PANTEX QUARTERLY PROGRESS REPORT

Remedial Action Progress

2nd Quarter 2019

In support of Hazardous Waste Permit #50284 and

Pantex Plant Interagency Agreement

September 2019

Pantex Plant

FM 2373 and U.S. Highway 60

P.O. Box 30030

Amarillo, TX 79120

NNSA PRODUCTION OFFICE — UNITED BY A COMMON GOAL

CNS consolidated nuclear security, llc
PANTEX PLANT | Y-12 NATIONAL SECURITY COMPLEX

CERTIFICATION STATEMENT

2nd Quarter 2019 Remedial Action Progress Report
Pantex Plant, September 2019

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.

James C. Cantwell 9/3/2019

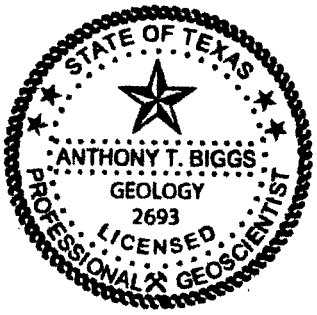
James C. Cantwell
Director
Environment, Safety and Health
Consolidated Nuclear Security, LLC

Date

Quarterly Progress Report
2nd Quarter 2019
in Support of Hazardous Waste Permit #50284
and Pantex Plant Interagency Agreement
for the Pantex Plant, Amarillo, Texas
September 2019

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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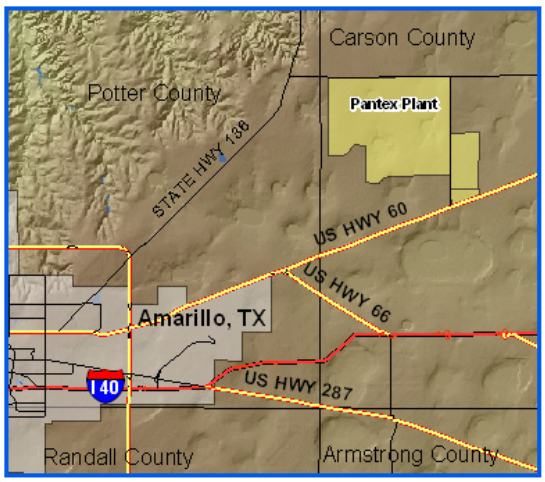
List of Acronyms

µg/L	micrograms per liter
CatOX	catalytic oxidation
COC	contaminant of concern
Cr(VI)	hexavalent chromium
DCE	dichloroethene
DHC	*Dehalococcoides* spp.
DNT4A	4-amino-2,6-dinitrotoluene
DO	dissolved oxygen
EVO	emulsified vegetable oil
FGZ	fine-grained zone
FY	fiscal year
FYR	five-year review
GWPS	groundwater protection standard
HE	high explosive
HW-50284	Hazardous Waste Permit #50284
IAG	Interagency Agreement
ISPM	in situ performance monitoring
ISB	in situ bioremediation
lb	pound
Mgal	million gallons
mV	millivolts
NAPL	non-aqueous phase liquid
ORP	oxidation-reduction potential
P1PTS	Playa 1 Pump and Treat System
PID	photoionization detector
PQL	practical quantitation limit
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
ROD	Record of Decision
SAP	sampling and analysis plan
SEPTS	Southeast Pump and Treat System
SVE	soil vapor extraction
SWMU	Solid Waste Management Unit
TCE	trichloroethene
THF	tetrahydrofuran
TNT	trinitrotoluene
VOC	volatile organic compound
WWTF	wastewater treatment facility

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 two 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 2nd quarter 2019.



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 required information from Hazardous Waste Permit #50284 (HW-50284) CP Table VII and the Pantex Interagency Agreement (IAG).

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 (PID) 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 by the wastewater treatment facility (WWTF) and irrigation system, for general Plant needs, 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. Operational priorities for the pump and treat systems emphasize beneficial use of water.

Pump and Treat System
2nd Quarter 2019 Operation

Playa 1 Pump and Treat System (P1PTS)	
Days Operated	28
% Operation Time	24%
Volume Water Treated (Mgal)	4.7
HE Mass Removal (lbs)	1.1
Beneficial Use of Water	0
Southeast Pump and Treat System (SEPTS)	
Days Operated	91
% Operation Time	99%
Volume Water Treated (Mgal)	32.4
HE Mass Removal (lbs)	144
Chromium Mass Removal (lbs)	20.3
Beneficial Use of Water	4.9%

Value below operational goals

SEPTS and P1PTS operation and throughput continued to be impacted in the 2nd quarter by a filter bank break at the irrigation system that occurred in late June 2017. Due to the severity of the break, engineering evaluation, contracting, and major repairs were required to restore the irrigation system. Repairs to the filter bank were completed in May 2019, with startup testing occurring afterward. Further testing is required to now evaluate the subsurface drip lines before the system can be operated. Meanwhile, Pantex continues to release all WWTF water to Playa 1. The flow to Playa 1 is restricted by permit, so flow from the systems must also be restricted until the irrigation system is operational.

Current and future operations of both systems will be impaired by the restricted flow to the WWTF until the irrigation system is operational. The SEPTS system has operated at a higher capacity using injection, release to Playa 1, and shutdown of P1PTS to allow full treatment at the system since January 14, 2019. After January, P1PTS has been only operated one week per month to ensure continued operability of the system. When P1PTS was operating, SEPTS operated at a lower flow, with treated water injected. A small amount of water was beneficially used at the Zone 11 ISB for injection and for reseeding of areas where buildings were removed.

Both systems were operated to optimize capture of water and mass in the southeast area during 2nd quarter 2019. For this reason, P1PTS throughput was lower than the usual goal of 90%. With

the increased flow after January 14, SEPTS throughput was near the 90% goal. Graphs of monthly operation and throughput are included in Appendix B. About 95% of the treated water was either released to Playa 1 or injected into perched injection wells. When both systems are operating, Pantex has focused on operating the highest priority wells at SEPTS to continue capture of water along the FM 2373 fence line, at the new wells east of FM 2373, and at the highest plume concentrations to the south on Texas Tech property. Wells on the northern fence line along FM 2373 are demonstrating impact from the reduction in water levels, and continued issues with pumping are expected. Most wells were operating at P1PTS.

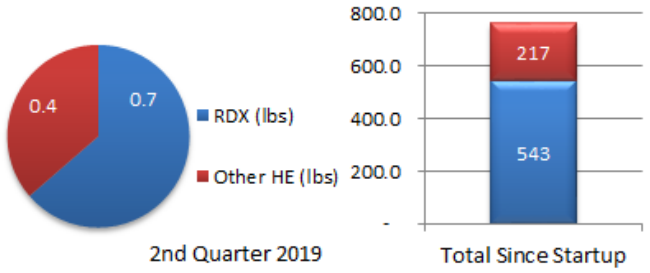


Figure 1. P1PTS Mass Removal

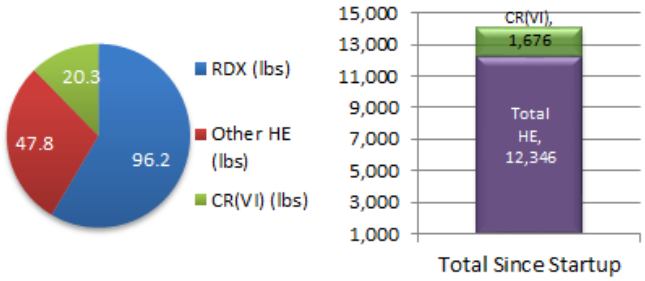


Figure 2. SEPTS Mass Removal

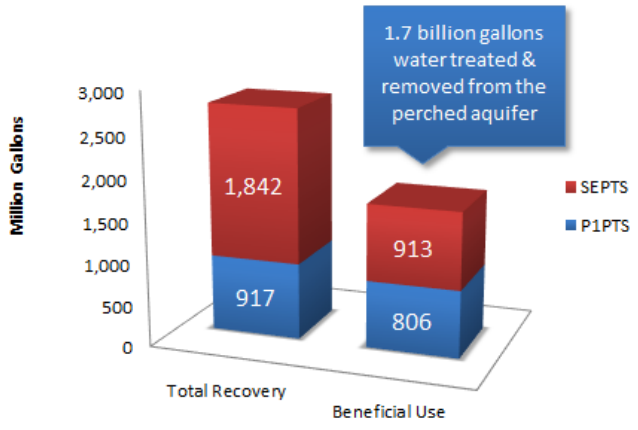


Figure 3. System Recovery and Use

P1PTS primarily treats RDX and SEPTS primarily treats RDX and hexavalent chromium [Cr(VI)]. Figures 1 and 2 provide mass removal information for RDX and other high explosives (HEs) and Cr(VI) for the 2nd quarter, as well as totals since system startup. Concentrations near Playa 1 are much lower due to declining source concentrations; therefore, mass removal is much lower at P1PTS. The primary goal of P1PTS is water removal to decrease saturated thickness and remove the head pressure that pushes groundwater out horizontally, with mass removal as a secondary goal. Overall, the systems have removed over 14,600 lbs of HE and chromium contaminants from perched groundwater since operations began.

The total recovery and treatment from both systems since startup has been calculated at about 2.8 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 1.7 billion gallons of treated water beneficially used since startup of the irrigation system. The recovery and beneficial use totals are presented in Figure 3. Currently the

systems are releasing water to the WWTF and then to Playa 1 or to injection wells, so most of the treated water is not currently beneficially used.

Evaluation of effluent data from both systems indicates that all COCs were treated to levels below the groundwater protection standard (GWPS).

Pantex is currently planning for other irrigation alternatives on the property east of FM 2373 to provide additional long-term use of the treatment system water. Funding has been requested in fiscal year (FY) 2021 to design and construct the infrastructure for irrigation of land east of FM 2373 using center pivot. Pantex has identified funding to design and construct three new perched injection wells to the east of Playa 2, and northwest of the Zone 11 ISB. Contracting for the design and construction of the injection wells and infrastructure is underway, with the project scheduled to be complete in 2020. These new injection wells will provide a consistent outlet for a portion of the treated water when irrigation is not an available method for beneficial use of the treated water. These wells will also provide a method to inject the treated water without affecting movement and capture of plumes in the southeast area.

Pantex has not observed any current issues with the movement of plumes due to the continued injection of water from the SEPTS. Changes in the plume have been observed, but changes appear to be related to the reduced extraction from the system. Pantex expects to continue injection at SEPTS in the near future, as repairs to the current irrigation system will be limited to two 100-acre plots. Once the three new injection wells are installed and a new irrigation system east of FM 2373 is designed and constructed, the systems will be able to consistently operate at or near capacity.

ISB Systems

Three ISB systems (Zone 11 ISB, Southeast ISB, and Southeast ISB Extension) are installed at Pantex. 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 were 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 is RDX.

Treatment data are presented in this report for the Southeast ISB Extension. The system was injected for the first time in February 2019 and data were collected in 2nd quarter 2019.

For the treatment zone wells, this report evaluates whether the conditions are present to degrade the COCs in each area, and evaluates the presence of a continued food source for the microbial reduction of COCs (see Table 1).

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. Table 1 also summarizes ISB system performance.

Table 1. ISB System Performance

	Treatment Zone Wells		Downgradient Performance Monitoring Wells		
System	**Reducing Conditions**	**Food Source Available**	**Primary COCs Reduced?**	**COCs < GWPS?**	**Degradation Products of COCs Reduced?**
Zone 11 ISB	Very mild to strong	Yes	Yes	Perchlorate in all wells TCE in 5 of 9 wells	No [1]
Southeast ISB	Very mild to strong	Yes	Yes	RDX in 1 of 3 wells Cr(VI) in 2 of 2 wells [2]	No [3]
Southeast ISB Extension	Mild to strong	Yes	No	No	No[4]

Mild conditions = oxidation-reduction potential (ORP) of 0 to -50 millivolts (mV)
Strong conditions = ORP < -100 mV and sulfate and nitrate reduced, indicating that conditions are present for reductive dechlorination.

[1] cis-1,2-Dichloroethene (DCE) concentrations remain above GWPS in three downgradient wells, while vinyl chloride concentrations (final breakdown compound) remain at low concentrations or not detected. During the 2nd quarter, cis-1,2-dichloroethene concentrations were near the GWPS, indicating that the system is nearing treatment to the GWPS. Pantex bioaugmented the original wells on the west side of the system during the seventh injection event in 2015. Pantex is continuing to monitor the effectiveness of the bioaugmentation.

[2] Pantex formerly sampled four downgradient wells at this system. However, one of the wells (PTX06-1123) continues to demonstrate low water conditions and can no longer be sampled. This well had demonstrated complete treatment of HEs and Cr(VI) from October 2012 to August 2015. PTX06-1037 has been sampled for limited analytes due to low water levels. Only HEs were collected at this location, with HEs not detected.

[3] PTX06-1153 is currently demonstrating partial treatment. Therefore, the degradation products of RDX are now observed above the GWPS.

[4]This system was injected for the first time in February 2019. The downgradient wells are not expected to demonstrate treatment for at least two years following the first injection.

ZONE 11 ISB

Installation of the Zone 11 ISB remedial action was completed in 2009, and an expansion was completed in early 2015 (see Appendix A maps). Nine injection events have been completed at the current system, with the first injection event occurring in the expansion zone in 2015. The ninth injection event for the ISB was completed in October 2018, with only the expansion area injected. As documented in the *2016 Annual Progress Report* (Pantex, 2017), data indicate that moving to a two-year injection frequency in the original portion of the system is appropriate for future injections with emulsified vegetable oil (EVO). However, as presented in the 4th quarter 2018 Progress Report, Pantex plans to move primarily 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 injection wells at a much higher concentration than EVO. More frequent injections are

anticipated for molasses and have been planned at least annually for the Zone 11 ISB due to the need to continue reducing conditions. Pantex will continue to evaluate the system for the timing of injections with the molasses. Pantex will also continue to evaluate the expansion area to determine the appropriate timing or need for bioaugmentation with *Dehalococcoides* spp. (DHC) to potentially boost the treatment efficiency for TCE. The entire system is currently undergoing injection and is scheduled to be completed in November.

The Zone 11 ISB has a well-established treatment zone in the original portion of the system, where injection has occurred since 2009. The expansion area (see map in Appendix A) has received three injections, so deeper reducing conditions are likely established at the injection wells. Deep reducing conditions have not been fully demonstrated at all of the treatment zone monitor wells located between the injection wells in the expansion area. The molasses injection is expected to improve conditions between injection wells. All wells downgradient of the system have indicated arrival of treated water.

Evaluation of data in the treatment zone indicates very mild to strong reducing conditions (ORP ranging from -10 to -117 and sulfate from non-detect to 25 µg/L across the Zone 11 ISB. Monitored conditions indicate that sulfate was reduced in nine of twelve wells inside the treatment zone, indicating deeper reducing conditions in those areas. The three wells that do not have deep reducing conditions are non-injected monitoring wells. Two of those wells are in the original part of the system that was not injected in 2018. Conditions improved at most of the non-injected wells in the expansion area, following the molasses/EVO injection in 2018. PTX06-1164, a first-row monitor well, had conditions improve following injection but recent data indicate conditions are reversing. However, methane concentrations were high in most treatment zone wells this quarter, indicating that strong reducing conditions continue to occur in many areas. TCE continues to be reduced to cis-1,2-dichloroethene (DCE), with TCE concentrations below GWPS in nine monitor wells inside of the treatment zone and cis-1,2-DCE present at concentrations below the GWPS in ten of the twelve monitor wells. The presence of TCE and cis-1,2-DCE continues to indicate partial treatment in the non-injected treatment zone wells, as concentrations tend to be higher in the non-injected 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 three wells inside the treatment zone, but ethene was not detected at any wells. The low vinyl chloride results, coupled with the lack of ethene results, indicate that a limited amount of TCE is being completely degraded in some areas of the treatment zone. When TCE concentrations inside the treatment zone are low (< 300 µg/L), these low degradation rates may be enough to treat TCE and its breakdown products to GWPS. Upgradient data still indicate TCE concentrations periodically fluctuating above 300 µg/L, with a concentration of 1500 µg/L indicated at an upgradient monitoring well in late 2018.

Pantex evaluates performance at nine downgradient ISPM wells for the Zone 11 ISB, including the wells in the expansion area. All of these wells have perchlorate concentrations below the GWPS in 2nd quarter. TCE concentrations are below the GWPS in five of nine ISPM wells. The first breakdown product of TCE, cis-1,2-DCE was detected above the GWPS in three downgradient wells, PTX06-1155, PTX06-1173, and PTX06-1174. Where cis-1,2-DCE is high, TCE is near or below the GWPS. Where TCE concentrations remain well above the GWPS at PTX06-1175 and PTX06-1150,

there is little or no cis-1,2-DCE indicating that reducing conditions are not conducive to treatment or that treatment is slower to reach the downgradient well. Data indicate that due to treatment, concentrations of TCE and its breakdown products are very close to meeting the GWPS in treated water from the original portion of the system. The only downgradient well that is not demonstrating strong treatment is PTX06-1175, located downgradient of the newer expanded area of the system.

Two former ISB injection wells (PTX06-ISB079 and PTX06-ISB082) are now monitored to evaluate conditions on the perchlorate (eastern) side of the ISB, in the second row of injection wells. Pantex will no longer inject into the second row of wells, and will evaluate these wells to ensure that treatment continues on the perchlorate side of the ISB. Additionally, the results for upgradient well PTX06-1127 indicate that TCE is increasing above GWPS on the eastern side of the ISB, so treatment of the TCE will also be evaluated to determine if changes in the system operation will be required. Currently, perchlorate and the low concentrations of TCE that occur on the eastern side are treated to non-detect. No degradation products of TCE were detected.

Although there are areas in the treatment zone that indicate mild reducing conditions, the downgradient data indicate that treatment is effectively reducing contaminants and risk across the Zone 11 ISB. The mild conditions at PTX06-1064, PTX06-1170, and PTX06-ISB075 indicate a greater loss of reducing conditions in that area of the ISB and possible higher concentrations of TCE moving through the system. Future downgradient COC concentrations may increase after the impacted water moves through the system.

Pantex began rehabilitation of wells in March 2019 and injection began in May 2019. Injection is scheduled for completion in November. Due to very mild conditions that occur in the new treatment zone wells in the expansion area, Pantex will continue to evaluate data to determine the appropriate timing and need for bioaugmentation.

Due to problems with plugging of the wells, Pantex has moved to injection of molasses only, as recommended in the 4th quarter 2018 report. Pantex has already encountered injection issues at a portion of the wells in the expansion area even though the 2018 injection event was only the third injection event for that area of the ISB. During 3rd quarter 2018, a dose response study was performed to evaluate the arrival of the carbon at non-injected treatment zone monitoring wells located between injection wells. The study indicates that the more soluble carbon is widely distributed at higher concentrations and that larger volumes of water/amendment injection using soluble carbon should improve distribution and reducing conditions between the wells. Data indicate that the conditions between wells has generally improved in the expansion area. Pantex will continue to evaluate the data and make appropriate recommendations for treatment in the upcoming progress reports.

SOUTHEAST ISB

The Southeast ISB was installed in 2007. Six injection events have been completed at this system. The Southeast ISB continues to demonstrate declining water levels at the system; as a result, only 50% of the system was injected during 2016. A discussion of the injection and issues encountered

is provided in the 2016 Annual Progress Report. Based on review of system data and ISB Pilot Study data, Pantex recommended waiting three years for the next injection in the Southeast ISB. That injection event is scheduled for later in 2019. Rehabilitation of wells began in August and injection is scheduled to begin in November. As recommended in the 2018 Annual Progress Report, Pantex plans to use molasses only for the upcoming injection events to improve distribution of amendment thereby improving reducing conditions at the ISBs. Pantex scheduled injection at this system in 2021 due to the use of molasses only during the 2019 injection.

Due to low water levels or dry conditions in wells, only four of eight treatment zone monitoring wells were sampled in 2nd quarter. Evaluation of treatment zone data indicates that mild to deep reducing conditions are present for treatment of HEs and Cr(VI). ORP is between -56 mV and 100 mV and sulfate is reduced to values less than 2 µg/L in all wells. The positive ORP value is anomalous since the sulfate data and DO data indicate deeper reducing conditions at the well (PTX06-ISB048). Data continue to indicate that reducing conditions are present for continued reduction of HEs and Cr(VI). Total organic carbon results indicate that a continued food source is available to maintain the reducing conditions, with only one well demonstrating TOC below 200 mg/L. All COCs were non-detect in the sampled treatment zone wells.

Four downgradient wells have historically been sampled at this system. One of the closest downgradient monitoring wells for the Southeast ISB, PTX06-1154, demonstrates reduction of RDX, RDX degradation products, and Cr(VI), with all COCs non-detect. PTX06-1123 had demonstrated COC concentrations below the GWPS until August 2015 when water levels dropped and the well could no longer be sampled. PTX06-1037 also demonstrated treatment from October 2011 through September 2018. Limited sampling has occurred at this well since November 2017 due to declining water levels. The HE sample collected at PTX06-1037 indicates that the primary COCS continue to be treated to non-detect. PTX06-1153 continues to exhibit RDX concentrations above the GWPS, but Cr(VI) concentrations remain below the GWPS. During the 2nd quarter, this well continued to demonstrate signs of partial treatment. Breakdown products of RDX were detected at concentrations above the GWPS (ranging from 16.1 to 23.3 µg/L). Upgradient dry wells were injected in 2013 and 2015 in an attempt to affect this well. It is possible that those injections were slow to respond at this location and may only be partially affecting the water that continues to move into PTX06-1153. As with other locations, water levels at this well continue to decline. Pantex will continue to monitor PTX06-1153 for contaminant concentrations and water levels over time. It is expected that injection with molasses will improve treatment conditions and affect PTX06-1153 in the future.

Many of the injection and performance monitoring wells indicate variable water conditions at the Southeast ISB. Two Southeast ISB performance monitoring wells (one upgradient and one farther downgradient) remain dry and cannot be sampled. PTX06-1123, a downgradient performance monitoring well, is no longer sampled due to insufficient water in the well. The remaining two downgradient wells demonstrate declining water levels, with only PTX06-1153 containing more than 4 ft of water above the bottom of screen. Only four of eight monitoring wells in the treatment zone could be sampled in the 2nd quarter due to insufficient water. Injection was completed at only 50% of the injection wells during the 2016 injection event due to dry or low water (< 1 ft)

conditions in the wells. The inability to sample or inject into these wells is expected to persist with continued upgradient removal of water by the SEPTS. Evaluation of data indicates that most wells in the Southeast ISB will not contain appreciable water by 2022. Pantex plans to inject the system in 2021 due to the use of molasses, but further injections may be limited or unnecessary.

SOUTHEAST ISB EXTENSION

The Southeast ISB Extension was installed in 2017 as an extension of the chosen remedy for the southeast perched groundwater. One injection event has been completed for this system, with the injection completed in February 2019. Due to the success with distribution of a more soluble carbon (molasses) and the long turnaround needed to order EVO, Pantex began injection at the Southeast ISB Extension using only soluble carbon (molasses), as recommended in the 3rd 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 six to nine months. Pantex started injecting this system in August and is scheduled to be complete in September.

The first post-injection treatment zone data were collected in 2nd quarter 2019. Treatment zone data collected at six injection wells indicate that mild to deep reducing conditions are present for treatment of HEs. ORP is between -5 mV and -63 mV, nitrate is reduced in all wells, and sulfate is reduced to values less than 2 µg/L in three wells (PTX06-ISB108, PTX06-ISB113, and PTX06-ISB127). Soluble metals (arsenic and manganese) increased, indicating that reducing conditions are establishing. Total organic carbon results indicate that a sufficient food source is available to continue to establish reducing conditions. Only RDX degradation products were detected in the sampled injection wells.

Because injections just started at this ISB, downgradient effects are not expected for at least two years following the first injection. Data indicate that RDX and 4-amino-2,6-dinitrotoluene exceed the GWPS at two downgradient wells. One well does not indicate COCs above the GWPS as affected upgradient water has not yet reached the well.

A second set of data were collected in 3rd quarter, prior to beginning rehabilitation and injection. Those results will provide an understanding of the longevity of the molasses to determine if lengthening injections to 9 months is appropriate.

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 focuses on treating residual non-aqueous phase liquid (NAPL) and soil gas at a single extraction well (SVE-S-20) near the source area.

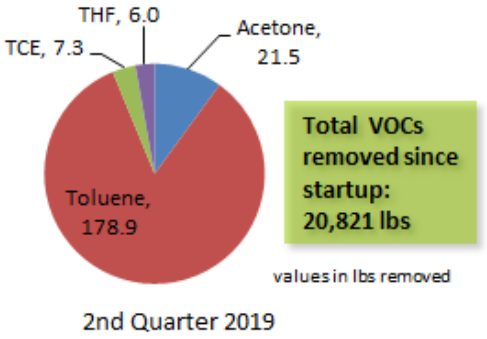


Figure 4. SVE Mass Removal

The system operated over most of 2nd quarter. It was shut down due to loss of power, low pH, and failure to maintain temperature. The system operated about 92% of the quarter (about 2,005 hours of operation). Figure 4 shows mass removal calculated for the 2nd quarter and since startup for VOCs contributing more than 2% of the total VOC concentration.

The system removed about 214 lbs of VOCs during 2nd quarter, and has removed over 20,800 lbs of VOCs since startup. Based on PID data collected at the system effluent port, system destruction efficiency was at least 96%. The system operated at a higher flow due to the modifications to the system, with the flow increased from 32 standard cubic feet per minute (scfm) in early 2017 to the current level of 44 scfm. The hourly VOC removal rates increased with the increased flow until 2nd quarter 2018. The removal rate declined during 2018, but the recent removal rate slightly improved. Pantex will continue to evaluate the effectiveness of the active system to determine when active remediation may no longer be effective.

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 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 2nd quarter indicates unexpected conditions at one Ogallala Aquifer well (PTX06-1056). No detections exceeded the GWPS in the Ogallala Aquifer uncertainty management/early detection wells sampled during the 2nd quarter. There were no unexpected conditions at perched uncertainty management wells in the 2nd quarter.

Summary of Unexpected Ogallala Detections, 2nd Quarter 2019

Well ID	Sample Date	Analyte	Measured Value (µg/L)	PQL (µg/L)	GWPS (µg/L)
PTX06-1056	4/16/2019	4-Amino-2,6-Dinitrotoluene	0.37	0.269	1.2
PTX06-1056	4/16/2019	1,2-Dichloroethane	0.77	1	5

PTX06-1056 continues to demonstrate detections of 4-amino-2,6-dinitrotoluene (DNT4A), a breakdown product of TNT, with the initial detection occurring in April 2014. Sample results collected since that time have been variable, with values slightly exceeding the PQL since late 2016. 1,2-Dichloroethane (DCA12) has been variably detected since August 2015, with all detections below the PQL. Trends of these analytes were performed using Mann-Kendall statistics; DNT4A and DCA12 continues to demonstrate a slight increasing trend across all data, with no trend across recent samples (last four samples).

Pantex has proactively evaluated potential sources for the contamination. A nearby perched well that was drilled deep into the fine-grained zone (FGZ) was plugged to address that potential source. An outside review indicated that, based on fate and transport modeling, the perched well was the most likely source of the contamination. A cement bond log was run on PTX06-1056 in October 2016 to determine the competency of the concrete seal at the FGZ. The log indicates that the seal is competent and that PTX06-1056 is likely not acting as a preferential pathway for contamination to reach the Ogallala Aquifer. As agreed with regulatory agencies, Pantex will continue with quarterly sampling to evaluate trends in these detections. Further actions will be determined based on results of sampling and in accordance with the Pantex Groundwater Contingency Plan.

Other Unexpected Conditions

Pantex routinely evaluates data as they come in from the laboratory to determine if data are off-trend, at an all-time high, or represent a new detection 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.

As discussed in previous quarterly reports, Pantex drilled PTX06-1182 in 2016 to evaluate water conditions in the southeastern lobe of perched groundwater based on the continued annual evaluation that indicated that some portions of the southeast perched groundwater are not under the influence of the pump and treat systems. Water containing HEs at concentrations above the GWPS was discovered in PTX06-1182. In response to that information, Pantex installed three new wells (PTX06-1184, PTX06-1185, and PTX06-1186 [subsequently changed to PTX06-ISB107, the first well on the west side of the ISB]) during 2nd quarter 2017 to define the extent of the plume to the southeast (see figure in Attachment A maps for well locations). Water was discovered in PTX06-1184 and PTX06-1186 and data confirmed the presence of two HEs, RDX and DNT4A at unexpected levels above the GWPS.

As previously recommended, Pantex obtained additional funding to extend the Southeast ISB remedy to the southeast boundary of the site and add new monitoring wells. Pantex completed drilling the ISB wells in December 2017. Pantex also obtained an agreement with the landowner to the south and completed installation of four monitoring wells in January 2018. Water was present in three of the wells; the other (PTX06-1193) was dry. Sampling of the three wells indicated that only one of the new wells on the neighboring property demonstrated detections of COCs above GWPS. In January 2018, Pantex also installed another monitoring well (PTX06-1195) along the Pantex eastern fence line, north of the final Southeast ISB extension well, to define extent in that area. Results indicate continue to indicate no detections of COCs above background concentrations or GWPS.

During 2nd quarter 2018, Pantex obtained an agreement with the neighbor to the southeast allowing three monitoring wells (PTX06-1196, PTX06-1197, and PTX06-1199) to be drilled in July 2018. Samples were collected in August 2018, and results indicated that we were near the extent of contamination to the east, but not to the southeast, as demonstrated by the detection of RDX in PTX06-1197 (the farthest downgradient well).

Because the contaminant distribution indicates flow primarily through an old subsurface paleochannel and the main RDX plume is only 500 to 700 ft wide at the property boundary, proper positioning of wells is important to identify the paleochannel and extent of contamination. The main paleochannel where the highest concentrations occur is narrower, likely only about 250 ft wide. To identify the boundaries of the subsurface paleochannel, Pantex conducted an electromagnetic study using Willowstick Technologies, LLC. The objective of this study was to attempt to identify the area with faster flow paths in the groundwater so that the extent of contamination can be positively identified. The report indicated the possibility of subsurface paleochannels extending through the ISB, with one primary paleochannel leading offsite to the south and southwest. The results of the study were less certain at the offsite property due to interference from utility lines and the wiring loop that connected the beginning and ending wells, homogeneity of the subsurface soils in the perched aquifer to the southeast, and lack of down-gradient wells. These issues resulted in the inability to identify any paleochannels to the southeast of Pantex. However, based on the one identified paleochannel and contaminant data collected at installed wells, Pantex began installing 6 new wells (PTX06-1200 through 1205) on the property to the south and southeast of Pantex property in December 2018. The well drilled to the south (PTX06-1205), in the area of the identified subsurface paleochannel in the Willowstick study, does not confirm the presence of a paleochannel. Data from the latest five wells installed to the southeast indicate that the extent of contamination is defined to the southeast.

To determine the best path forward for cleanup of the offsite southeast plume that is beyond the influence of the new Southeast ISB Extension, Pantex contracted to have the conceptual site model and perched fate and transport model updated in early 2019. The updated fate and transport model was used to determine the best options for cleanup and to optimize the system for cost, schedule, and completeness of cleanup. The results indicate that the best path forward for cleanup of the offsite plume is a combination of ISB and pump and treat. This recommendation is consistent with the chosen remedy for the Record of Decision (ROD) and the Compliance Plan. Pantex will

plan to include this remedy expansion in the upcoming Explanation of Significant Difference for the ROD.

Modeling predicted that the new system will cleanup to GWPS within 25 years. The new system will consist of 89 ISB system wells (51 injection and 38 extraction/recirculation wells) and 6 pump and treat system wells (3 extraction and 3 injection). The system will not be reliant on water sources from other areas; therefore, extraction/recirculation wells are a necessary component of the system. System installation will occur across four phases, beginning in FY 2020 and ending in FY 2023, depending on available funding. Modeling indicates that injections will be required for approximately 10 years and pump and treat system operation for five years. The area is expected to be monitored for more than 20 years to verify predicted concentrations. Pantex is planning to install all Phase 1 injection and extraction wells during 2020. Phase 1 focuses on controlling the toe of the plume to prevent further movement and control of the head of the plume where concentrations are highest. One injection event will be scheduled in September 2020 for the Phase 1 system installation. Pump and treat extraction is not scheduled to begin until April 2021 and operation only occurs during warm months of the year. The system configuration and phasing is depicted in a map in Appendix A.

Pantex also plans to work with the offsite landowners to gain needed agreements (deed restrictions and lease or purchase of property). Those agreements will be in place prior to installation of the system components in 2020. Pantex is also preparing for additional permitting under an Underground Injection Control (UIC) authorization.

SCHEDULE UPDATE

Pantex provided a detailed schedule of upcoming work in the 2018 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:

- Landfill repair work (soil placement and seeding) was completed in July 2019.

Pantex continues progress toward completion of the following items:

- A separate contract is underway for maintenance of the Landfill 1 Closure Turf. This work is expected to be completed in 2019.
- Pantex is currently working on contracting for the design and construction of infrastructure and new injection wells for the SEPTS near Playa 2. Design and construction is scheduled to be completed in 2020.
- Pantex has contracted for the update of the perched groundwater fate and transport model and evaluation of treatment options for the off-site plume. Results were received in June

2019 so that planning for the new system could begin. The conceptual model update and remedy selection report is scheduled to be completed in September 2019.

- Well rehabilitation began at the Zone 11 ISB in March 2019. Injection began on the western side of the system in May 2019. The contractor is modifying the second injection trailer to complete injection on the eastern side of the ISB. Injection of this system is scheduled to be completed in November 2019.
- Rehabilitation and injection of the Southeast ISB Extension began in July 2019. Injection is scheduled to be completed in September 2019.
- Contracting of new injection wells at the Zone 11 ISB, new monitor wells required by the Five-Year Review and Phase 1 of the Offsite ISB/pump and treat remedy is underway. Contracting is expected to be completed in September 2019, with field work beginning in November.
- Update of the *Pantex Plant Ogallala Aquifer and Perched Groundwater Contingency Plan* to address new remediation systems to the southeast and update general information. This report is scheduled to be submitted to regulatory agencies in September 2019.
- Update of the *Long-Term Monitoring Design*. This design document is scheduled to be submitted to regulatory agencies in September 2019.
- Update of the *Sampling and Analysis Plan*. This document is scheduled to be submitted to regulatory agencies in September 2019.
- Rehabilitation of the Southeast ISB began in August 2019.

Upcoming work includes the following:

- Pantex plans to meet with neighbors to address long-term control of perched groundwater on the offsite properties and to gain access for cleanup of the offsite plume.
- Injection of the Southeast ISB is scheduled to begin in November, after completion of the Zone 11 ISB injection.
- Pantex will begin preparation for the annual public meeting that is scheduled for Tuesday, November 12.
- Pantex will begin contracting for the development of the infrastructure (roads, pads, electrical, pump installation for extraction wells) and development of treatment vessels for the offsite ISB and pump and treat system. Infrastructure will be phased to match system installation.

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 for 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 the existing remediation systems. Pantex is also working to extend treated water injection and beneficial use to new areas to ensure consistent operation of the pump and treat systems.

The pump and treat systems continue to remove COC mass and water from critical areas in the perched aquifer, thus decreasing head that is driving vertical and lateral movement of perched groundwater. The systems have been impacted by the shutdown of the irrigation system and Pantex is continuing to evaluate other options for release or use of the treated water. Pantex will continue to inject and release water to Playa 1 until the irrigation system is repaired or other uses can be identified and constructed. Pantex recommended the installation of perched injection wells east of the Playa 2 area. These wells will help provide a consistent outlet for release of treated water from SEPTS when beneficial use is not possible. Pantex expects to inject up to 150 gpm of treated perched groundwater once construction is complete in 2020. Pantex is also planning to design and construct a center pivot irrigation system east of FM 2373. Funding has been requested for that project in 2021.

Monitoring results for areas downgradient of the established ISB systems continue to demonstrate that system treatment has been generally effective. The new Southeast ISB Extension is demonstrating treatment in the treatment zone where injection has occurred, but downgradient wells are not expected to demonstrate treatment for at least 2 years following the first injection (expected in 2021).

COC concentrations meet the GWPS at the Southeast ISB at three downgradient wells. One downgradient well (PTX06-1153) for the Southeast ISB is not responding to treatment as well as the others. Pantex plans to inject molasses at the 2019 injection event to attempt better distribution of the amendment and will monitor the results over time to determine if the injection will impact the water moving into that area. Monitoring will continue at PTX06-1153 as described in the SAP, as the quarterly samples will provide adequate information for this well. Further recommendations will be made based on evaluation of data over time.

Downgradient wells at the Zone 11 ISB are generally demonstrating treatment. All of the nine downgradient ISPM wells exhibit perchlorate concentrations below the GWPS, with perchlorate concentrations declining near GWPS in the remaining well. Since the start of the remedial action, TCE concentrations continue to indicate a decreasing trend, with current concentrations below the GWPS in six of nine downgradient wells. Only one of the three wells not meeting GWPS does not yet indicate strongly declining concentrations of TCE. Detected concentrations of the TCE breakdown product cis-1,2-DCE persist, although the latest results indicate that it is being treated to

concentrations below the GWPS in the five of nine ISPM wells and concentrations declining toward the GWPS in the other wells. Pantex has changed the injection strategy at the ISB to attempt better distribution between wells and provide better treatment of TCE. Early data indicate that the injection of a more soluble carbon source (molasses) has distributed widely where injected and that reducing conditions have improved in those areas. It will take two or more years to evaluate the results downgradient. Based on the results of the use of molasses, Pantex is solely injecting molasses during the 2019 injection event for the Zone 11 ISB. This measure is expected to help avoid issues with plugging of the wells and formation by the EVO and resulting biomass. Pantex will continue to evaluate the data and make appropriate recommendations for treatment in the upcoming progress reports.

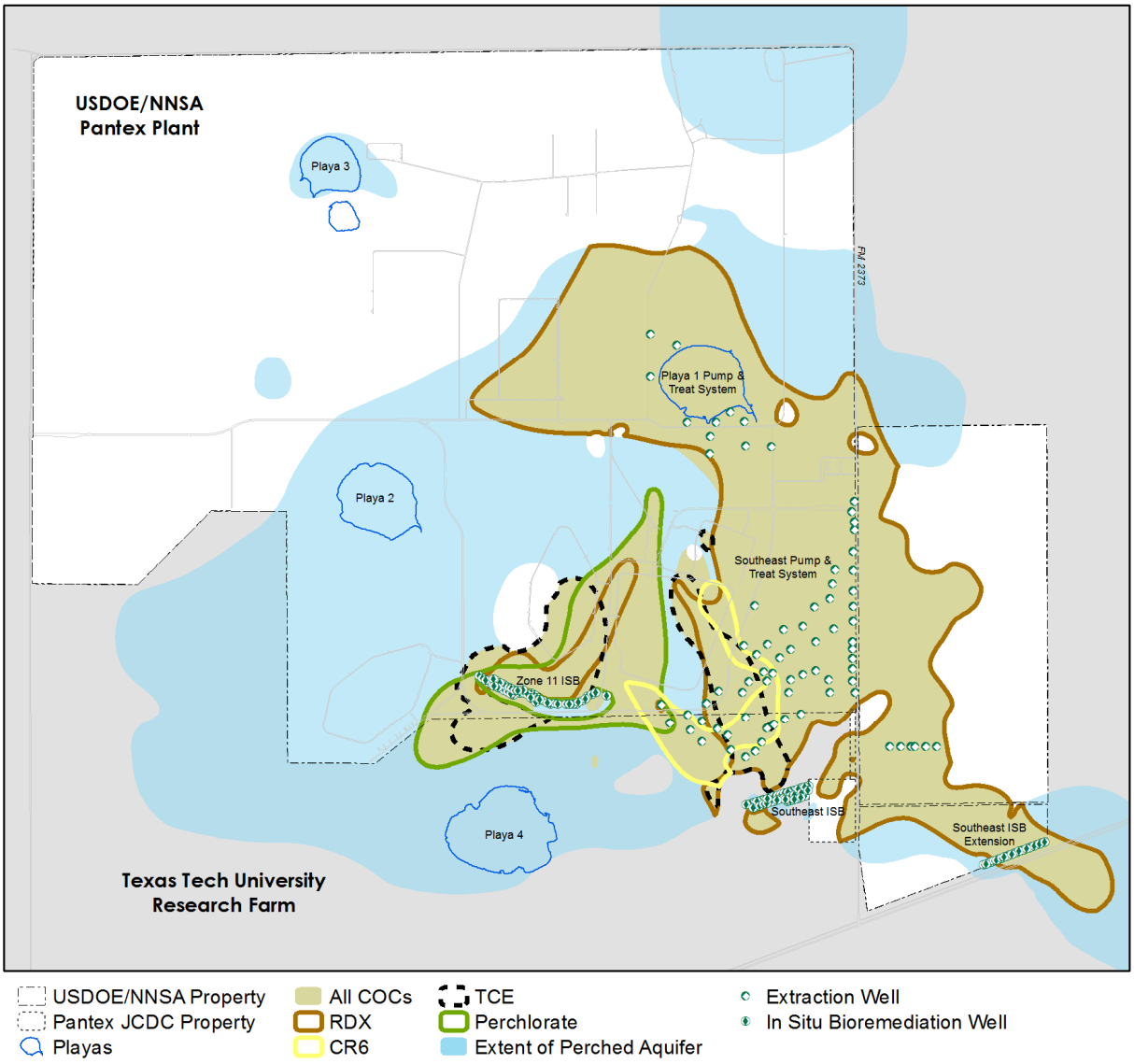
The SVE system continues to treat soil gas and residual NAPL in the solvent evaporation pit/ chemical burn pit area of the Burning Ground, thereby mitigating vertical movement of VOCs to groundwater. Pantex has continued to have problems with completing rebound tests, and has been unable to prepare a path to closure as recommended in the first Five-Year Review (FYR). 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 air flow through the formation while the system is operating. The air flow was increased from 32 scfm to about 45 scfm over time. Evaluation of hourly VOC removal indicates that the mass removal rate initially increased with the increase in influent air flow. Although the removal rate increased slightly this quarter, recent data indicate a decline in the mass removal rate as well as a drop in influent gas concentrations. Pantex will continue to evaluate the VOC removal to determine when active removal will no longer be effective. Pantex will provide further recommendations based on review of influent SVE data over time.

The groundwater remedies are considered to be protective for the short-term, as untreated perched groundwater use is controlled to prevent human contact and monitoring data continue to indicate that the remedial actions remain protective of the Ogallala Aquifer. Detections of DNT4A and 1,2-dichloroethane at concentrations below the GWPS continue to occur in one Ogallala well (PTX06-1056), and Pantex is actively following the Groundwater Contingency Plan to guide the response. Pantex proactively conducted work to determine possible causes of the detections; those results indicate that the most likely cause is the nearby perched well that was drilled deep into the FGZ. Pantex plugged the nearby perched well in November 2014. Pantex will continue to monitor this Ogallala well quarterly to determine if a trend emerges, and will determine if further steps are necessary for the protection of the Ogallala Aquifer.

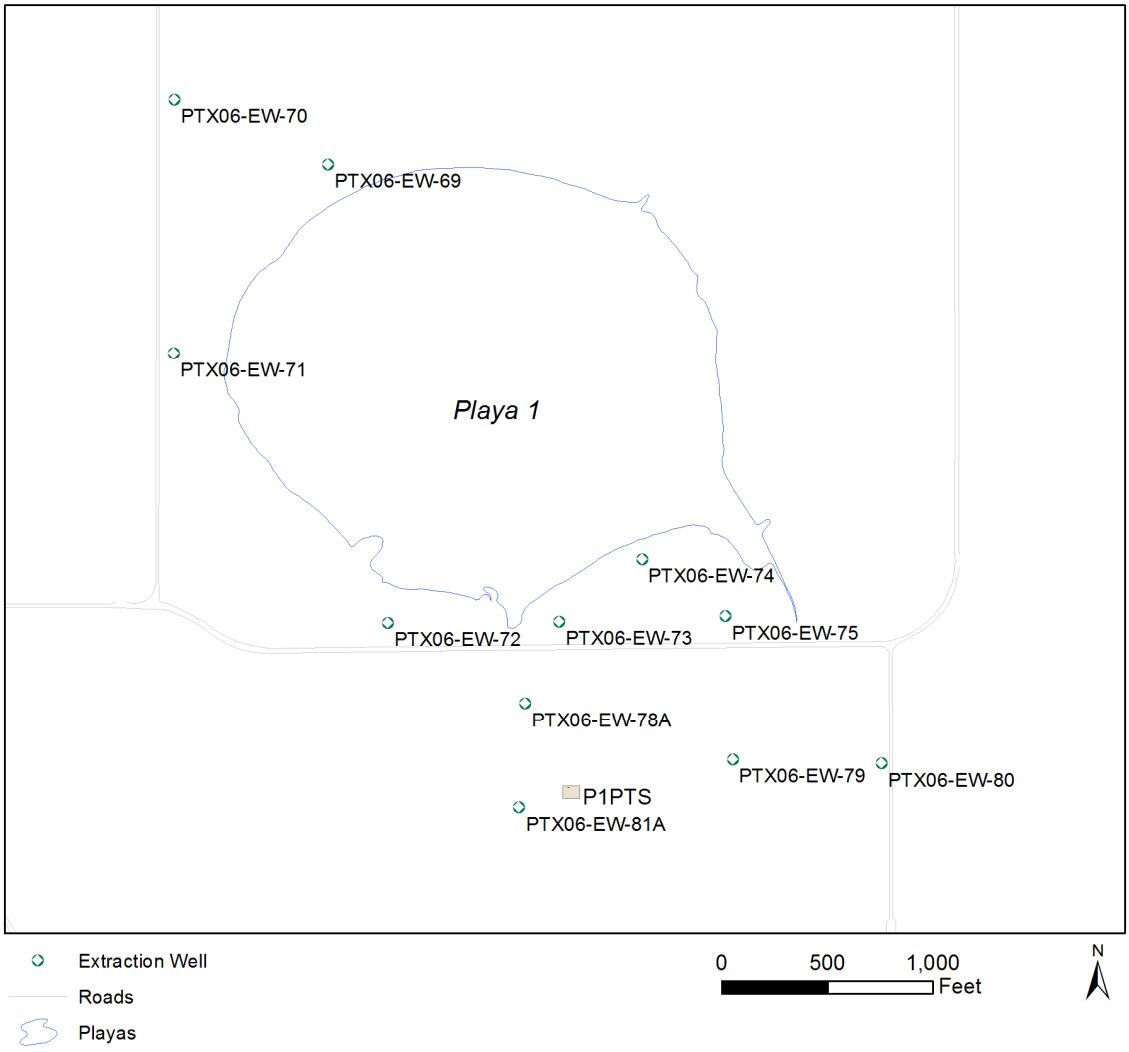
Pantex continues to progress toward cleanup of the southeast lobe of perched groundwater. As recommended in the 2016 Annual Progress Report, Pantex has completed extending the SEPTS operation to that area to address the continued plume movement to the south. Pantex also extended the Southeast ISB to the southeast boundary of the site to prevent further offsite movement of contamination. Wells drilled on a neighboring property in early 2019 indicate that extent of contamination has been found. Pantex has updated the perched groundwater conceptual site model and fate and transport model. Fate and transport modeling has been used to design a

remedial action to address the offsite contamination. Pantex is recommending the installation of a new Offsite ISB and pump and treat system to clean up the offsite plume. Pantex is working with neighbors to gain access for remediation and ensure long-term control of the perched groundwater for protection of people and the environment. Pantex is also pursuing permitting for a UIC authorization. Phase 1 system installation and treatment is scheduled to begin in 2020.

Appendix A
Maps

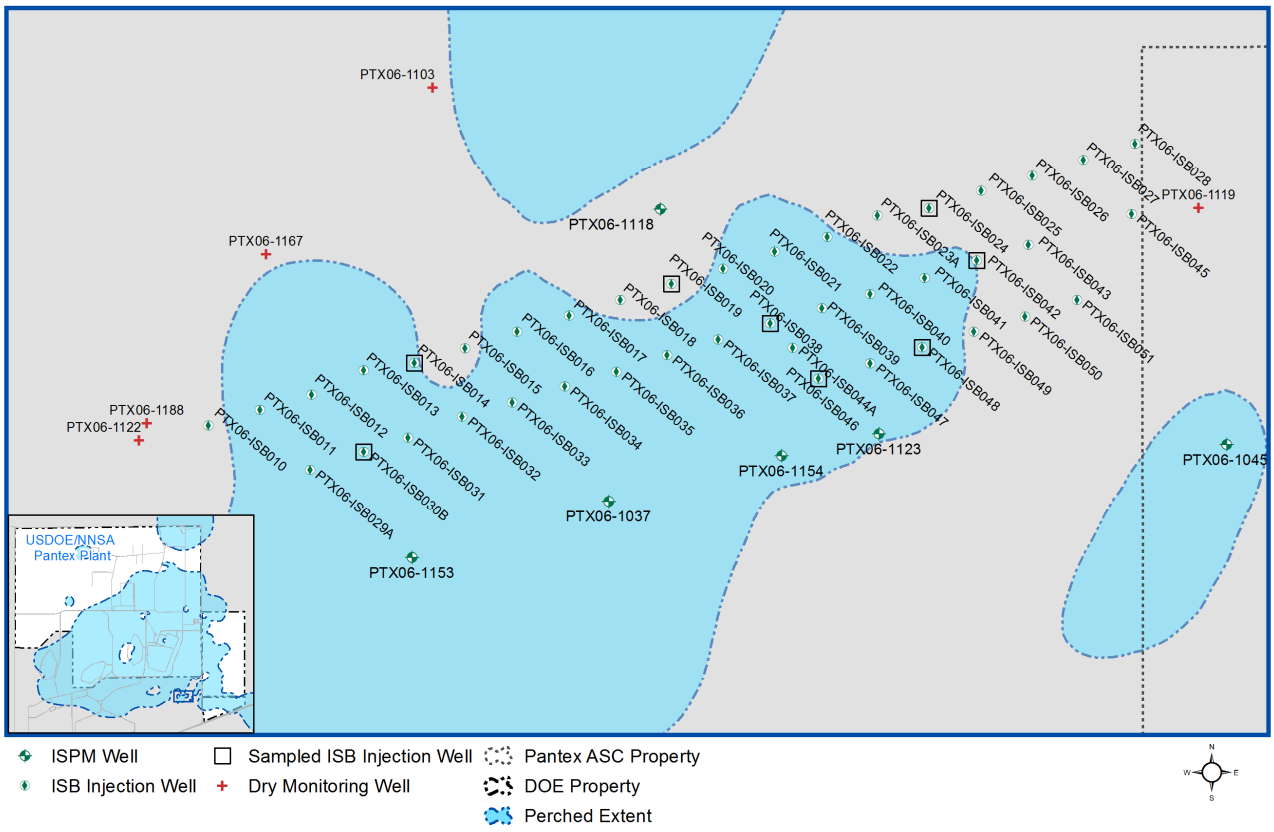


Extent of Perched Groundwater and Contaminant Plumes

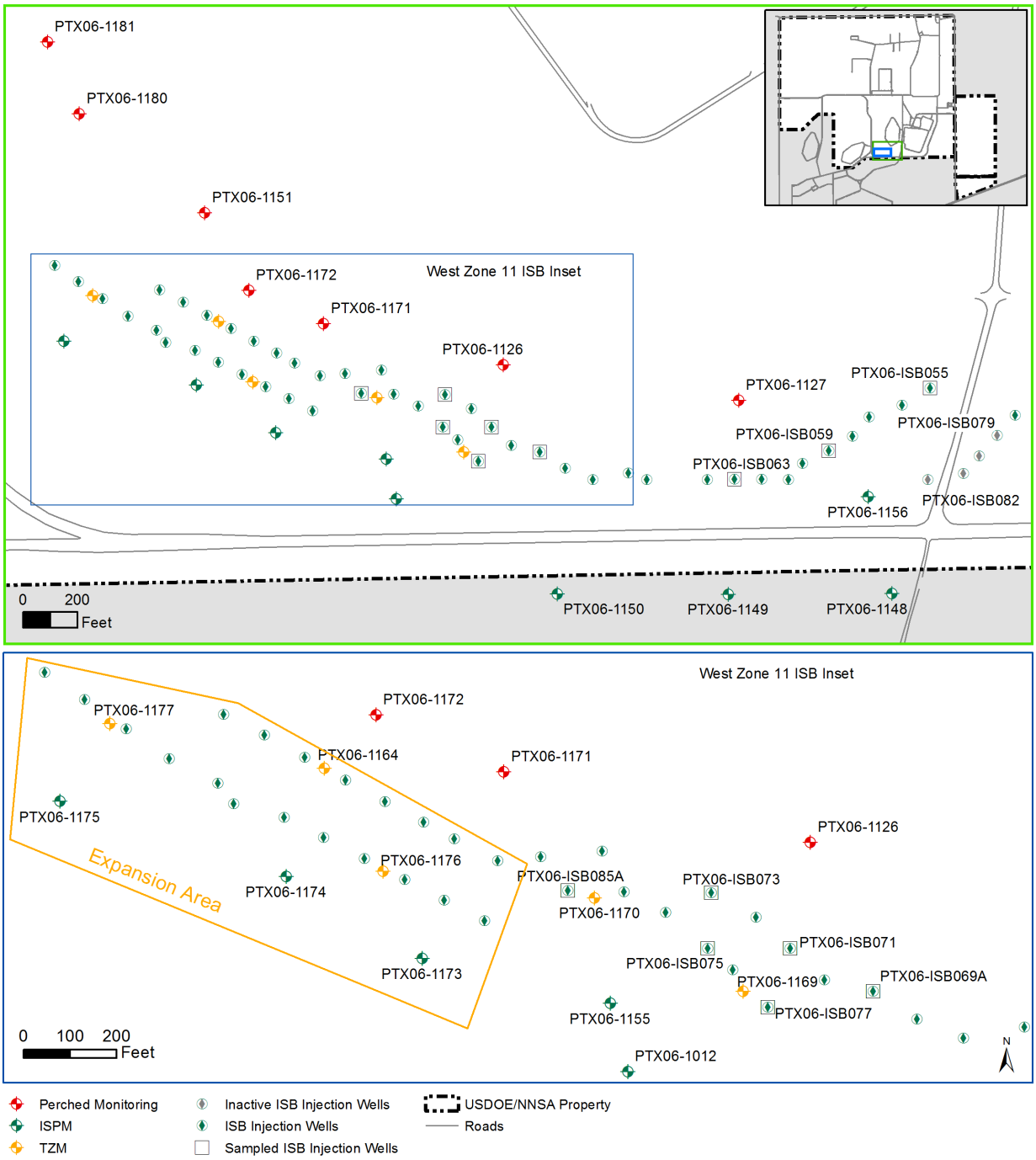


Playa 1 Pump and Treat System Wells

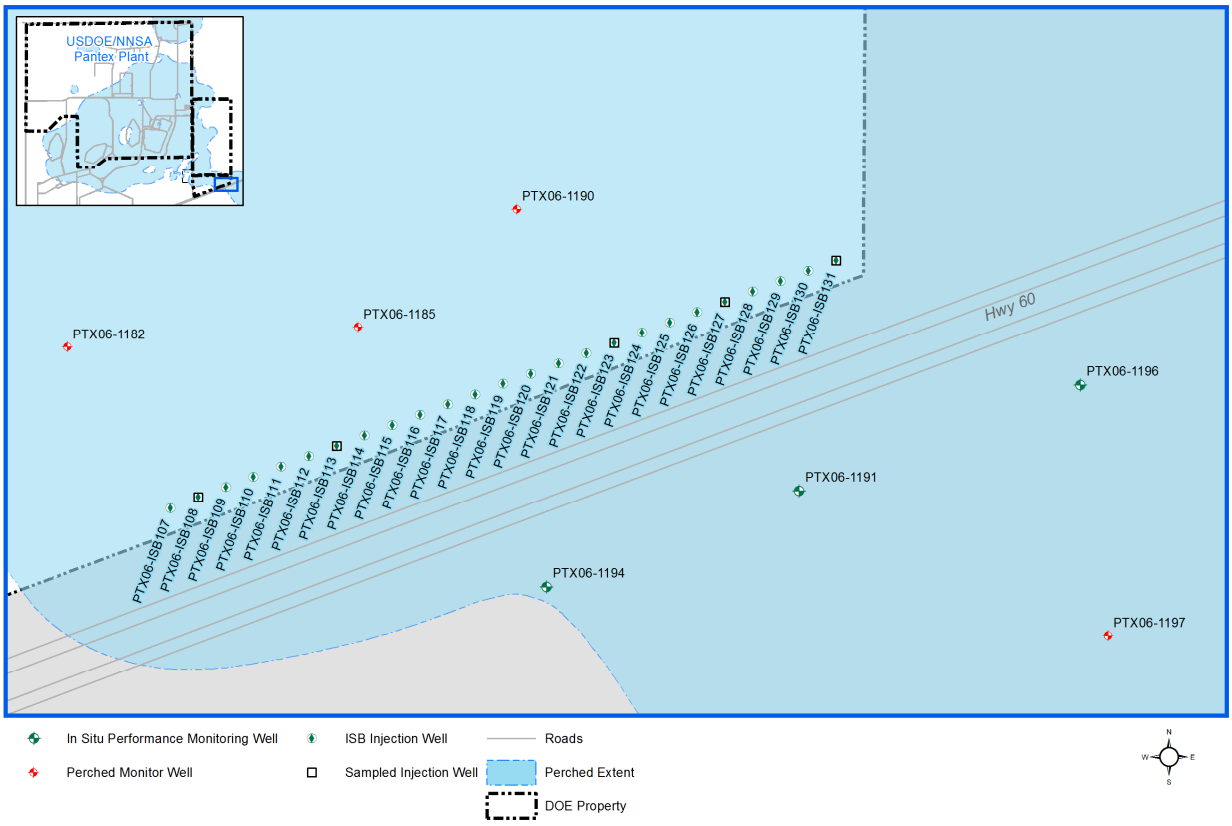
Southeast Pump and Treat System Wells



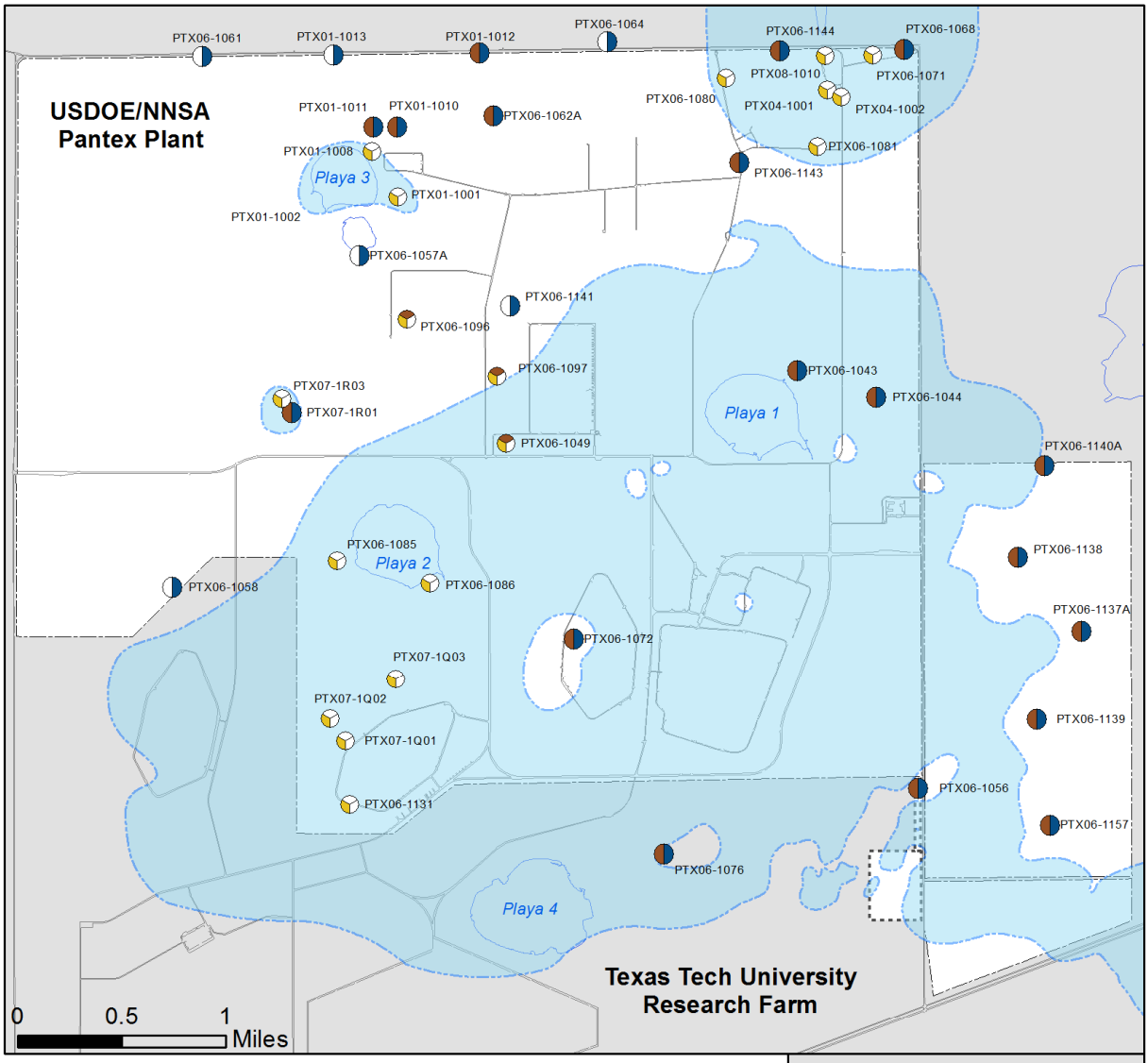
Southeast ISB Wells and Sampling Locations



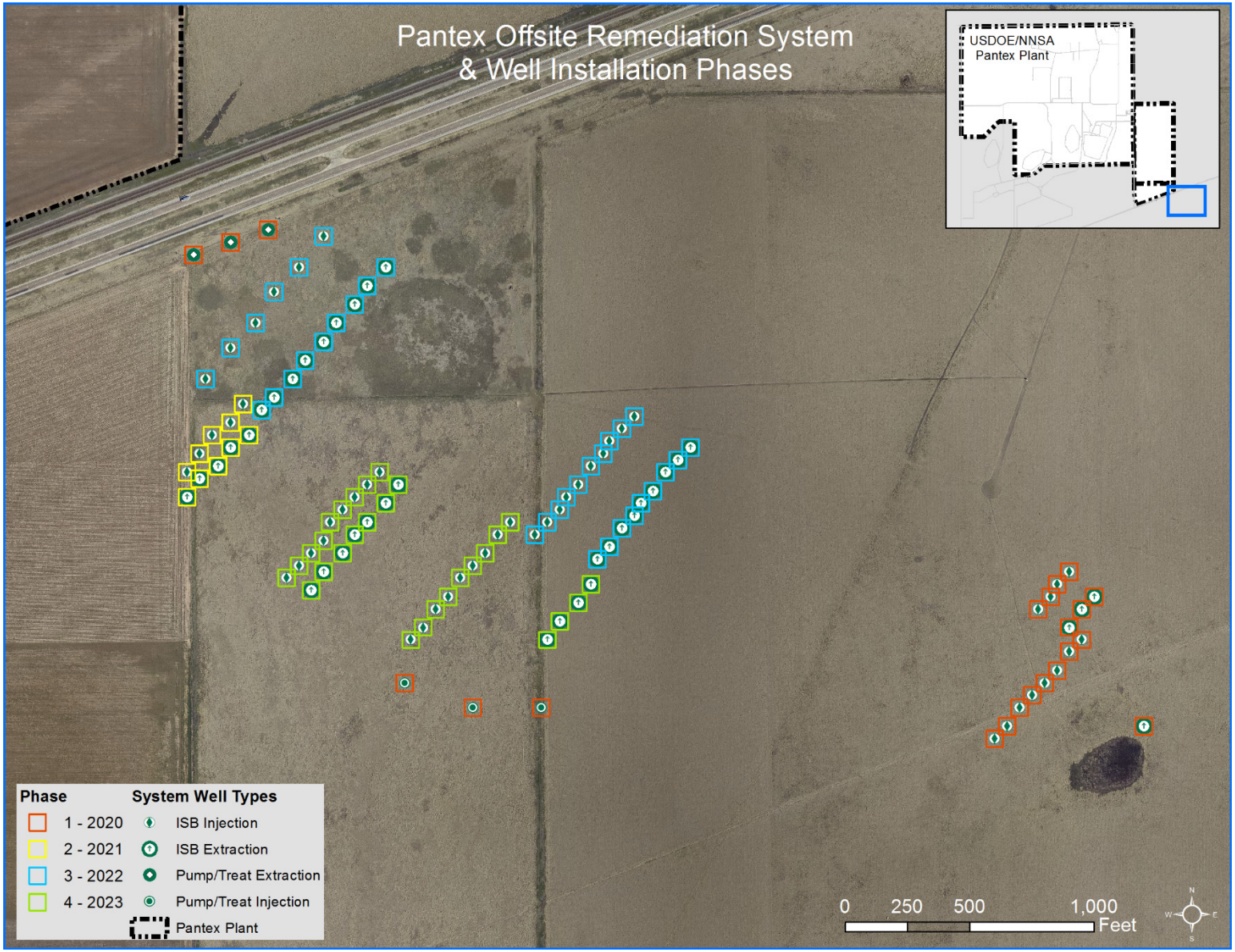
Zone 11 ISB Wells and Sampling Locations



Southeast ISB Extension Wells and Sampling Locations



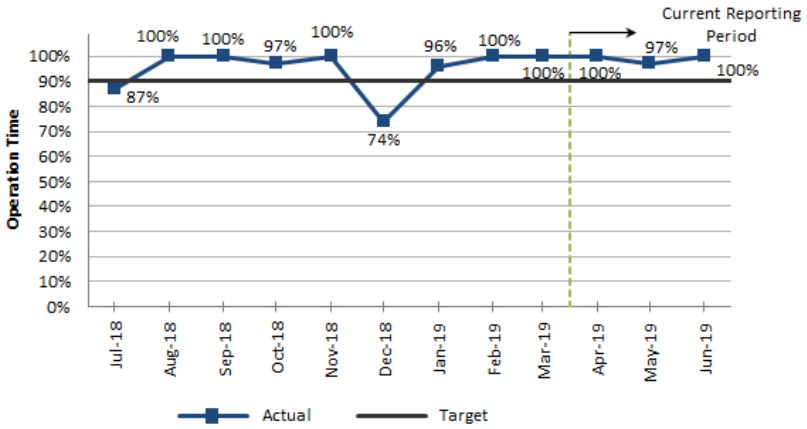
Uncertainty Management and Early Detection Wells Evaluated in the Quarterly Progress Report



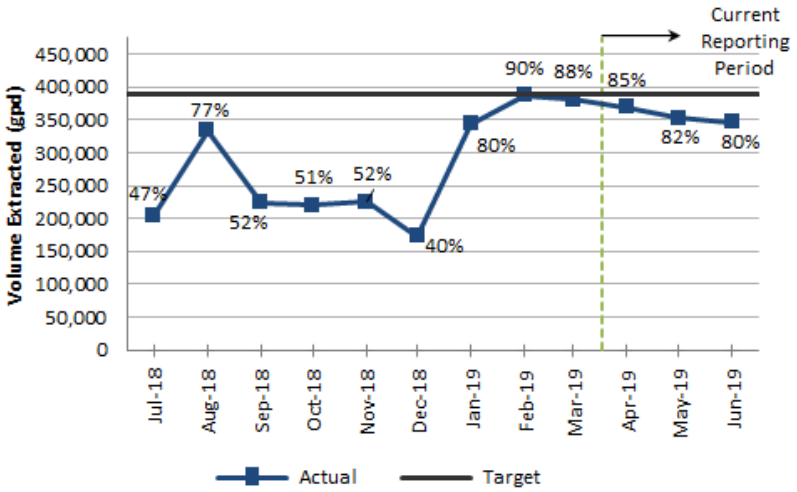
Recommended Offsite ISB and Pump and Treat System and Installation Phasing

Appendix B
Pump and Treat System Graphs

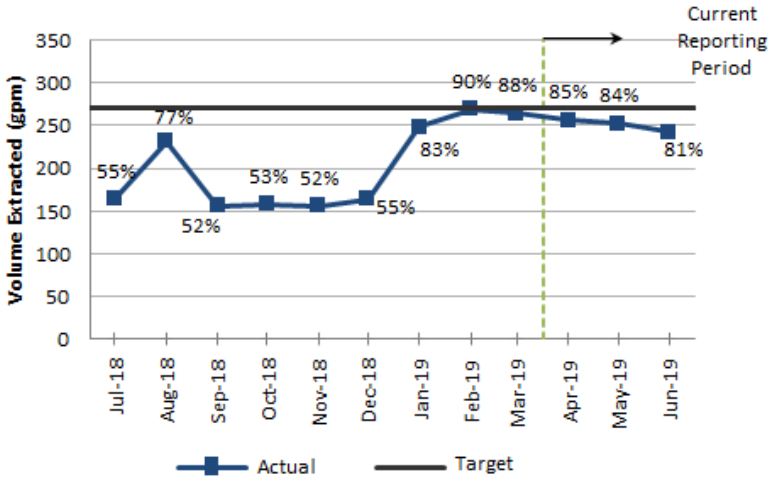
Southeast Pump and Treat System Graphs



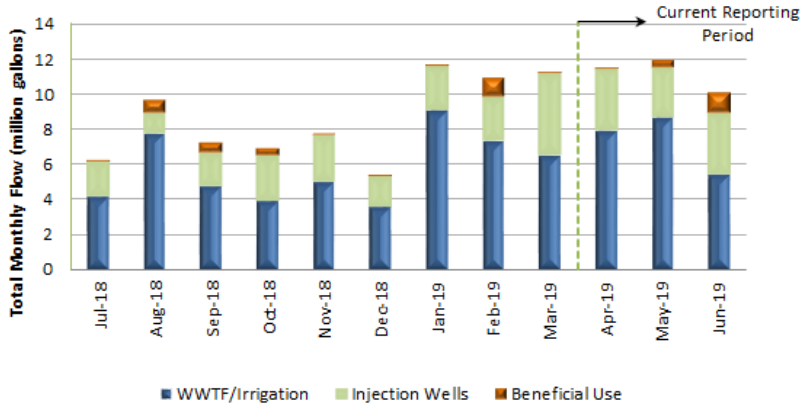
SEPTS Operation Time vs Target



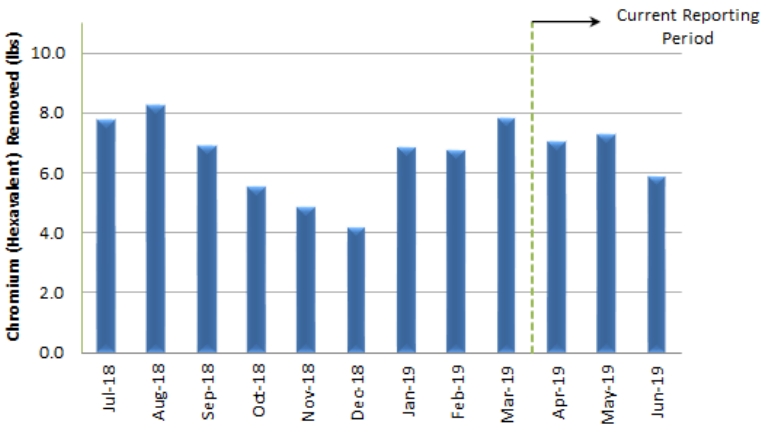
SEPTS GPD and % Capacity



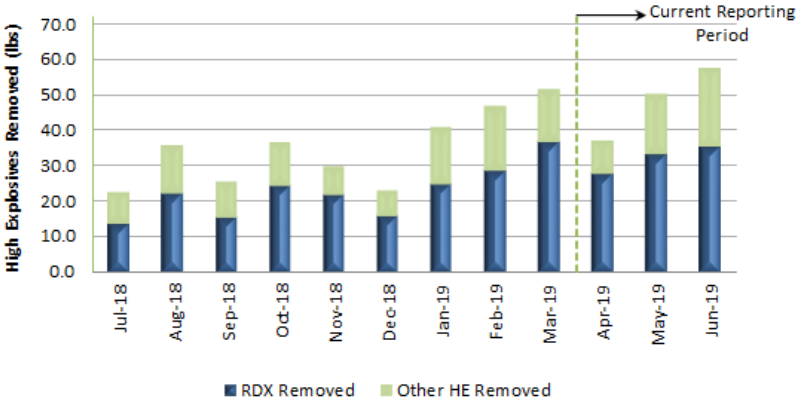
SEPTS Average GPM and % Capacity



SEPTS Monthly Total Flow

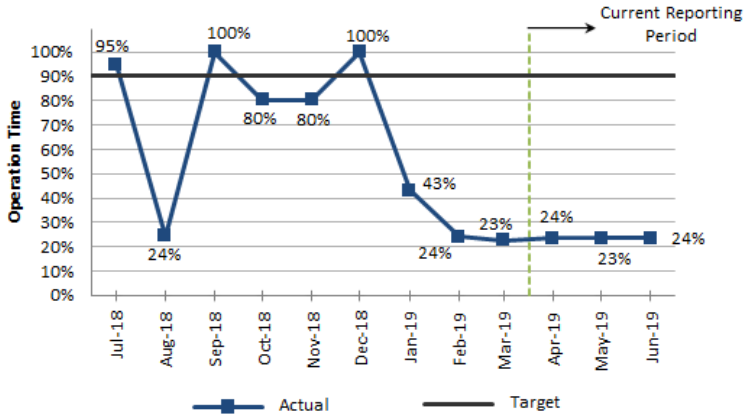


SEPTS Chromium Mass Removal by Month

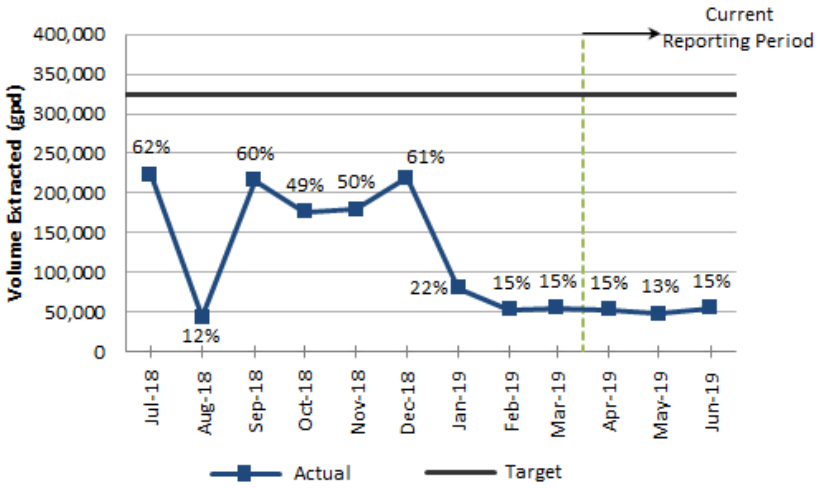


SEPTS HE Mass Removal by Month

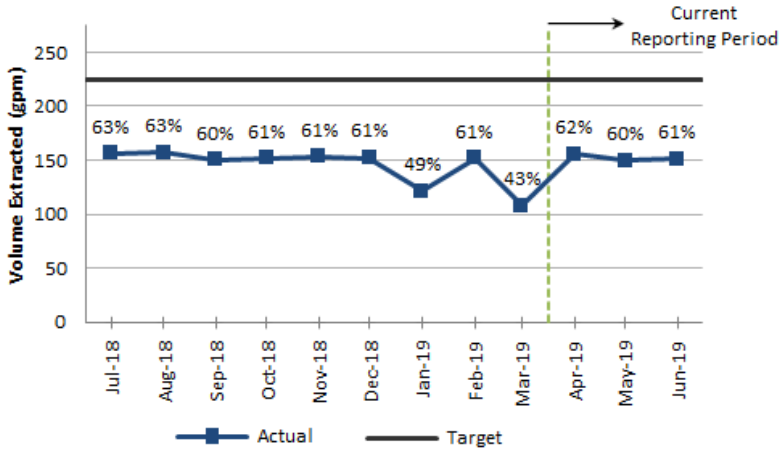
Playa 1 Pump and Treat System Graphs



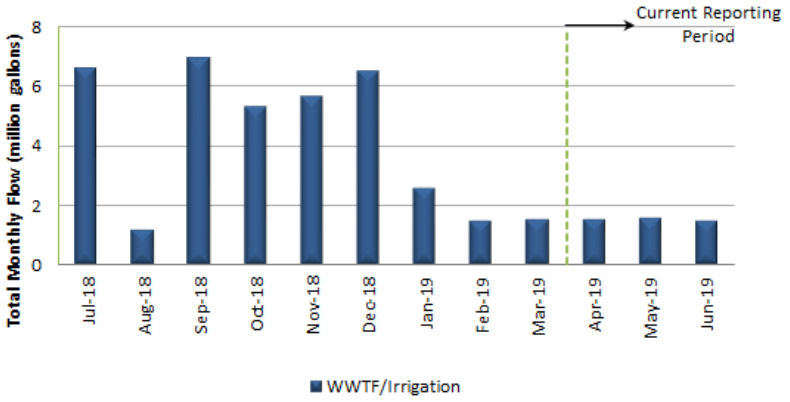
P1PTS Operational Time Vs Target



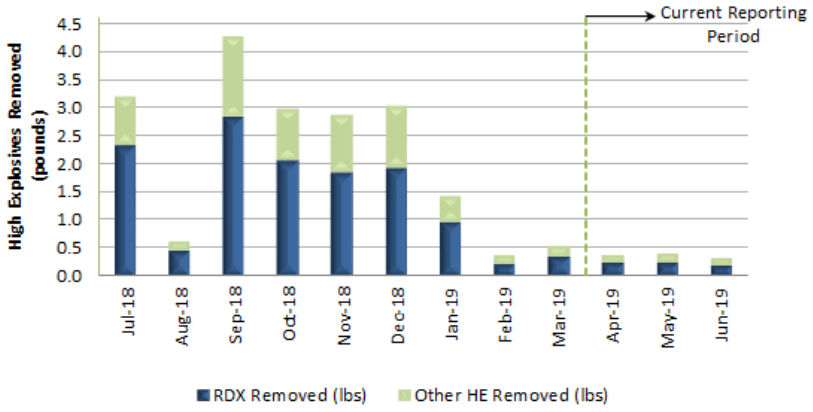
P1PTS Average GPD and % Capacity



P1PTS Average GPM and % Capacity



P1PTS Monthly System Total Flow



P1PTS HE Mass Removal by Month

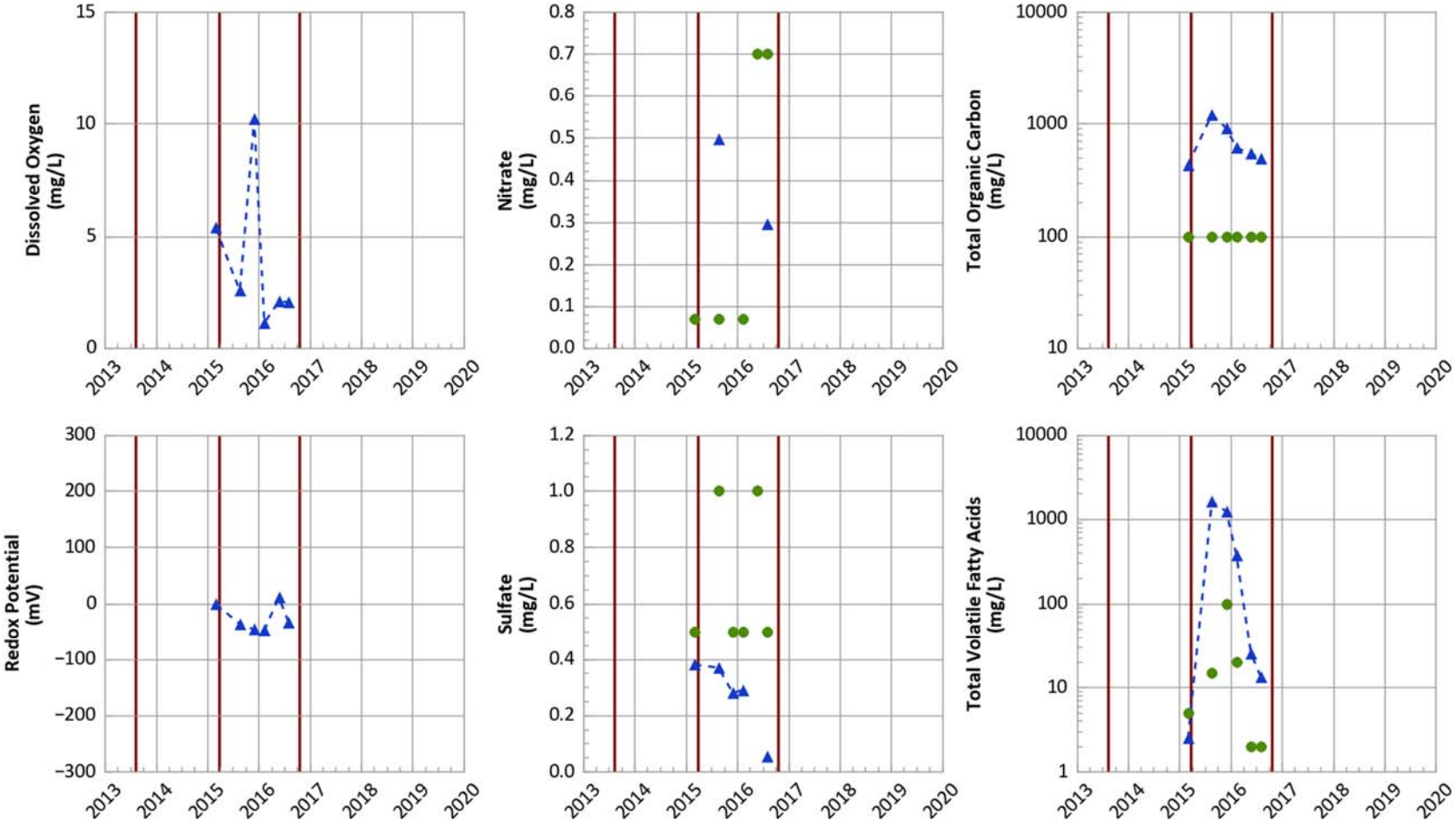
Appendix B Glossary

Operation Time	Operation time represents the percentage of the total number of hours the system was actually operated vs. the total possible hours the system could have operated on a monthly basis.
GPM Extraction	The gallons per minute (GPM) extraction rate represents the extraction rate from the well field while the system was operating. This is a measurement of the well field's capability to support the overall system throughput goals. Low well field rates can occur due to inoperable wells or decline in saturated thickness that makes extraction difficult.
GPD Extraction	The gallons per day (GPD) extraction rate represents the system's ability to meet overall throughput goals, considering the well field extraction rate and the system's operational rate. This rate is affected by the ability to extract water from the well field and the system downtime.
Total Monthly Flow	Total monthly flow is the total volume of extracted water measured at the influent point of the pump and treat system. Individual well measurements and flow rates are provided in the annual progress report.

Appendix C
ISB Graphs

Southeast ISB Graphs

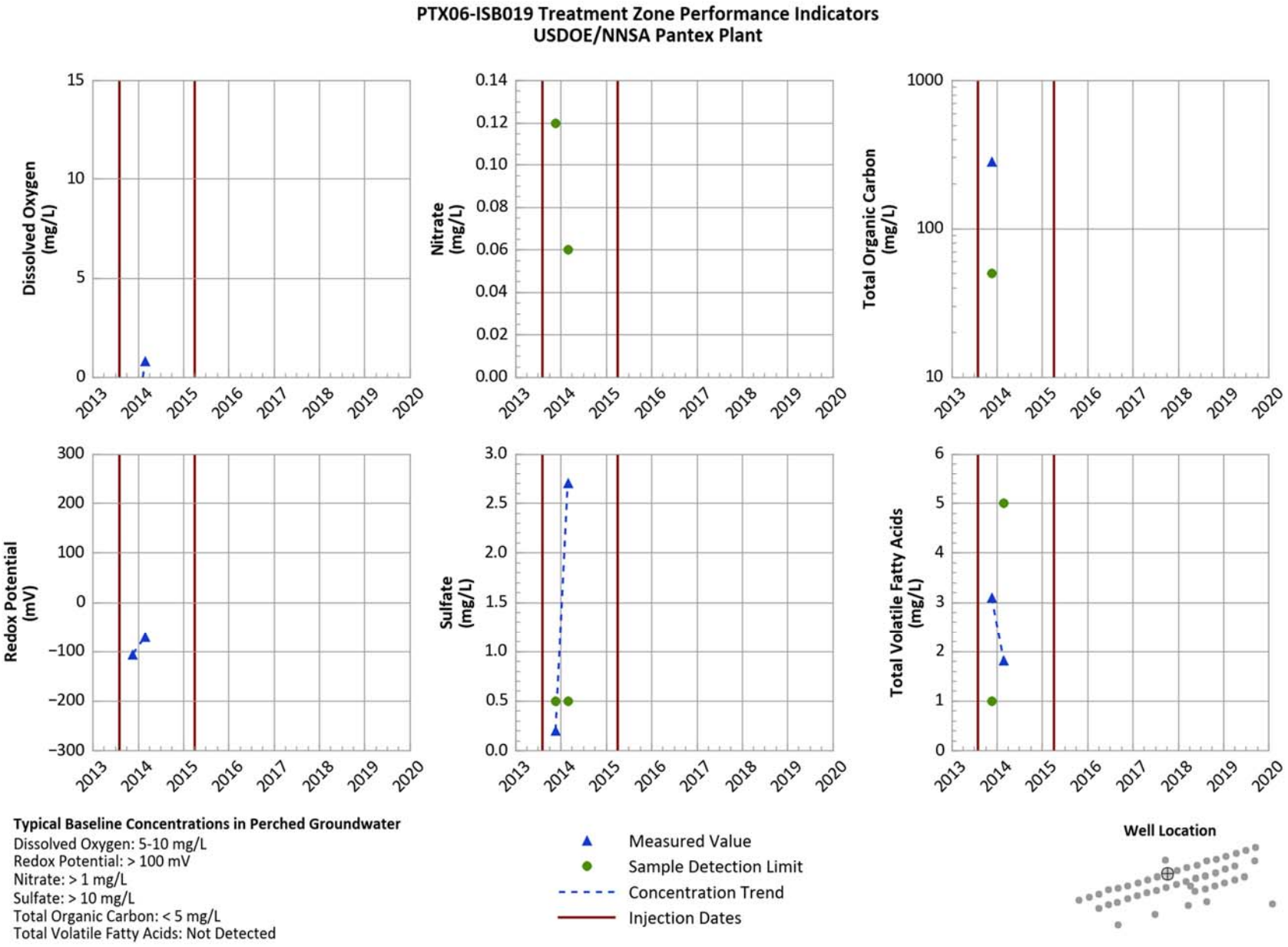
PTX06-ISB014 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant



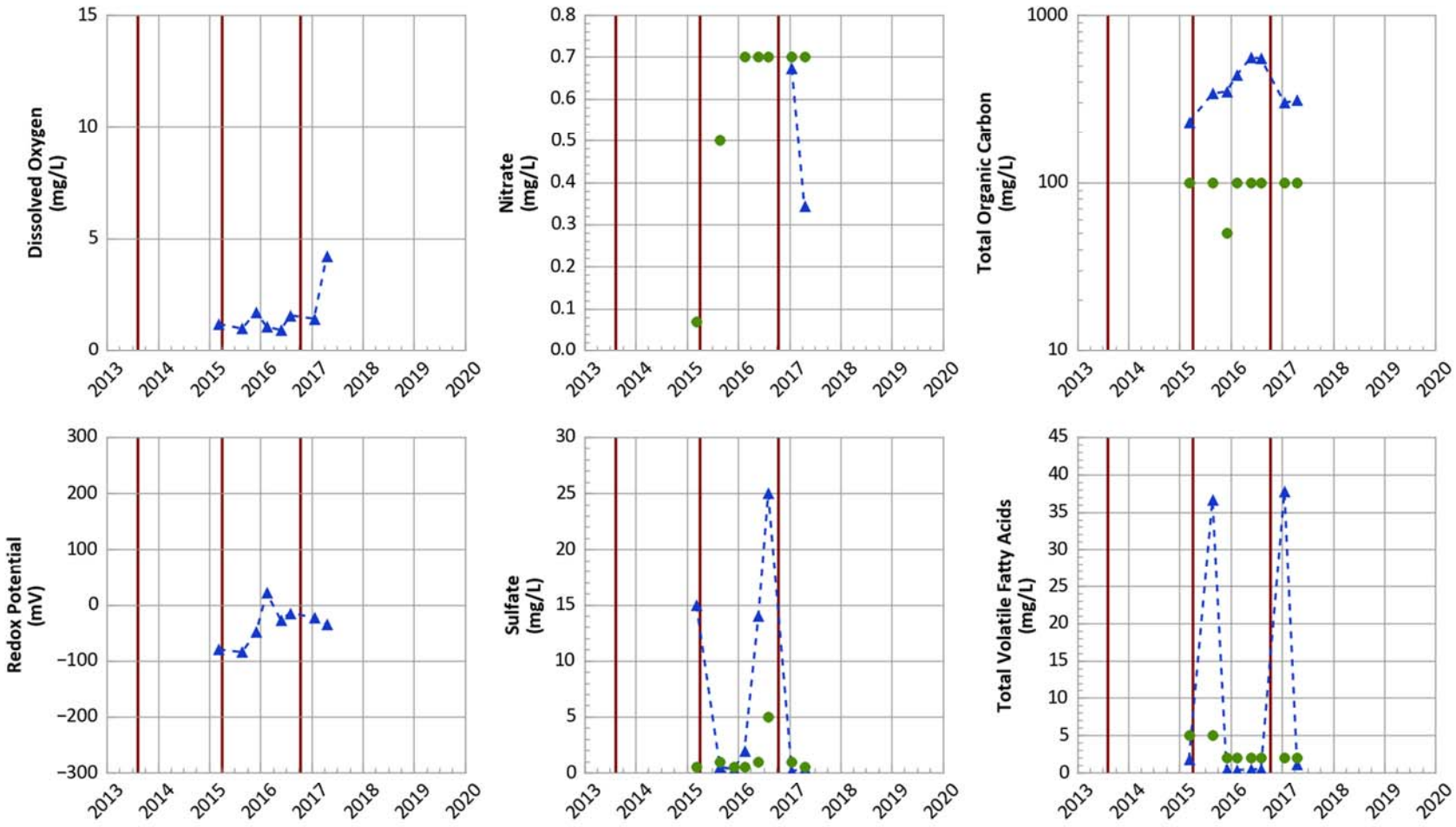
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected

Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates

Well Location


PTX06-ISB019 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
2013
2014
2015
2016
2017
2018
2019
2020
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

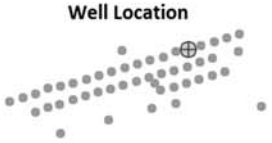
PTX06-ISB024 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant

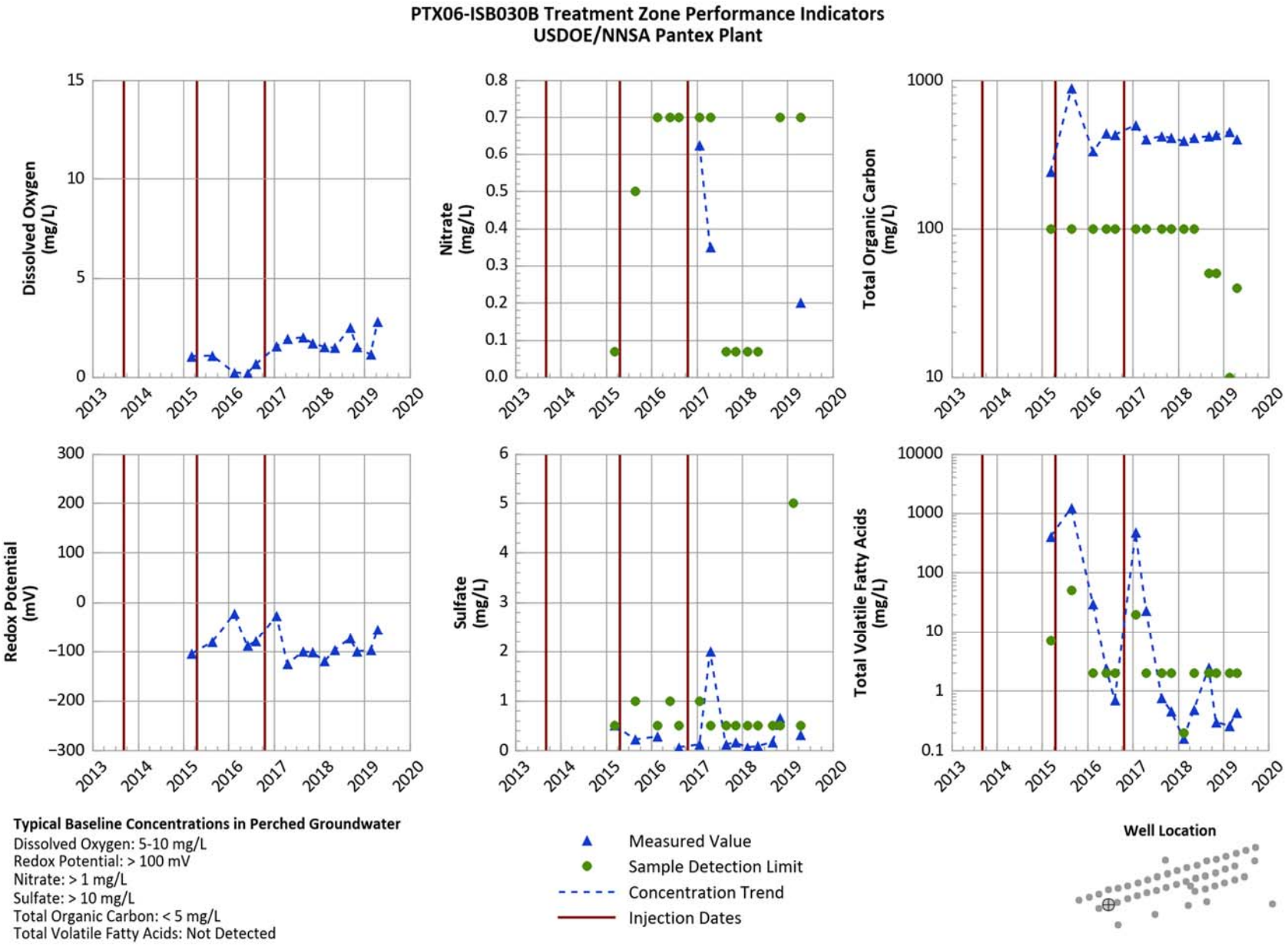


Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected

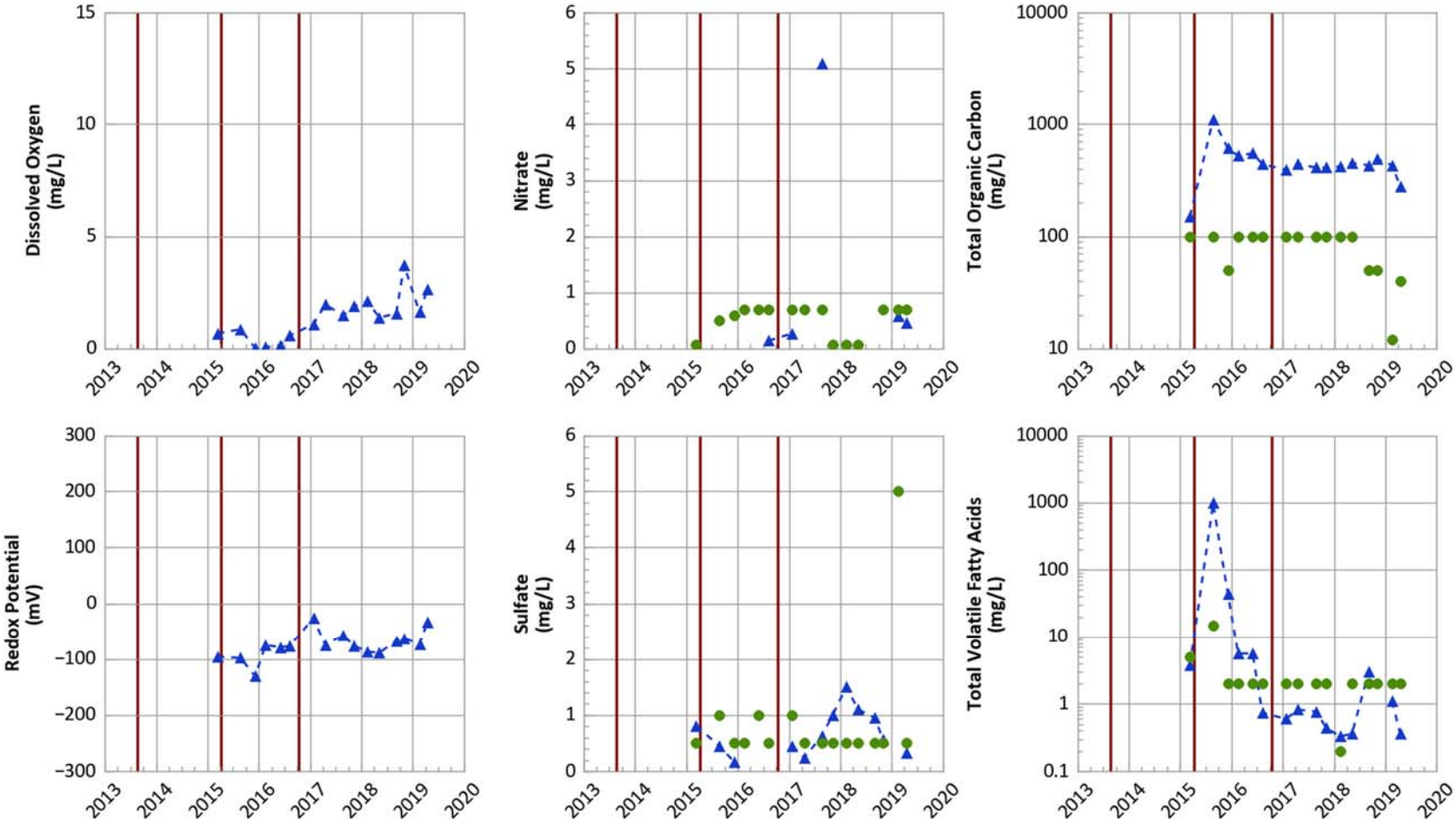
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates

Well Location




PTX06-ISB030B Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

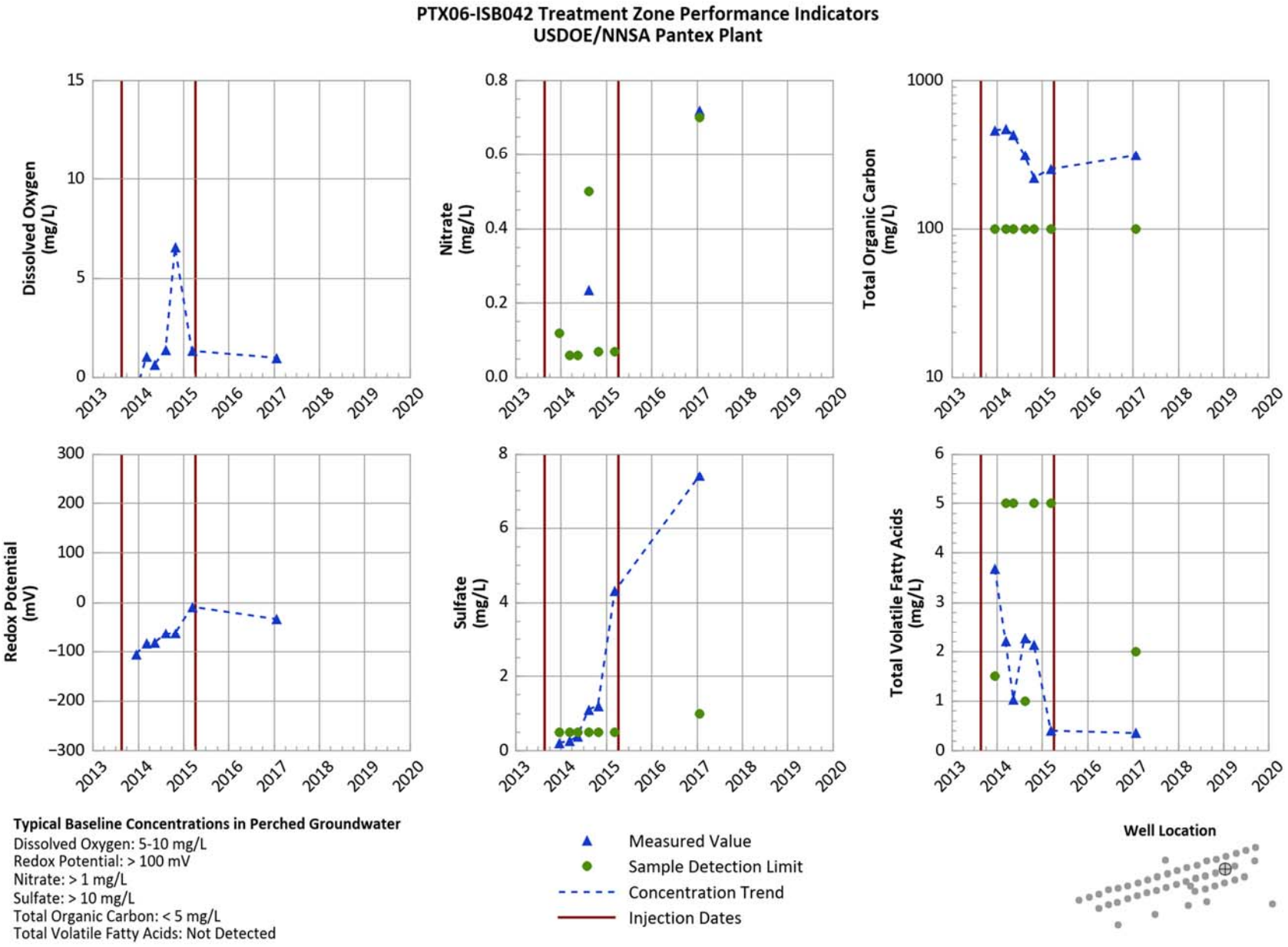
PTX06-ISB038 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant



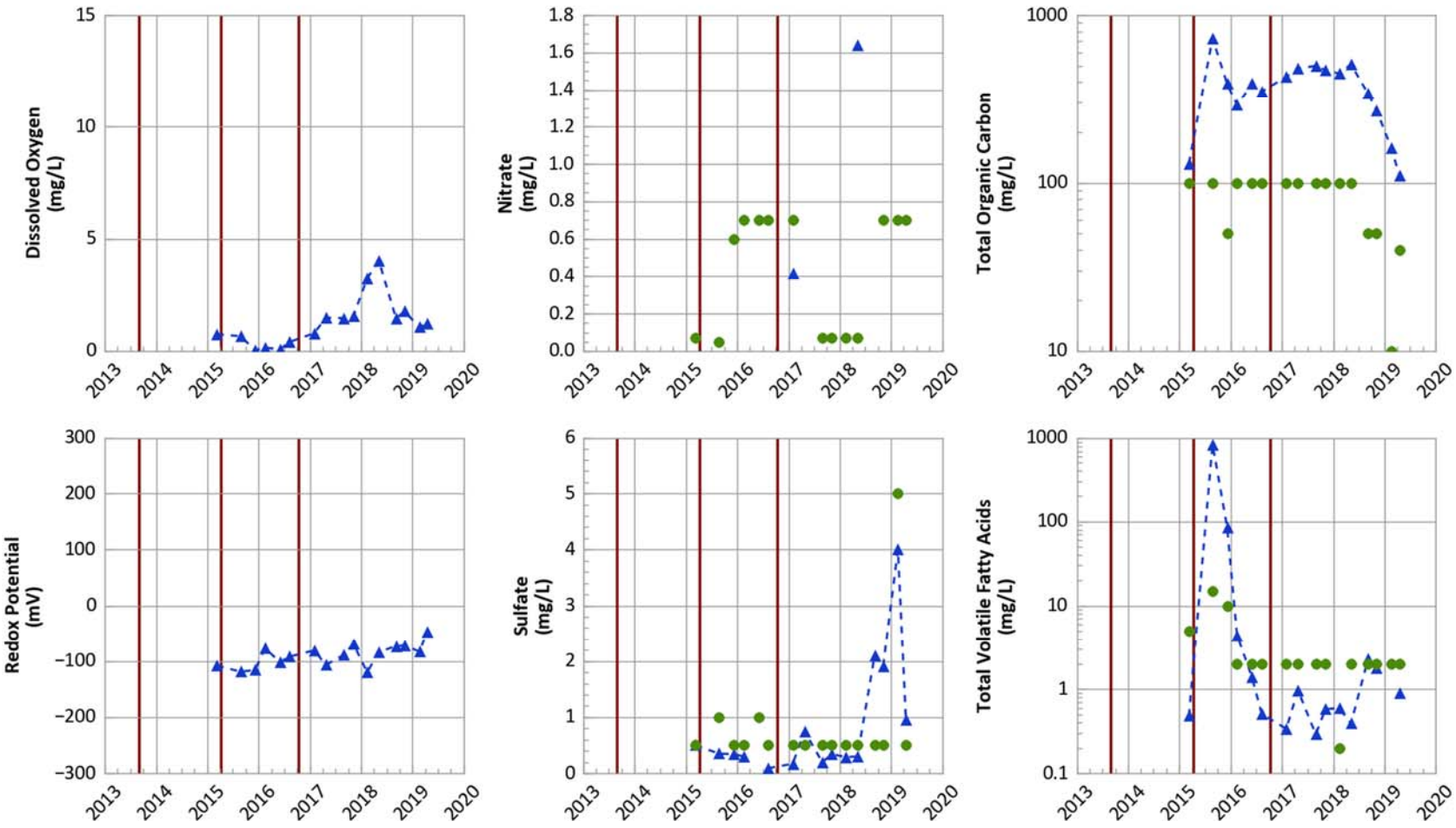
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected

Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates

Well Location


PTX06-ISB042 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
2013
2014
2015
2016
2017
2018
2019
2020
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

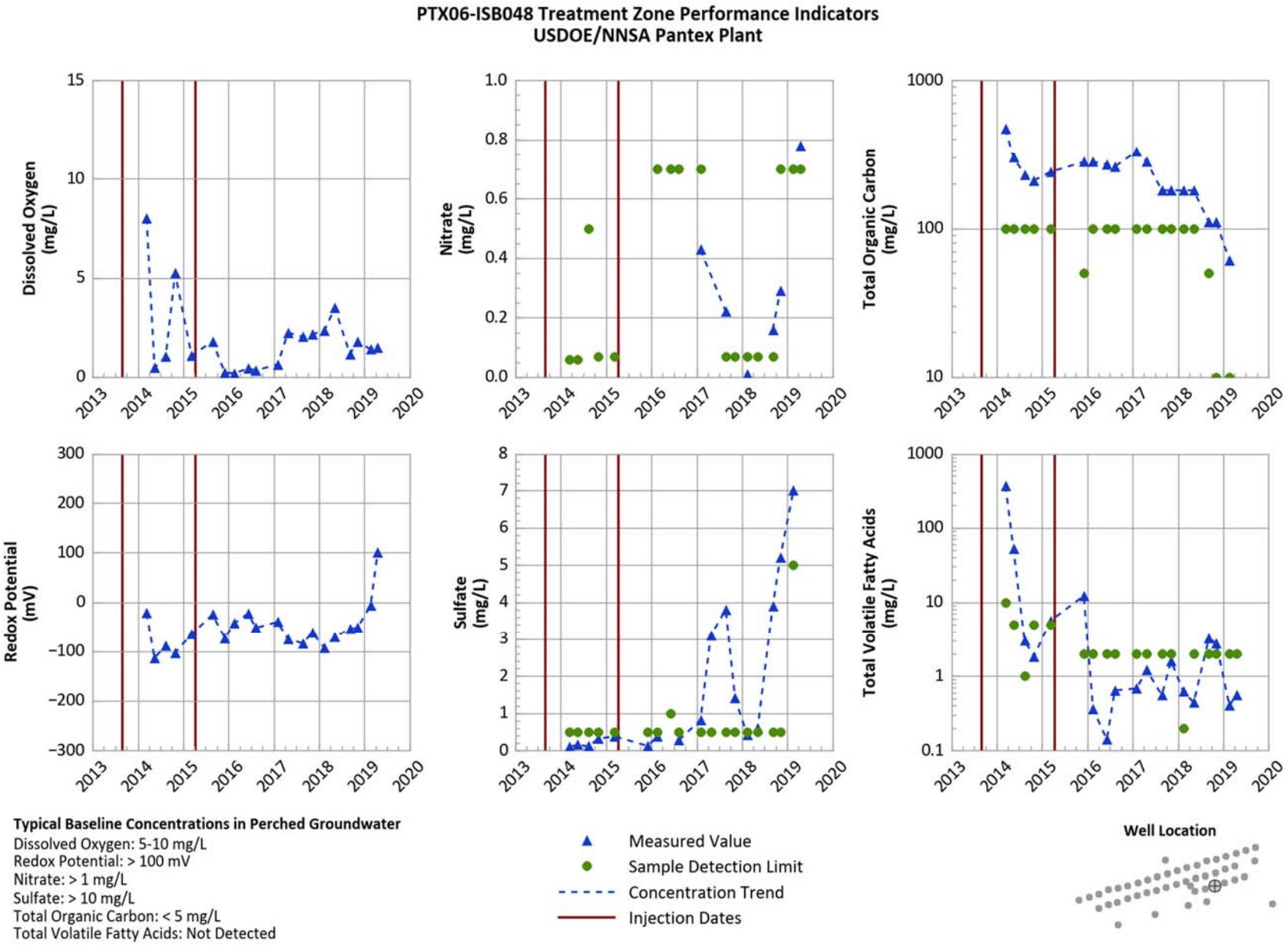
PTX06-ISB046 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant



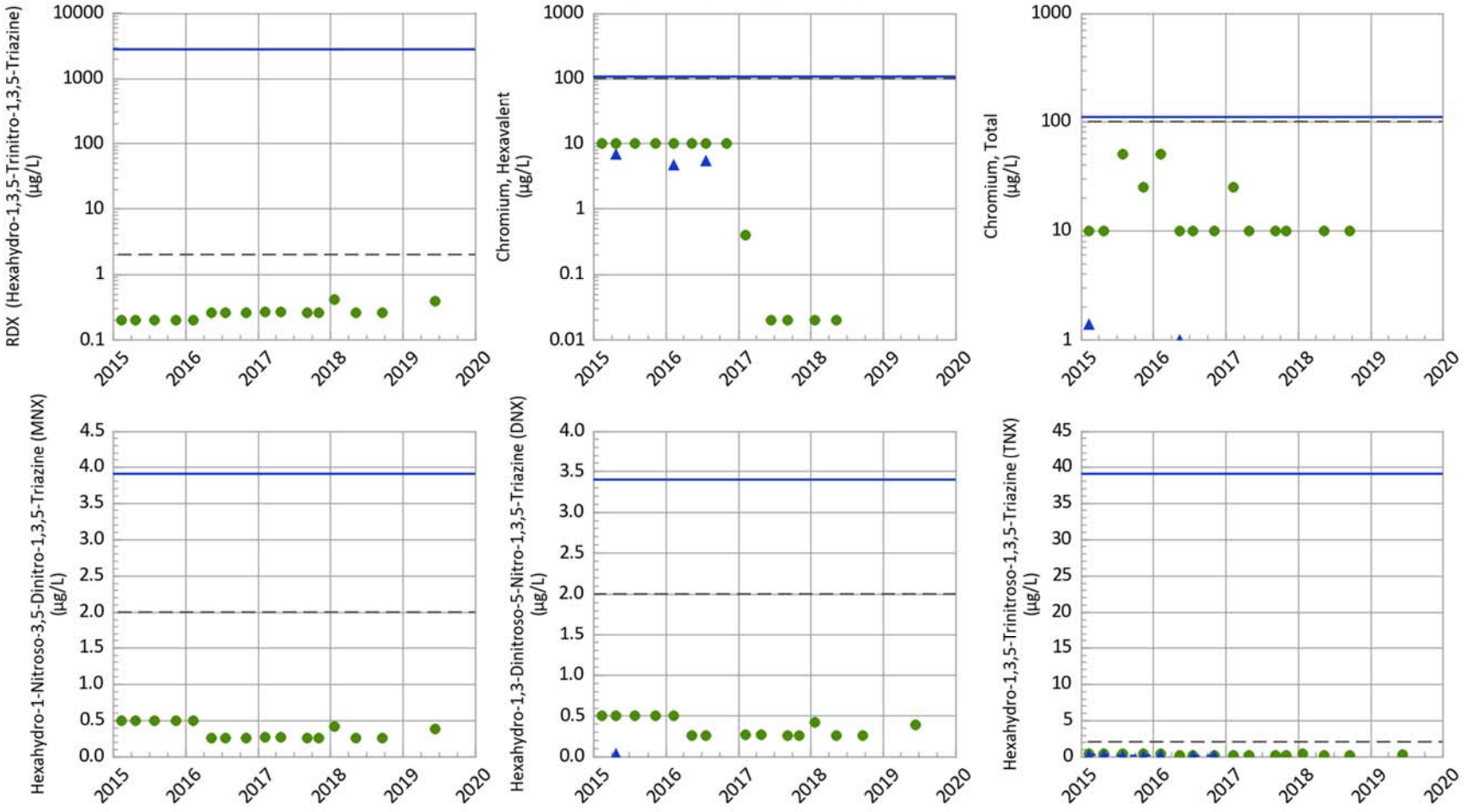
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected

Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates

Well Location

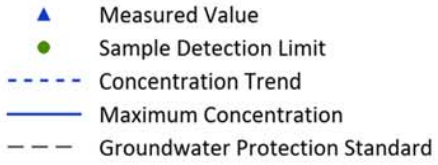

PTX06-ISB048 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

PTX06-1037 Downgradient Performance Indicators
Southeast In Situ Bioremediation System
USDOE/NNSA Pantex Plant

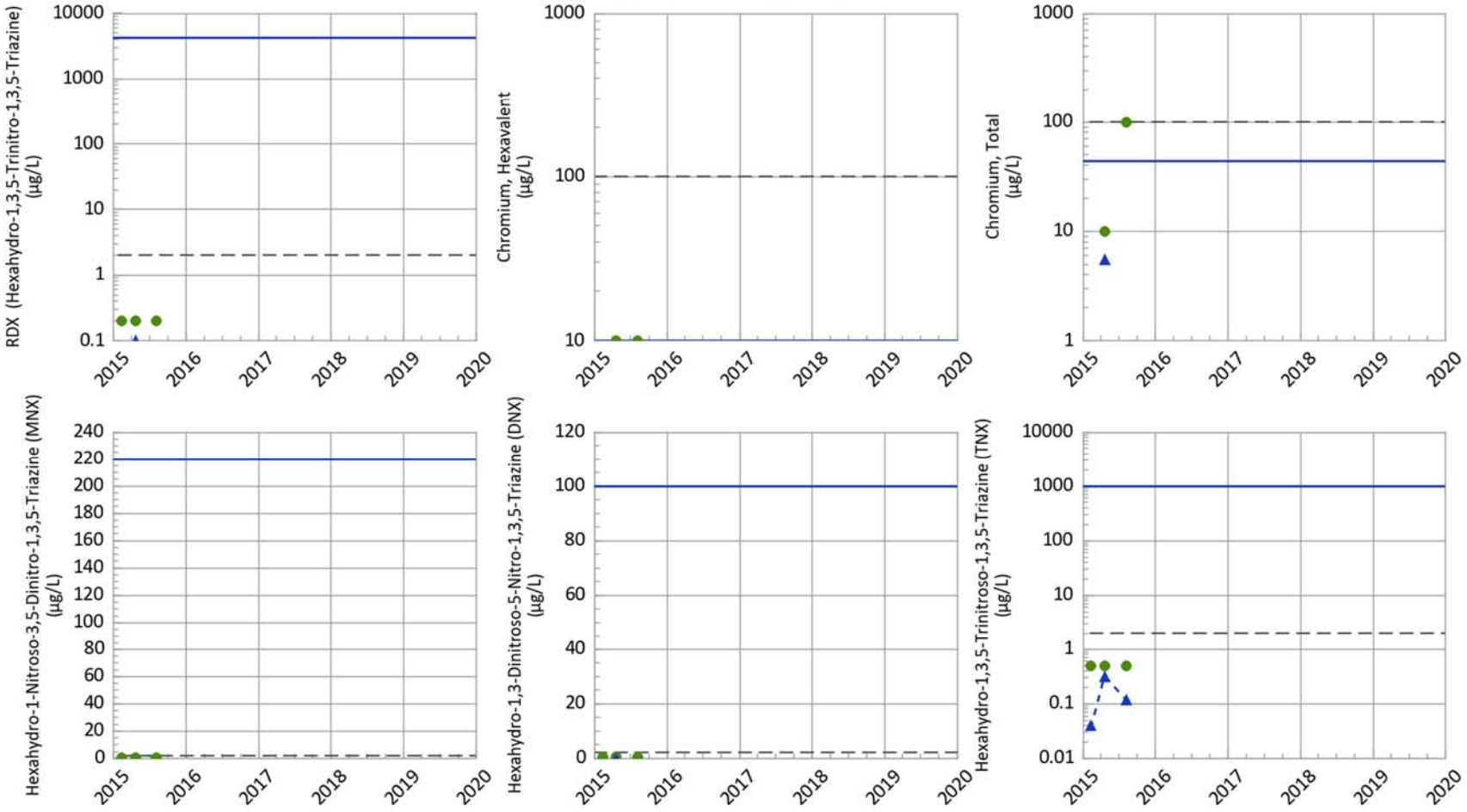


Most Recent Measured COC Concentrations (Nov 02, 2016)

COC	Concentration (µg/L)	GWPS (µg/L)
RDX	Non-Detect	2.0
MNX	Non-Detect	2.0
CR-6	Non-Detect	100.0
DNX	Non-Detect	2.0
CR	Non-Detect	100.0
TNX	Non-Detect	2.0

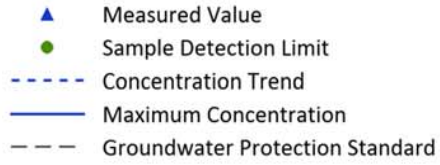


PTX06-1123 Downgradient Performance Indicators
Southeast In Situ Bioremediation System
USDOE/NNSA Pantex Plant



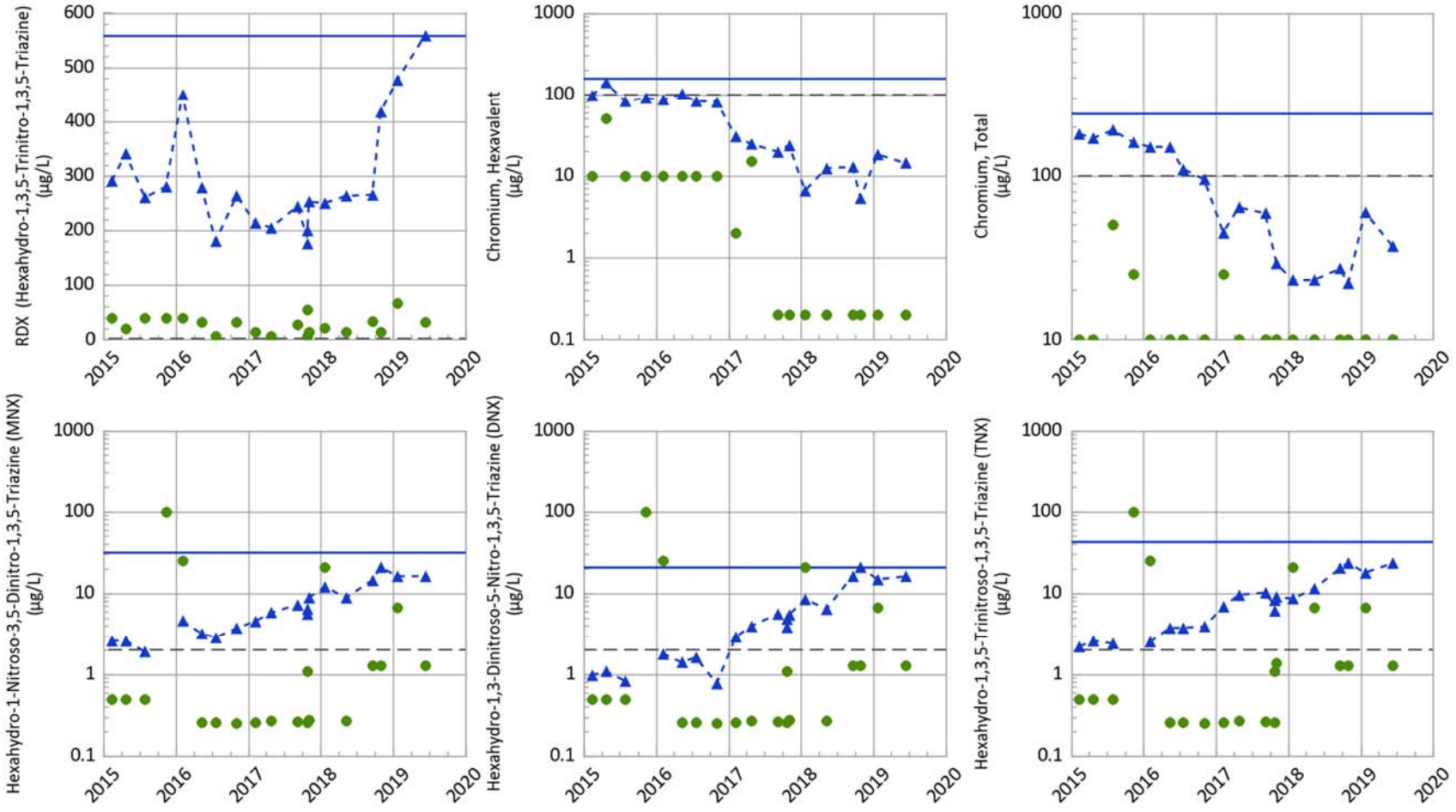
Most Recent Measured COC Concentrations (Aug 05, 2015)

COC	Concentration (µg/L)	GWPS (µg/L)
RDX	Non-Detect	2.0
MNX	Non-Detect	2.0
CR-6	Non-Detect	100.0
DNX	Non-Detect	2.0
CR	Non-Detect	100.0
TNX	0.12	2.0



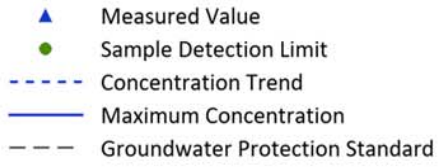
Well Location

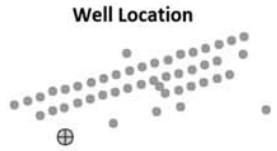
PTX06-1153 Downgradient Performance Indicators
Southeast In Situ Bioremediation System
USDOE/NNSA Pantex Plant



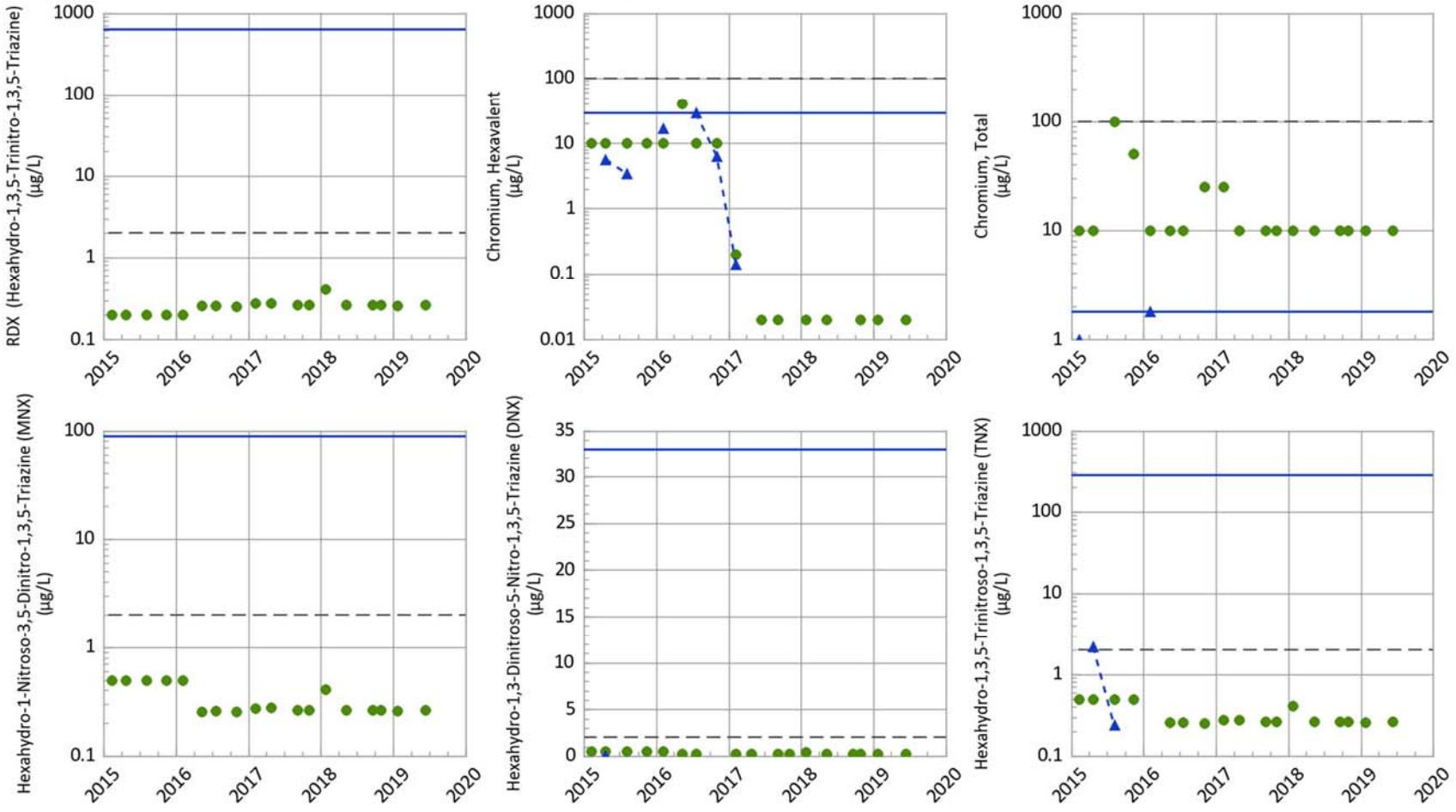
Most Recent Measured COC Concentrations (Jun 11, 2019)

COC	Concentration (µg/L)	GWPS (µg/L)
RDX	559.0	2.0
MNX	16.2	2.0
CR-6	14.29	100.0
DNX	16.1	2.0
CR	37.0	100.0
TNX	23.3	2.0



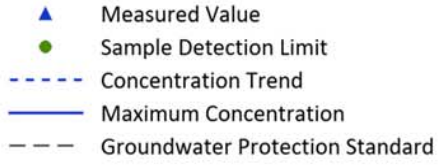


PTX06-1154 Downgradient Performance Indicators
Southeast In Situ Bioremediation System
USDOE/NNSA Pantex Plant



Most Recent Measured COC Concentrations (Aug 05, 2015)

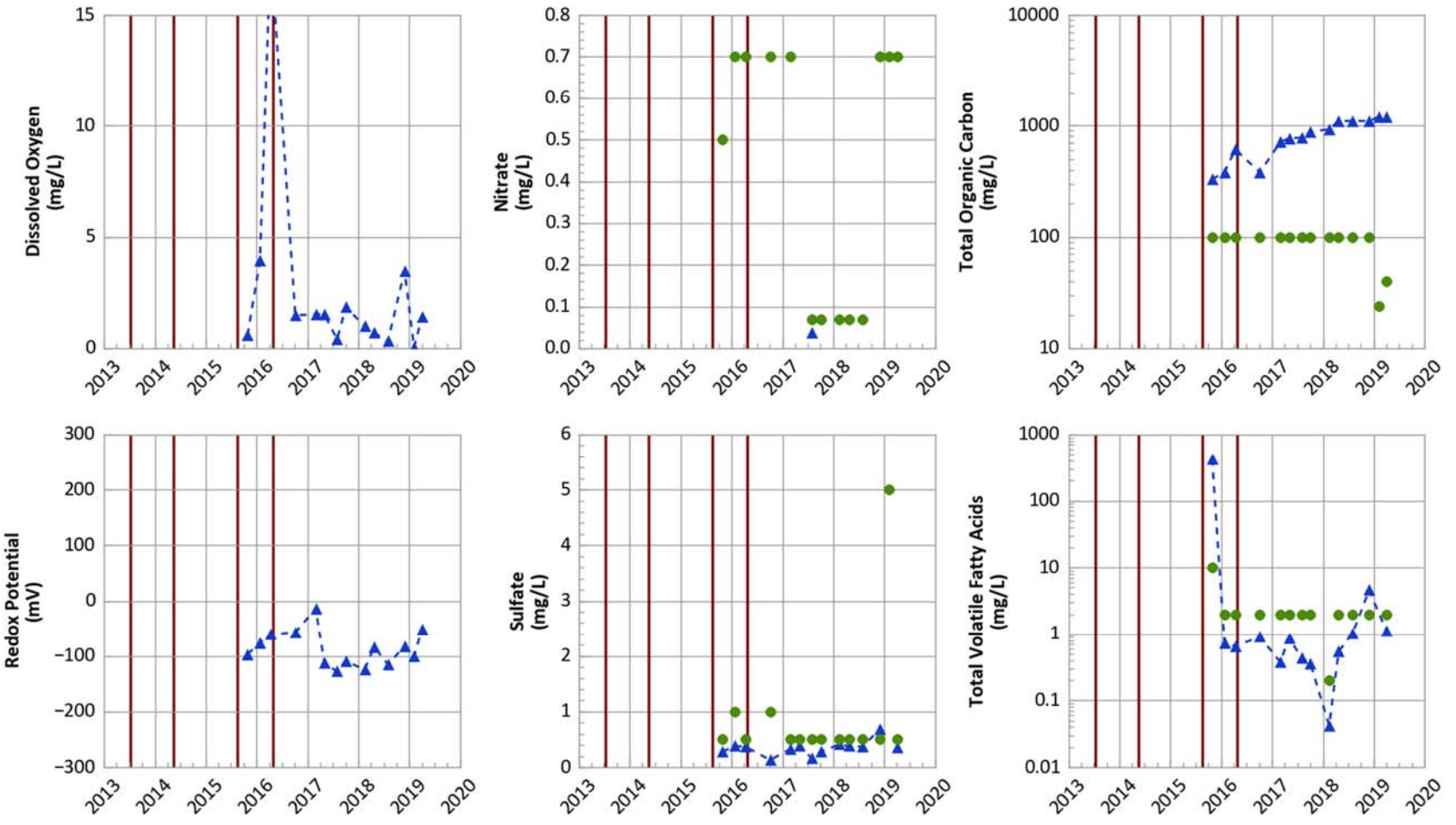
COC	Concentration (µg/L)	GWPS (µg/L)
RDX	Non-Detect	2.0
MNX	Non-Detect	2.0
CR-6	Non-Detect	100.0
DNX	Non-Detect	2.0
CR	Non-Detect	100.0
TNX	Non-Detect	2.0



Well Location

Zone 11 ISB Graphs

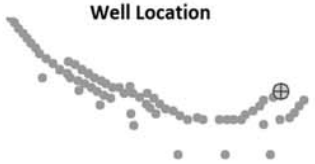
PTX06-ISB055 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant

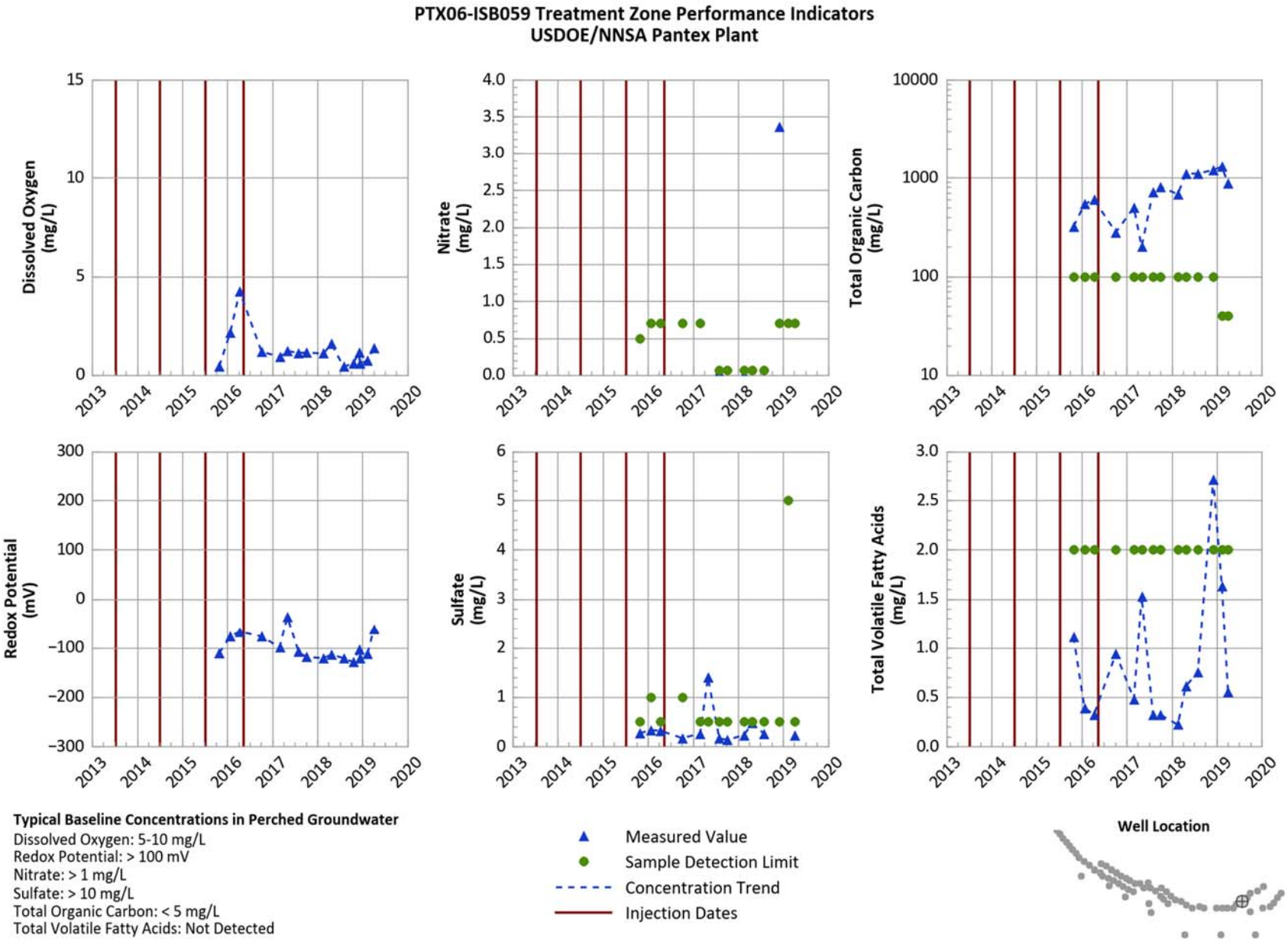


Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected

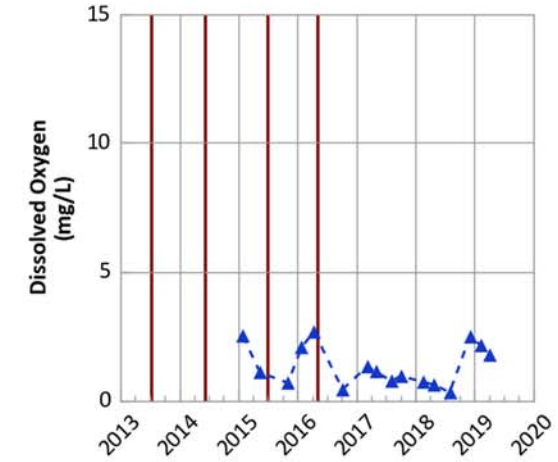
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates

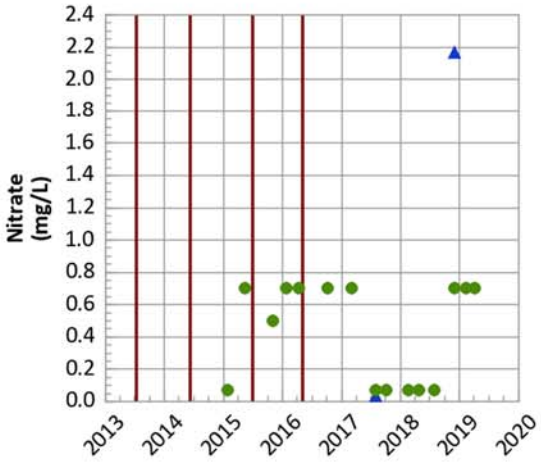
Well Location

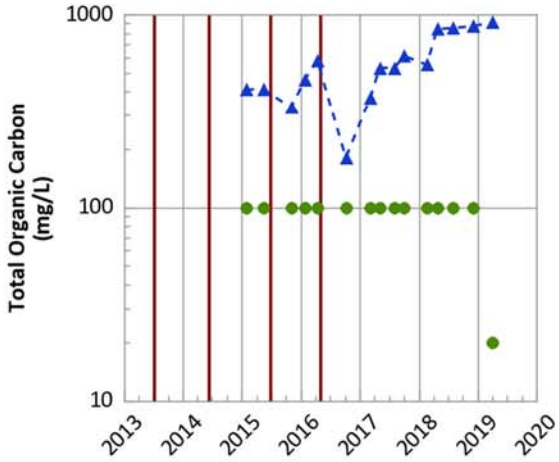


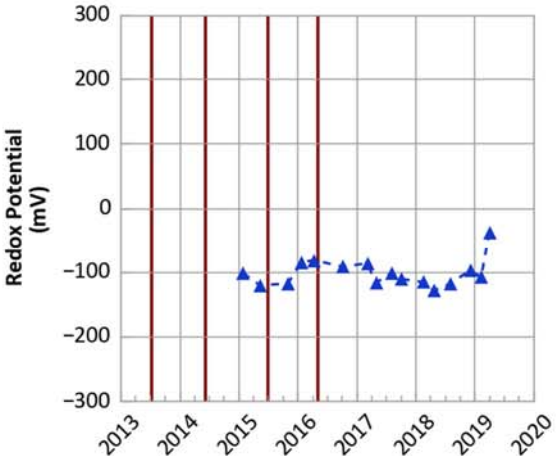

PTX06-ISB059 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

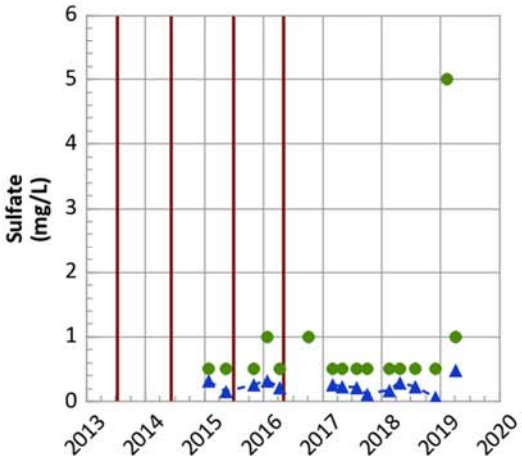
PTX06-ISB063 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant

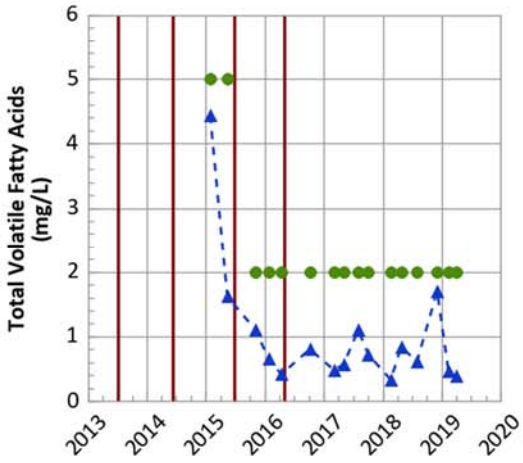




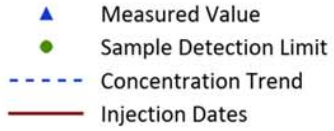


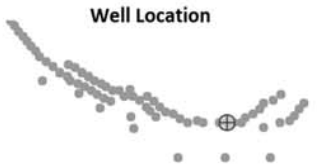


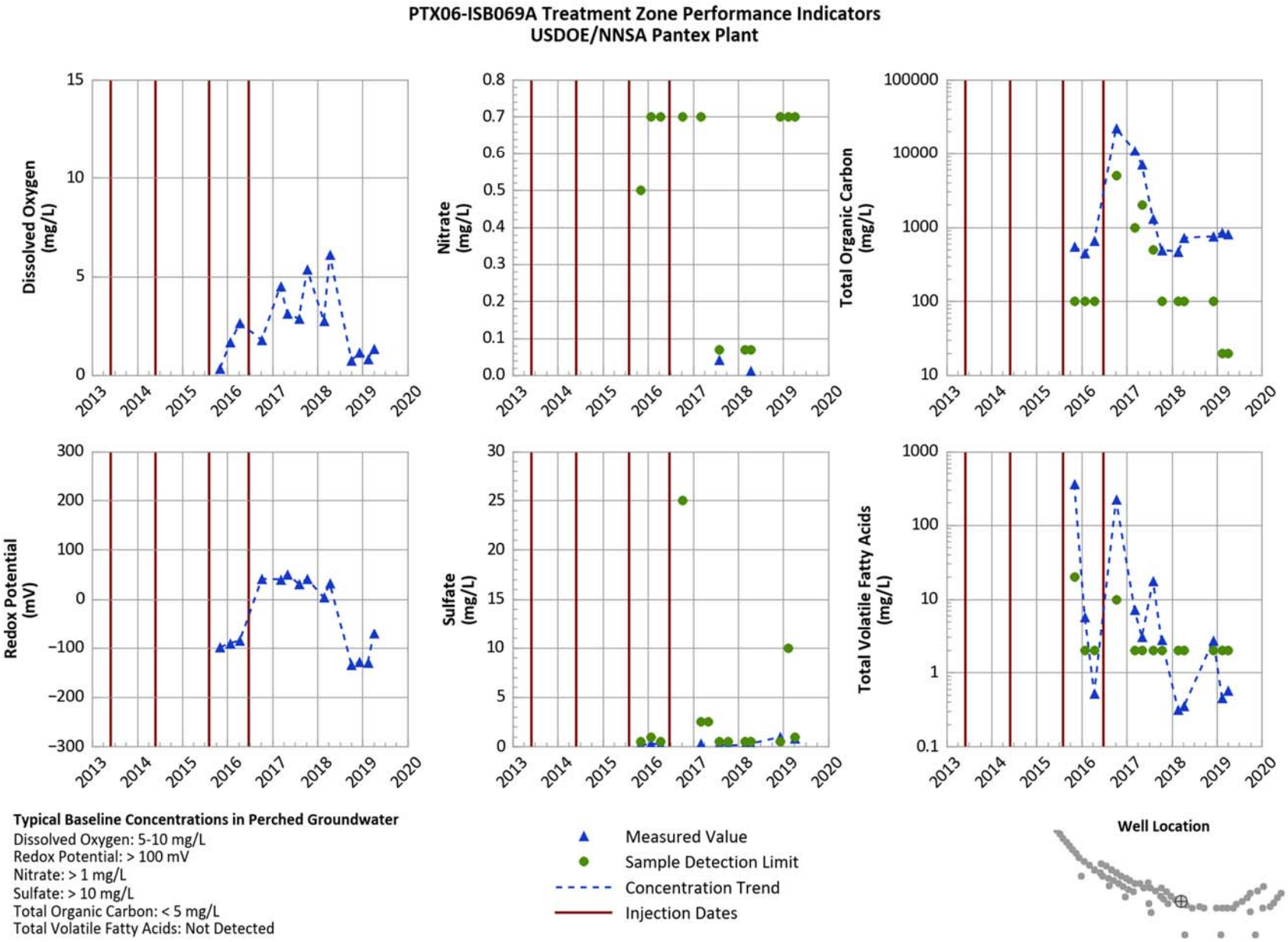




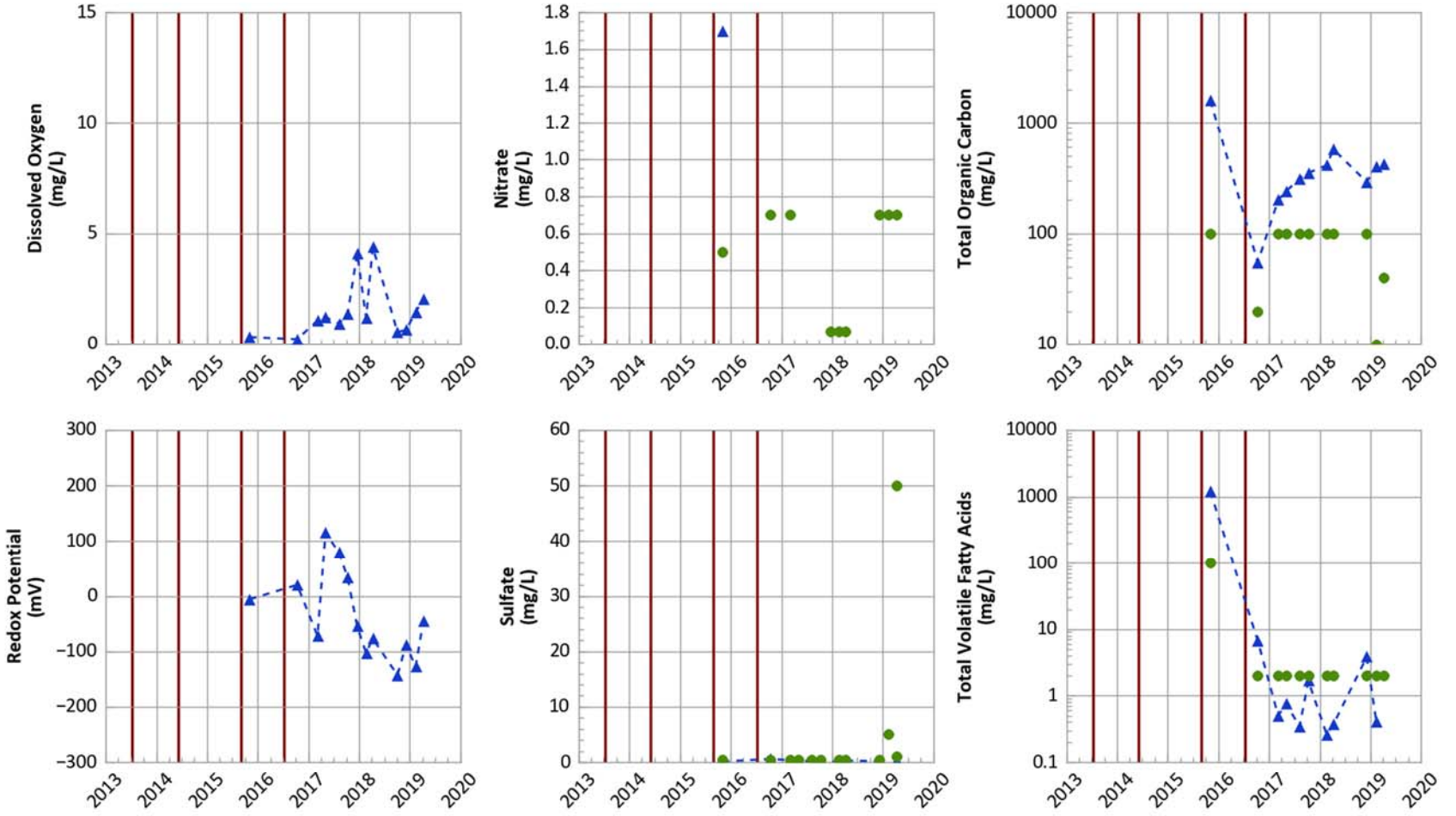
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected






PTX06-ISB069A Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
2013
2014
2015
2016
2017
2018
2019
2020
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

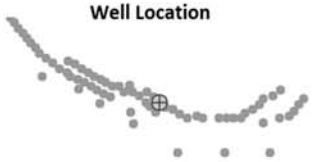
PTX06-ISB071 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant

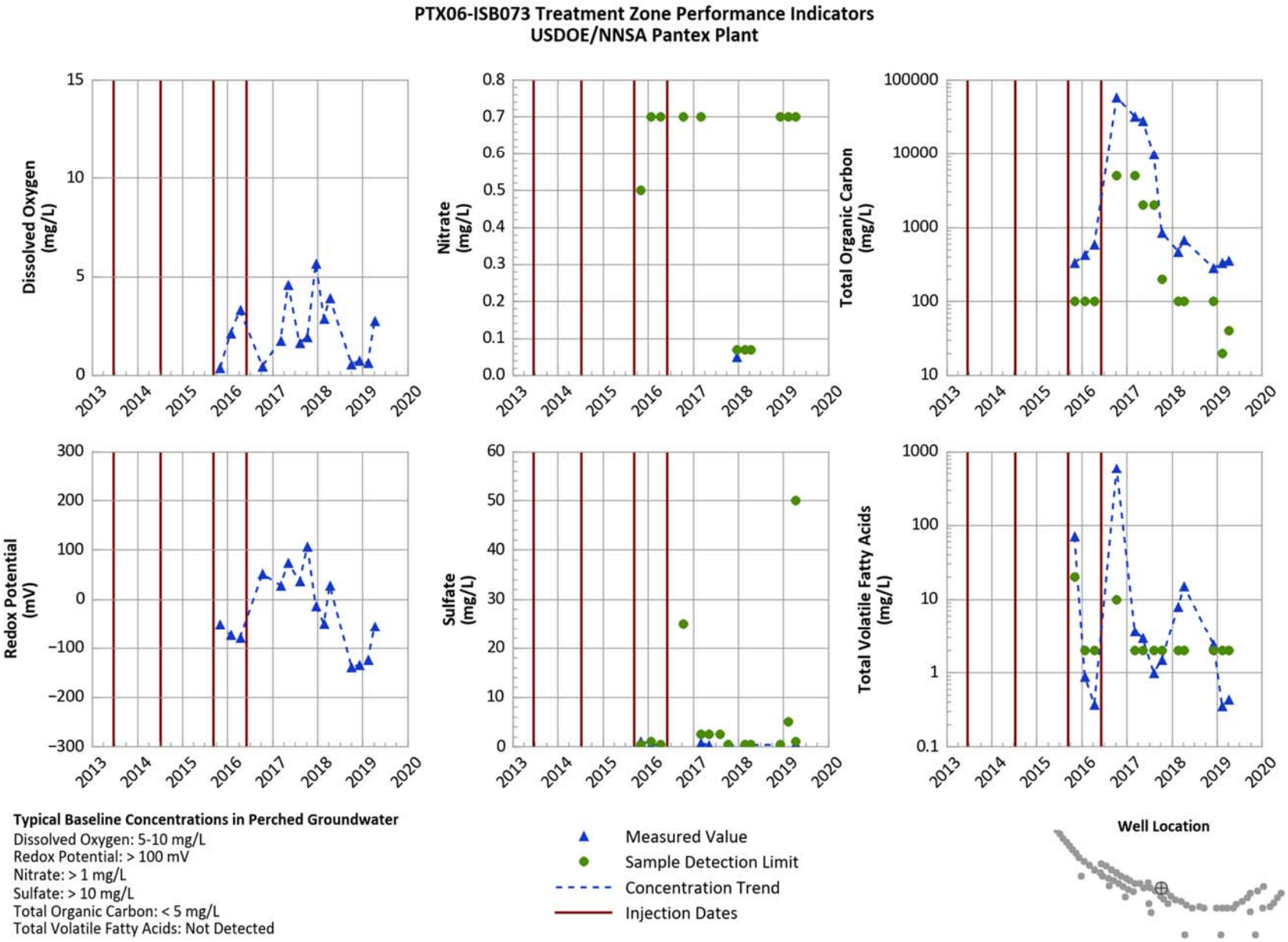


Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected

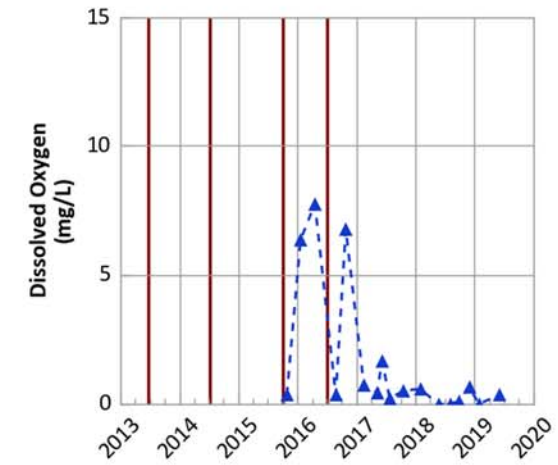
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates

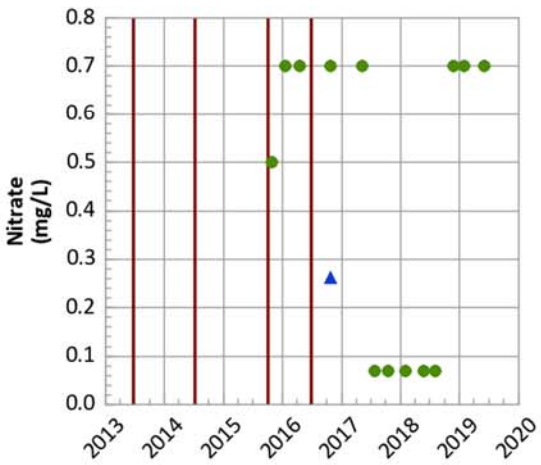
Well Location

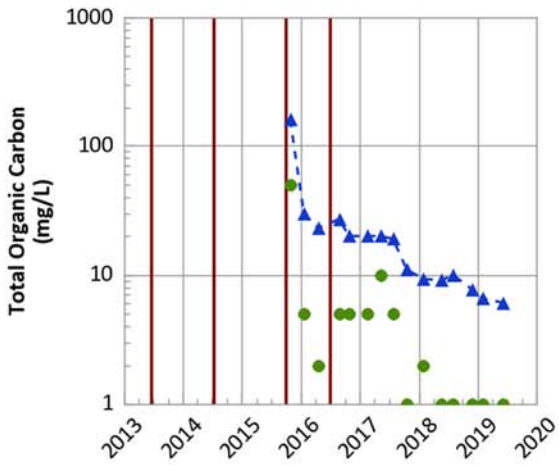


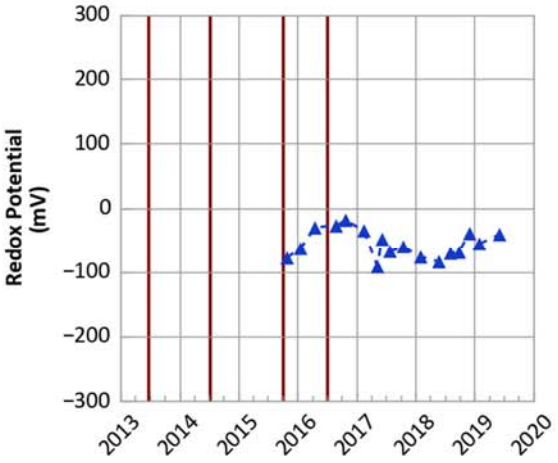

PTX06-ISB073 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

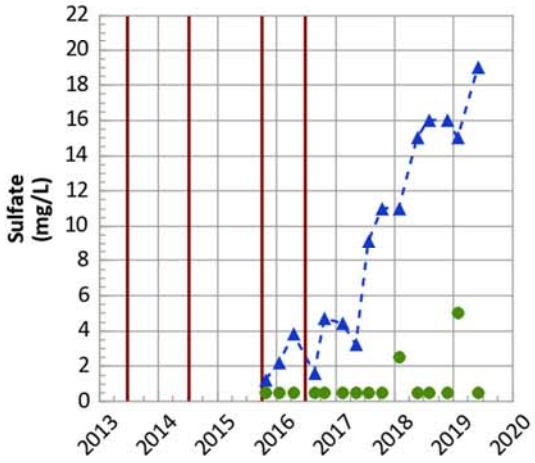
PTX06-ISB075 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant

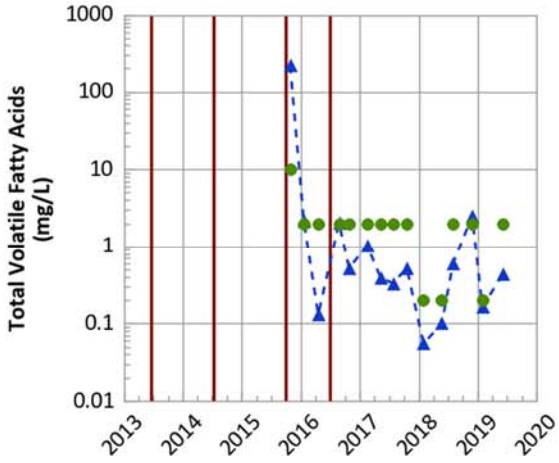




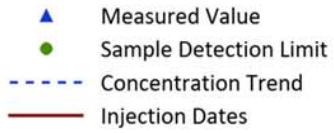


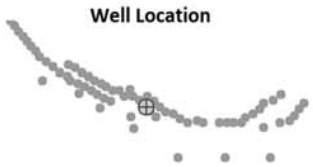




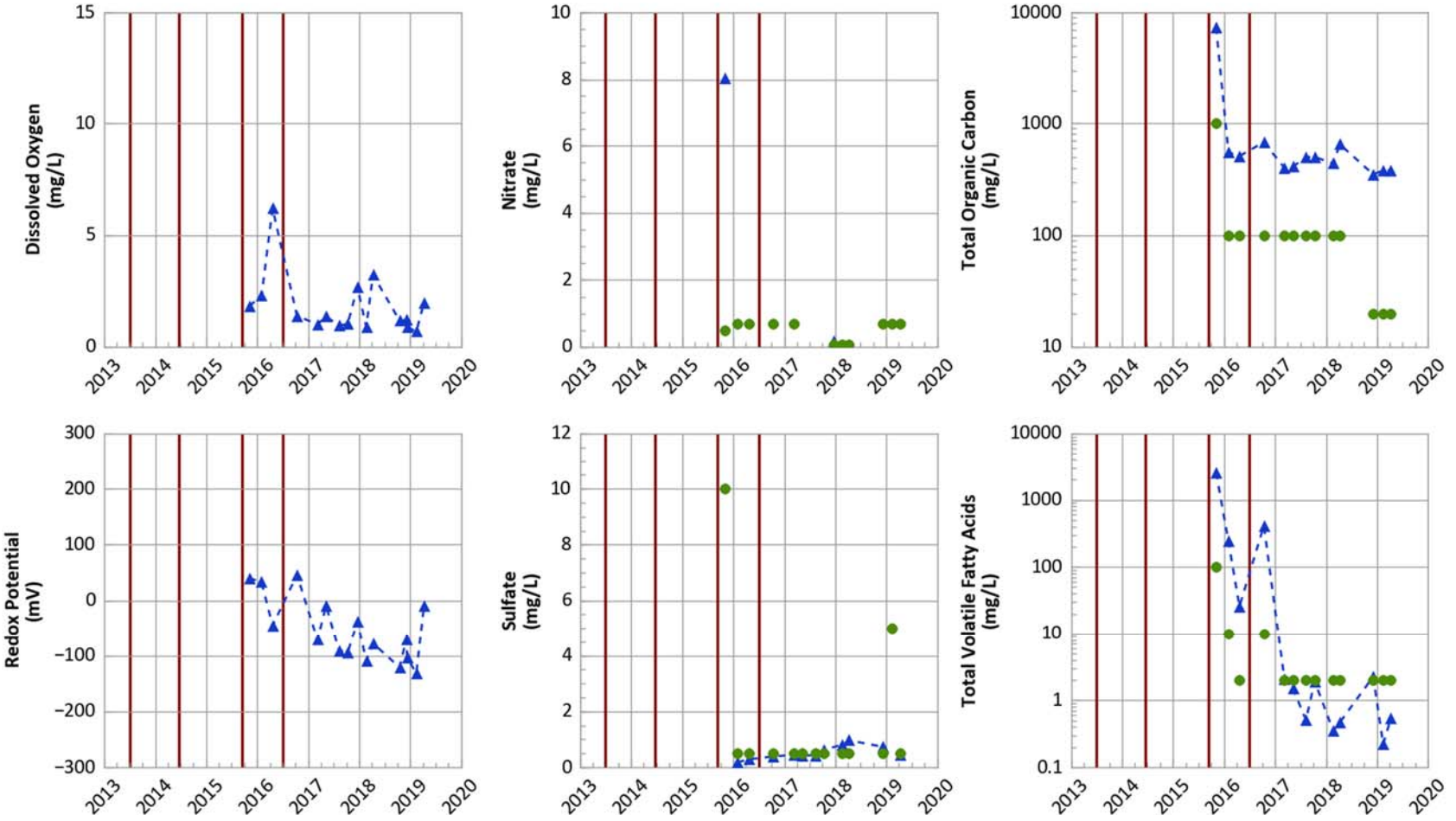


Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected





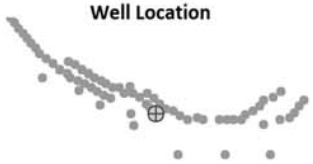
PTX06-ISB077 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant



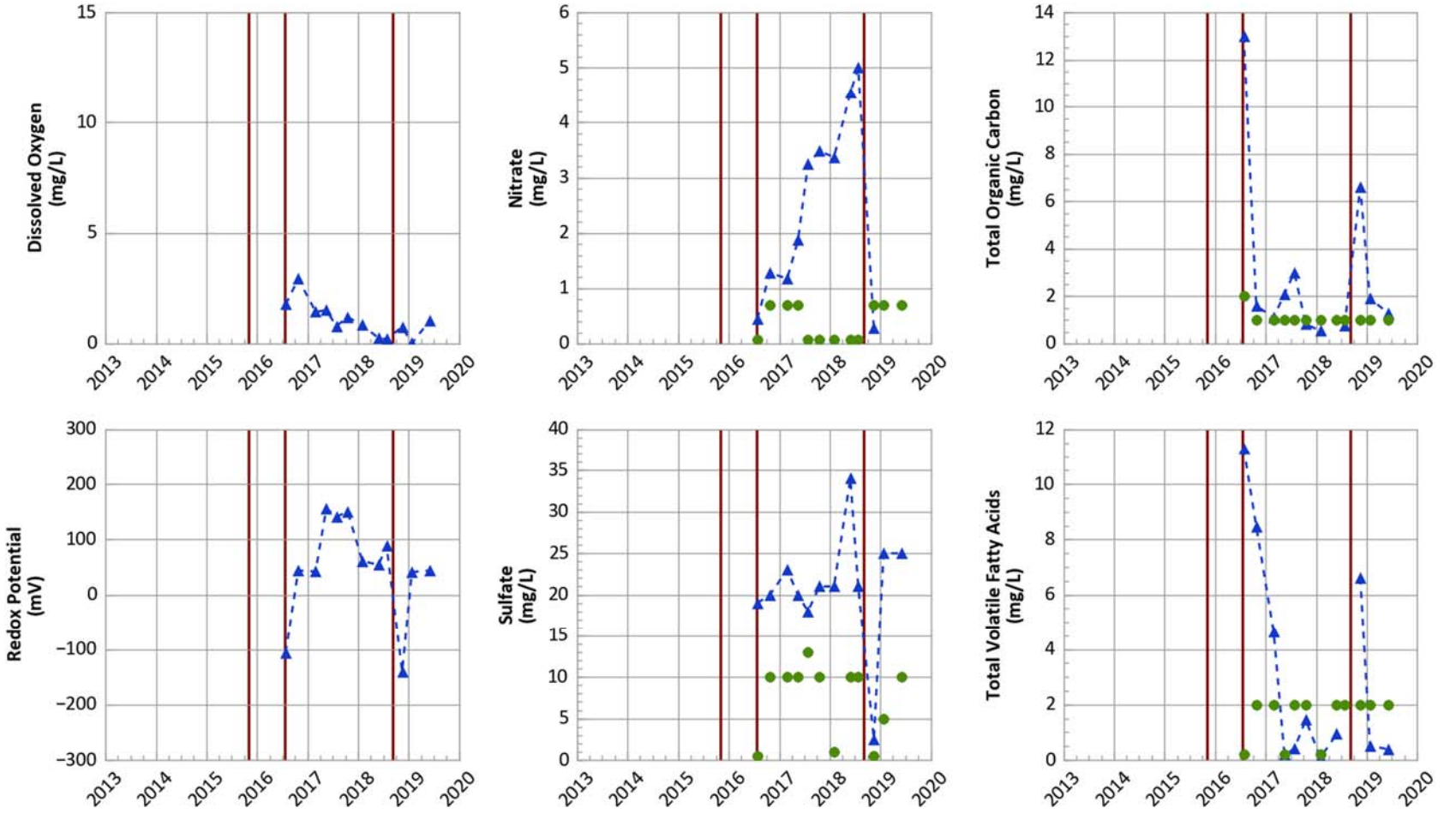
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected

Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates

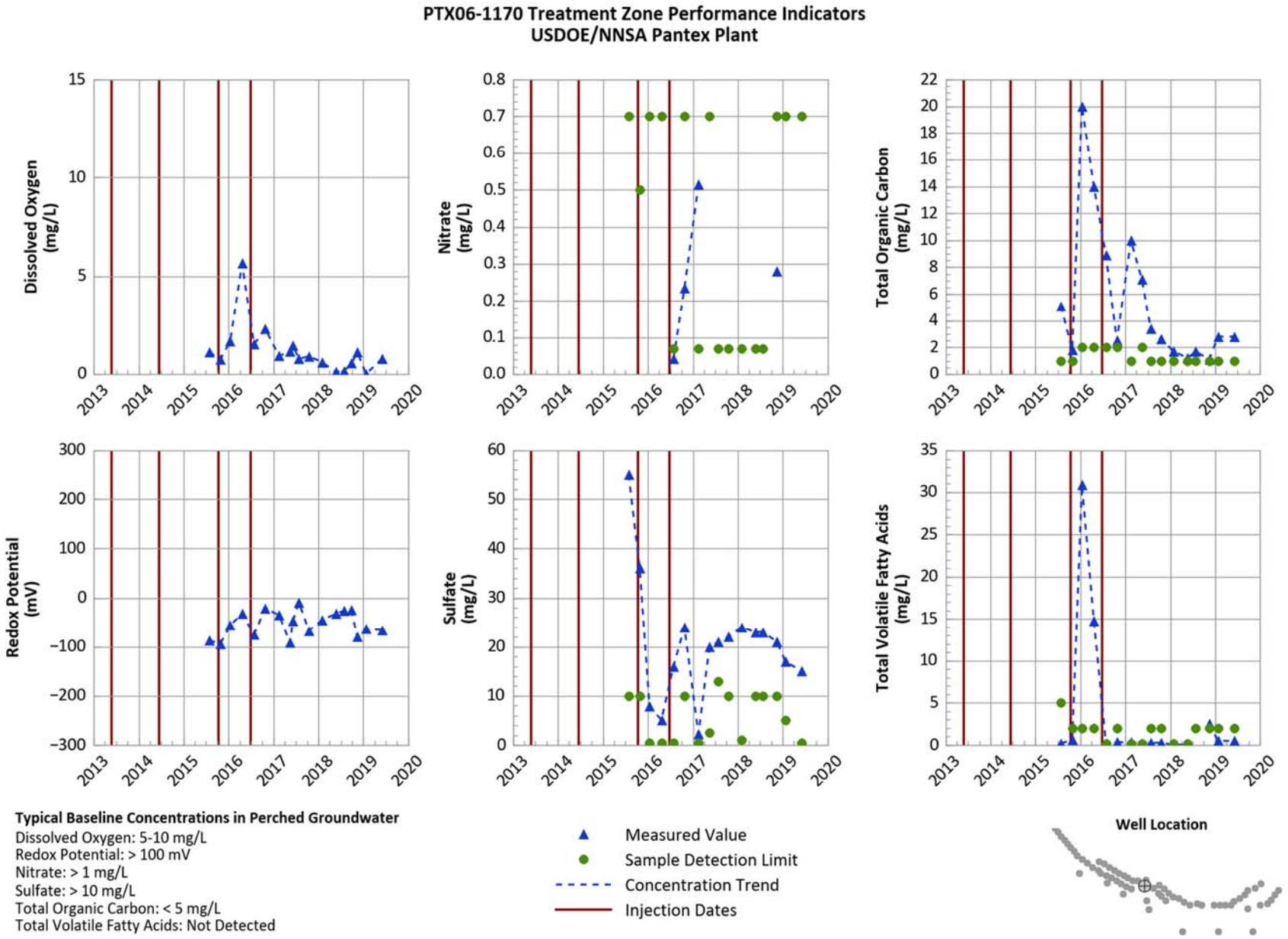
Well Location



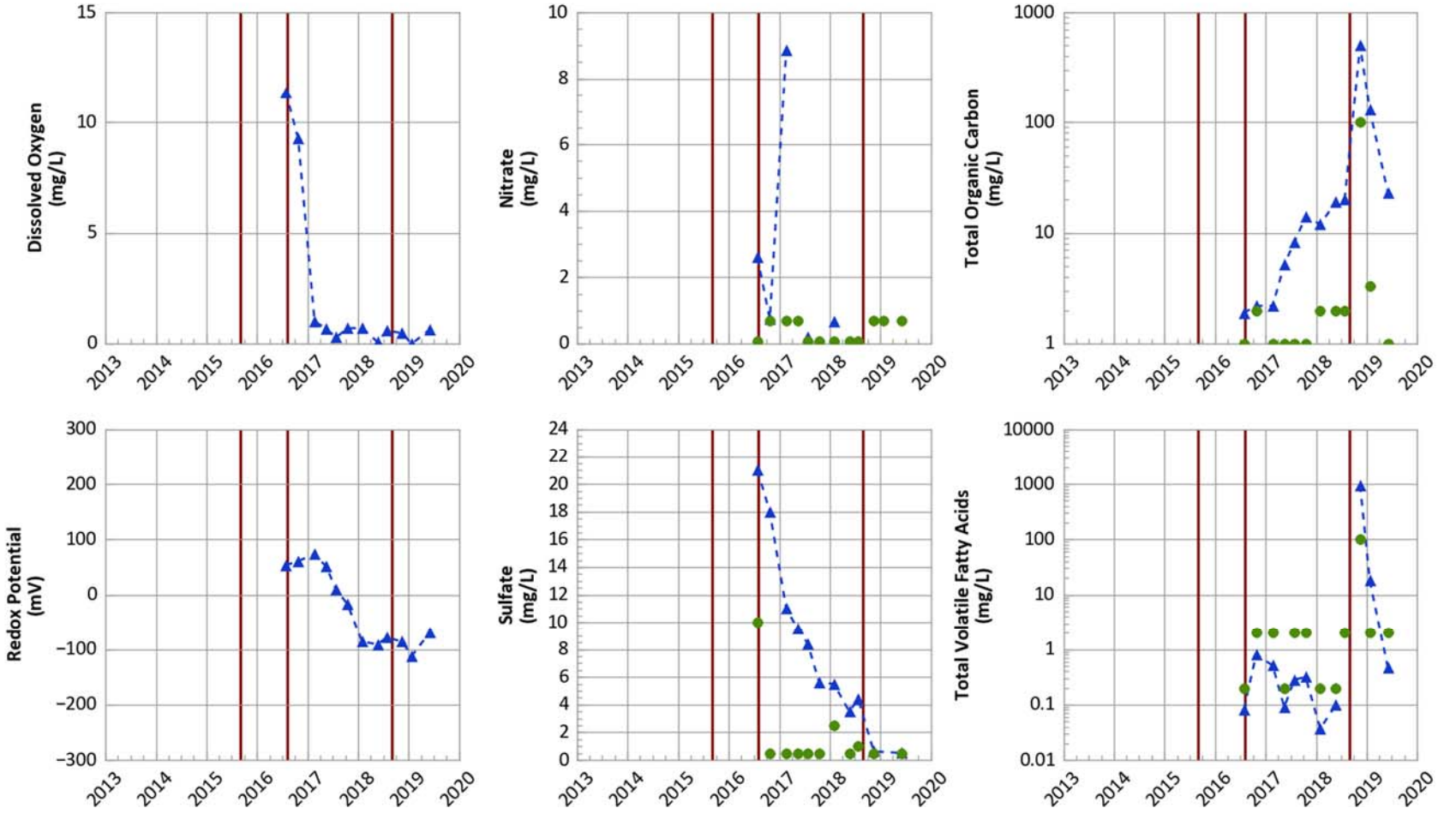
PTX06-1164 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant



Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected


PTX06-1170 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
2013
2014
2015
2016
2017
2018
2019
2020
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

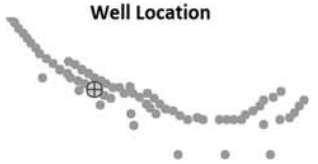
PTX06-1176 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant

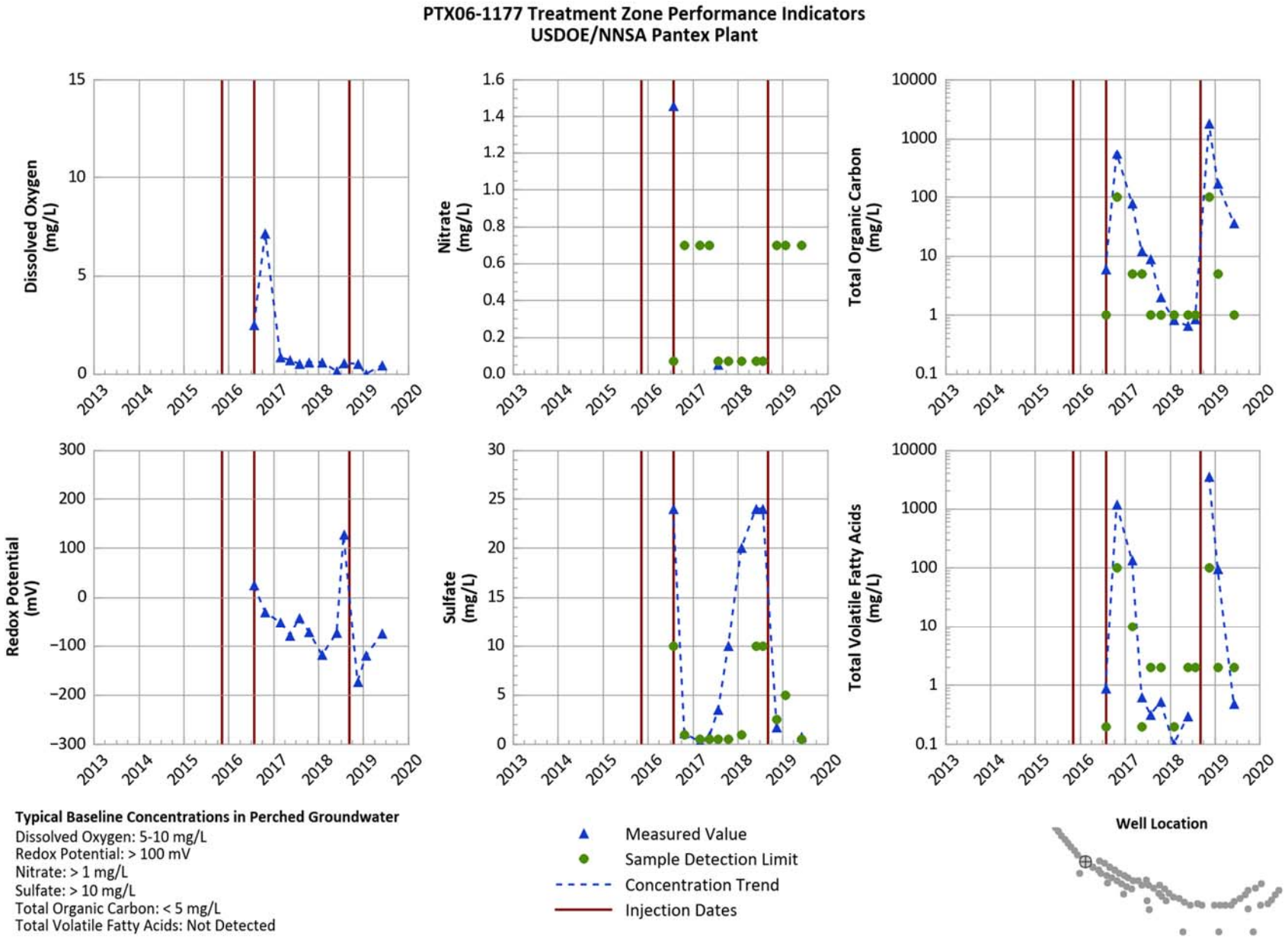


Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected

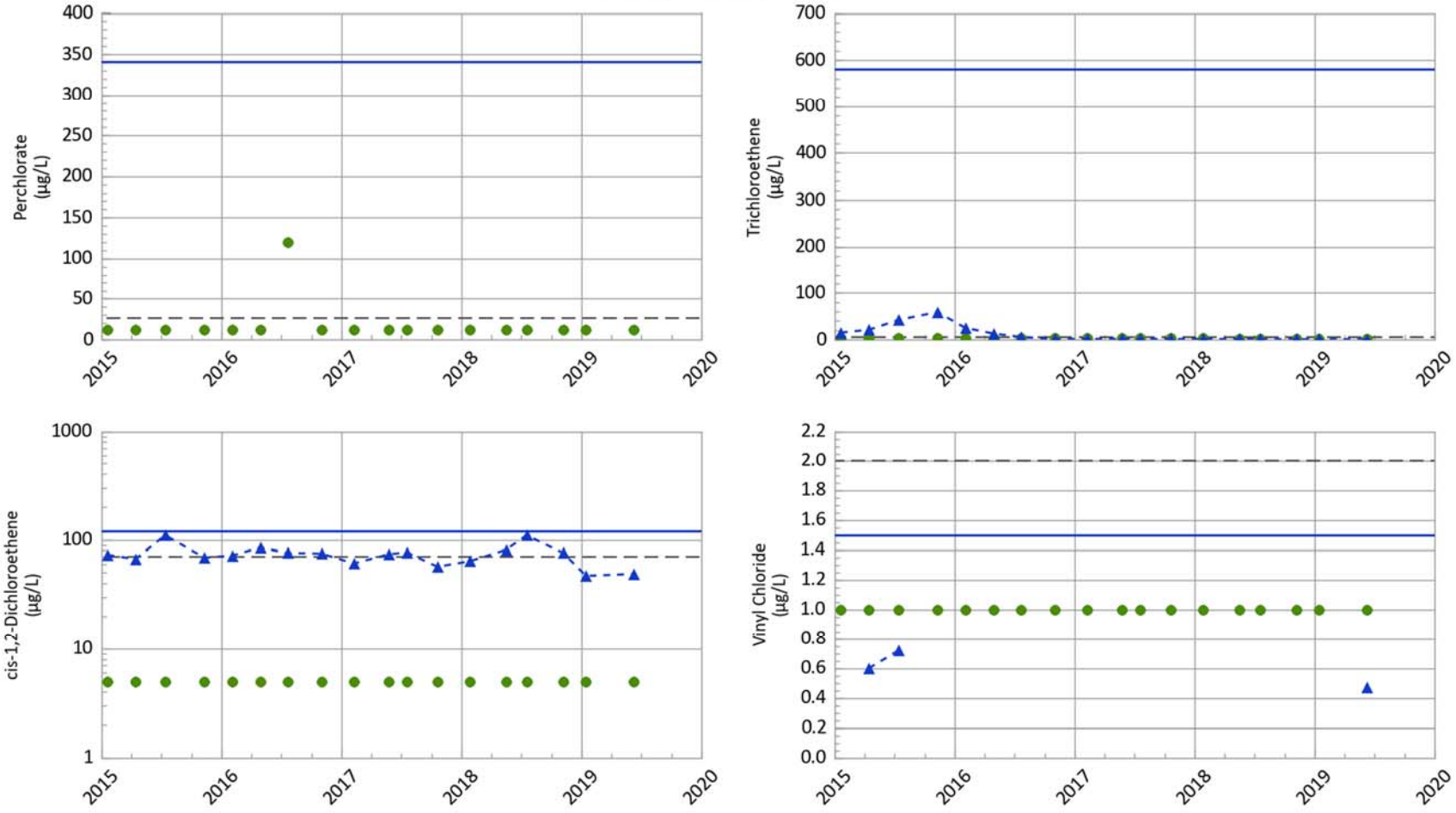
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates

Well Location




PTX06-1177 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
2013
2014
2015
2016
2017
2018
2019
2020
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

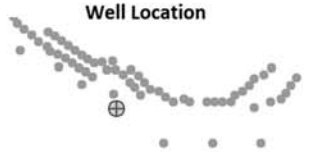
PTX06-1012 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant



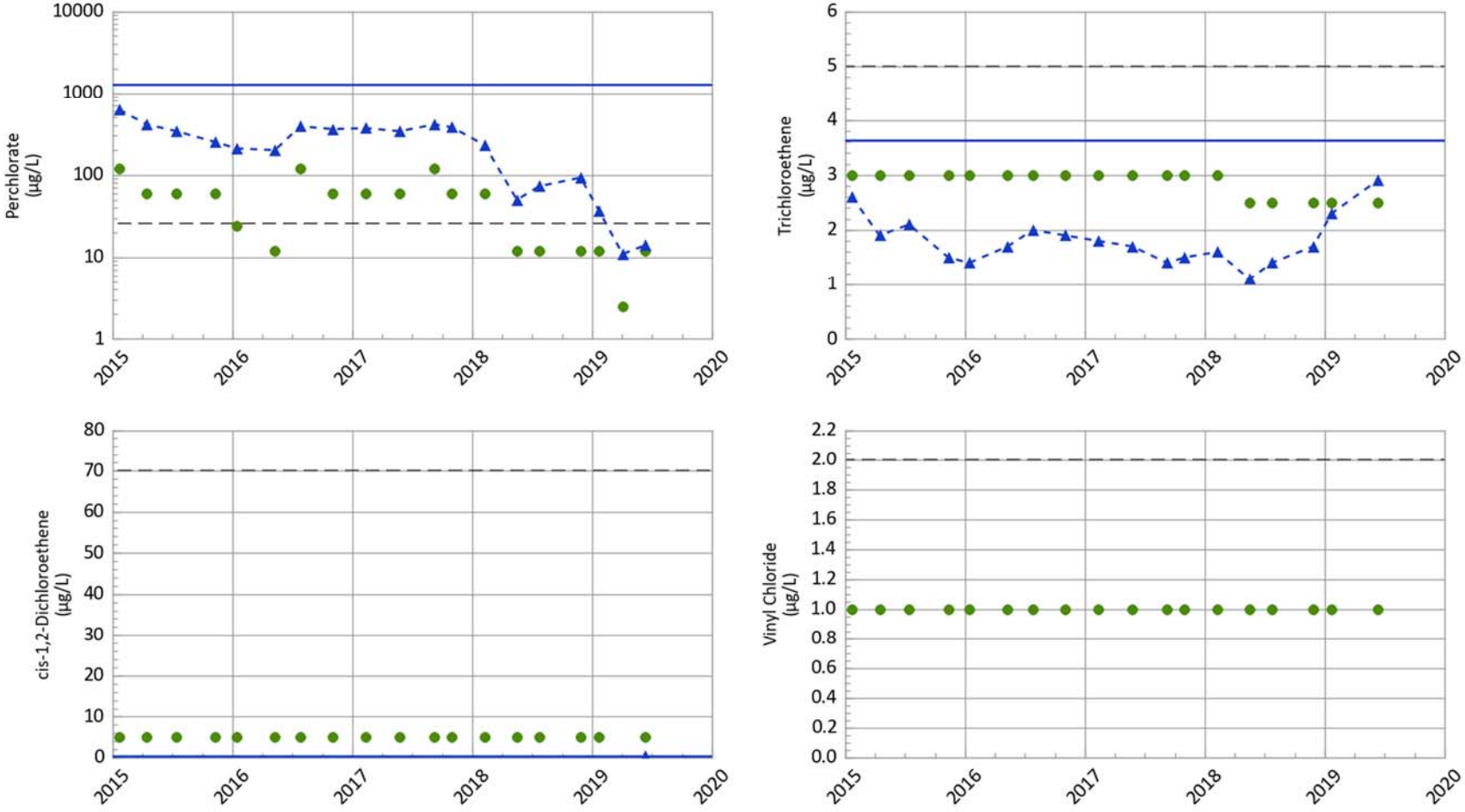
Most Recent Measured COC Concentrations (Jun 09, 2019)

COC	Concentration (µg/L)	GWPS (µg/L)
PERC	Non-Detect	26.0
DCE12C	49.0	70.0
TCE	0.8	5.0
VC	0.47	2.0

- Measured Value
- Sample Detection Limit
- Concentration Trend
- Maximum Concentration
- Groundwater Protection Standard

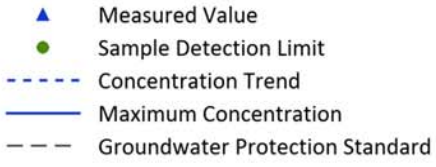


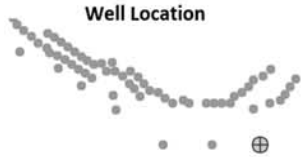
PTX06-1148 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant



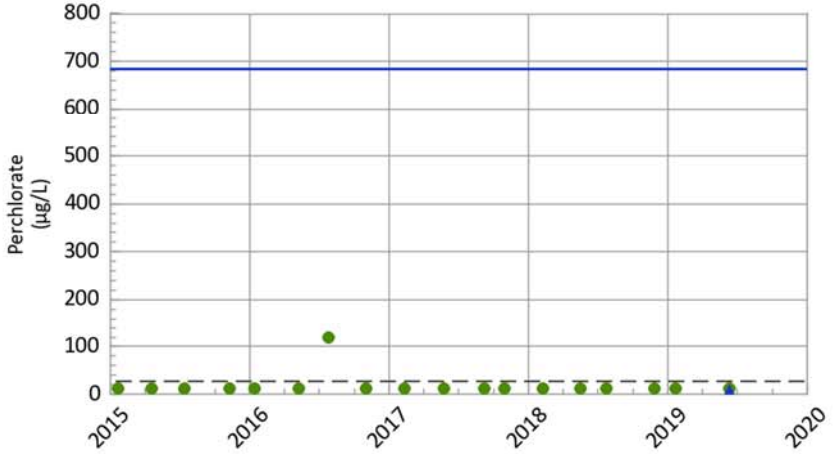
Most Recent Measured COC Concentrations (Jun 10, 2019)

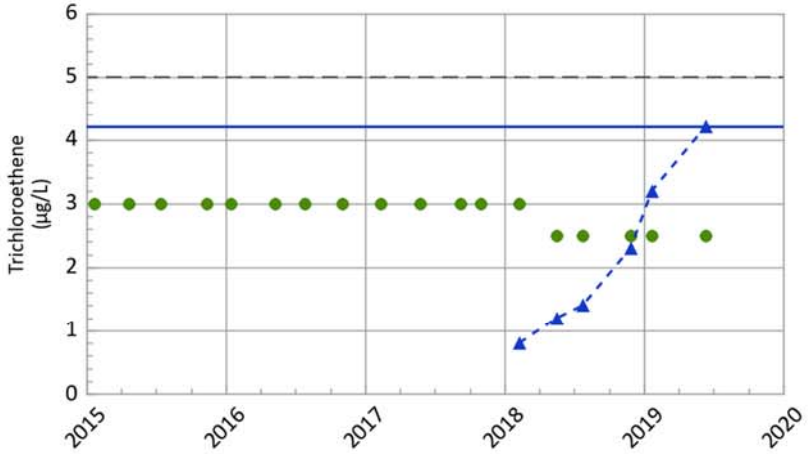
COC	Concentration (µg/L)	GWPS (µg/L)
PERC	14.0	26.0
DCE12C	0.45	70.0
TCE	2.9	5.0
VC	Non-Detect	2.0

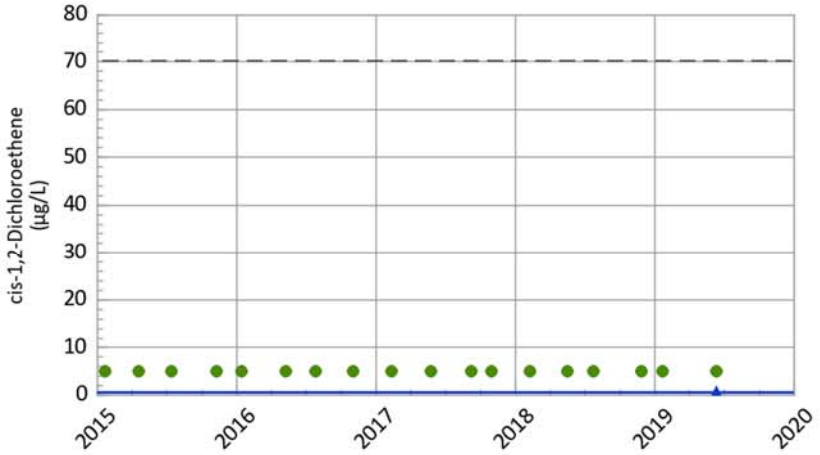


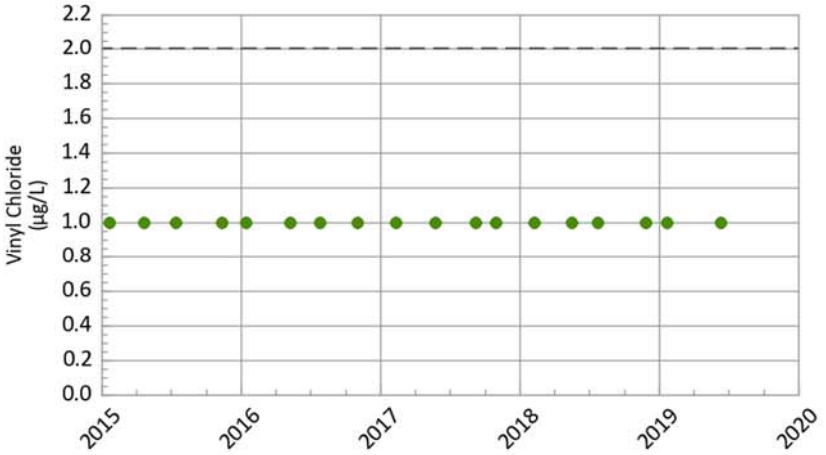


PTX06-1149 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant



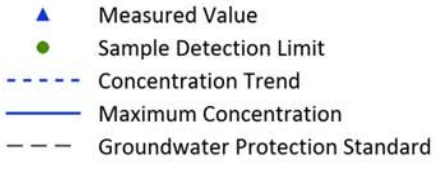


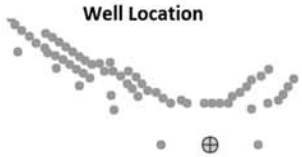




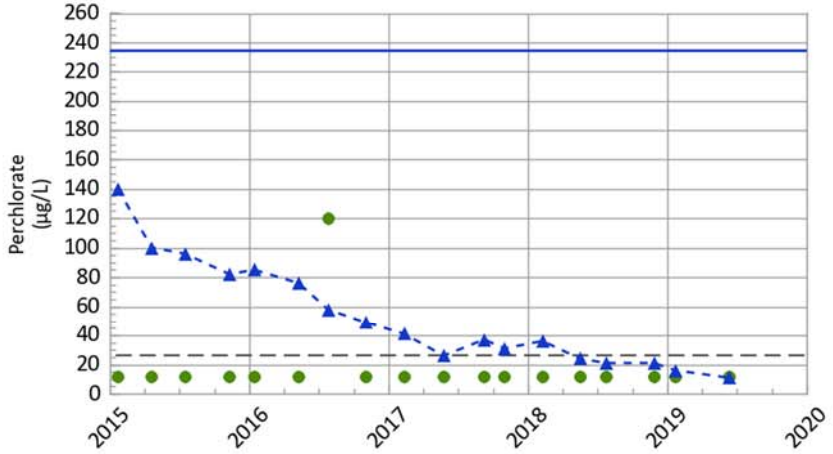
Most Recent Measured COC Concentrations (Jun 10, 2019)

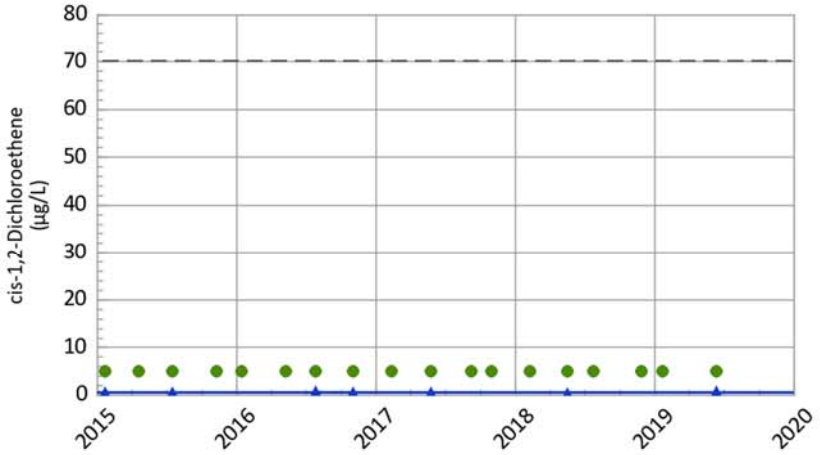
COC	Concentration (µg/L)	GWPS (µg/L)
PERC	5.4	26.0
DCE12C	0.57	70.0
TCE	4.2	5.0
VC	Non-Detect	2.0

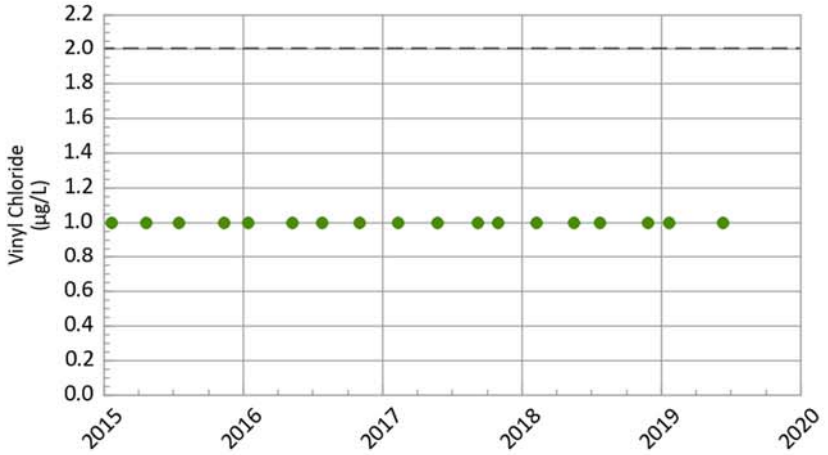




PTX06-1150 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant

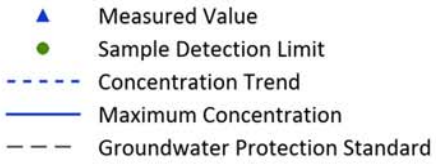


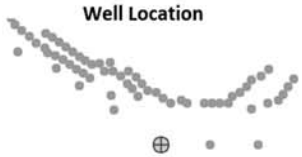




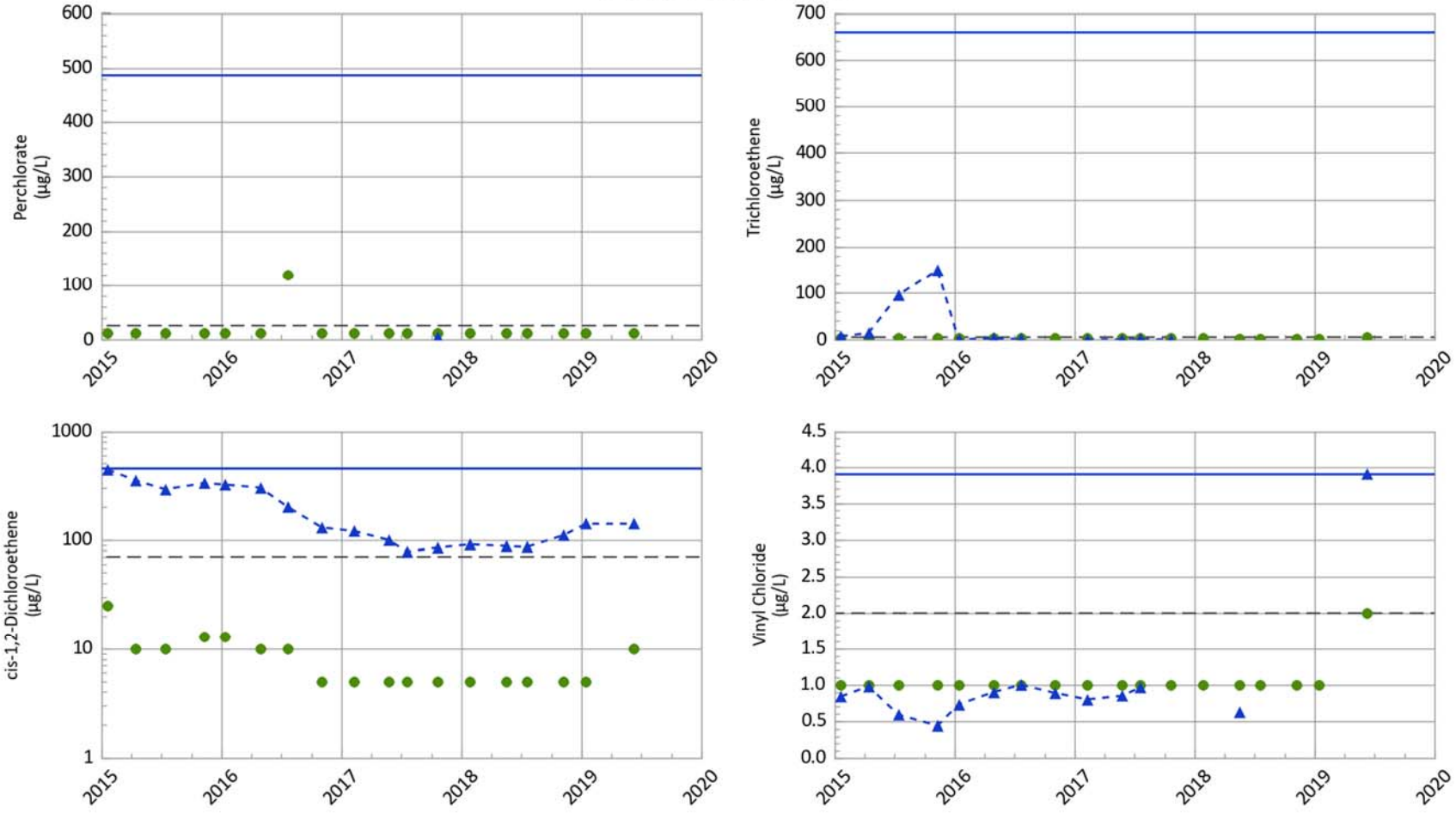
Most Recent Measured COC Concentrations (Jun 10, 2019)

COC	Concentration (µg/L)	GWPS (µg/L)
PERC	11.0	26.0
DCE12C	0.51	70.0
TCE	7.0	5.0
VC	Non-Detect	2.0





PTX06-1155 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant

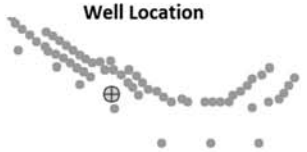


Most Recent Measured COC Concentrations (Jun 09, 2019)

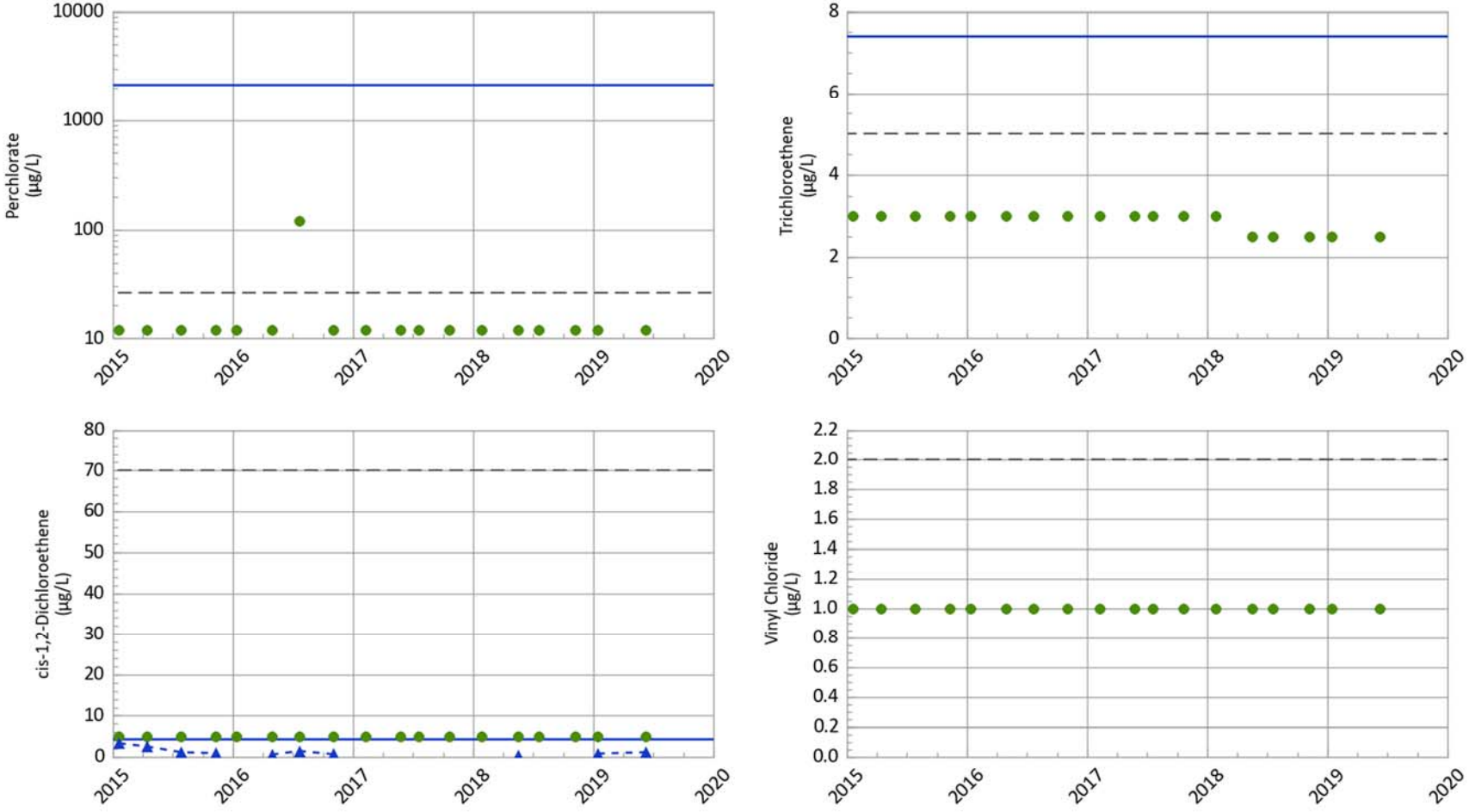
COC	Concentration (µg/L)	GWPS (µg/L)
PERC	Non-Detect	26.0
DCE12C	140.0	70.0
TCE	Non-Detect	5.0
VC	3.9	2.0

Measured Value
Sample Detection Limit
Concentration Trend
Maximum Concentration
Groundwater Protection Standard

Well Location



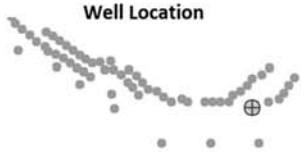
PTX06-1156 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant



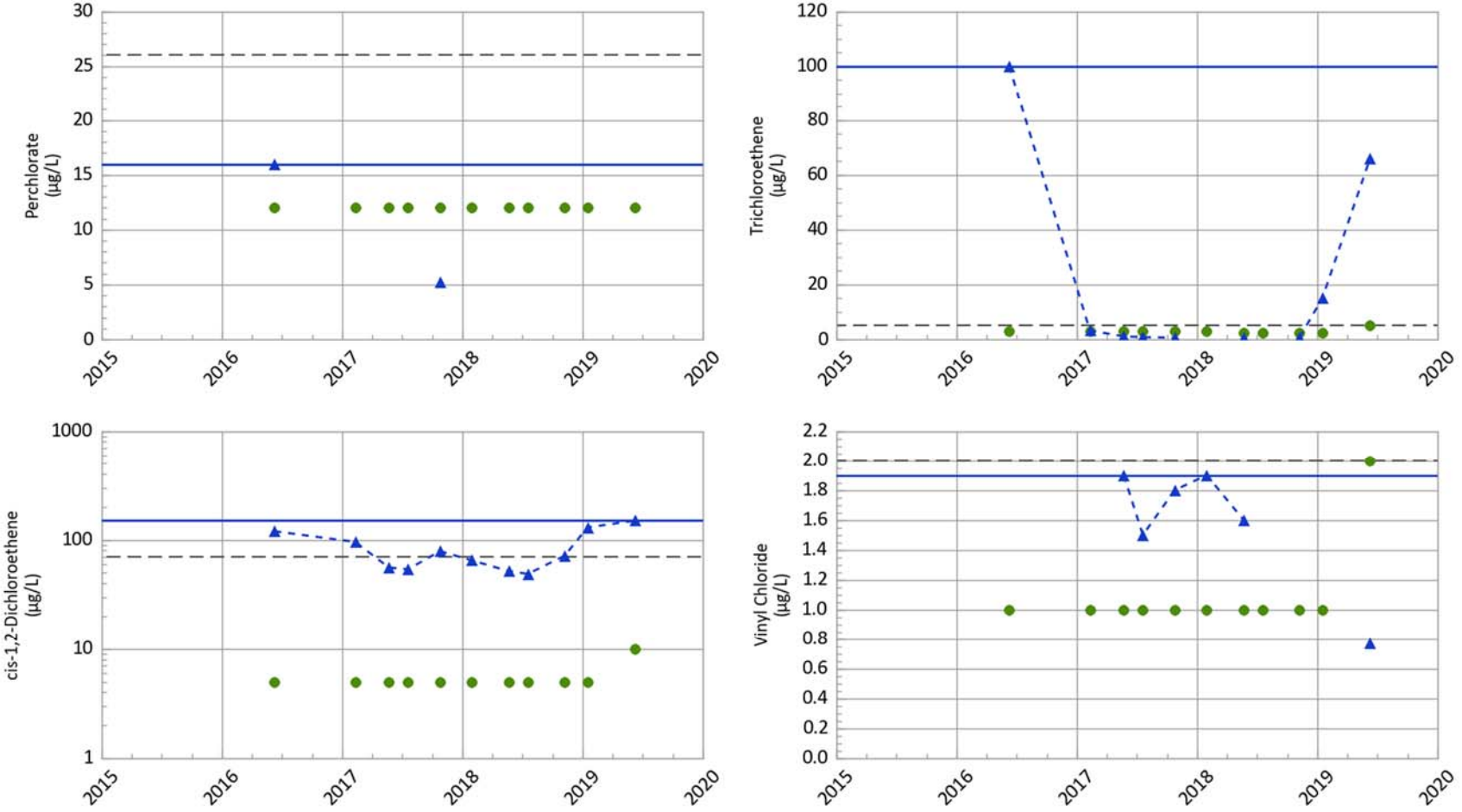
Most Recent Measured COC Concentrations (Jun 09, 2019)

COC	Concentration (µg/L)	GWPS (µg/L)
PERC	Non-Detect	26.0
DCE12C	1.2	70.0
TCE	Non-Detect	5.0
VC	Non-Detect	2.0

▲ Measured Value
● Sample Detection Limit
- - - - Concentration Trend
——— Maximum Concentration
– – – Groundwater Protection Standard



PTX06-1173 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant

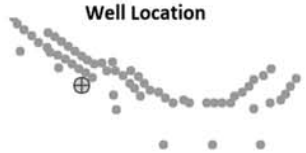


Most Recent Measured COC Concentrations (Jun 09, 2019)

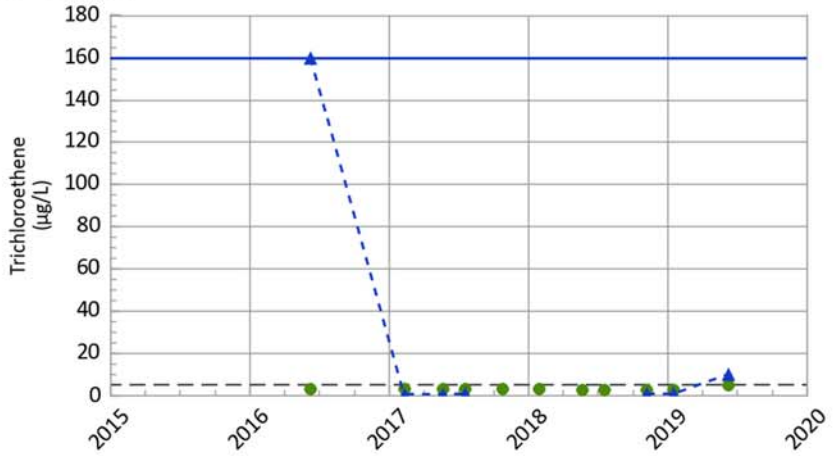
COC	Concentration (µg/L)	GWPS (µg/L)
PERC	Non-Detect	26.0
DCE12C	150.0	70.0
TCE	66.0	5.0
VC	0.77	2.0

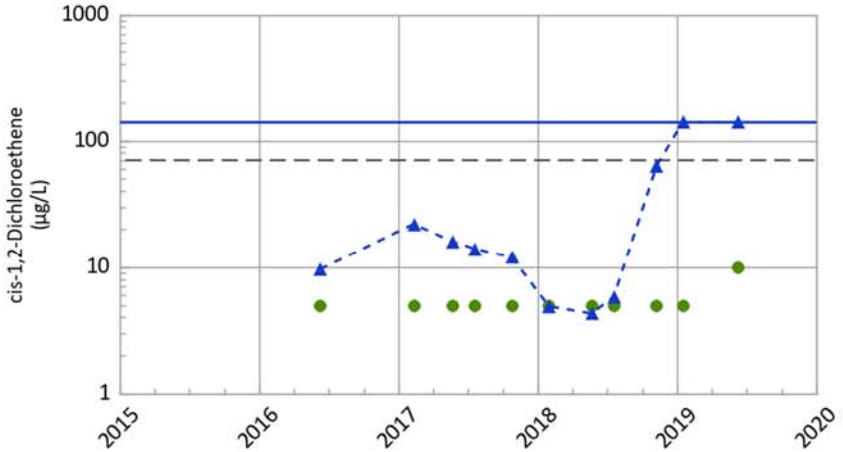
Measured Value
Sample Detection Limit
Concentration Trend
Maximum Concentration
Groundwater Protection Standard

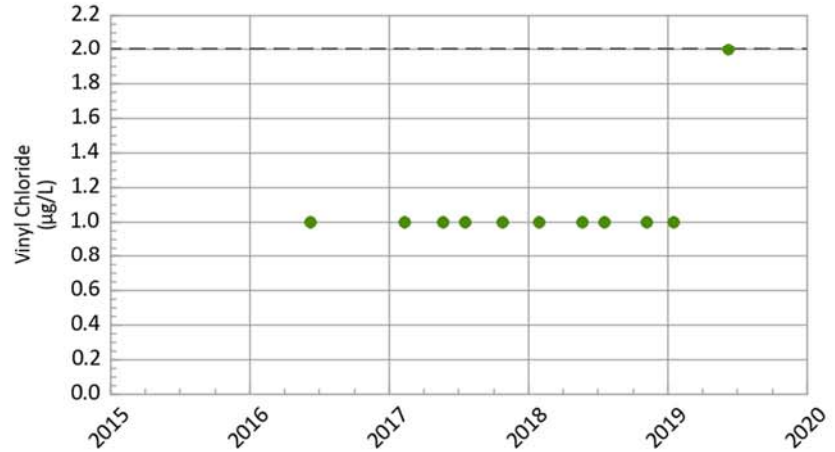
Well Location



PTX06-1174 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant

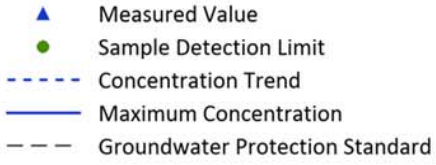


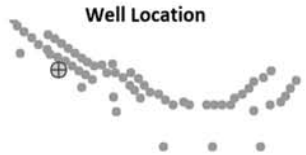




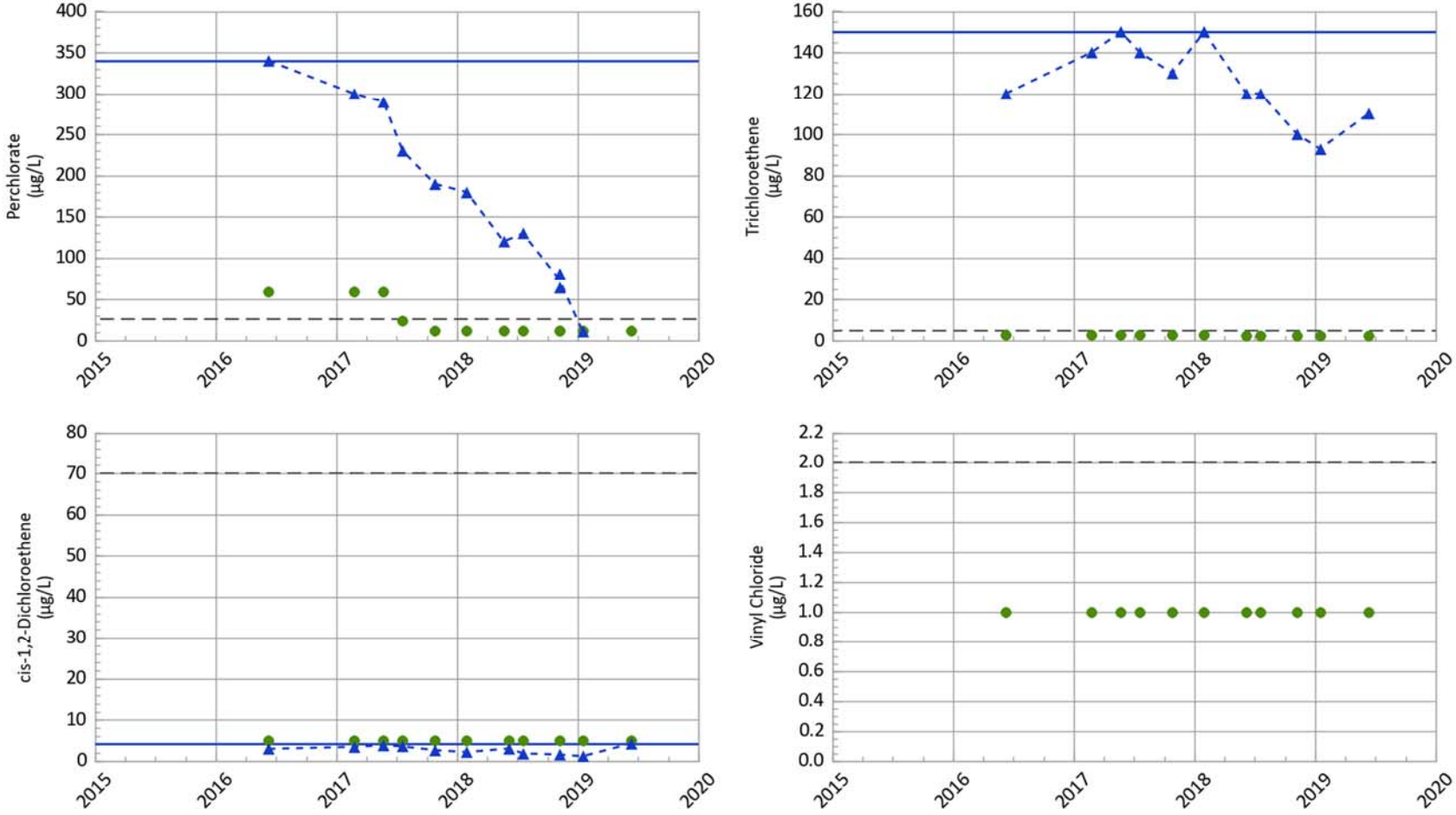
Most Recent Measured COC Concentrations (Jun 09, 2019)

COC	Concentration (µg/L)	GWPS (µg/L)
PERC	Non-Detect	26.0
DCE12C	140.0	70.0
TCE	10.0	5.0
VC	Non-Detect	2.0





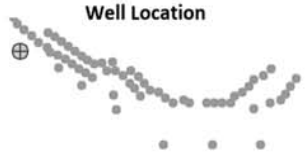
PTX06-1175 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant



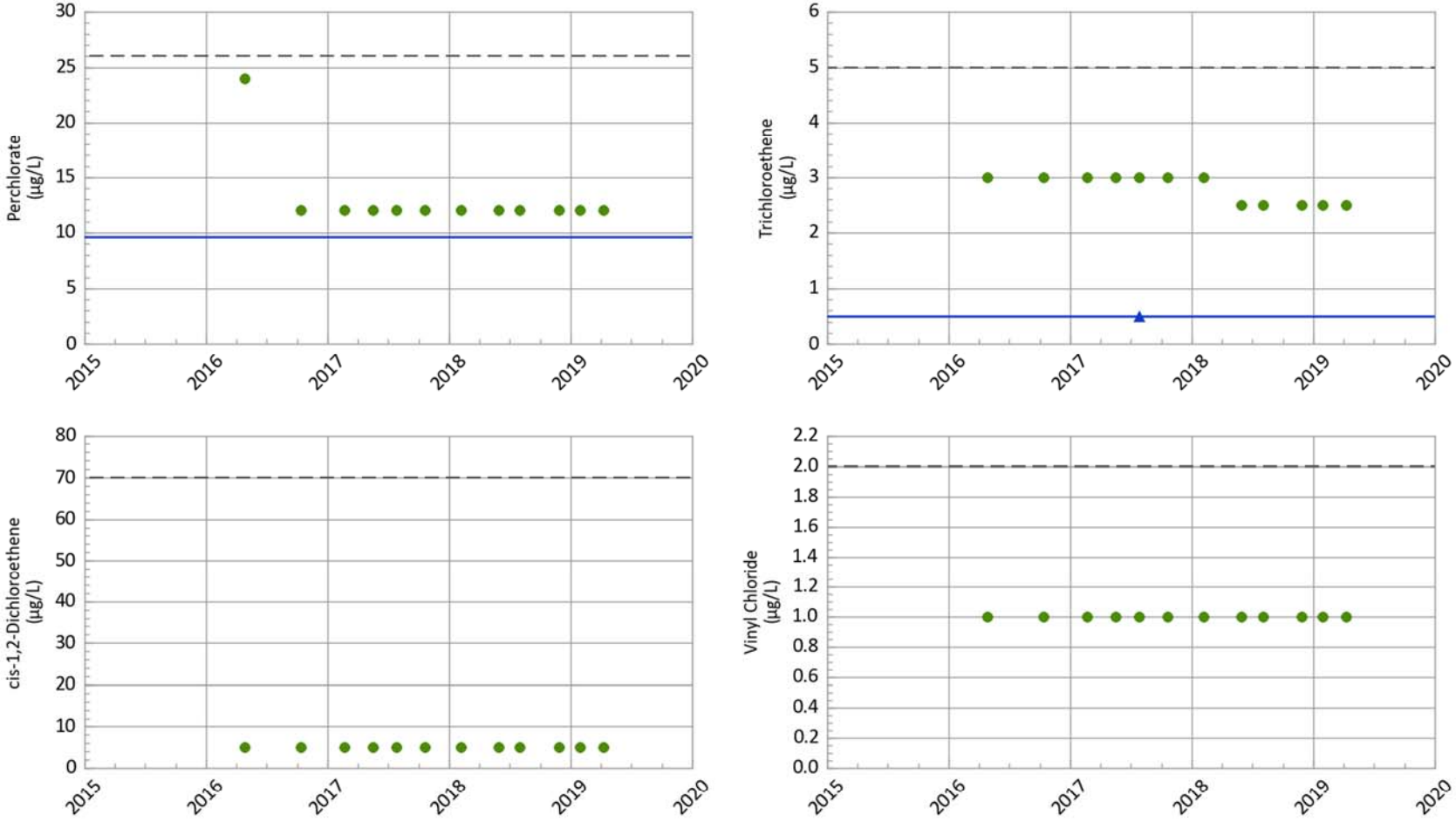
Most Recent Measured COC Concentrations (Jun 10, 2019)

COC	Concentration (µg/L)	GWPS (µg/L)
PERC	Non-Detect	26.0
DCE12C	4.3	70.0
TCE	110.0	5.0
VC	Non-Detect	2.0

Measured Value
Sample Detection Limit
Concentration Trend
Maximum Concentration
Groundwater Protection Standard



PTX06-ISB079 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant

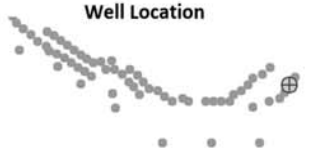


Most Recent Measured COC Concentrations (Apr 09, 2019)

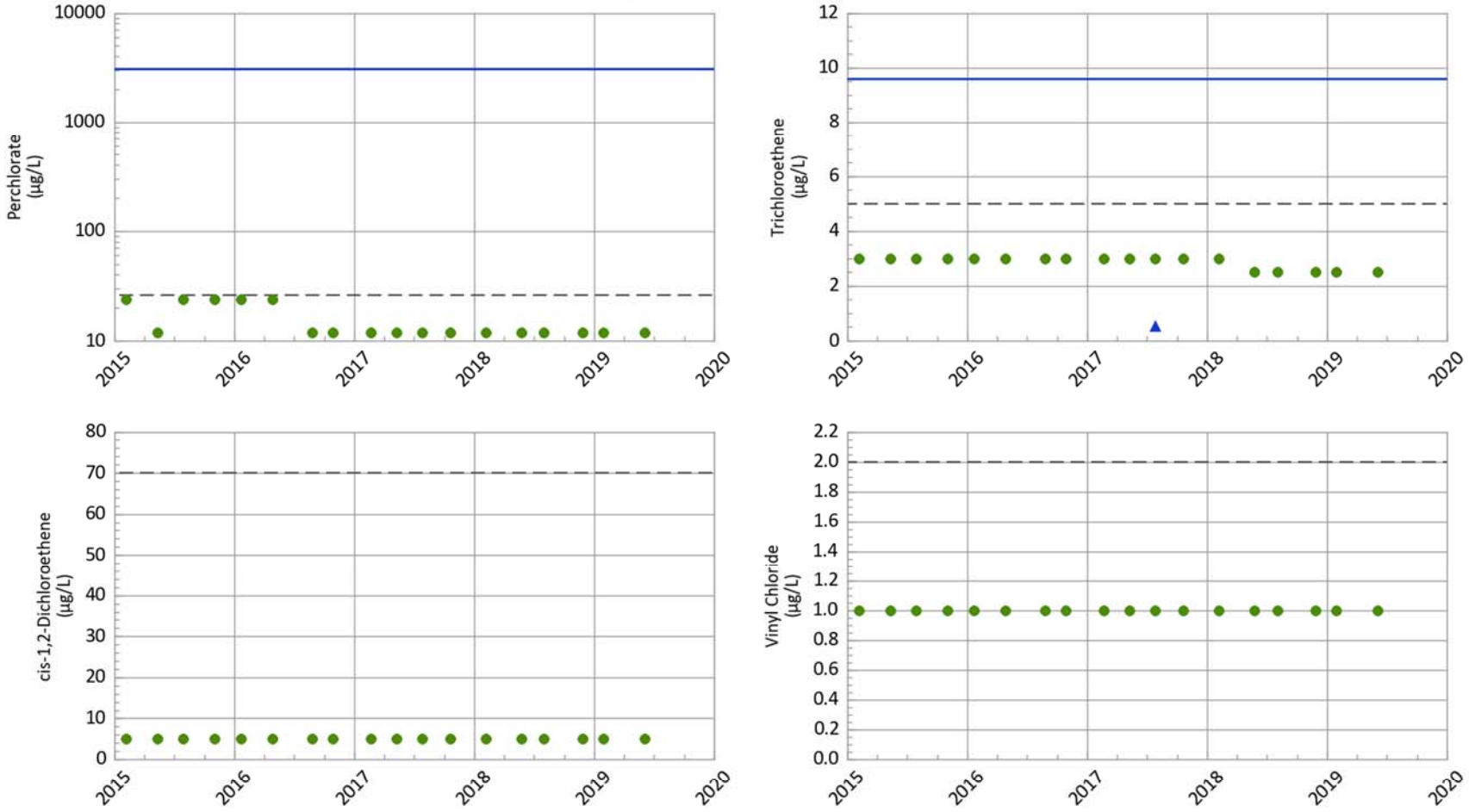
COC	Concentration (µg/L)	GWPS (µg/L)
PERC	Non-Detect	26.0
DCE12C	Non-Detect	70.0
TCE	Non-Detect	5.0
VC	Non-Detect	2.0

▲ Measured Value
● Sample Detection Limit
- - - Concentration Trend
——— Maximum Concentration
– – – Groundwater Protection Standard

Well Location



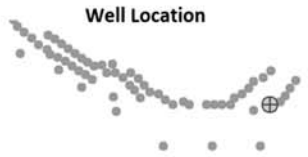
PTX06-ISB082 Downgradient Performance Indicators
Zone 11 In Situ Bioremediation System
USDOE/NNSA Pantex Plant



Most Recent Measured COC Concentrations (Jun 03, 2019)

COC	Concentration (µg/L)	GWPS (µg/L)
PERC	Non-Detect	26.0
DCE12C	Non-Detect	70.0
TCE	Non-Detect	5.0
VC	Non-Detect	2.0

▲ Measured Value
● Sample Detection Limit
- - - - Concentration Trend
——— Maximum Concentration
– – – Groundwater Protection Standard



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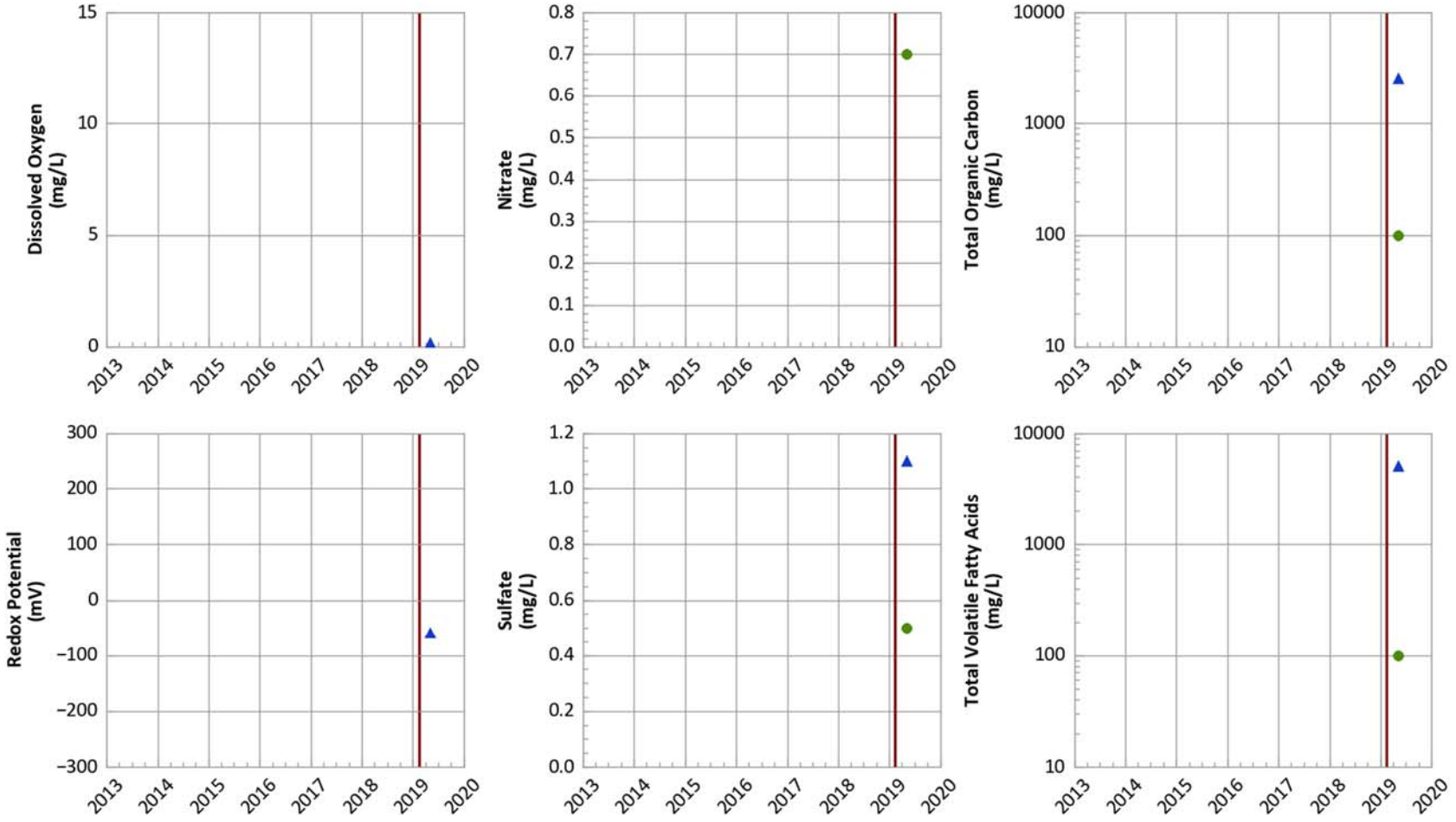
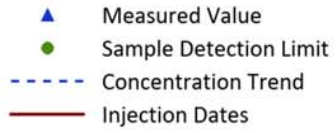
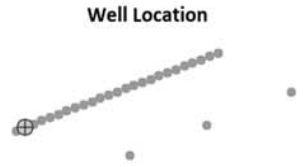
Southeast ISB Extension

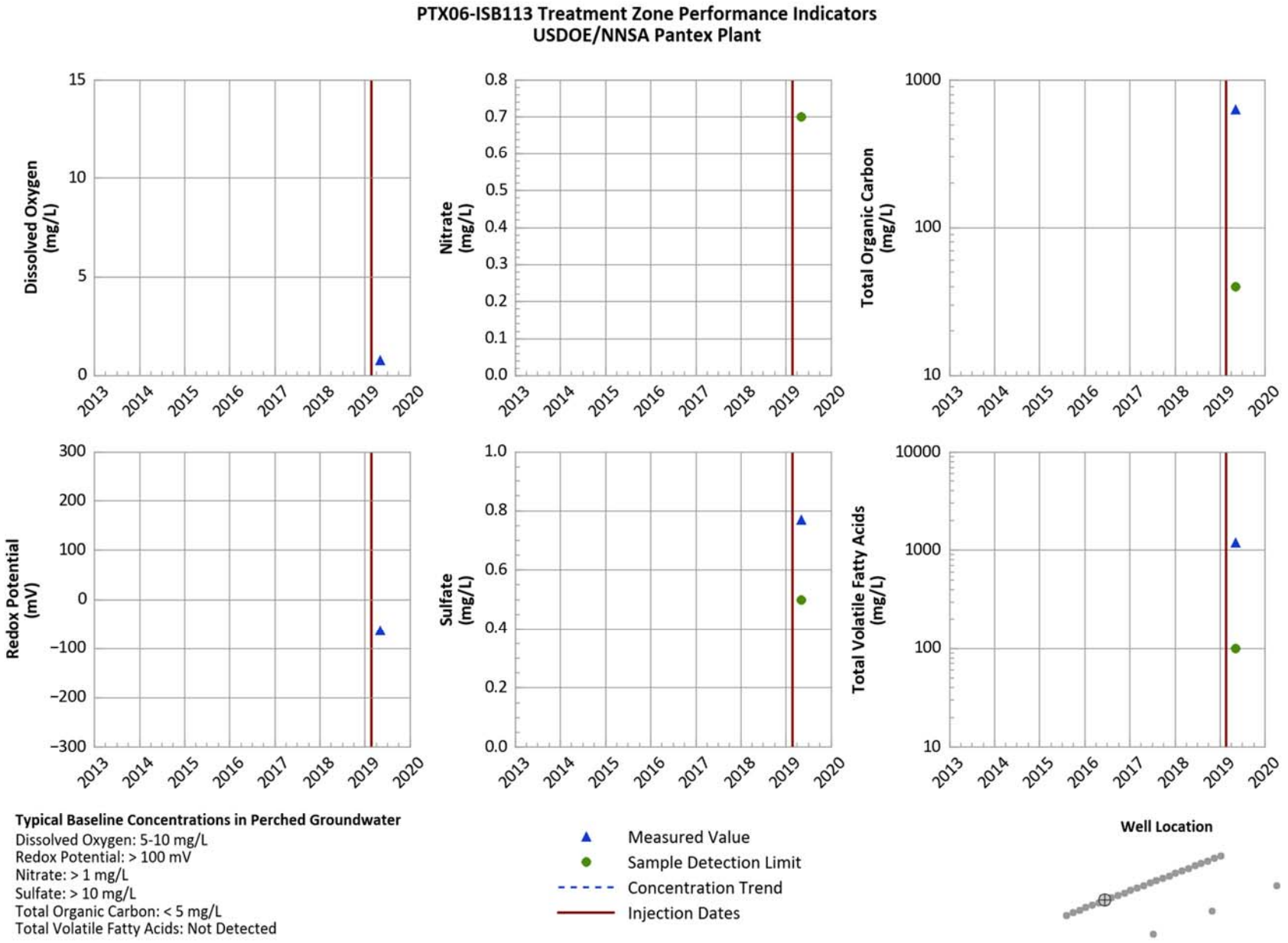
PTX06-ISB108 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant



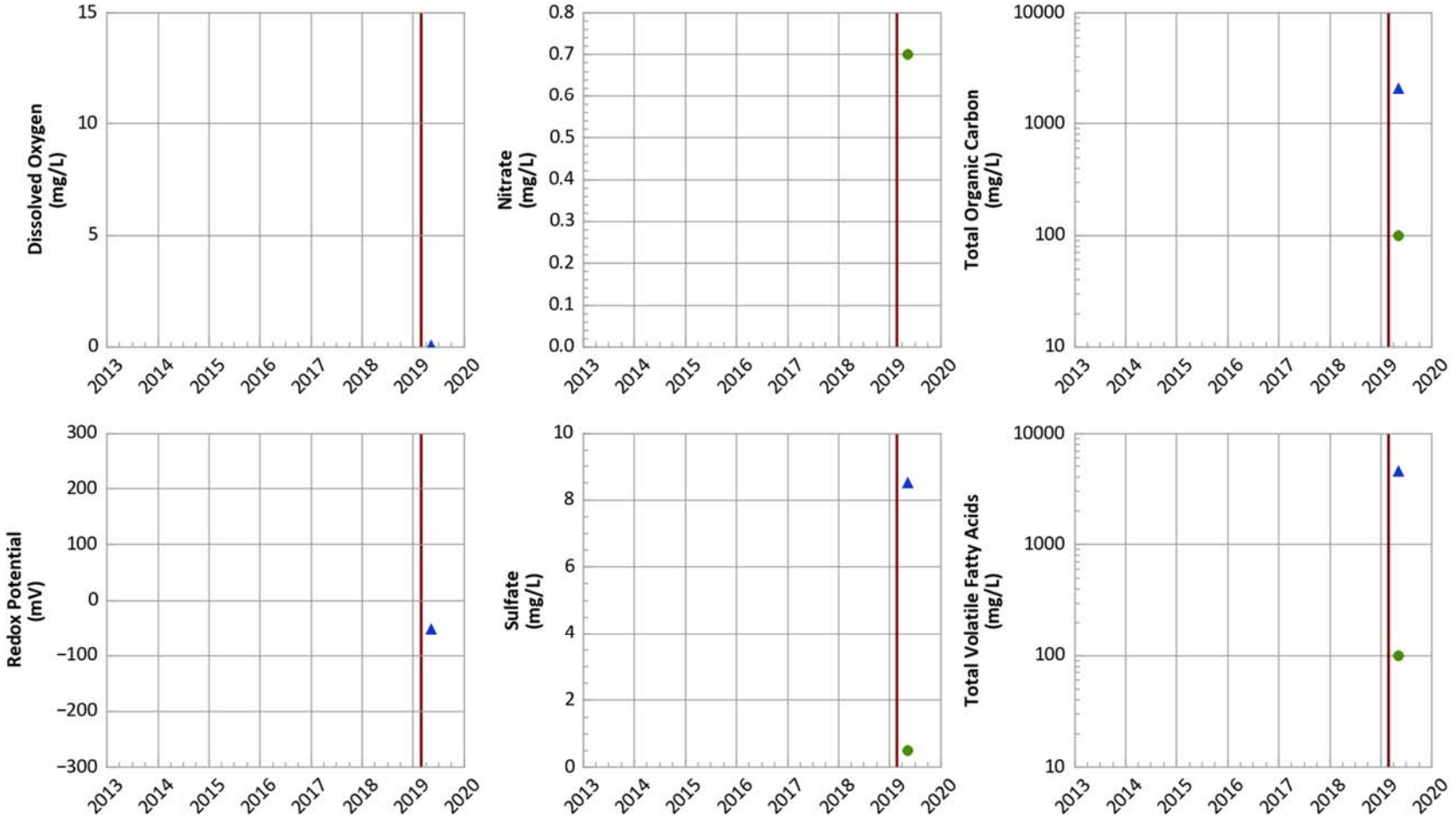
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected



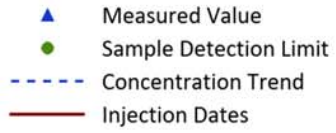


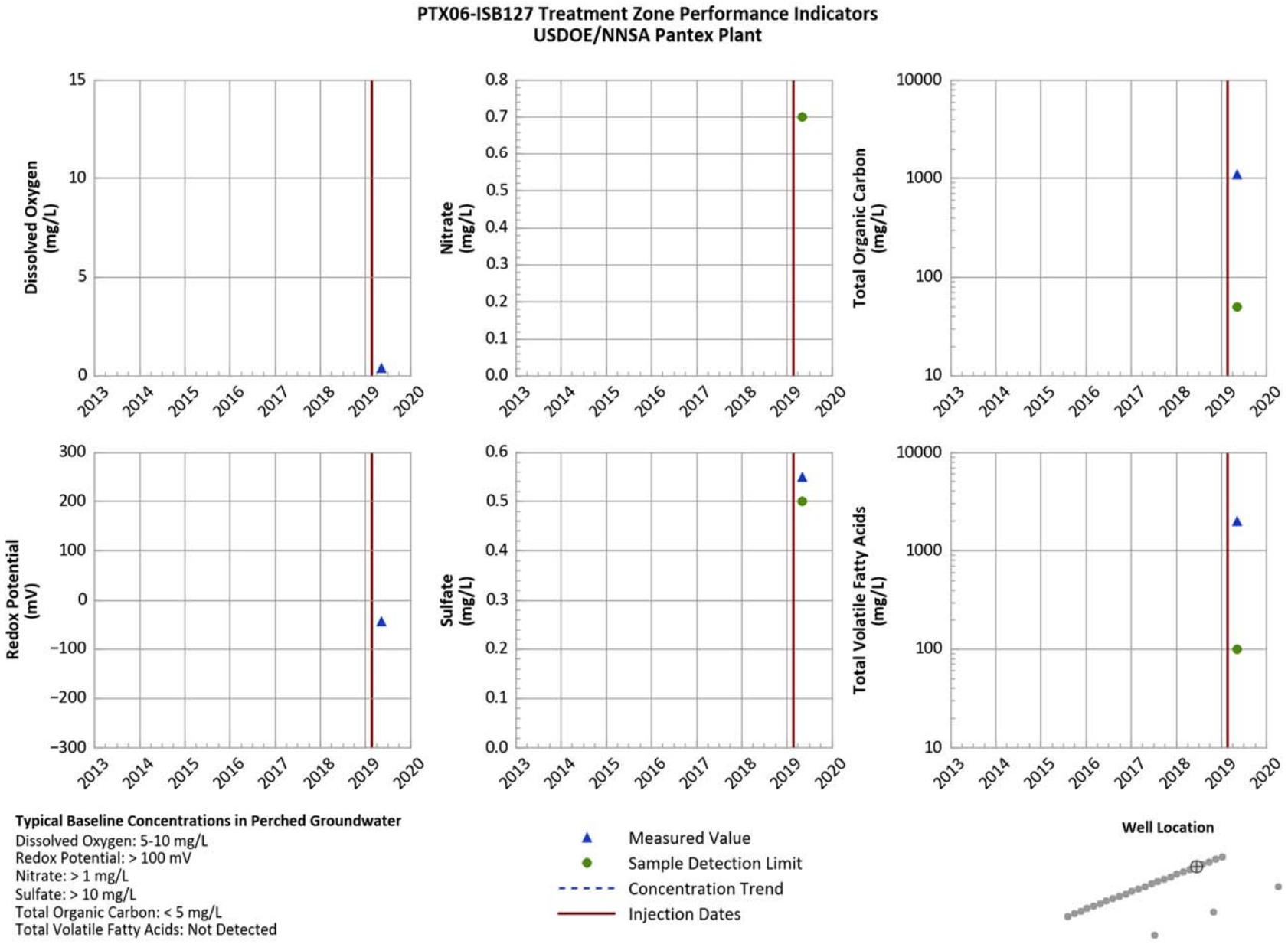

PTX06-ISB113 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
2013
2014
2015
2016
2017
2018
2019
2020
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

PTX06-ISB123 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant

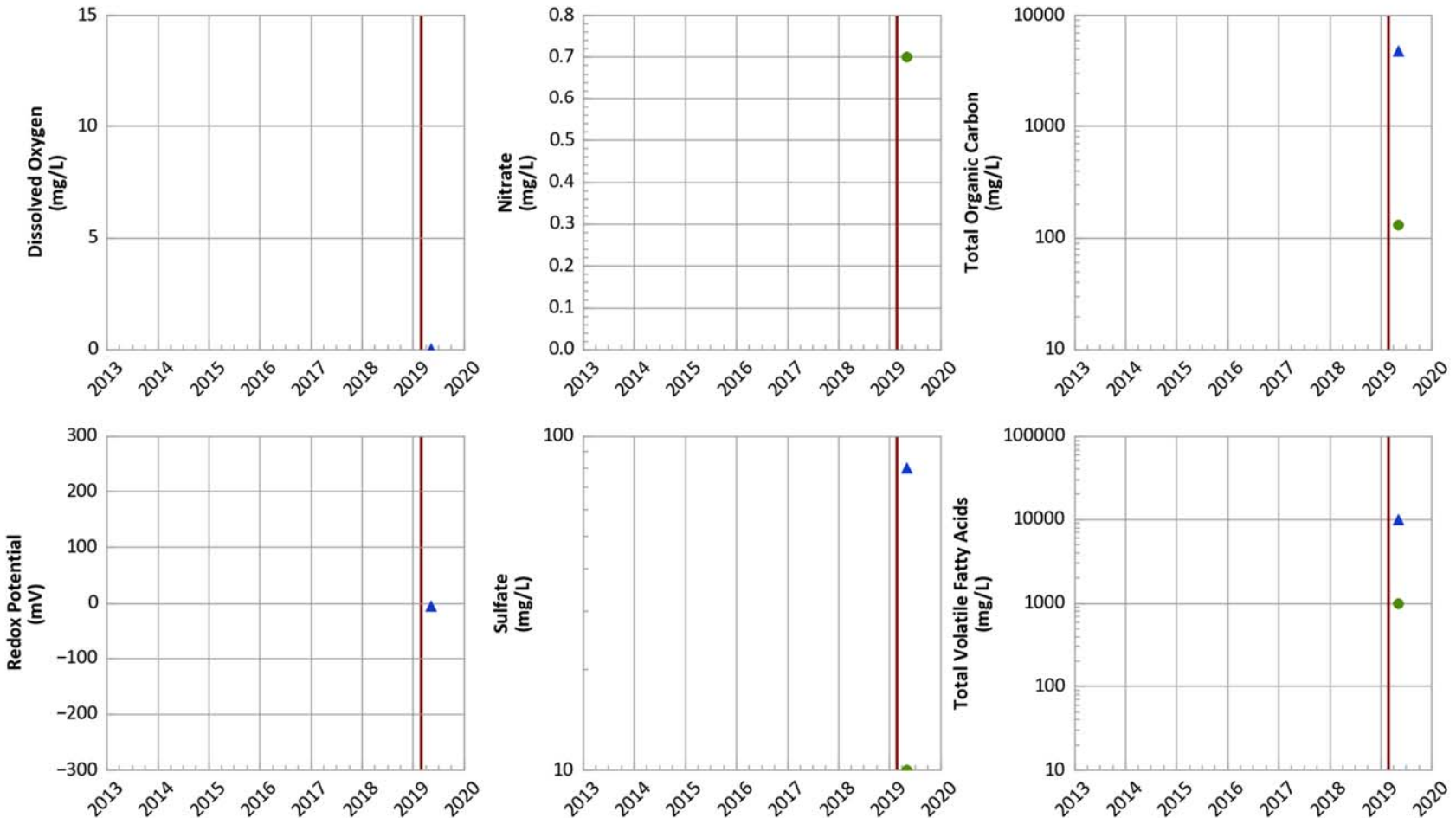


Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected




PTX06-ISB127 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant
Dissolved Oxygen (mg/L)
Nitrate (mg/L)
Total Organic Carbon (mg/L)
Redox Potential (mV)
Sulfate (mg/L)
Total Volatile Fatty Acids (mg/L)
2013
2014
2015
2016
2017
2018
2019
2020
Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected
Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates
Well Location

PTX06-ISB131 Treatment Zone Performance Indicators
USDOE/NNSA Pantex Plant

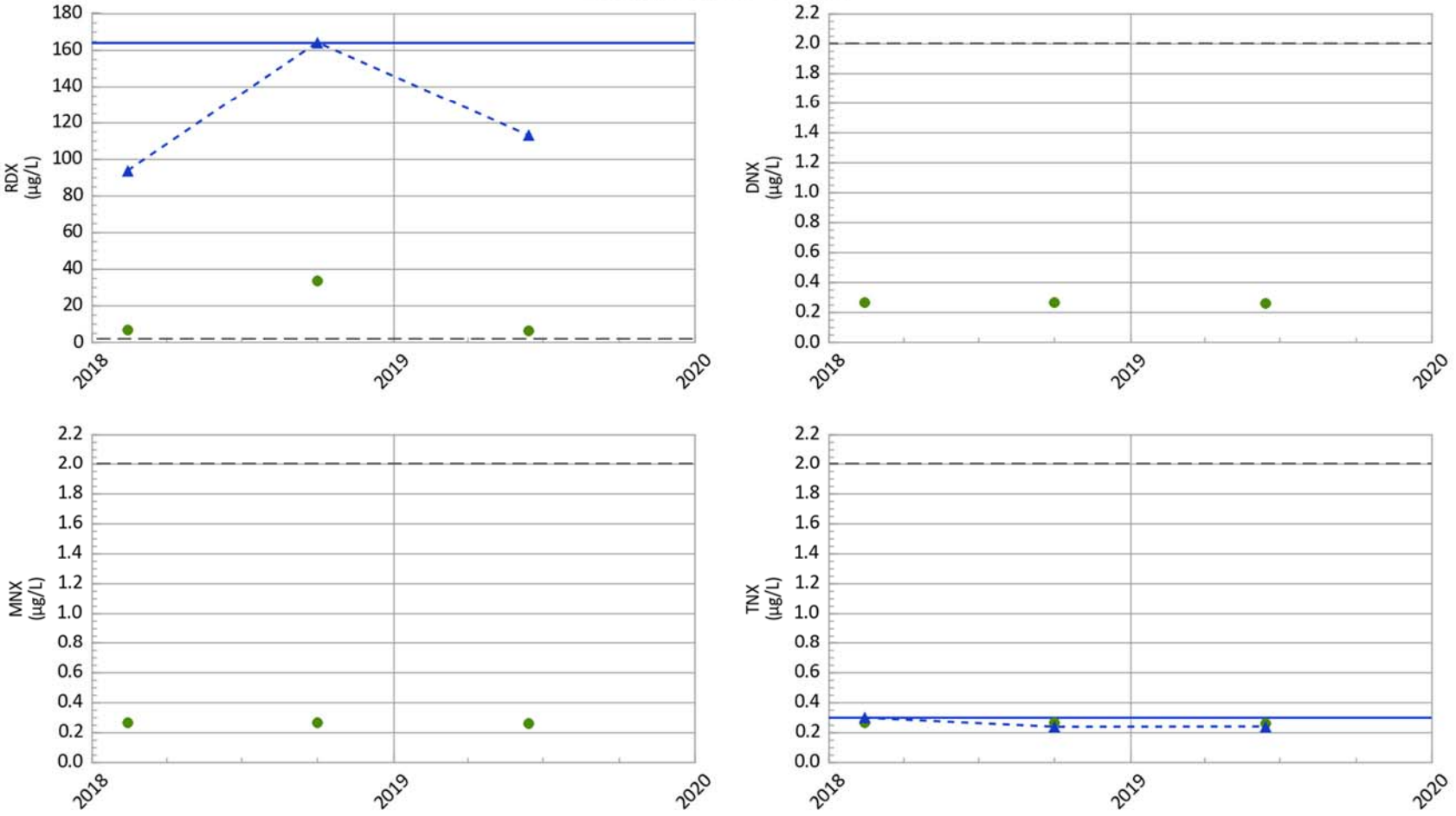


Typical Baseline Concentrations in Perched Groundwater
Dissolved Oxygen: 5-10 mg/L
Redox Potential: > 100 mV
Nitrate: > 1 mg/L
Sulfate: > 10 mg/L
Total Organic Carbon: < 5 mg/L
Total Volatile Fatty Acids: Not Detected

Measured Value
Sample Detection Limit
Concentration Trend
Injection Dates

Well Location

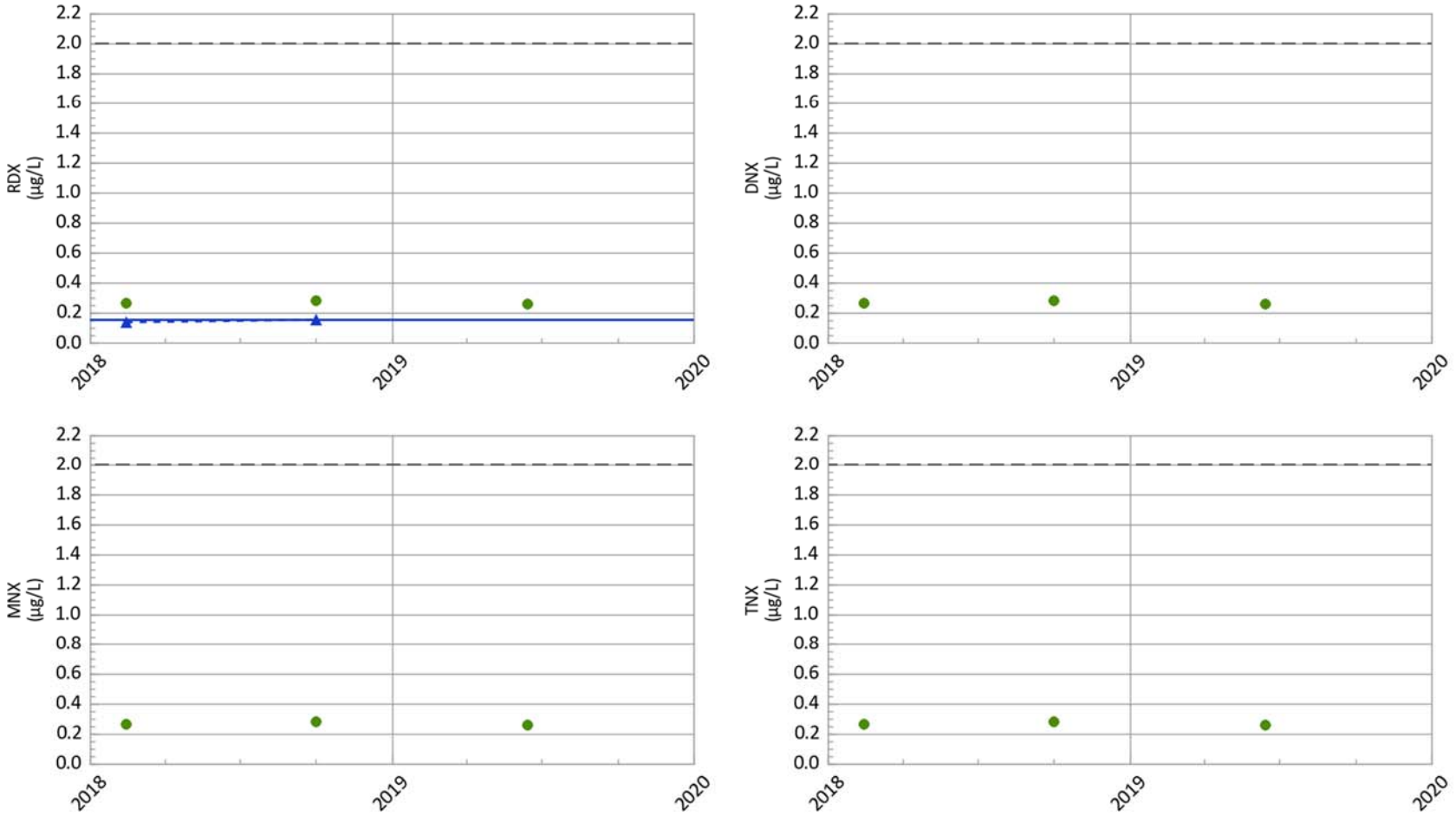
PTX06-1191 Downgradient Performance Indicators
Southeast Ext In Situ Bioremediation System
USDOE/NNSA Pantex Plant



Most Recent Measured COC Concentrations (Jun 13, 2019)

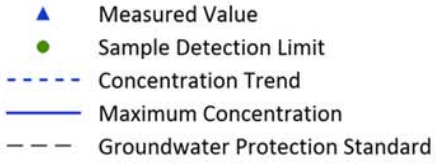
COC	Concentration (µg/L)	GWPS (µg/L)
RDX	113.0	2.0
MNX	Non-Detect	2.0
DNX	Non-Detect	2.0
TNX	0.239	2.0

PTX06-1194 Downgradient Performance Indicators
Southeast Ext In Situ Bioremediation System
USDOE/NNSA Pantex Plant

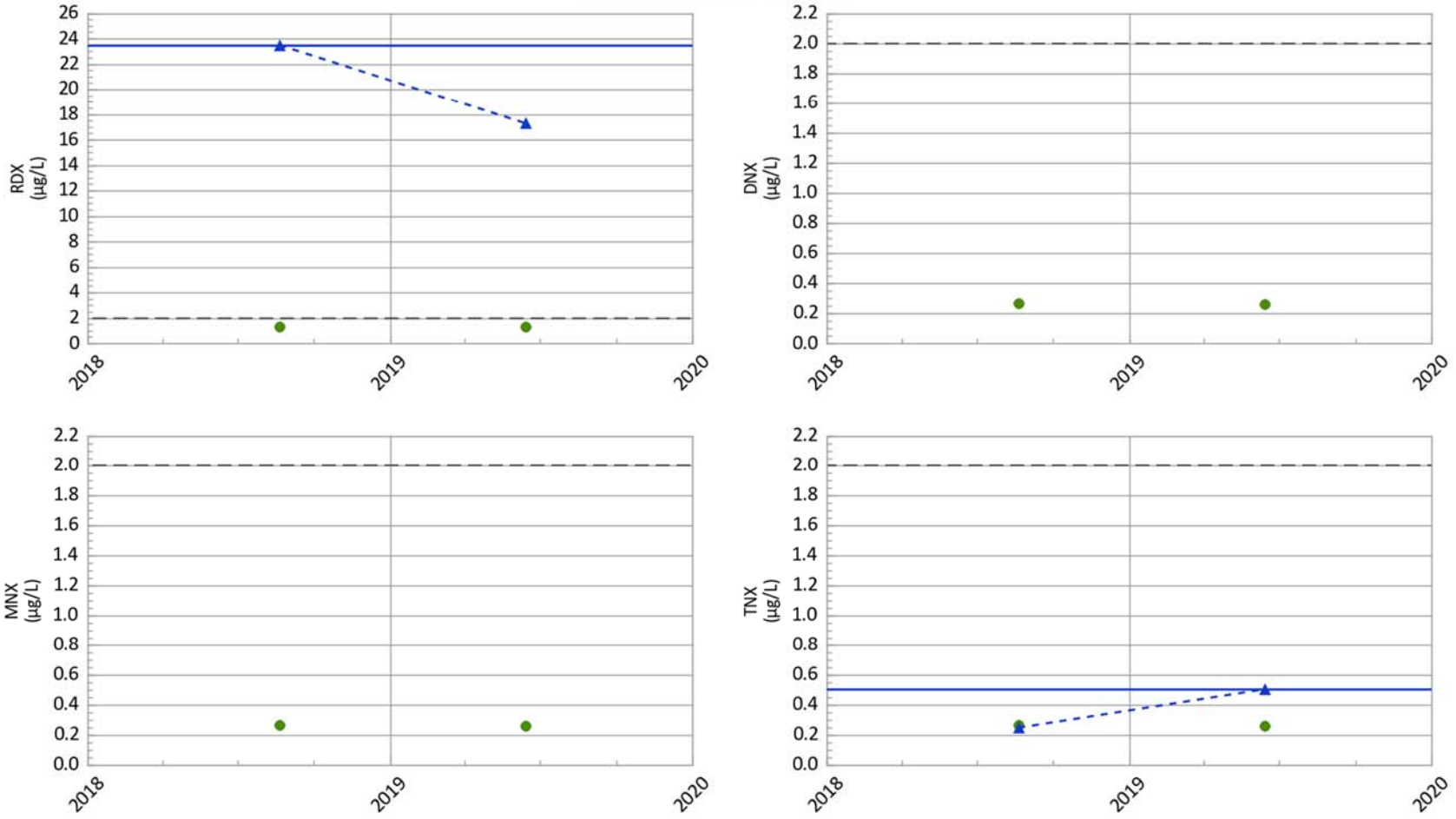


Most Recent Measured COC Concentrations (Jun 13, 2019)

COC	Concentration (µg/L)	GWPS (µg/L)
RDX	Non-Detect	2.0
MNX	Non-Detect	2.0
DNX	Non-Detect	2.0
TNX	Non-Detect	2.0



PTX06-1196 Downgradient Performance Indicators
Southeast Ext In Situ Bioremediation System
USDOE/NNSA Pantex Plant



Most Recent Measured COC Concentrations (Jun 13, 2019)

COC	Concentration (µg/L)	GWPS (µg/L)
RDX	17.3	2.0
MNX	Non-Detect	2.0
DNX	Non-Detect	2.0
TNX	0.504	2.0