Summary of Unexpected Ogallala Detections at PTX06-1076, Fourth Quarter 2023

Well ID	Sample Date	Analyte	Measured Value (µg/L)	PQL (µg/L)	GWPS (µg/L)
PTX06-1076	10/17/2023	DNT4A	0.162	0.104	1.2
	11/14/2023	DNT4A	0.159	0.104	1.2
	12/06/2023	DNT4A	0.168	0.104	1.2

In response to the recent detections of high explosives in Ogallala Aquifer well PTX06-1056, Pantex installed three new Ogallala monitoring wells to investigate nature and extent of the contamination (see Appendix A for well locations). The new wells were installed in areas identified in earlier plume modeling for being at risk of vertical contamination migration from the perched to the Ogallala Aquifer and within the Ogallala flow path. Two wells were initially installed in May 2023. PTX06-1223 was installed upgradient of PTX06-1056 and PTX06-1224 was installed as a side gradient well to PTX06-1056. Initial sampling at PTX06-1224 detected no contaminants of concern.

Initial results from PTX06-1223 measured DNT4A and RDX at similar concentrations to recent samples from PTX06-1056, though all concentrations were below the GWPS.

Summary of Unexpected Ogallala Detections at PTX06-1223, Fourth Quarter 2023

Well ID	Sample Date	Analyte	Measured Value (µg/L)	PQL (µg/L)	GWPS (µg/L)
PTX06-1223	12/06/2023	DNT4A	1.03	0.104	1.2
		RDX	1.03	0.102	2
		TNX	0.308	0.104	2

PTX06-1229 was installed in September 2023 as part of continuing efforts to investigate the detections. PTX06-1229 was installed downgradient of PTX06-1223, after early sampling results indicated the presence of high explosives in PTX06-1223. Initial sampling results received in late December 2023 for PTX06-1229 indicated the presence of three high explosives constituents in the Ogallala Aquifer at concentrations above GWPS.

Summary of Unexpected Ogallala Detections at PTX06-1229, Fourth Quarter 2023

Well ID	Sample Date	Analyte	Measured Value (µg/L)	PQL (µg/L)	GWPS (µg/L)
PTX06-1229	12/06/2023	DNT2A	0.407	0.104	1.2
		DNT4A	5.98	0.104	1.2
		HMX	8.93	1.03	360
		RDX	307	10.3	2
		TNX	20.0	1.03	2
		MNX	0.08	0.103	2
		DNT26	0.04	0.103	1

At this time, Pantex does not believe the detection is a result of natural migration from the perched groundwater to the underlying Ogallala Aquifer. The installation of a perched well (PTX06-1103, originally identified as PTX06-EW52), located upgradient of PTX06-1229, may have created a previous preferential pathway for the migration of high explosive contaminants from the perched groundwater into the Ogallala Aquifer. The perched well in question was drilled in 2005 for the intent of extraction and treatment of contaminated perched groundwater and treatment in the Southeast Pump and Treat System. This well was plugged in October 2010 after indications that it was acting as a preferential pathway to the Ogallala Aquifer. A verification sample was completed at PTX06-1229 in January 2024 that confirmed the high explosive detections above the GWPS. Pantex has requested special funding to implement measures to begin evaluating extent of the detections by installing two additional Ogallala monitor wells in 2024. Further installations will be evaluated after gaining information from the new wells. Further actions will be determined based on future

sampling results and in accordance with the *Pantex Plant Ogallala Aquifer and Perched Groundwater Contingency Plan*.

OTHER UNEXPECTED CONDITIONS

Pantex routinely evaluates data received from the laboratory to determine if it presents off-trend, all-time high or new detection conclusions that may require further sampling or evaluation. Through the well maintenance program, Pantex also inspects wells at least every five years to ensure they are not silting in and to evaluate whether the well remains in contact with the formation. No unexpected conditions were noted in the fourth quarter.

SCHEDULE UPDATE

Pantex provided a detailed schedule of upcoming work in the *2022 Annual Progress Report*. An update of the activities scheduled to be started or completed by the publication date of this report is provided below.

Pantex completed the following:

- The second 2023 injection event was completed at the Offsite ISB wells in December 2023.
- Injections were completed at the Zone 11 ISB system at the end of December.
- Pantex submitted a Request for Proposal for the design of the upgrade to the SCADA system for SEPTS and P1PTS. The contract was awarded in September 2022 and the 90% design was submitted and approved in November. Due to funding expectations in the upcoming fiscal years, a phased design approach is being added. The final phased design was submitted in February 2024.
- Pantex submitted the application for HW-50284 permit renewal in November 2023, with request to remove the Burning Ground SVE system from the permit, add three new ISB Systems (East ISB, Perchlorate/Chromium ISB, and County Road 8 ISB), and remove PTX06-1153 as a monitor well in CP Table V.
- Pantex submitted an underground injection control application for 5X2600215 in December 2023 to increase injection capacity for current and new systems.

CONCLUSIONS AND RECOMMENDATIONS FOR CHANGE

The remedial actions continue to operate and meet short-term expectations for cleanup of the perched groundwater in areas under the influence of the remediation systems. Perched water levels are declining, mass is being removed or reduced, and institutional controls provide protection from use of impacted groundwater, while the remedial actions continue to operate to meet long-term goals. Pantex is working to extend treatment systems to areas that are not currently under the influence of existing remediation systems. Pantex has completed projects to provide new injection and irrigation capabilities for treated water injection and beneficial use to ensure consistent operation of the pump and treat systems.

The Southeast Pump and Treat System continued to remove COC mass and water from critical areas in the perched aquifer; thus, decreasing head that drives vertical and lateral movement of perched groundwater. P1PTS ran a majority of the fourth quarter until a break at the pivot irrigation system occurred during December. The system was shutdown on December 7th to prioritize operations at SEPTS. The wet well break was repaired in February 2024.

Monitoring results for areas downgradient of the established ISB systems continue to demonstrate that treatment has been generally effective. COC concentrations meet the GWPS at the Southeast ISB at two downgradient wells, with a third dry well having previously met GWPS. One downgradient well (PTX06-1153) for the Southeast ISB is not responding to treatment as well as the others. Pantex injected molasses during the 2019 and 2022 injection event to attempt better distribution of the amendment and will continue to monitor the results over time to determine if the injection will affect the water moving into that area. Pantex has recommended removing PTX06-1153 from HW-50284 so the monitor well can be used for injection. Pantex has also requested to add this well to the underground injection control permit so the well can be used for injection. Further recommendations will be made based on evaluation of data over time.

Downgradient wells at the Zone 11 ISB are demonstrating treatment. Most downgradient wells meet or are near the GWPS for the primary contaminants and breakdown products. Pantex has changed the injection strategy at the Z11 ISB to attempt better distribution of amendment between wells and provide better treatment of TCE and perchlorate. Data indicates injection of a more soluble carbon source (molasses) has distributed widely where injected and that reducing conditions have improved in areas where wells are widely spaced. Molasses is the primary amendment used at the system, but a mixture of EVO and molasses was used at select wells during the 2023 injection to establish deeper reducing conditions at newer wells that are closely spaced. Pantex will continue to evaluate the data and make appropriate recommendations for treatment in the upcoming progress reports.

The Southeast ISB Extension was installed at the Pantex fence line to arrest the continued movement of COCs to offsite properties. The system has been operating and is being evaluated for its effectiveness at the offsite property. The Southeast ISB Extension is demonstrating treatment in the zone where injection has occurred, but downgradient monitoring wells are not expected to exhibit the effects of complete treatment until 2025. Pantex continues progress toward cleanup of the southeast lobe of perched groundwater. A new ISB system (Offsite ISB) was designed to address HE contamination found beneath neighboring properties. Installation of infrastructure for Phase 1 and 2 of the Offsite ISB completed in 2021 and the first injection into the system was completed in October 2021, with semi-annual injections occurring afterward. Phase 3 well construction is also complete and construction of Phase 3 and 4 infrastructure was completed by September 2023. As more injections occur at the system, concentrations of HEs are trending downward in sampled REC wells, including those at the leading edge of the plume. The final downgradient monitoring well for the system indicates that all high explosives remain below the GWPS.

Since 2002, the SVE system has treated soil gas and residual NAPL in the solvent evaporation pit/chemical burn pit area of the Burning Ground, mitigating vertical movement of VOCs to groundwater. Pantex was unable to complete rebound tests successfully, and was unable to

prepare a path to closure as recommended in the first Five-Year Review. Therefore, Pantex has evaluated other paths to closure for this system. In May 2017, Pantex completed a modification to six inactive SVE extraction wells surrounding the active extraction well SVE-S-20 to open the wells to ambient air. This modification enhances airflow through the formation while the system is operating. The airflow increased from 32 scfm to about 44 scfm over time. Evaluation of hourly VOC removal indicates that the mass removal rate initially increased with the increase in influent airflow; however, influent concentrations and mass removal have greatly decreased since the system was modified. Pantex pulsed the system to evaluate its readiness for final closure. Based on data collected since 2020, Pantex has recommend closure of the system by submitting a closure report to TCEQ and EPA and requested removal of the system in the recently submitted application for renewal of the Hazardous Waste Permit. EPA approved the closure report in October 2023 and TCEQ followed with approval in December 2023.

The groundwater remedies are considered protective for the short-term, as untreated perched groundwater usage is controlled to prevent human contact and monitoring data continue to indicate that the remedial actions remain generally protective of the Ogallala Aquifer. Additional investigation of the area of the Ogallala Aquifer near PTX06-1056 began in early 2023 with installation of two new monitoring wells. Installation of a third well was also completed in September 2023. Initial detections at the newly installed third well, PTX06-1229, indicate the presence of high explosives above the GWPS. At this time, Pantex does not believe the detections are a result of natural migration from the perched groundwater to the underlying Ogallala Aquifer, but rather a previous preferential pathway from a now plugged perched well. Further actions at PTX06-1056 and PTX06-1229 will be determined based on future sampling results and in accordance with the *Pantex Plant Ogallala Aquifer and Perched Groundwater Contingency Plan*.