May 1, 2017

Mr. Erich Weissbart
Remedial Project Manager
US EPA Region III, 3LC20
701 Mapes Road
Fort Meade, MD 20755

Ms. Barbara Brown
Project Coordinator
Maryland Department of the Environment
1800 Washington Blvd.
Baltimore, MD 21230

Re: ***COKE OVEN AREA INTERIM MEASURES SIX MONTH PROGRESS REPORT OCTOBER 2106 THROUGH MARCH 2017***

Dear Mr. Weissbart and Ms. Brown:

On behalf of Tradepoint Atlantic and Sparrows Point, LLC, enclosed please find the Coke Oven Area Interim Measures Six Month Progress Report, detailing operations from October 2016 through March 2017, completed for the Tradepoint Atlantic site. This report was distributed electronically on May 1, 2017 in accordance with the reporting requirements outlined in the US EPA Interim Measures Progress Report frequency letter dated March 26, 2013. Please advise if paper copies are required for your use and we will distribute accordingly.

The report summarizes implementation progress for the interim measures (IMs) that have been developed to address identified environmental conditions at the Coke Oven Area through March 31, 2017. Please contact me at (314) 620-3056 should questions arise during your review of the enclosed progress report.

Sincerely,

James Calenda

James Calenda
Project Manager

Enclosure

COKE OVEN AREA INTERIM MEASURES SIX MONTH PROGRESS REPORT

(October 2016 – March 2017)

Prepared for:

Sparrows Point, LLC and Tradepoint Atlantic

May 1, 2017

Prepared by:

EnviroAnalytics Group

Environmental Engineers

Introduction

This document presents operational data and monitoring information collected in the 4th quarter of 2016 and the 1st quarter of 2017 for Interim Measures (IMs) that have been installed to address identified environmental conditions at the former Coke Oven Area (COA) Special Study Area at the Tradepoint Atlantic site located in Sparrows Point, Maryland. This progress report summarizes IM performance including data collected from Oct 1, 2016 to March 31, 2017 and is submitted in accordance with reporting requirements outlined in correspondence received from US EPA on March 26, 2013 as further modified in discussions in late 2016. The following designations are applied in this document to identify the operating IM "Cells" (**Figure 1**) at the COA:

- Cell 1: Air Sparge/Soil Vapor Extraction (AS/SVE) System in the Former Benzol Processing Area,
- Cell 2: Air Sparge/Soil Vapor Extraction (AS/SVE) System in the shallow groundwater zone, groundwater pump and treat (GW P&T) system in the intermediate zone, Former Coal Basin Area,
- Cell 3: AS/SVE System in "Cove" Area,
- Cell 5: Dual Phase Extraction (DPE) system for the shallow zone, "Turning Basin" side of former Coke Oven Area,
- Cell 5: Dense Non-Aqueous Phase Liquid (DNAPL) Recovery
- Cell 6: Multi-Phase Extraction (MPE) of Light Non-Aqueous Phase Liquid (LNAPL) at the Former Benzol Processing Area.

As of the end of the first quarter 2017, Cells 2, 3, 5 and 6 remediation systems are operational. Cell 1 AS/SVE system operations were halted for modifications. The Cell 1 system resumed operations on April 7, 2017 and is currently in full operation.

Groundwater and soil gas sampling were conducted during the 4th quarter of 2016 and 1st quarter 2017 to assess current conditions and removal efficiencies of the operating IM systems. The results of these sampling events, including trending graphs from IM startup, are detailed in this report. Additional detail on the design, operation, operation and maintenance, modifications and groundwater monitoring for these systems is provided in this progress report.

Cell 1: AS/SVE System in the Former Benzol Processing Area

Cell 1 consists of an AS/SVE system installed to remove volatile hydrocarbons that is coupled with vapor destruction via two vapor carbon vessels. During the 4th quarter 2016 and into the 1st quarter 2017, the cell 1 Sparge/SVE system was sent to National Environmental Systems (NES) located in Attleboro, MA to make the following modifications:

- Install new a PLC for the system
- Install a larger, higher powered Soil Vapor Extraction motor (SVE)
- Replace the moisture separator tank

Modifications were done to enhance the performance of the system and increase overall hydrocarbon recovery rate within the cell.

Figure 2 shows the system layout of Cell 1 and locations of the major design components including the air sparging wells, vapor collection trenches and groundwater monitoring wells.

4th Quarter 2016 and 1st quarter 2017 Operational Performance

During the 4th quarter on October 24, 2016, the AS/SVE system encountered an issue, shut down and could not be restarted. After troubleshooting, it was determined that the heating element was the source of the failure and would need to be replaced. Instead of replacing the heating element, the vapor treatment system was modified from a CATOX to vapor carbon vessels. The opportunity was taken to change out the problematic PLCs and add a larger SVE blower to the system for performance optimization. The system maintenance and process upgrades were completed on April 5, 2017 and the system is currently in full operation as of April 7th.

Vapor sample collections will continue immediately after system overhaul is complete and system returns to operations. Operations will continue to be in conformance with the manufacturer's specifications at all times that soil gases are collected in accordance with the May 20, 2011 modified permit-to-construct conditions as reflected in the Permit to Operate issued to Sparrows Point LLC on December 8, 2014.

Operational performance of the AS/SVE System at Cell 1 during this reporting period is summarized in **Table 1**. In summary, the CATOX unit operated for 168 hours in October 2016 during this reporting period. **Table 1** shows 0.486 lbs of estimated hydrocarbons were destroyed during the period of run time. **Table 1** also includes a cumulative summary of

operational performance since system startup in August 3, 2010. **Table 2** gives the total volatile organics recovered based on the average of the soil gas samples that were taken throughout the quarter. The data from **Table 2** is used with a 99.5% VGAC destruction calculation to obtain the recovery data seen in **Table 1** using the following equation:
lb/hr = [(x ug/m3) (SCFM VGAC unit)]/2.67 x108 = lb/hr. **Appendix A** includes the calculation data used for hydrocarbon recovery.

The results were minimal for the 4th quarter of 2016 and not applicable for the 1st quarter of 2017 due to lack of concentration data due to the extended system down time previously explained. Cumulatively, the AS/SVE system at Cell 1 has destroyed approximately 12,582 pounds of recovered hydrocarbons as shown graphically in **Figure 3**.

Soil gas sample collection occurred during the 4th quarter of 2016 for laboratory analysis to monitor CATOX unit performance. One untreated soil gas sample for the month of October was collected in a Suma Canister during the 4th quarter of 2016 and submitted to Pace Analytical Services, Inc. in Melville, New York for analysis by US EPA Method TO-15. This was the only sample taken throughout the 4th quarter of 2016 and the 1st quarter of 2017 due to the previously mentioned system downtime.

4th Quarter 2016 and 1st quarter 2017 Groundwater Monitoring Results

Groundwater samples were collected on December 13, 2016 and March 21, 2017 from the following wells; the location of the wells are shown on Figure 2:

- CO93-PZM (former BP-MW-09 , upgradient of Cell 1),
- CO18-PZM006 (upgradient of Cell 1 at edge of berm), and
- CO02-PZM006 (downgradient of Cell 1).

The groundwater samples were submitted to Pace Analytical Services, Inc., located in Greensburg, Pennsylvania for the analyses shown in **Table 3**. These data indicate benzene is the most prevalent volatile organic compound (VOC) constituent. Since system startup in August 2010, a decreasing total VOC concentration trend is documented at the wells monitored for system performance as illustrated in **Figure 4**.

For the 4th quarter 2016, all monitoring wells showed an increase in concentrations as indicated in **Figure 4**. The recent increase in concentrations in Cell 1 area monitoring wells may be relative to the suspension of the remediation system. Data for these monitoring wells will continue to be assessed during Cell 1 system operation in future months to determine trends.

Cell 2: Air Sparge/Soil Vapor Extraction (AS/SVE) System in the Shallow Groundwater Zone, Groundwater Pump and Treat (GW P&T) System in the Intermediate Groundwater Zone, Former Coal Basin Area

Cell 2 consists of an AS/SVE system coupled with vapor destruction via an electric catalytic oxidation (CATOX) unit for volatile hydrocarbon groundwater treatment in the shallow zone and a pump and treat system for recovery of groundwater and volatile hydrocarbon treatment from the intermediate zone. The system design plans were approved by US EPA in correspondence received on September 10, 2013 and began full scale operation in October 2014. **Figure 5** shows the system layout of Cell 2 and locations of the major design components including the air sparging wells, vapor collection trenches, intermediate groundwater recovery wells, groundwater injection wells and groundwater monitoring well locations.

AS/SVE System

The delivery and recovery systems for the shallow AS/SVE system include the use of air sparge points and a horizontal vapor extraction trench. Eight (8) air sparge points along a 500 feet long stretch were installed near the shore line of Cell 2. Details of the air sparge zone and recovery trench include the following:

- Air sparge zone: 8 – 2-inch diameter AS points @ approximately 56 ft spacing, center to center (C-C)
    - Installed to 15 ft -17 ft bgs (bottom of slag fill)
    - Bottom 2 ft of each point to be screened with 20-slot screen

- Recovery trench
    - 500 ft of horizontal, 4-inch diameter perforated pipe (or 20-slot screen) installed to a total depth (TD) of 5 ft
    - 5 vertical 4-inch risers spaced every 100 ft, C-C
    - Top 2 ft is a clay cap
    - Geotextile fabric @ 2 ft bgs (under clay)
    - Granular screened slag backfill from 2 ft -5 ft
    - Horizontal recover piping located approximately 3 ft bgs (above water table)

GW P&T System

The pump and treat groundwater system includes a low-profile air stripper that then utilizes an oxidizer to destroy all VOC vapors generated prior to exhausting to the atmosphere. The design groundwater flow is for a maximum of 40 gallons per minute (gpm). The oxidizer is sized to handle up to a 600 cubic feet per minute air flow. The recovery and re-injection systems include the use of six groundwater recovery wells and six groundwater injection wells. The six recovery wells are installed along a 500 feet long stretch near the shore line of Cell 2.

- 6 – 4-inch diameter GW RWs @ approximately 83 ft spacing, C-C
  - Installed to 40-45 ft bgs (intermediate sand zone)
  - Bottom 15 ft of each RW screened with 20-slot screen
  - An electric pump in each RW, resting approximately 7-10 ft above the bottom of the well

- Recovered GW Treatment
  - Enters low profile air stripper
  - Off-gas sent to Electric Oxidizer for destruction
  - Treated groundwater pumped to six-6-inch diameter re-injection wells screened from 5 to 15 feet in depth for recirculation in shallow GW zone

4th Quarter 2016 and 1st Quarter 2017 Operational Performance

AS/SVE System

Operational performance of the AS/SVE System at Cell 2 during this reporting period is summarized in **Table 4**. In summary, the CATOX unit operated for 360 hours (16%) during 4th quarter 2016 and 1,512 hours (70%) during the 1st quarter 2017. Cell 2 AS/SVE did not operate during the month of October. The transformer that was damaged during the 3rd quarter 2016 was replaced 31 October 2016. Additional maintenance was required and performed to restart the system, which took place November 11, 2016. A pulsating schedule was implemented for the remainder of the 4th quarter 2016 then returned to a continuous schedule for the 1st quarter 2017.

On March 10, 2017, the sparge compressor for the SV/SVE system shut down. Upon operational review of the system, the compressor appeared to be damaged. After further inspecting of the damage, it was clear the sparge compressor had encountered severe internal damage and would need repaired or replaced. Through the remainder of the reporting period, the system operated without the sparge and only with the soil vapor extraction vacuum running continuously. A replacement sparge compressor has been ordered as of April 7, 2017 and the former has been removed from the system trailer. Installment date will be noted in the next report.

Soil gas sample collection occurred during the 4th quarter of 2016 and 1st quarter of 2017 for laboratory analysis to monitor CATOX unit performance. Five untreated soil gas samples were collected in a Suma Canister and submitted to Pace Analytical Services, Inc. in Melville, New York for analysis by US EPA Method TO-15. The average influent soil gas hydrocarbon concentration of the two samples taken in the 4th quarter 2016 was 390 ug/m^3 and 2,017ug/m^3 for the 3 samples taken in the 1st quarter of 2017 as summarized in **Table 5**. Operations were in conformance with the manufacturer's specifications at all times that soil gases were collected in accordance with the March 24, 2014 permit-to-construct conditions as reflected in the Permit to Operate issued to Sparrows Point LLC on December 8, 2014.

Table 4 also includes a cumulative summary of operational performance since system startup in October 2014. In total, the AS/SVE system at Cell 2 has destroyed approximately 282.59 pounds of recovered hydrocarbons as shown graphically in **Figure 3**. Recovered hydrocarbons are estimated through the data provided from the soil gas samples data and the assumption of a 99.5% CATOX destruction rate with the following equation:
lb/hr = [(x ug/m3) (SCFM CATOX unit)]/2.67 x108 = lb/hr. **Appendix A** includes the calculation data used for hydrocarbon recovery.

AS/SVE Operation and Maintenance

Cell 2 AS/SVE system CATOX was taken offline, removed and replaced by two 55-gallon vapor carbon drums. Soil gas samples were taken while CATOX was still in operation before the changeover occurred. Other system O&M events occurred as follows:

October 31, 2016 – System electrical transformer installed

November 11, 2016 – SVE motor had seized and was broken loose

February 15, 2017 – Sparge compressor oil changed and greased, motor also greased

March 10, 2017 – Sparge compressor shut-off. Damage to the cooling fan and vent covers observed, therefore, did not attempt to operate.

April 4, 2017 – CATOX taken offline and replaced with two 55-gallon vapor treatment carbon drums

GW P&T System Operation and Maintenance

The Cell 2 groundwater pump and treat system operated fairly maintenance free during the 4th quarter of 2016 or the 1st quarter of 2017. The system experienced some downtime at the end of the reporting period (March 28-31, 2017) to disassemble and clean the air stripper trays. This maintenance and other Issues or maintenance occurred as follows:

October 3-4, 2016 – Power Loss, no known damage, power restored approx. 1500 Oct 4, 2016

December 14, 2016 – Replaced leaking inlet transfer pump

January 17, 2017 – High level alarm in EFF tank would not clear – floats were stuck. Floats cleaned and high levels cleared.

February 22, 2017 – Installed inline static mixer to combat separation of anti-foaming solution

March 21, 2017 – System not running upon arrival. MS tank and Inlet tank high level alarms present. MS tank had to be drained to restart.

March 28-31, 2017– Air stripper trays disassembled and cleaned. Reassembled March 31. While dissembling air stripper cap, it was noted the demister had fallen out of its holding bracket and was lying flat on the 1st stage tray holes. Reason for MS tank high levels of water and loss of flow can be directly related to the demister material falling out of place to prevent excessive overflow of groundwater out of stripper top and into moisture separator tank. Also, falling onto and obstructing holes caused decreasing performance of airflow.

Evaluation of Pump and Treat System Effectiveness

A total of 1,446,840 gallons of water were extracted from the Cell 2 Area pumping wells and treated during the 4th quarter of 2016. A total of 1,580,887 gallons of water were extracted and treated during the 1st quarter 2017 totaling to 3,027,727. The average pumping rate for the pump and treat system was 16,727 gpd, or 11.6 gpm over the 6-month period.

Operations were in conformance with the manufacturer's specifications at all times that stripped hydrocarbons were discharged through the Cat OX unit to the atmosphere in accordance with the March 24, 2014 permit-to-construct conditions as reflected in the Permit to Operate issued to Sparrows Point LLC on December 8, 2014. In addition, treated groundwater discharges were in compliance with discharge permit conditions outlined in Discharge Permit 11-DP-3746 issued to Sparrows Point LLC on May 6, 2013. These pumping rates appear to effectively capture the most impacted groundwater beneath Cell 2, as revealed by **Figure 7** and discussed in the following section.

A total of 2,777 lbs of benzene, toluene and xylene compounds (btex) and 64.1 lbs of naphthalene were removed and treated during the 4th quarter of 2016 and 1st quarter 2017. This total is shown graphically in **Figure 3**. The following table presents data for influent and effluent (treated) groundwater.

Field ID	Analysis	Units	17-Oct	28-Oct	11-Nov	14-Nov	21-Dec	22-Dec	Quarter Average
GWPT Cell 2 INFLUENT	Benzene	ug/L	21,000	57,000	51,000	36,000	30,000	41,000	39,333
GWPT Cell 2 INFLUENT	Toluene	ug/L	2,400	7,600	6,200	4,300	2,800	3,800	4,516
GWPT Cell 2 INFLUENT	Ethylbenzene	ug/L	0	0	0	0	0	0	0
GWPT Cell 2 INFLUENT	Total Xylenes	ug/L	560	1,300	1,400	970	620	0	808.3
GWPT Cell 2 INFLUENT	Naphthalene	ug/L	2800	2100	2600	3600	1900	2100	2,516.7
GWPT Cell 2 EFFLUENT	Benzene	ug/L	160	170	350	360	280	360	280
GWPT Cell 2 EFFLUENT	Toluene	ug/L	23	31	52	52	34	53	40.8333
GWPT Cell 2 EFFLUENT	Total Xylenes	ug/L	8	18	23	25	18	19	18.5
GWPT Cell 2 EFFLUENT	Naphthalene	ug/L	210	220	290	290	200	210	236.667

Field ID	Analysis	Units	11-Jan	12-Jan	24-Feb	27-Feb	16-Mar	22-Mar	Quarter Average
GWPT Cell 2 INFLUENT	Benzene	ug/L	32,000	37,000	190,000	200,000	22,0000	220,000	149,833
GWPT Cell 2 INFLUENT	Toluene	ug/L	2900	3300	18000	18000	21000	22000	14,200
GWPT Cell 2 INFLUENT	Ethylbenzene	ug/L	0	0	430	430	480	480	303.33
GWPT Cell 2 INFLUENT	Total Xylenes	ug/L	0	0	4500	4300	5000	5100	3,150
GWPT Cell 2 INFLUENT	Naphthalene	ug/L	1500	1600	4600	2600	4400	2900	2,933
GWPT Cell 2 EFFLUENT	Benzene	ug/L	300	240	250	240	360	210	266.66
GWPT Cell 2 EFFLUENT	Toluene	ug/L	33	29	30	28	41	24	30.833
GWPT Cell 2 EFFLUENT	Total Xylenes	ug/L	17	17	9	9	16	7	12.5
GWPT Cell 2 EFFLUENT	Naphthalene	ug/L	180	170	140	140	160	150	156.66

The pump and treat system is removing significant amounts of volatile hydrocarbons from groundwater within the intermediate water bearing zone at the current pumping rates, and it is controlling groundwater flow and associated migration within the intermediate water bearing zone.

4th Quarter 2016 and 1st Quarter 2017 Groundwater Monitoring Results

Groundwater samples were collected in September 2016 from the following wells; the well locations are shown on **Figure 5**.

- CO27- PZM012 – shallow zone
- CO27-PZM046 - intermediate zone
- CO36-PZM008 – shallow zone
- CO36-PZM043 – intermediate zone
- CO37-PZM038 – intermediate zone
- CO38-PZM006 – shallow zone
- CO38-PZM043– intermediate zone
- CO39-PZM007– shallow zone
- CO39-PZM042– intermediate zone
- CO40-PZM008– shallow zone
- CO41-PZM 001– shallow zone
- CO41-PZM 036– intermediate zone
- CO42-PZM004 – shallow zone

CO37-PZM003 was not sampled due to the presence of free product first identified in November 2014 and is discussed in further detail below.

Light non-aqueous product (LNAPL) was encountered in well CO37-PZM003 in the shallow groundwater zone in November 2014. The well was hand baled multiple times recovering approximately 10 gallons of free product. The LNAPL levels were reduced and CO37-PZM003 was then hand baled on a monthly basis. The product level in CO37-PZM003 became trace during the last 2 quarters of 2015. It was then measured for product on a bi-weekly basis throughout 2016. A trace amount of product is still detected within the monitoring well.

The groundwater samples were submitted to Pace Analytical Services, Inc., located in Greensburg, Pennsylvania for the analyses shown in **Table 7**. These data indicate benzene is the most prevalent volatile organic compound (VOC) constituent. The VOC concentrations for the 4th quarter 2016 and 1st quarter 2017 sampling events are shown for the groundwater wells monitored for system performance in **Figure 8A** and **8B**.

Groundwater monitoring well levels and potentiometric elevation contours for the shallow zone are shown in **Figure 6.** Groundwater in the shallow zone is flowing from the east to west most likely in response to the injection of treated groundwater in this zone (injection points shown in green on Figure 6.

Groundwater monitoring well levels and associated potentiometric elevation contours for the intermediate zone are shown on Figure 7. During the 4th quarter 2016 and 1st quarter 2017, extraction well CO46-PZM047 was the only active pumping well. This was done in an attempt to extract groundwater from the specific zone where the highest concentration of VOCs had been indicated through extraction well sampling data performed in March of 2016. The resulting cone of depression of groundwater is shown in Figure 7. During this current reporting event, remediation system influent data have reacted positively to this modification – influent concentrations have shown an overall increase in BTEX and specifically benzene with concentrations ranging from 32,000 ug/l in 11-Jan data to 220,000 ug/l for the 16 - Mar data as shown in the tables above. **Figures 8A** and **8B** provide a graphical representation of collected data over the operating period; **Figure 9** presents a plan view of the concentration of benzene in the intermediate zone from analytical results from the March 2017 monitoring event.

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Cell 3: AS/SVE System in the "Cove" Area

Cell 3 consists of an AS/SVE system coupled with vapor contaminant capture via two 1,000 lb. vapor carbon vessels. **Figure 1** shows the location of the Cell 3 AS/SVE treatment area at the COA. The major design components are described in the Cell 3 final design report (*Coke Oven Area Interim Measures Cell 3 "Cove" Area Air Sparge/Soil Vapor Extraction System Design*), submitted to US EPA on March 1, 2011. A layout of Cell 3 is shown in **Figure 10.**

Cell 3 AS/SVE Objective

The cell 3 AS/SVE system was developed with EPA design approval. The system design goal was to volatilize, capture and reduce hydrocarbons dissolved in groundwater within the Cell 3 zone (depicted in **Figure 10).** There has not been conclusive evidence that the system is substantially achieving this goal. The groundwater data within the area monitoring wells have not shown significant increase or decrease since startup of system. The graph of historical data can be seen in **Figure 11**.

Cell 3 AS/SVE Operation and Maintenance:

Cell 3 underwent a PLC changeover along with several of our other systems during this reporting period. This system was one of two systems that PLC failure prevented it from operating. The system at cell 3 also continues to have incoming power issues interfering with a consistent running schedule. Downtime for maintenance and other related O&M items during the 4th quarter of 2016 and the 1st quarter of 2017 are listed below:

October 28, 2017 – Breakthrough in field sparge line; replaced.

January 16, 2017 – System would not start, diagnosed as PLC failure

February 9, 2017 – PLC changeover completed by NES

February 27, 2017 – Loss of power; discovered electricians were making repairs upstream of current

March 7, 2017 – Operator notices multiple "phase loss" alarms occurring daily

March 23, 2017 – Check valve replaced in effluent sparge blower line

4th Quarter 2016 and 1st quarter 2017 Operational Performance

Operational performance of Cell 3 during this reporting period is summarized in **Table 9**. In summary, the AS/SVE unit operated for 696 hours (31.5%) during the 4th quarter of 2016 and 792 hours (36.7%) during the 1st quarter 2017. Operations continue to be in conformance with the manufacturer's specifications at all times that soil gases were collected in accordance with the May 20, 2011 modified permit-to-construct conditions.

The hydrocarbon removal rate was calculated to be approximately 0.03 pounds per operating hour (estimated quarterly total of 21.6 pounds) for 4th quarter of 2016 and 0.01 pounds per hour (estimated quarterly total of 9.36 pounds) for the 1st quarter of 2017. **Table 9** also includes a cumulative summary of operational performance since system startup on June 24, 2011. In total, Cell 3 has destroyed approximately 1,714.8 pounds of recovered hydrocarbons as shown graphically in **Figure 3**.

Soil gas samples were collected for laboratory analysis to monitor unit performance. Three untreated soil gas samples were collected in 6L Suma Canisters and submitted to Pace Analytical Services. The average influent soil gas hydrocarbon concentration of the three samples taken throughout the 4th quarter was 63,592 ug/m^3 as summarized in **Table 9**. During the 1st quarter of 2017, only one sample grab was taken.

Hydrocarbon removal calculations were based entirely on the analytical results and the average daily field-measured influent flow rates. The mass removal calculations assume that the samples collected throughout the 4th quarter of 2016 and 1st quarter of 2017 are representative of hydrocarbon concentrations for the semi-annual period. This assumption is based on the fact that the same air sparge wells (AS-2 thru AS-12) and extraction wells (V-1 thru V-15) were online when the system was operational. The following calculation is used:
lb/hr = [(x ug/m3) (SCFM VGAC unit)]/2.67 x108 = lb/hr. **Appendix A** includes the calculation data used for hydrocarbon recovery.

Operations at this Cell will continue to be evaluated in the future to improve system recovery rates to determine if improvement of VOC within the groundwater in the Cell 3 zone are decreasing.

4th Quarter 2016 Groundwater Monitoring

Groundwater samples were collected in December 2016 and March of 2017 from the following wells (**Figure 10**):

- CO101-PZM (downgradient of Cell 3),
- CO102-PZM (upgradient of Cell 3),

- CO103-PZM (upgradient of Cell 3),
- CO104-PZM (downgradient of cell 3),
- CO30-PZM015 (downgradient of Cell 3).

The groundwater samples were submitted to Pace Analytical for the analyses shown in **Table 11**. These data indicate that benzene is the most prevalent VOC constituent. Since system startup on June 24, 2011, a generally inconclusive VOC concentration trend is documented, as illustrated in **Figure 11.** Groundwater for this area will continue to be monitored and assessed to determine a possible trend of decreasing VOC concentrations within the cell 3 remediation zone.

Cell 5: Dual Phase Extraction (DPE) System for the Shallow Zone, "Turning Basin" side of Former Coke Oven Area

Cell 5 consists of a dual phase (vapor and water) system (DPE) with a low-profile air stripper followed by vapor phase granular activated carbon (VGAC) for removal and treatment of vapor and dissolved volatile hydrocarbons in the shallow groundwater zone. The system design plans were approved by US EPA in correspondence received on September 10, 2013 and began full scale operation in October 2014. **Figure 12** shows the system layout of Cell 5 and locations of the major design components including the dual phase recovery points, treatment system, groundwater injection wells and groundwater monitoring well locations.

The recovery and re-injection systems include the use of dual phase (soil vapor and groundwater) recovery wells and six groundwater re-injection wells. Twelve (12) recovery wells were installed along an approximate 500 feet long stretch downgradient of the most recent 10,000 ug/L is contour line for naphthalene (between the naphthalene source area and the eastern shore line along the Turning Basin).

- 12 – 1.5-inch diameter DPE RWs @ approximately 42 ft spacing, C-C
  - Installed to 15-17 ft bgs (to bottom of shallow slag)
  - Bottom 2 ft of each RW screened with 20-slot screen
  - Vapor recovery perforations located between 10-12 ft bgs

- Recovered GW and vapor Treatment
  - Enters MS knockout tank to separate air and water phases
  - Water sent to low profile air stripper
  - Off-gas sent to VGAC for capture
  - Treated groundwater pumped to six-6-inch diameter re-injection wells screened from 5 to 15 feet in depth for recirculation in shallow GW zone

The Cell 5 system was developed with EPA design approval. The system design goal was to volatilize, capture and reduce hydrocarbons dissolved in groundwater within the Cell 5 zone (depicted in **Figure 12).** There has not been conclusive evidence that the system is substantially achieving this goal. The groundwater data within the area monitoring wells have not shown significant increase or decrease since startup of system. The graph of historical data can be seen in **Figures 14a and 14b**.

4th Quarter 2016 and 1st quarter 2017 Operational Performance

Evaluation of Pump and Treat System Effectiveness

A total of 1,983,038 gallons of water were extracted from the Cell 5 Area dual phase extraction wells and treated during the 4th quarter of 2016 and 577,811 gallons during the 1st quarter of 2017. The average recovery rate for the Dual Phase Extraction (DPE) system was 21,555 gpd (15 gpm) for 4th quarter of 2016 and 6,420 gpd (4.45 gpm) for the 1st quarter of 2017.

A total of 20.3 pounds (lbs) of benzene, toluene and xylene compounds (btex) and 70.6 pounds (lbs) of naphthalene were removed during the 4th quarter of 2016. A total of 5.74 lbs of btex and 21 lbs of naphthalene were removed during the 1st quarter 2017. This total is shown graphically in **Figure 3** of the respective quarters. The following table presents data for influent and effluent (treated) groundwater.

Field ID	Analysis	Units	17-Oct	20-Oct	11-Nov	14-Nov	21-Dec	22-Dec	**AVG**
GWPT Cell 5 INFLUENT	Benzene	ug/L	350	390	400	380	580	550	441.7
GWPT Cell 5 INFLUENT	Toluene	ug/L	220	250	250	240	310	290	260
GWPT Cell 5 INFLUENT	Styrene	ug/L	0	0	0	20	0	0	3.33
GWPT Cell 5 INFLUENT	Total Xylenes	ug/L	336	317	390	359	360	345	351.2
GWPT Cell 5 INFLUENT	Naphthalene	ug/L	89	71	96	89	94	90	88.2

GWPT Cell 5 EFFLUENT	Benzene	ug/L	0	0	0	0	0	0	0
GWPT Cell 5 EFFLUENT	Toluene	ug/L	0	0	0	0	0	0	0
GWPT Cell 5 EFFLUENT	Total Xylenes	ug/L	0	0	480	0	0	0	80
GWPT Cell 5 EFFLUENT	Naphthalene	ug/L	0	0	0	0	0	0	0

Field ID	Analysis	Units	11-Jan	12-Jan	24-Feb	27-Feb	16-Mar	22-Mar	AVG
GWPT Cell 5 INFLUENT	Benzene	ug/L	32000	37000	190000	200000	220000	220000	149,833
GWPT Cell 5 INFLUENT	Toluene	ug/L	2900	3300	18000	18000	21000	22000	14,200
GWPT Cell 5 INFLUENT	Styrene	ug/L	0	0	430	430	480	480	303.3
GWPT Cell 5 INFLUENT	Total Xylenes	ug/L	0	0	4500	4300	5000	5100	3,150
GWPT Cell 5 INFLUENT	Naphthalene	ug/L	1500	1600	4600	2600	4400	2900	2,933
GWPT Cell 5 EFFLUENT	Benzene	ug/L	300	240	250	240	360	210	266.7
GWPT Cell 5 EFFLUENT	Toluene	ug/L	33	29	30	28	41	24	30.8
GWPT Cell 5 EFFLUENT	Total Xylenes	ug/L	17	17	9	9	16	7	12.5
GWPT Cell 5 EFFLUENT	Naphthalene	ug/L	180	170	140	140	160	150	156.7

The DPE system is removing volatile hydrocarbons from groundwater within the shallow water bearing zone at the current recovery rates. The system has shown continual improvement in performance since the first few quarters of operation, mostly attributed to the recent addition of the liquid carbon treatment tanks during the 2nd quarter of 2015.

Operations were in conformance with the manufacturer's specifications at all times that stripped hydrocarbons were discharged to the atmosphere in accordance with the March 24, 2014 permit-to-construct conditions as reflected in the Permit to Operate issued to Sparrows Point LLC on December 8, 2014.

4th Quarter 2016 and 1st Quarter 2017 Groundwater Monitoring Results

Groundwater samples were collected in December 2016 and March 2017 from the following shallow zone monitoring wells **(Figure 12):**

- CO23- PZM008
- CO24-PZM007
- CO26-PZM007
- CO55-PZM000
- CO56-PZP001
- CO57-PZP002
- CO58-PZM001
- CO59-PZP002
- CO60-PZP001

Figure 13 presents shallow groundwater elevations for the area. No discernable gradient is present for the shallow groundwater; thus, no contours are shown on the figure.

The groundwater samples were submitted to Pace Analytical Services, Inc., located in Greensburg, Pennsylvania for the analyses shown in **Table 13**. These data indicate naphthalene is the most prevalent hydrocarbon constituent. The naphthalene concentrations for the 2014-1st quarter of 2017 sampling events are shown for the groundwater wells monitored for system performance as illustrated in **Figure 14A** and **14B.**

VOC and naphthalene concentrations slightly decreased for 4th quarter sampling event. **Figure 15** presents a plan view of the concentration of naphthalene in the shallow zone from analytical results from the June 2016 monitoring event. No significant increases or decreases were seen for this quarter's sampling results.

Cell 5: DNAPL Extraction

Cell 5 Objective:

DNAPL product removal began from the Cell 5 area in the latter part of the 4th quarter 2015. The objective is to proceed with the extraction of as much DNAPL as possible within the zone by use of Xitech Instruments DNAPL extraction pumps. Continuous evaluations are conducted of removal efficiency using current method verses alternative methods.

4th Quarter 2016 and 1st Quarter 2017 Operational Performance

DNAPL was extracted from several newly constructed extraction wells that have collection DNAPL sumps below the screened interval. Compressed air DNAPL pumps were installed within three extraction wells that had shown to produce the greatest amounts of DNAPL: CO123-PZM, CO124-PZM and CO125-PZM. 55-gallon drums have been placed next to CO125-PZM, CO124-PZM and CO123-PZM.

DNAPL recovery pumps were shutoff throughout the 3rd quarter of 2016 as the DNAPL recovery became minimal and had emptied the collection sumps. The wells underwent a period of inactivity for the product to collect into the well sumps. The wells with pumping stations were returned to operation during the 4th quarter of 2016 and the 1st quarter of 2017

Table 14 summarizes 1) DNAPL occurrence and recovery observed in monitoring wells for this Cell during the reporting period, 2) the start date of extraction from recovery wells and 3) cumulative DNAPL recovered since the beginning of the interim measure.

The DNAPL was recovered from the following wells:

Well	Total DNAPL Recovery Period		DNAPL Recovery (gal/lbs)	
	Begin	End	4th Qtr 2016 (gal/lbs)	Cumulative Recovery (gal/lbs)
CO123-PZMxxx	1-Jan-16	On-going	100/960	298/2,860
CO124-PZMxxx	1-Jan-16	On-going	50/480	100/960
CO125-PZMxxx	1-Jan-16	On-going	0/0	0/0
CO169-PZMxxx	1-Jan-16	On-going	0/0	30/288
	Total		**150/1,440**	**428/4,108**

Well	Total DNAPL Recovery Period		DNAPL Recovery (gal/lbs)	
	Begin	**End**	**1st Qtr 2017 (gal/lbs)**	**Cumulative Recovery (gal/lbs)**
CO123-PZMxxx	1-Jan-16	On-going	50/480	348/3,340
CO124-PZMxxx	1-Jan-16	On-going	100/960	200/1,919
CO125-PZMxxx	1-Jan-16	On-going	0/0	0/0
CO169-PZMxxx	1-Jan-16	On-going	50/480	80/768
	Total		**200/1,919**	**628/6,027**

The weight in lbs from gallons of product recovered was calculated based on an oil density of 1.15 grams per cubic centimeter.

Cell 6: LNAPL Extraction at the Former Benzol Processing Area

The Cell 6 LNAPL Multi-Phase Extraction (MPE) recovery system was constructed and put into operation October 2016. The system recovers VOCs in vapor and product phases. The phases are separated and treated or captured. The LNAPL is pulled in through 53 extraction wells, each well is plumbed with an individual vacuum line. The product is skimmed into an oil/water separator system from where it is pumped into a 5,000-gal product holding tank. The vapor is destroyed via an electrically operated CATOX and the groundwater is reinjected via 7 reinjection wells to maintain the groundwater elevation. The layout of the system consists of 53 extraction wells and 7 reinjection wells as shown on **Figure 16.**

Cell 6 Operation and Maintenance

Cell 6 was originally designed with two carbon vessels for vapor treatment. The amount of vapor and the level of concentrations were extremely high. Breakthrough of both vessels was experienced in less than two weeks of running the system. An electric CATOX was installed to replace the carbon vessels. Installment and testing for the CATOX were completed January 16, 2017. Other Maintenance included:

January 25, 2017 – Generator serviced (oil and filters) by United Rentals technician

February 8, 2017 – NES programmed CATOX alarms into the system HMI

February 10, 2017 – Generator shut-off, system showed high voltage/frequency alarms. United Rentals technician arrived, determined bad alternator to be cause - replaced alternator.

March 22, 2017 – System shutoff from voltage alarms. Voltage adjustment knob on generator had been turned to lowest setpoint (200v). Knob re-adjusted to 208.

March 24, 2017 – United Rentals performed Generator service (oil and filters)

4th Quarter 2016 and 1st Quarter 2017 Operational Performance

Approximately 1,100 gallons of product was recovered into a 5,000-gal capacity tank during the 4th quarter of 2016. The 1,100 gallons was removed Jan. 19, 2017 by a tanker truck from U.S. Environmental. An additional 350 gal was recovered from that point through the end of the 1st quarter. **Table 15** summarizes the amount of product 1) LNAPL recovered prior to the MPE being put into place 2) LNAPL recovered by the MPE system during the reporting quarters and 3) total LNAPL recovered.

CELL 6 LNAPL Extraction Wells	Total LNAPL Recovery Period		LNAPL Recovered During Fourth Quarter 2016		Cumulative Total LNAPL Recovered	
	Begin	End	(gal)	(lbs) (a)	(gal)	(lbs) (a)
Skimmer Pumps	23-Jul-10	1-Aug-16	0	0	15,797	115,761
Cell 6 MPE system	1-Oct-16	On-going	1100	8,061	1,100	8,061
Total Recovery:			**1,100**	**8,061**	**16,897**	**123,822**

CELL 6 LNAPL Extraction Wells	Total LNAPL Recovery Period		LNAPL Recovered During First Quarter 2017		Cumulative Total LNAPL Recovered	
	Begin	End	(gal)	(lbs) (a)	(gal)	(lbs) (a)
Skimmer Pumps	23-Jul-10	1-Aug-16	0	0	15,797	115,761
Cell 6 MPE system	1-Oct-16	On-going	350.6	2,569	1,451	10,630
Total Recovery:			**350.6**	**2,569**	**17,248**	**126,391**

PROPOSED OPERATING PLAN FOR 2017

The Proposed Operating Plan for 2017 includes the following requirements:

- Operation, maintenance and monitoring of the Coke Oven Area systems on a year-round basis;
- Quarterly monitoring of groundwater quality, including sampling and analysis from 31 monitoring wells; and
- Semi-annual groundwater level measurements and evaluation of groundwater flow characteristics;

In addition to the Interim Measures underway at the former Coke Oven Area, environmental work is planned in 2017 to collect the data to evaluate the effectiveness of the various operations being conducted in the Cells and define long term objectives for required final corrective measures.

TABLES

Table 1
Summary of Operation Conditions
Cell 1: Prototype AS/SVE System in Former Benzol Processing Area
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Cell 1 First Quarter 2017 Estimated Hydrocarbon Recovery

Parameter	Units	Quantity
Total CATOX Operating Time (October 1, 2016 - March 31, 2017)	hours	0
Overall CATOX Operational Time	%	0.0%
Estimated Total Hydrocarbons Destroyed	pounds	0.000
Estimated Hydrocarbon Removal Rate	pounds/hour	0.00000

Cell 1 Cumulative Summary of Estimated Hydrocarbon Recovery

Parameter	Units	Quantity
Total ICE/CATOX Operating Time (August 3, 2010 - March 31, 2017)	hours	25,252
Overall CATOX Operational Time	%	50.3%
Estimated Total Hydrocarbons Destroyed	pounds	12,582.0
Estimated Hydrocarbon Removal Rate	pounds/hour	0.50

Table 2
Summary of Soil Gas Analytical Results (First Quarter 2017)
Cell 1: Prototype AS/SVE System in Former Benzol Processing Area
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Analyte	Sample ID Date Time Dilution Factor Units	CATOX Influent Q1 2017
TO-15 Volatile Organics		
Acetone	ug/m^3	NS
Benzene	ug/m^3	NS
Bromoform	ug/m^3	NS
2-Butanone (MEK)	ug/m^3	NS
Carbon disulfide	ug/m^3	NS
Carbon tetrachloride	ug/m^3	NS
Chlorobenzene	ug/m^3	NS
Chloroethane	ug/m^3	NS
Chloroform	ug/m^3	NS
1,1-Dichloroethane	ug/m^3	NS
1,2-Dichloroethane	ug/m^3	NS
1,1-Dichloroethene	ug/m^3	NS
trans-1,2-Dichloroethene	ug/m^3	NS
1,2-Dichloropropane	ug/m^3	NS
cis-1,3-Dichloropropene	ug/m^3	NS
trans-1,3-Dichloropropene	ug/m^3	NS
Ethylbenzene	ug/m^3	NS
2-Hexanone	ug/m^3	NS
Methylene Chloride	ug/m^3	NS
4-Methyl-2-pentanone (MIBK)	ug/m^3	NS
1,1,2,2-Tetrachloroethane	ug/m^3	NS
Tetrachloroethene	ug/m^3	NS
Toluene	ug/m^3	NS
1,1,1-Trichloroethane	ug/m^3	NS
1,1,2-Trichloroethane	ug/m^3	NS
Trichloroethene	ug/m^3	NS
Vinyl chloride	ug/m^3	NS
m&p-Xylene	ug/m^3	NS
o-Xylene	ug/m^3	NS
Total Volatile Organics	ug/m^3	**NS**

Notes:

VOC concentrations are averages derived from the 3 monthly influent air samples taken during the quarter (one sample taken each month of the quarter)

BOLD = Analyte detected

ug/m^3 = micro grams per cubic meter

ND = Analyte not detected above laboratory reporting limit

Table 3
Summary of Groundwater Analytical Results (First Quarter 2017)
Cell 1: Prototype AS/SVE System in Former Benzol Processing Area
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Parameter	Units	CO02-PZM006	CO18-PZM006	CO93-PZM
Volatile Organics				
1,1,1,2-Tetrachloroethane	µg/L	ND	ND	ND
1,1,1-Trichloroethane	µg/L	ND	ND	ND
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND
1,1-Dichloroethane	µg/L	ND	ND	ND
1,1-Dichloroethene	µg/L	ND	ND	ND
1,2,3-Trichloropropane	µg/L	ND	ND	ND
1,2-Dibromo-3-chloropropane	µg/L	ND	ND	ND
1,2-Dibromoethane	µg/L	ND	ND	ND
1,2-Dichlorobenzene	µg/L	ND	ND	ND
1,2-Dichloroethane	µg/L	ND	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND
1,4-Dichlorobenzene	µg/L	ND	ND	ND
2-Butanone	µg/L	ND	ND	ND
2-Hexanone	µg/L	ND	ND	ND
4-Methyl-2-pentanone	µg/L	ND	ND	ND
Acetone	µg/L	**44.2**	**40.7**	ND
Acrylonitrile	µg/L	ND	ND	ND
Benzene	µg/L	**339,000**	**669,000**	**180,000**
Bromochloromethane	µg/L	ND	ND	ND
Bromodichloromethane	µg/L	ND	ND	ND
Bromoform	µg/L	ND	ND	ND
Bromomethane	µg/L	ND	ND	ND
Carbon Disulfide	µg/L	ND	ND	**18.1**
Carbon Tetrachloride	µg/L	ND	ND	ND
Chlorobenzene	µg/L	ND	ND	ND
Chloroethane	µg/L	ND	ND	ND
Chloroform	µg/L	ND	ND	ND
Chloromethane	µg/L	ND	ND	ND
Dibromochloromethane	µg/L	ND	ND	ND
Dibromomethane	µg/L	ND	ND	ND
Ethylbenzene	µg/L	**367**	**98.8**	**1,430**
Iodomethane	µg/L	ND	ND	ND
Methyl tertiary-butyl ether	µg/L	ND	ND	ND
Methylene Chloride	µg/L	ND	ND	ND
Styrene	µg/L	**7.2**	ND	**1,600**
Tetrachloroethene	µg/L	ND	ND	ND
Toluene	µg/L	**122**	**36,500**	**55,400**
Trichloroethene	µg/L	ND	ND	ND
Trichlorofluoromethane	µg/L	ND	ND	ND
Vinyl Acetate	µg/L	ND	ND	ND
Vinyl Chloride	µg/L	ND	ND	ND
Xylenes	µg/L	**738**	**2,520**	**17,800**
cis-1,2-Dichloroethene	µg/L	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND
trans-1,2-Dichloroethene	µg/L	ND	ND	ND
trans-1,3-Dichloropropene	µg/L	ND	ND	ND
trans-1,4-Dichloro-2-butene	µg/L	ND	ND	ND
Total Volatile Organics	µg/L	**340,278**	**708,160**	**256,248**
Semi-Volatile Organics				
Naphthalene	µg/L	**360**	**262**	**1,970**

Notes:

Bold = Analyte Detected

ND = Analyte not detected above laboratory reporting limit

µg/L = Micrograms per liter

Table 4
Summary of Operation Conditions
Cell 2 AS/SVE System
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Cell 2 First Quarter 2017 Estimated Hydrocarbon Recovery

Parameter	Units	Quantity
Total CATOX Operating Time (October 1, 2016 - March 31, 2017)	hours	1,512
Overall CATOX Operational Time	%	70.0%
Estimated Total Hydrocarbons Destroyed	pounds	2.57
Estimated Hydrocarbon Removal Rate	pounds/hour	0.0017

Cell 2 Cumulative Summary of Estimated Hydrocarbon Recovery

Parameter	Units	Quantity
Total ICE/CATOX Operating Time (October 1, 2014 - March 31, 2017)	hours	12,264
Overall CATOX Operational Time	%	56.0%
Estimated Total Hydrocarbons Destroyed	pounds	283.45
Estimated Hydrocarbon Removal Rate	pounds/hour	0.023

Table 5
Summary of Soil Gas Analytical Results (First Quarter 2017)
Cell 2 AS/SVE System
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Analyte	Sample ID Date Time Dilution Factor Units	CATOX Influent Q1 2017
TO-15 Volatile Organics		
Acetone	ug/m^3	ND
Benzene	ug/m^3	**1,646**
Bromoform	ug/m^3	ND
2-Butanone (MEK)	ug/m^3	ND
Carbon disulfide	ug/m^3	**0.63**
Carbon tetrachloride	ug/m^3	ND
Chlorobenzene	ug/m^3	ND
Chloroethane	ug/m^3	ND
Chloroform	ug/m^3	ND
1,1-Dichloroethane	ug/m^3	ND
1,2-Dichloroethane	ug/m^3	ND
1,1-Dichloroethene	ug/m^3	ND
trans-1,2-Dichloroethene	ug/m^3	ND
1,2-Dichloropropane	ug/m^3	ND
cis-1,3-Dichloropropene	ug/m^3	ND
trans-1,3-Dichloropropene	ug/m^3	ND
Ethylbenzene	ug/m^3	**52**
2-Hexanone	ug/m^3	ND
Methylene Chloride	ug/m^3	ND
Methyl ethyl ketone	ug/m^3	**0.76**
4-Methyl-2-pentanone (MIBK)	ug/m^3	ND
1,1,2,2-Tetrachloroethane	ug/m^3	ND
Tetrachloroethene	ug/m^3	ND
Toluene	ug/m^3	**974**
1,1,1-Trichloroethane	ug/m^3	ND
1,1,2-Trichloroethane	ug/m^3	ND
Trichloroethene	ug/m^3	ND
Vinyl chloride	ug/m^3	ND
m&p-Xylene	ug/m^3	**237**
o-Xylene	ug/m^3	**118**
Total Volatile Organics	ug/m^3	**3,027**

Notes:

VOC concentrations are averages derived from the 3 monthly influent air samples taken during the quarter (one sample taken each month of the quarter)

BOLD = Analyte detected

ug/m^3 = micro grams per cubic meter

ND = Analyte not detected above laboratory reporting limit

Table 6
Cell 2 and Cell 5 Monitoring Well Data

Location Designation	Monitoring Well Designation	Monitoring Well Temporary Identification	Installation Method	Date Installed	Well Use	Northing	Easting	Top of Casing Elevation	Protection Cover Type	Well Total Depth	Riser Length	Screen Length	Filter Pack Interval	Seal Interval	Grout Interval
CO24	CO24-PZM007		Hollow Stem Auger	12/6/2001		562048.175	1457276.816	12.02	Flush Mount	19.00	9.00	10.00	19-7	7-5	5-0
CO26	CO26-PZM007		Hollow Stem Auger	12/5/2001		561682.425	1458048.048	12.76	Flush Mount	20.00	10.00	10.00	20-8	8-6	6-0
CO27	CO27-PZM012					563239.965	1454916.917	5.12							
CO27	CO27-PZM046					563239.958	1454913.372	5.17							
CO36	CO36-PZM008	Cell 2 - MW1 (S)	Hollow Stem Auger			563212.310	1454571.760	6.94	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO36	CO36-PZM043	Cell 2 - MW8 (I)	Hollow Stem Auger			563214.490	1454578.370	6.92	Steel Riser	50.00	30.00	20.00	28-50	27-28	0-27
CO37	CO37-PZM038	Cell 2 - MW9 (I)	Hollow Stem Auger			563268.500	1455154.680	12.12	Steel Riser	50.00	30.00	20.00	28-50	27-28	0-27
CO38	CO38-PZM006	Cell 2 - MW3 (S)	Hollow Stem Auger			563078.800	1454743.790	6.75	Steel Riser	13.00	3.00	10.00	2-13	1-2	0-1
CO38	CO38-PZM043	Cell 2 - MW10 (I)	Hollow Stem Auger			563078.330	1454737.750	6.65	Steel Riser	50.00	30.00	20.00	28-50	27-28	0-27
CO39	CO39-PZM007	Cell 2 - MW4 (S)	Hollow Stem Auger			563141.660	1455095.700	7.75	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO39	CO39-PZM042	Cell 2 - MW11 (I)	Hollow Stem Auger			563140.070	1455089.800	7.91	Steel Riser	50.00	30.00	20.00	28-50	27-28	0-27
CO40	CO40-PZM008	Cell 2 - MW5 (S)	Hollow Stem Auger			563039.410	1455081.700	7.47	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO41	CO41-PZM001	Cell 2 - MW6 (S)	Hollow Stem Auger			562873.180	1454953.000	13.57	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO41	CO41-PZM036	Cell 2 - MW12 (I)	Hollow Stem Auger			562865.340	1454950.750	13.60	Steel Riser	50.00	30.00	20.00	28-50	27-28	0-27
CO42	CO42-PZM004	Cell 2 - MW7 (S)	Hollow Stem Auger			563177.720	1455458.510	10.83	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO55	CO55-PZM000	Cell 5 - MW1 (S)	Hollow Stem Auger			561434.420	1457585.900	15.10	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO55	CO55-PZM000	Cell 5 - MW1 (S)	Hollow Stem Auger			561434.420	1457585.900	15.10	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO55	CO55-PZM000	Cell 5 - MW1 (S)	Hollow Stem Auger			561434.420	1457585.900	15.10	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO56	CO56-PZP001	Cell 5 - MW2 (S)	Hollow Stem Auger			561668.410	1457790.050	15.92	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO57	CO57-PZP002	Cell 5 - MW3 (S)	Hollow Stem Auger			561122.520	1457530.000	16.59	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO58	CO58-PZM001	Cell 5 - MW4 (S)	Hollow Stem Auger			561331.310	1457989.130	14.31	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO59	CO59-PZP002	Cell 5 - MW5 (S)	Hollow Stem Auger			561446.980	1457308.790	16.75	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2
CO60	CO60-PZP001	Cell 5 - MW6 (S)	Hollow Stem Auger			561872.550	1457913.360	15.83	Steel Riser	15.00	5.00	10.00	3-15	2-3	0-2

Table 7
Cell 2
Monitoring Well Groundwater Elevations

Well ID	Temporary Well ID	Top of PVC Elevation (ft)	Aquifer	Well Depth from Ground Surface (ft)	3/20/2017-3/21/2017	
					Depth to Groundwater	Groundwater Elevation (ft)
CO27-PZM012		5.12	S		4.77	0.35
CO27-PZM046		5.17	I		9.05	-3.88
CO36-PZM008	Cell 2 - MW1 (S)	6.94	S	15.00	7.34	-0.40
CO36-PZM043	Cell 2 - MW8 (I)	6.92	I	50.00	7.84	-0.92
CO37-PZM038	Cell 2 - MW9 (I)	12.12	I	50.00	12.45	-0.33
CO38-PZM006	Cell 2 - MW3 (S)	6.75	S	13.00	6.82	-0.07
CO38-PZM043	Cell 2 - MW10 (I)	6.65	I	50.00	7.67	-1.02
CO39-PZM007	Cell 2 - MW4 (S)	7.75	S	15.00	5.94	1.81
CO39-PZM042	Cell 2 - MW11 (I)	7.91	I	50.00	8.29	-0.38
CO40-PZM008	Cell 2 - MW5 (S)	7.47	S	15.00	7.15	0.32
CO41-PZM001	Cell 2 - MW6 (S)	13.57	S	15.00	12.98	0.59
CO41-PZM036	Cell 2 - MW12 (I)	13.60	I	50.00	13.83	-0.23
CO42-PZM004	Cell 2 - MW7 (S)	10.83	S	15.00	3.95	6.88

Notes:

I = Intermediate depth wells

S = Water table well

Table 8
Summary of Groundwater Analytical Results (First Quarter 2017)
Cell 2
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Parameter	Units	CO27-PZM012	CO27-PZM046	CO36-PZM008	CO36-PZM043	CO37-PZM038	CO38-PZM006	CO38-PZM043	CO39-PZM007	CO39-PZM042	CO40-PZM008	CO41-PZM001	CO41-PZM036	CO42-PZM004
Volatile Organics														
1,1,1,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	µg/L	ND	ND	ND	ND	**32**	ND	ND	ND	ND	**64**	**22.7**	**45.8**	ND
Acrylonitrile	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	µg/L	**16,100**	**55,600**	**21,300**	**15,400**	**69,400**	**10,700**	**1.4**	**386**	**5,720**	**302**	**20,500**	**102,000**	ND
Bromochloromethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.3	ND
Carbon Tetrachloride	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	µg/L	**171**	**35.4**	**54.3**	**101**	**244**	**269**	ND	**2.8**	**63.3**	**4.4**	**314**	**858**	ND
Iodomethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tertiary-butyl ether	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	µg/L	**213**	**7.8**	**15.4**	**95.6**	**12.2**	**340**	ND	**1.5**	**97.9**	**4.1**	**10.8**	**420**	ND
Tetrachloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	µg/L	**5,390**	**6,920**	**4,610**	**1,690**	**6,180**	**7,210**	ND	**37.2**	**2,220**	**89.2**	**12,700**	**57,900**	ND
Trichloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Acetate	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	µg/L	**1,500**	**617**	**1,370**	**836**	**2,230**	**2,120**	ND	**15.9**	**554**	**48.4**	**3,420**	**25,600**	ND
cis-1,2-Dichloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Volatile Organics	µg/L	**23,374**	**63,180**	**27,350**	**18,123**	**78,098**	**20,639**	**1.4**	**443**	**8,655**	**512**	**36,968**	**186,827**	**0**
Semi-Volatile Organics														
Naphthalene	µg/L	**5,670**	**1,170**	**723**	**7,980**	**1,280**	**6,620**	ND	**676**	**1,050**	**287**	**280**	**322**	**6.1**

Notes:

Bold = Analyte Detected

ND = Analyte not detected above laboratory reporting limit

µg/L = Micrograms per liter

Table 9
Summary of Operation Conditions
Cell 3: AS/SVE System in the "Cove" Area
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Cell 3 First Quarter 2017 Estimated Hydrocarbon Recovery

Parameter	Units	Quantity
Total CATOX Operating Time (October 1, 2016 - March 31, 2017)	hours	792
Overall CATOX Operational Time	%	36.7%
Estimated Total Hydrocarbons Destroyed	pounds	9.356
Estimated Hydrocarbon Removal Rate	pounds/hour	0.011813

Cell 3 Cumulative Summary of Estimated Hydrocarbon Recovery

Parameter	Units	Quantity
Total ICE/CATOX Operating Time (August 3, 2010 - March 31, 2017)	hours	21,095
Overall CATOX Operational Time	%	54.5%
Estimated Total Hydrocarbons Destroyed	pounds	1,714.8
Estimated Hydrocarbon Removal Rate	pounds/hour	0.08

Table 10
Summary of Soil Gas Analytical Results (First Quarter 2017)
Cell 3: AS/SVE System in the "Cove" Area
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Analyte	Sample ID Date Time Dilution Factor Units	CATOX Influent Q1 2017
TO-15 Volatile Organics		
Acetone	ug/m^3	ND
Benzene	ug/m^3	**21,700**
Bromoform	ug/m^3	ND
2-Butanone (MEK)	ug/m^3	ND
Carbon disulfide	ug/m^3	ND
Carbon tetrachloride	ug/m^3	ND
Chlorobenzene	ug/m^3	ND
Chloroethane	ug/m^3	ND
Chloroform	ug/m^3	ND
1,1-Dichloroethane	ug/m^3	ND
1,2-Dichloroethane	ug/m^3	ND
1,1-Dichloroethene	ug/m^3	ND
trans-1,2-Dichloroethene	ug/m^3	ND
1,2-Dichloropropane	ug/m^3	ND
cis-1,3-Dichloropropene	ug/m^3	ND
trans-1,3-Dichloropropene	ug/m^3	ND
Ethylbenzene	ug/m^3	**44**
2-Hexanone	ug/m^3	ND
Methylene Chloride	ug/m^3	ND
4-Methyl-2-pentanone (MIBK)	ug/m^3	ND
1,1,2,2-Tetrachloroethane	ug/m^3	ND
Tetrachloroethene	ug/m^3	ND
Toluene	ug/m^3	ND
1,1,1-Trichloroethane	ug/m^3	ND
1,1,2-Trichloroethane	ug/m^3	ND
Trichloroethene	ug/m^3	ND
Vinyl chloride	ug/m^3	ND
m&p-Xylene	ug/m^3	**471**
o-Xylene	ug/m^3	**314**
Total Volatile Organics	ug/m^3	**22,529**

Notes:

VOC concentrations are averages derived from the 3 monthly influent air samples taken during the quarter (one sample taken each month of the quarter)

BOLD = Analyte detected

ug/m^3 = micro grams per cubic meter

ND = Analyte not detected above laboratory reporting limit

Table 11
Summary of Groundwater Analytical Results (First Quarter 2017)
Cell 3: AS/SVE System in the "Cove" Area
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Parameter	Units	CO101-PZM	CO102-PZM	CO103-PZM	CO104-PZM	CO30-PZM015	CO30-PZM060
Volatile Organics							
1,1,1,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	µg/L	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	µg/L	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	µg/L	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	µg/L	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	µg/L	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	µg/L	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	µg/L	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	µg/L	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	µg/L	ND	ND	ND	ND	ND	ND
2-Butanone	µg/L	ND	ND	ND	ND	ND	ND
2-Hexanone	µg/L	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	µg/L	ND	ND	ND	ND	ND	ND
Acetone	µg/L	**22.4**	**67.7**	**76.1**	ND	**46.2**	ND
Acrylonitrile	µg/L	ND	ND	ND	ND	ND	ND
Benzene	µg/L	**17,400**	**15,700**	**27,700**	**16.5**	**52,800**	ND
Bromochloromethane	µg/L	ND	ND	ND	ND	ND	ND
Bromodichloromethane	µg/L	ND	ND	ND	ND	ND	ND
Bromoform	µg/L	ND	ND	ND	ND	ND	ND
Bromomethane	µg/L	ND	ND	ND	ND	ND	ND
Carbon Disulfide	µg/L	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	µg/L	ND	ND	ND	ND	ND	ND
Chlorobenzene	µg/L	ND	ND	ND	ND	ND	ND
Chloroethane	µg/L	ND	ND	ND	ND	ND	ND
Chloroform	µg/L	ND	ND	ND	ND	ND	ND
Chloromethane	µg/L	ND	ND	ND	ND	ND	ND
Dibromochloromethane	µg/L	ND	ND	ND	ND	ND	ND
Dibromomethane	µg/L	ND	ND	ND	ND	ND	ND
Ethylbenzene	µg/L	**21.3**	**19.6**	**55.5**	ND	**71.3**	ND
Iodomethane	µg/L	ND	ND	ND	ND	ND	ND
Methyl tertiary-butyl ether	µg/L	ND	ND	ND	ND	ND	ND
Methylene Chloride	µg/L	ND	ND	ND	ND	ND	ND
Styrene	µg/L	**6.6**	**6.1**	**10.4**	ND	**10.9**	ND
Tetrachloroethene	µg/L	ND	ND	ND	ND	ND	ND
Toluene	µg/L	**1,220**	**1,150**	**1,980**	**1.1**	**3,620**	ND
Trichloroethene	µg/L	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	µg/L	ND	ND	ND	ND	ND	ND
Vinyl Acetate	µg/L	ND	ND	ND	ND	ND	ND
Vinyl Chloride	µg/L	ND	ND	ND	ND	ND	ND
Xylenes	µg/L	**249**	**238**	**960**	ND	**1,060**	ND
cis-1,2-Dichloroethene	µg/L	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	µg/L	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	µg/L	ND	ND	ND	ND	ND	ND
Total Volatile Organics	µg/L	**18,919**	**17,181**	**30,782**	**17.6**	**57,608**	**0**
Semi-Volatile Organics							
Naphthalene	µg/L	**2,150**	**875**	**12,300**	**5.5**	**1,830**	ND

Notes:

Bold = Analyte Detected

ND = Analyte not detected above laboratory reporting limit

µg/L = Micrograms per liter

Table 12
Cell 5
Monitoring Well Groundwater Elevations

Well ID	Temporary Well ID	Top of PVC Elevation (ft)	Aquifer	Well Depth from Ground Surface (ft)	3/22/2017-3/23/2017	
					Depth to Groundwater	Groundwater Elevation (ft)
CO55-PZM000	Cell 5 - MW1 (S)	15.10	S	15.00	15.32	-0.22
CO56-PZP001	Cell 5 - MW2 (S)	15.92	S	15.00	16.14	-0.22
CO57-PZP002	Cell 5 - MW3 (S)	16.59	S	15.00	16.82	-0.23
CO58-PZM001	Cell 5 - MW4 (S)	14.31	S	15.00	14.57	-0.26
CO59-PZP002	Cell 5 - MW5 (S)	16.75	S	15.00	16.95	-0.20
CO60-PZP001	Cell 5 - MW6 (S)	15.83	S	15.00	16.08	-0.25
CO24-PZM007		15.95	S	19.00	15.48	0.47
CO26-PZM007		12.76	S	20.00	12.92	-0.16

Notes:

S = Water table well

Table 13
Summary of Groundwater Analytical Results (First Quarter 2017)
Cell 5 DPE Groundwater Pump and Treat System
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Parameter	Units	CO24-PZM007	CO26-PZM007	CO55-PZM000	CO56-PZP001	CO57-PZP002	CO58-PZM001	CO59-PZP002	CO60-PZP001
Volatile Organics									
1,1,1,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	µg/L	ND	ND	ND	ND	ND	**0.39**	ND	ND
1,1-Dichloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	µg/L	**35.6**	ND	**50**	**50.2**	**33.8**	**19.9**	**19**	**23**
Acrylonitrile	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	µg/L	**5**	**410**	ND	**437**	ND	**316**	**393**	**151**
Bromochloromethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	µg/L	ND	ND	ND	ND	**7.5**	ND	ND	**3**
Carbon Disulfide	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	µg/L	ND	ND	ND	ND	ND	ND	ND	**1.7**
Chloromethane	µg/L	**1.4**	ND	**1.6**	ND	**3**	**3.8**	**1**	**1.8**
Dibromochloromethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	µg/L	**4.5**	**14.7**	ND	**14**	ND	**13.4**	**19.5**	**3.7**
Iodomethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tertiary-butyl ether	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	µg/L	ND	**97.8**	ND	**78.5**	ND	**45.1**	**22.8**	**16.4**
Tetrachloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	µg/L	**3.4**	**236**	**0.33**	**186**	ND	**146**	**230**	**19.3**
Trichloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Acetate	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes	µg/L	**10.9**	**337**	ND	**313**	ND	**249**	**325**	**73.9**
cis-1,2-Dichloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	µg/L	ND	ND	ND	ND	ND	ND	ND	ND
Semi-Volatile Organics									
Naphthalene	µg/L	**5,900**	**6,130**	ND	**17,900**	ND	**3,040**	**4,720**	**676**
Total Volatile Organics	µg/L	**5,961**	**7,226**	**51.9**	**18,979**	**44.3**	**3,834**	**5,730**	**970**

Notes:

Bold = Analyte Detected

ND = Analyte not detected above laboratory reporting limit

µg/L = Micrograms per liter

Table 14
DNAPL Occurrence and Recovery
Cell 5: DNAPL Recovery System
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

Well ID	DNAPL Occurrence During Third Quarter 2016 (ft)	Total DNAPL Recovery Period		Estimate DNAPL Recovered During First Quarter 2017		Cumulative Total DNAPL Recovery	
		Begin	End	(gal)	(lbs) (a)	(gal)	(lbs) (a)
CO123	0.79	1-Jan-16	On-going (b)	50	480	348	3,340
CO124	2.03	1-Jan-16	On-going (b)	100	960	250	2,399
CO125	2.20	1-Jan-16	On-going (b)	0	0	0	0
CO169	2.00	1-Jan-16	On-going (b)	50	480	50	480
			Total Recovery:	**200**	**1,919**	**648**	**6,219**

Notes:

(a) Weight is calculated based on oil density of 1.15 grams per cubic centimeter.

(b) Skimmer

(c) Bailing

Table 15
LNAPL Occurrence and Recovery
Cell 6: LNAPL Recovery System in Former Benzol Processing Area
Former Coke Oven Area Interim Remedial Measures
Sparrows Point, MD

CELL 6 LNAPL Extraction Wells	Total LNAPL Recovery Period		LNAPL Recovered During First Quarter 2017		Cumulative Total LNAPL Recovered	
	Begin	End	(gal)	(lbs) (a)	(gal)	(lbs) (a)
Former Recovery Methods (b)(c)	23-Jul-10	1-Aug-16	na	na	15,797	115,761
Cell 6 MPE system	1-Oct-16	On-going	350.6	2,569	1,451	10,630
		Total Recovery:	**351**	**2,569**	**17,248**	**126,391**

Notes:

(a) Weight is calculated based on average BP-MW-05 and BP-MW-08 oil density of 0.878 grams per cubic centimeter, measured by EA (2009) by ASTM Method D1481

(b) Skimmer

(c) Bailing

(d) Multi-Phase Extraction System

(e) Cumulative recovery volumes are calculated using an estimated recovery from 12/28/11 to 1/18/12 as well as 5/24/12 to 6/22/12.

FIGURES

N

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1 inch = 330 feet

0 300 600 Feet

Former Coke Oven Area Interim Measures Cell Locations

Date: 4/27/2017

Legend

- Former Coke Oven Area Boundary
- Former COA IM Cells

Figure 1

N

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1 inch = 63 feet

0 55 110 Feet

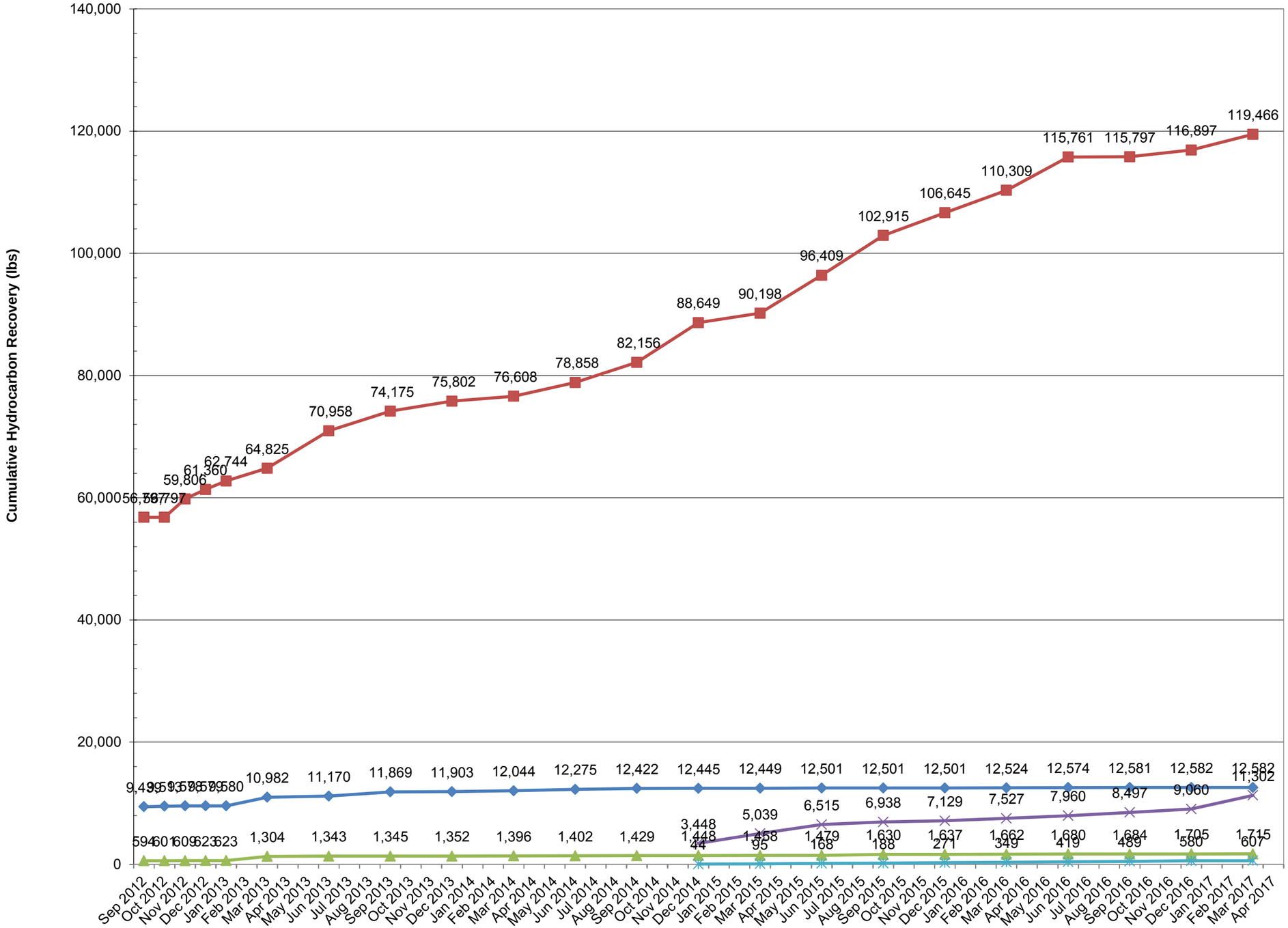
Former Coke Oven Area
Cell 1 AS/SVE System Layout

Date: 4/27/2017

Legend

- Monitoring Wells
- Air Sparge Wells
- Vapor Extraction Headers
- Vapor Collection Trench

Figure 2



LEGEND

- Cell 1
- Cell 2
- Cell 3
- Cell 5
- Cell 6

EnviroAnalytics Group

Environmental Engineers

Project

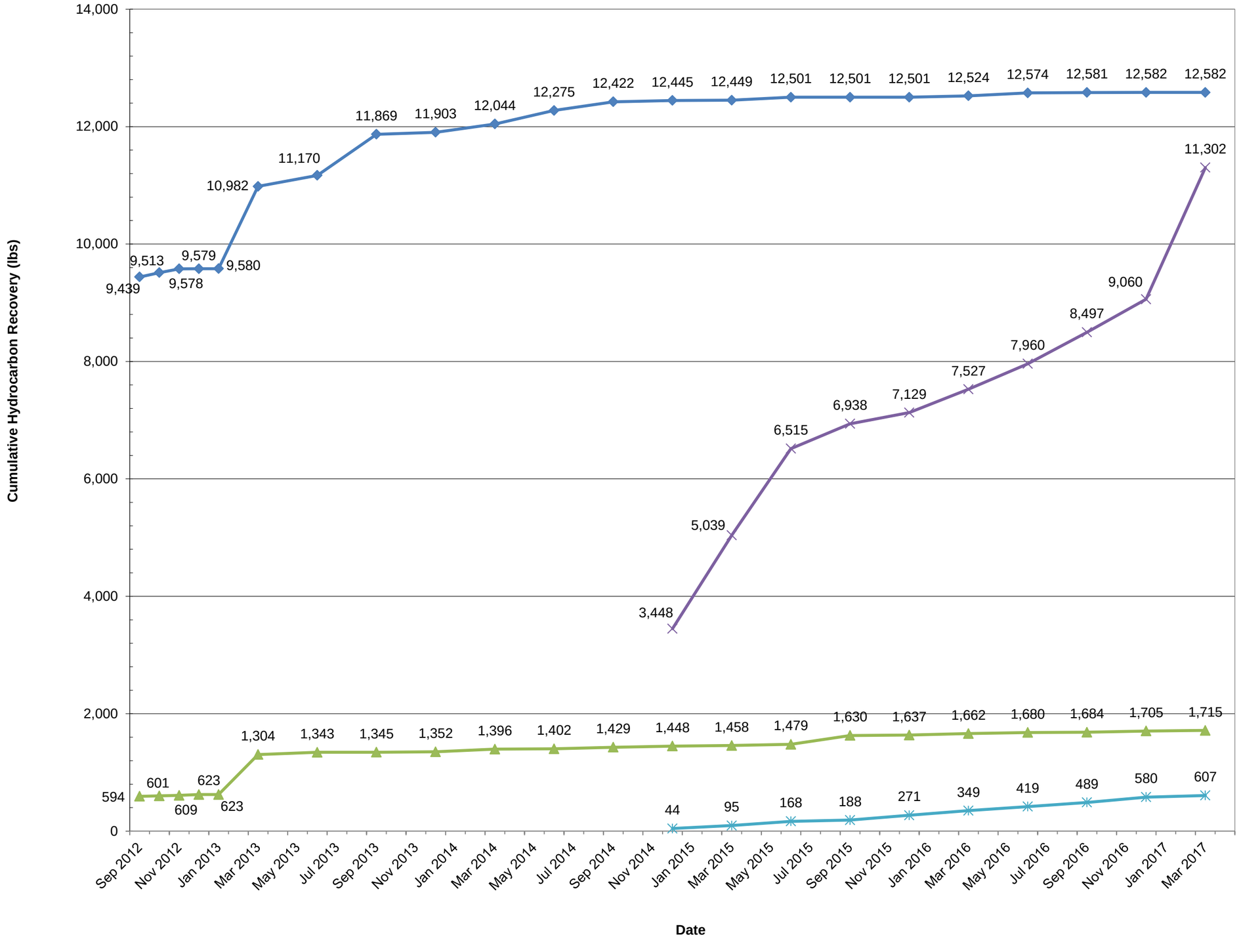
Sparrow Point Terminal
Baltimore, Maryland

CUMULATIVE SUMMARY OF ESTIMATED HYDROCARBON RECOVERY FORMER COKE OVEN AREA INTERIM REMEDIAL MEASURES

Project Number	File Number

Date	Figure
April 17, 2017	3

PE/RG	PM	DR



LEGEND

- Cell 1
- Cell 2
- Cell 3
- Cell 5

EnviroAnalytics Group

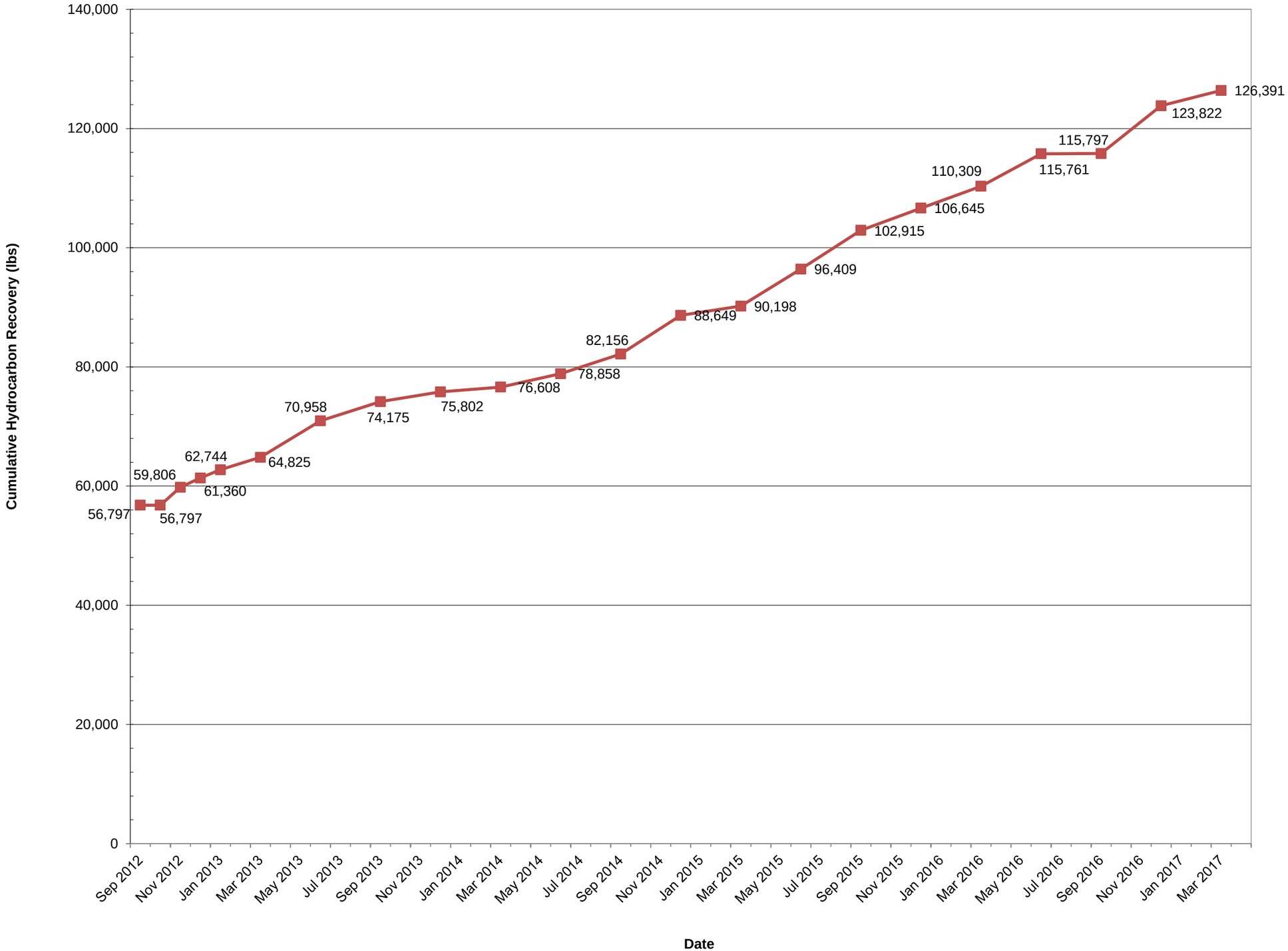
Environmental Engineers

Project

Sparrow Point Terminal, LLC
Baltimore, Maryland

CUMULATIVE SUMMARY OF ESTIMATED HYDROCARBON RECOVERY FORMER COKE OVEN AREA INTERIM REMEDIAL MEASURES

Project Number	File Number
Date: April 27, 2017	Figure: 3A
PE/RG	PM / DR



LEGEND

Cell 6

EnviroAnalytics Group

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Project

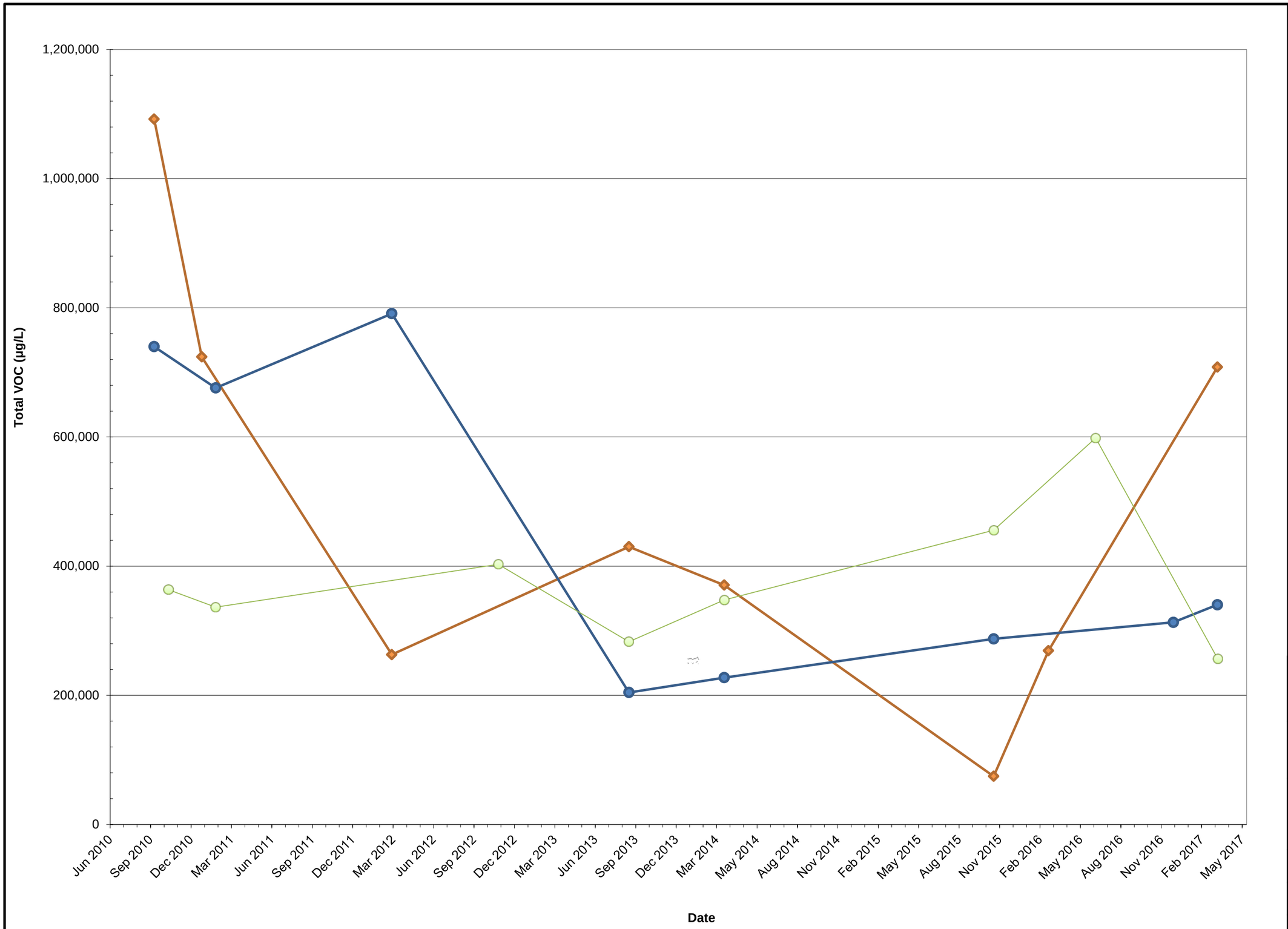
Sparrow Point Terminal, LLC
Baltimore, Maryland

CUMULATIVE SUMMARY OF ESTIMATED HYDROCARBON RECOVERY FORMER COKE OVEN AREA INTERIM REMEDIAL MEASURES

Project Number	File Number

Date	Figure
April 27, 2017	3B

PE/RG	PM	DR



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Baltimore, Maryland

**MEASURED GROUNDWATER VOC CONCENTRATION BY MONTH
CELL 1: PROTOTYPE AS/SVE SYSTEM
IN THE FORMER BENZOL PROCESSING AREA**

Date	Figure
April 27, 2017	4

PE/RG	PM	DR

N

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1 inch = 62 feet

0 55 110 Feet

Former Coke Oven Area
Cell 2 System Layout
AS/SVE and GW P&T
Date: 4/27/2017

Legend

- Monitoring Well Shallow Zone
- Monitoring Well Intermediate Zone
- Groundwater Extraction Wells
- Reinjection Wells
- Vapor Extraction Headers
- Air Sparge Wells
- Vapor Collection trench

Figure 5

N

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1 inch = 62 feet

0 55 110 Feet

Former Coke Oven Area
Cell 2 Groundwater Elevation Contours
Shallow Zone
Date: 4/27/2017

Legend

- Monitoring Well Shallow Zone
- Groundwater Extraction Wells
- Reinjection Wells
- Groundwater Elevation Contours Shallow Zone

Water Levels Recorded
3/20/2017-3/21/2017

Figure 6

N

EnviroAnalytics Group

1 inch = 62 feet

0 55 110 Feet

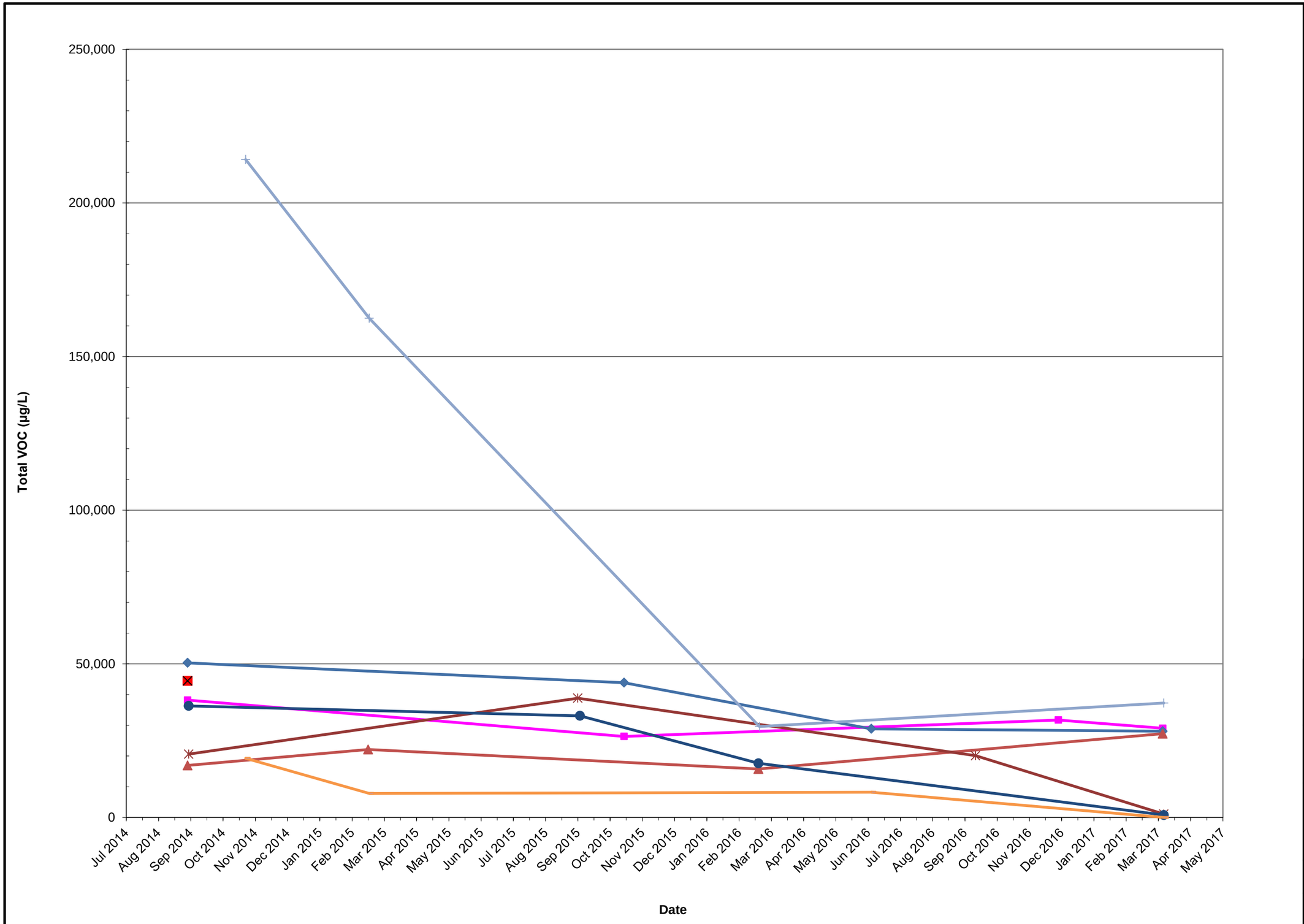
Former Coke Oven Area
Cell 2 Groundwater Elevation Contours
Intermediate Zone
Date: 4/27/2017

Legend

- Monitoring Well Intermediate Zone
- Groundwater Extraction Wells
- Reinjection Wells
- Groundwater Elevation Contours Intermediate Zone

Water Levels Recorded
3/20/2017-3/21/2017

Figure 7



LEGEND

- CO27-PZM012
- CO36-PZM008
- CO37-PZM003
- CO38-PZM006
- CO39-PZM007
- CO40-PZM008
- CO41-PZM001
- CO42-PZM004

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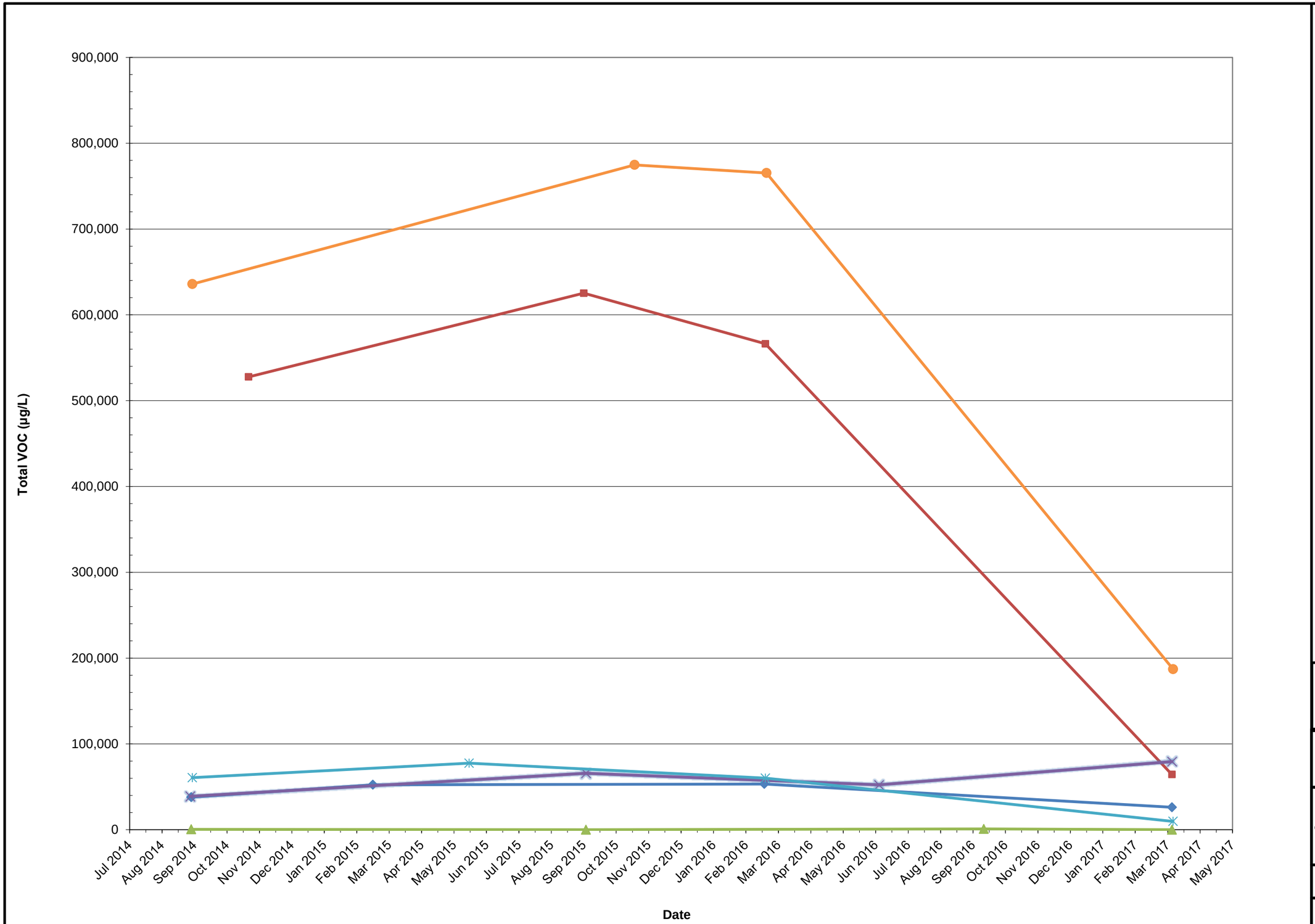
MEASURED GROUNDWATER VOC CONCENTRATION BY MONTH
CELL 2: GROUNDWATER PUMP AND TREAT SYSTEM SHALLOW ZONE

Date	Figure
April 27, 2017	**8A**

PE/RG	PM	DR



LEGEND

- CO27-PZM046
- CO36-PZM043
- CO37-PZM038
- CO38-PZM043
- CO39-PZM042
- CO41-PZM036

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**MEASURED GROUNDWATER VOC CONCENTRATION BY MONTH
CELL 2: GROUNDWATER PUMP AND TREAT SYSTEM
INTERMEDIATE ZONE**

Date	Figure
April 27, 2017	**8B**

PE/RG	PM	DR

N

EnviroAnalytics Group

1 inch = 62 feet

0 55 110 Feet

Former Coke Oven Area
Cell 2 Benzene Concentrations
Intermediate Zone
Date: 4/27/2017

Legend

- Monitoring Well Intermediate Zone
- Groundwater Extraction Wells
- Reinjection Wells

Monitoring Wells Sampled 3/20/2017-3/21/2017

Results in ug/L

Figure 9

N

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1 inch = 51 feet

0 45 90 Feet

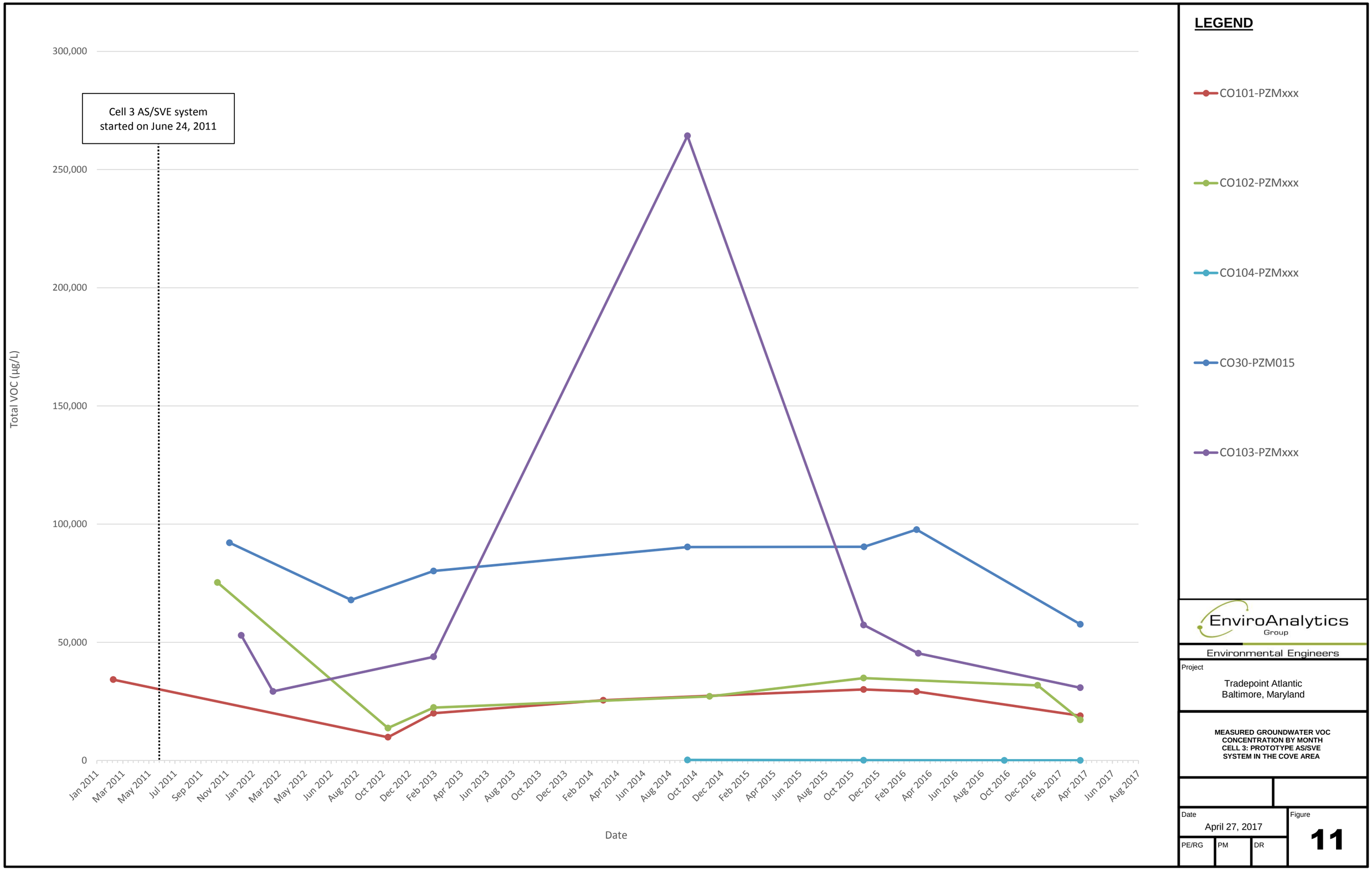
Former Coke Oven Area Cell 3 AS/SVE System Layout

Date: 4/27/2017

Legend

- Monitoring Wells
- Air Sparge Wells
- Vapor Extraction Headers
- Vapor Collection Trench

Figure 10



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MEASURED GROUNDWATER VOC CONCENTRATION BY MONTH CELL 3: PROTOTYPE AS/SVE SYSTEM IN THE COVE AREA

Date	Figure
April 27, 2017	11

PE/RG	PM	DR

N

EnviroAnalytics Group

1 inch = 120 feet

0 105 210 Feet

Former Coke Oven Area
Cell 5 System Layout
DPE System and DNAPL Recovery Pumps

Date: 4/27/2017

Legend

- Monitoring Wells
- DPE Wells
- Reinjection Wells
- DNAPL Recovery Well
- Extraction Area
- Naphthalene Source Area

Figure 12

N

EnviroAnalytics Group

1 inch = 120 feet

0 105 210 Feet

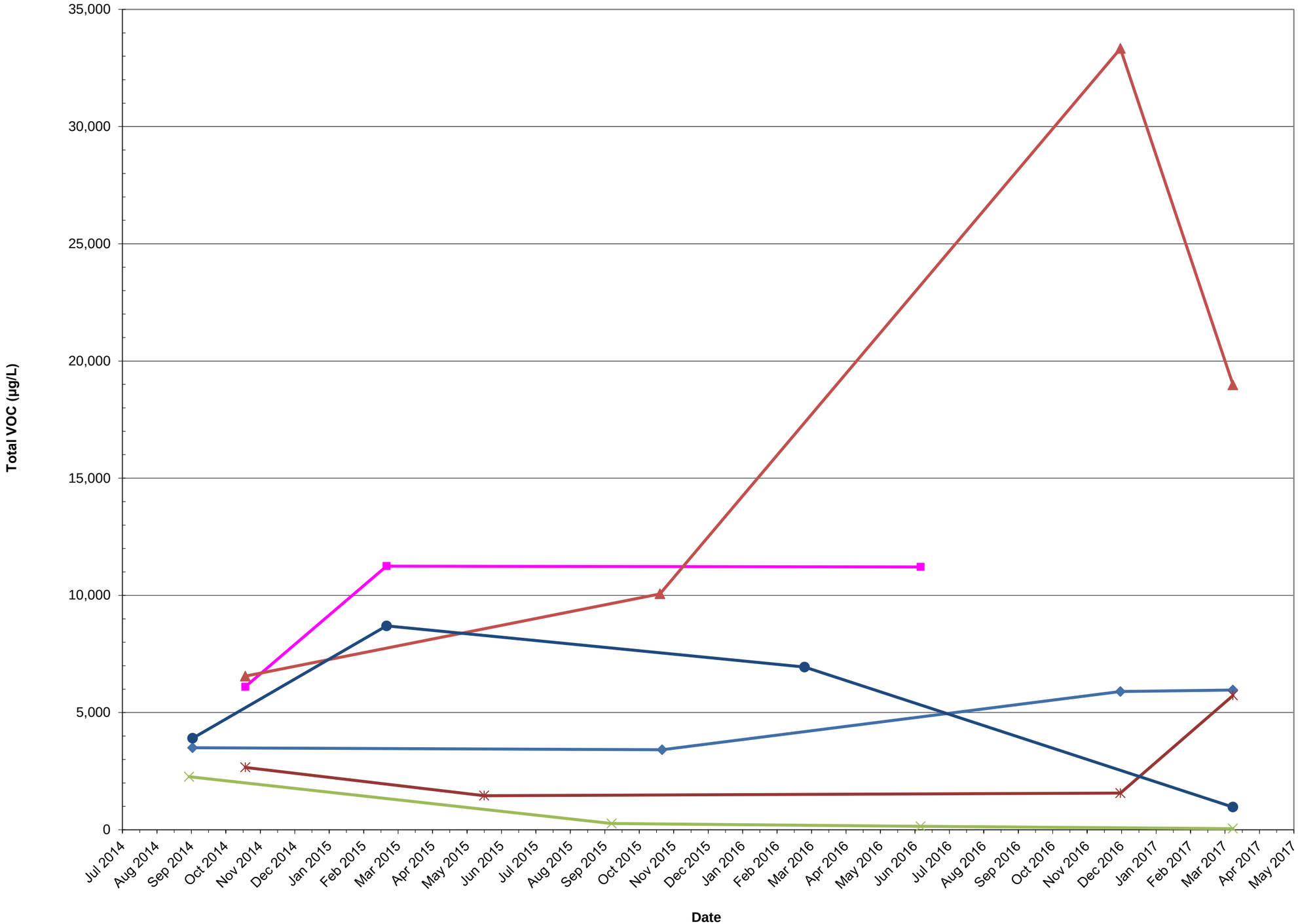
Former Coke Oven Area
Cell 5 Groundwater Elevation
Shallow Zone
Date: 4/28/2017

Legend

- Monitoring Wells
- Reinjection Wells
- DPE Wells

Water Levels Rcorded
3/22/2017-3/23/2017

Figure 13



LEGEND

- CO23-PZM008
- CO24-PZM007
- CO55-PZM000
- CO56-PZP001
- CO59-PZP002
- CO60PZP001

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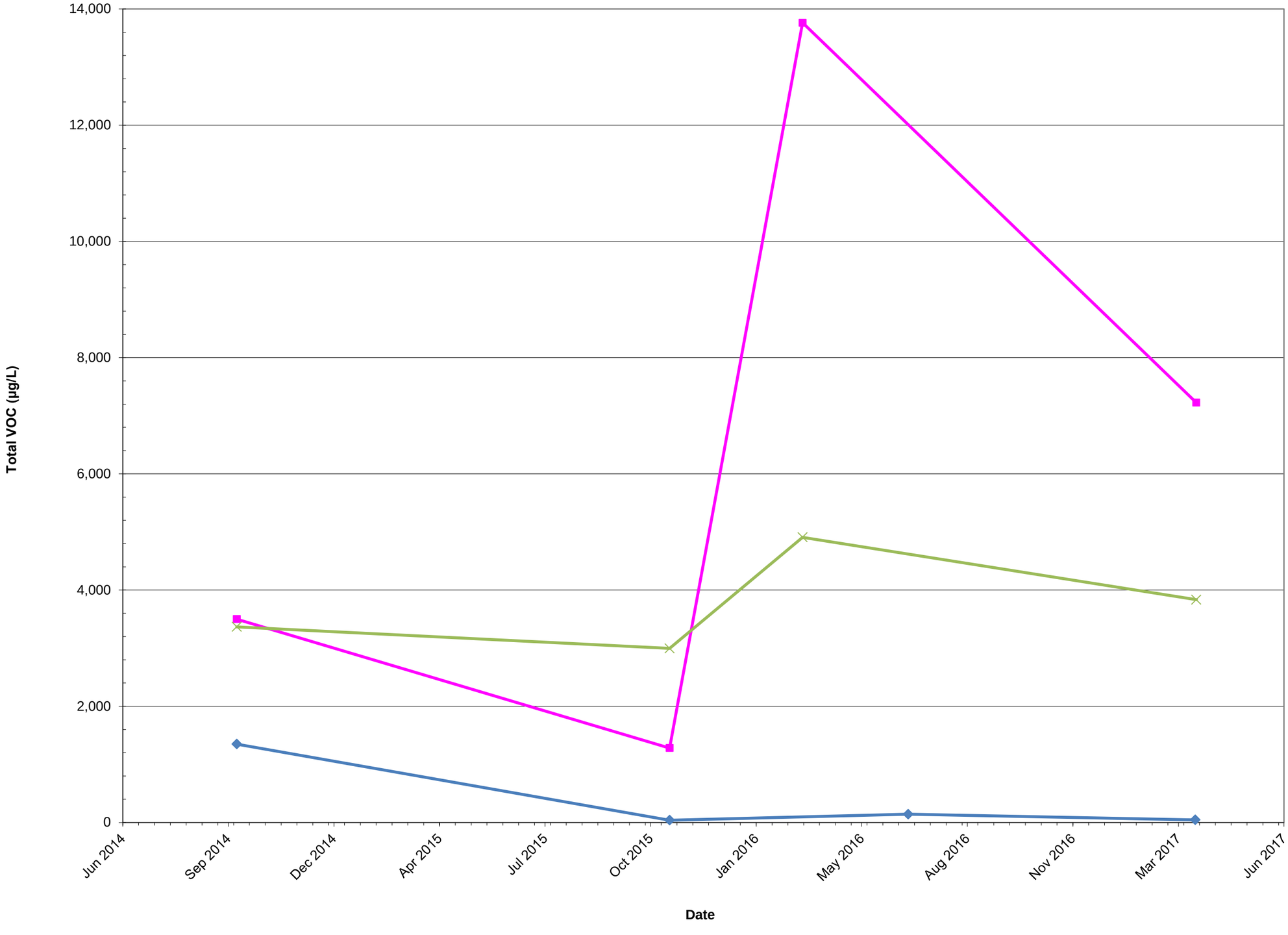
MEASURED GROUNDWATER VOC CONCENTRATION BY MONTH CELL 5: DPE GROUNDWATER PUMP AND TREAT SYSTEM

Date: April 27, 2017

Figure: 14A

PE/RG | PM | DR



LEGEND

- CO26-PZM007
- CO57-PZP002
- CO58-PZM001

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MEASURED GROUNDWATER VOC CONCENTRATION BY MONTH CELL 5: DPE GROUNDWATER PUMP AND TREAT SYSTEM

Date	Figure
April 27, 2017	14B

PE/RG	PM	DR

N

EnviroAnalytics Group

1 inch = 120 feet

0 105 210 Feet

Former Coke Oven Area
Cell 5 Naphthalene Concentrations
Shallow Zone
Date: 4/27/2017

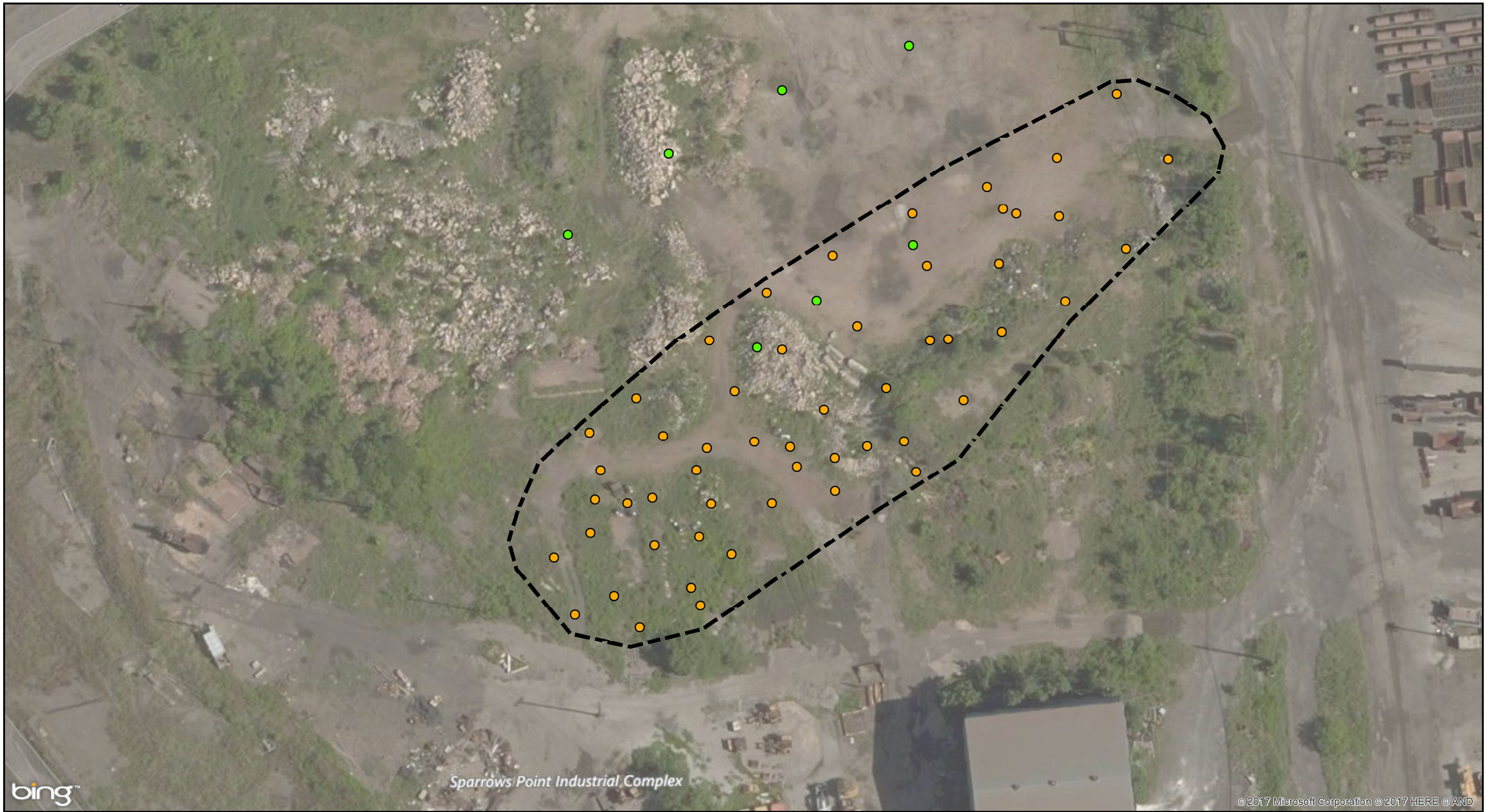
Legend

- Monitoring Wells
- Reinjection Wells
- DPE Wells

Monitoring Wells Sampled 3/22/2017-3/23/2017

Results in ug/L

Figure 15



N

EnviroAnalytics Group

1 inch = 60 feet

0 50 100 Feet

Former Coke Oven Area Cell 6 System Layout

Date: 4/28/2017

Legend

- Reinjection Wells
- Extraction Wells
- Estimated Source Area

Figure 16

Cell 1 AS/SVE - VGAC					
	JAN	FEB	MAR	Sum	Average
Acetone		0	0		0.0
Benzene				**0**	**#DIV/0!**
Bromoform				0	0.0
2-Butanone (MEK)				0	0.0
Carbon disulfide				0	#DIV/0!
Carbon tetrachloride				0	0.0
Chlorobenzene				0	0.0
Chloroethane				0	#DIV/0!
Chloroform				0	#DIV/0!
1,1-Dichloroethane				0	#DIV/0!
1,2-Dichloroethane				0	#DIV/0!
1,1-Dichloroethene				0	#DIV/0!
trans-1,2-Dichloroethene				0	#DIV/0!
1,2-Dichloropropane				0	#DIV/0!
cis-1,3-Dichloropropene				0	#DIV/0!
trans-1,3-Dichloropropene				0	#DIV/0!
Ethylbenzene				**0**	**#DIV/0!**
2-Hexanone				0	#DIV/0!
Methylene Chloride				0	#DIV/0!
4-Methyl-2-pentanone (MIBK)				0	#DIV/0!
1,1,2,2-Tetrachloroethane				0	#DIV/0!
Tetrachloroethene				0	#DIV/0!
Toluene				**0**	**#DIV/0!**
1,1,1-Trichloroethane				**0**	**#DIV/0!**
1,1,2-Trichloroethane				0	#DIV/0!
Trichloroethene				0	#DIV/0!
Vinyl chloride				0	#DIV/0!
m&p-Xylene				**0**	**#DIV/0!**
o-Xylene				**0**	**#DIV/0!**
Total	**0**	**0**	**0**	**0**	
				0	**#DIV/0!**
Quarterly Average			**0**		

Assumption = 99.5% destruction efficiency of VGAC unit (air permit application)

Units = ug/m3

Equation: lb/hr = [(x ug/m^3) (SCFM VGAC unit)]/2.67 x10^8 = lb/hr

Quarterly Average = 0 ug/m^3

Removed = 0 ug/m^3

lb/hr = 0.00000

Cell 1 - Hours Operated	
Jan	0
Feb	0
Mar	0
Q4 Total	0

Cell 2 AS/SVE - VGAC					
	JAN	FEB	MAR	Sum	Average
Acetone	0	0	0	0	0.0
Benzene	**2,940**	**351**	0	**3,291**	**1,097**
Bromoform	0	0	0	0	0
2-Butanone (MEK)	0	0	0	0	0
Carbon disulfide	0	**1**	0	**1**	**0**
Carbon tetrachloride	0	0	0	0	0
Chlorobenzene	0	0	0	0	0
Chloroethane	0	0	0	0	0
Chloroform	0	0	0	0	0
1,1-Dichloroethane	0	0	0	0	0
1,2-Dichloroethane	0	0	0	0	0
1,1-Dichloroethene	0	0	0	0	0
trans-1,2-Dichloroethene	0	0	0	0	0
1,2-Dichloropropane	0	0	0	0	0
cis-1,3-Dichloropropene	0	0	0	0	0
trans-1,3-Dichloropropene	0	0	0	0	0
Ethylbenzene	**87.5**	**15.5**	0	**103**	**34**
2-Hexanone	0	0	0	0	0
Methylene Chloride	0	0	0	**0**	**0**
4-Methyl-2-pentanone (MIBK)	0	0	0	0	0
1,1,2,2-Tetrachloroethane	0	0	0	0	0
Tetrachloroethene	0	0	0	**0**	0
Toluene	**1660**	**287**	0	**1,947**	**649**
1,1,1-Trichloroethane	0	0	0	0	0
1,1,2-Trichloroethane	0	0	0	0	0
Trichloroethene	0	0	0	**0**	0
Vinyl chloride	0	0	0	0	0
m&p-Xylene	**379**	**95**	0	**474**	**158**
o-Xylene	**187**	**48.5**	0	**236**	**79**
Total	**5,254**	**798**	**0**		
				6,052	**2,017**
Quarterly Average			**2,017**		

Assumption = 99.5% destruction efficiency of VGAC unit (air permit application)

Equation: lb/hr = [(x ug/m^3) (SCFM VGACunit)]/2.67 x10^8 = lb/hr

Quarterly Average = 2,017 ug/m^3

Removed = 2,007 ug/m^3

lb/hr = 0.0011

Cell 2 - Hours Operated	
Jan	552
Feb	408
Mar	552
Q4 Total	1,512

Cell 3 AS/SVE - VGAC					
	JAN	FEB	MAR	Sum	Average
Acetone	0	0	0	**0**	**0**
Benzene		**21,700**		**21,700**	**21,700**
Bromoform	0	0	0	0	0
2-Butanone (MEK)	0	0	0	0	0
Carbon disulfide	0	0	0	0	0
Carbon tetrachloride	0	0	0	0	0
Chlorobenzene	0	0	0	0	0
Chloroethane	0	0	0	0	0
Chloroform	0	0	0	0	0
1,1-Dichloroethane	0	0	0	0	0
1,2-Dichloroethane	0	0	0	0	0
1,1-Dichloroethene	0	0	0	0	0
trans-1,2-Dichloroethene	0	0	0	0	0
1,2-Dichloropropane	0	0	0	0	0
cis-1,3-Dichloropropene	0	0	0	0	0
trans-1,3-Dichloropropene	0	0	0	0	0
Ethylbenzene		**43.5**		**43.5**	**44**
2-Hexanone	0	0	0	0	0
Methylene Chloride	0	0	0	0	0
4-Methyl-2-pentanone (MIBK)	0	0	0	0	0
1,1,2,2-Tetrachloroethane	0	0	0	0	0
Tetrachloroethene	0	0	0	0	0
Toluene	0	0	0	**0**	**0**
1,1,1-Trichloroethane	0	0	0	0	0
1,1,2-Trichloroethane	0	0	0	0	0
Trichloroethene	0	0	0	0	0
Vinyl chloride	0	0	0	0	0
m&p-Xylene		**471**		**471**	**471**
o-Xylene		**314**		**314**	**314**
	0	**22,529**	**0**		
				22,529	**22,529**
Quarterly Average			**7,510**		

Assumption = 99.5% destruction efficiency of VGAC unit (air permit application)

Units = ug/m3

Equation: lb/hr = [(x ug/m^3) (SCFM VGAC unit)]/2.67 x10^8 = lb/hr

Quarterly Average = 7,510 ug/m^3

Removed = 7,472 ug/m^3

lb/hr = 0.003938

Cell 3 - Hours Operated	
Jan	192
Feb	216
Mar	384
Q4 Total	792