



November 1, 2013

Mr. Andrew Fan, PE  
US EPA Region III, 3LC20  
1650 Arch Street  
Philadelphia, PA 19103-2029

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

**Re:** *COKE OVEN AREA INTERIM MEASURES PROGRESS REPORT 3rd QUARTER 2013*

Dear Mr. Fan and Ms. Brown:

Enclosed with this correspondence is the Coke Oven Area Interim Measures Progress Report for the third quarter of 2013 completed for the Sparrows Point site. This report was distributed electronically on November 1, 2013 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 October 31, 2013. Please me at (314) 686-5611 should questions arise during your review of the enclosed progress report.

Sincerely,

Russell Becker  
Vice President, Remediation  
Sparrows Point LLC

Enclosure

# COKE OVEN AREA INTERIM MEASURES PROGRESS REPORT

(Third Quarter 2013)

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*Prepared for*

**SPARROWS POINT  
LLC 1428 SPARROWS POINT  
BOULEVARD SPARROWS POINT MD  
21219**

**October 31, 2013**



EnviroAnalytics Group  
1428 Sparrows Point Blvd  
Sparrows Point, MD 21219

# Coke Oven Area Interim Remedial Measures Progress Report

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## Introduction

This document presents operational data and monitoring information collected in the 3<sup>rd</sup> quarter of 2013 for interim measures (IMs) that have been installed to address identified environmental conditions at the Coke Oven Area (COA) Special Study Area at the Sparrows Point LLC site located in Sparrows Point, Maryland. This progress report also summarizes IM performance including data from the third quarter of 2013 and is submitted in accordance with reporting requirements outlined in correspondence received from US EPA on March 26, 2013.

The following designations are applied in this document to 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 3: AS/SVE System in "Cove" Area,
- Cell 4: In-Situ Anaerobic Bio-treatment Area,
- Cell 6: Light Non-Aqueous Phase Liquid (LNAPL) Recovery at the Former Benzol Processing Area.

As of the end of the third quarter 2013, Cells 1, 3, and 6 continue to be operational. Groundwater and soil gas sampling were conducted during the third quarter of 2013 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. LNAPL removal continued at Cell 6 without interruption.

Design work was completed on the IM remediation systems for Cell 2 and Cell 5 and design plan was submitted for these cells in early August 2013. Approval for both systems was received from EPA on September 10, 2013. As part of this approval, the bio-treatment process at Cell 4 has been discontinued and a combined Cell4/Cell5 remediation design has been approved. Implementation of final design work and equipment selection for the remediation systems for Cells 2 and Cells 4/5 is underway.

# Coke Oven Area Interim Remedial Measures Progress Report

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

Cell 1 consists of an AS/SVE system coupled with vapor destruction via an electric catalytic oxidation (CATOX) unit. **Figure 2** shows the system layout of Cell 1 and locations of the major design components including the air sparging wells and vapor collection trenches.

### 3rd Quarter 2013 Operational Performance

Operational performance of Cell 1 during this reporting period is summarized in **Table 1**. In summary, the CATOX unit operated for 576 hours (26.4 %) during this reporting period. The system at Cell 1 continues to operate on a pulsing schedule; where the system is in recovery or on mode for one day and then turned off to let the area rebound for two or three days. This practice was implemented during the first quarter 2013 to improve recovery of hydrocarbons from the subsurface. 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 1.21 pounds per operating hour (estimated quarterly total of 699.6 pounds). Significant improvement in hydrocarbon recovery is noted with the pulsed operational process. **Table 1** also includes a cumulative summary of operational performance since system startup on August 3, 2010. In total, Cell 1 has destroyed approximately 11,869 pounds of recovered hydrocarbons.

Soil gas samples were collected for laboratory analysis to monitor CATOX unit performance. Three (3) untreated soil gas sample were collected in Suma Canisters and submitted to Pace Analytical Services, Inc. in Minneapolis, Minnesota for analysis by US EPA Method TO-15. The average influent soil gas hydrocarbon concentration of the three samples taken throughout the second quarter was 927,027 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) as summarized in **Table 2**.

Hydrocarbon removal calculations were based on the analytical results and the average daily field-measured influent flow rates. The mass removal calculations assume that the samples collected throughout the third quarter are representative of hydrocarbon concentrations for the entire quarter. This assumption is based on the fact that the same air sparge wells (AS-1 thru AS-8) and extraction wells (V-1 thru V-6) were online when the system was operational. The pulsing operational method continues to show improved recovery concentrations in the influent soil gases and will be maintained in the future.

# Coke Oven Area Interim Remedial Measures Progress Report

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## 3rd Quarter 2013 Groundwater Monitoring Results

Groundwater samples were collected on August 19, 2013 from the following wells:

- 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. The identified trend for these monitoring wells will continue to be monitored and assessed during system operation in future months.

# Coke Oven Area Interim Remedial Measures Progress Report

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## Cell 3: AS/SVE System in the “Cove” Area

Cell 3 consists of an AS/SVE system coupled with vapor destruction via an electric CATOX unit. **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.

## 3rd Quarter 2013 Operational Performance

Operational performance of Cell 3 during this reporting period is summarized in **Table 4**. In summary, the CATOX unit operated for 576 hours (26.4%) during the third quarter of 2013. The system at Cell 3 continues to operate on a pulsing schedule; where the system is in recovery or on mode for one day and then turned off to let the area rebound for two or three days. This practice was implemented to improve recovery of hydrocarbons from the subsurface. 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 0.0035 pounds per operating hour (estimated quarterly total of 2.0 pounds). **Table 4** also includes a cumulative summary of operational performance since system startup on June 24, 2011. In total, Cell 3 has destroyed approximately 1,344.5 pounds of recovered hydrocarbons.

Soil gas samples were collected for laboratory analysis to monitor CATOX unit performance. Three (3) untreated soil gas sample was collected in Suma Canisters and submitted to Pace Analytical Services. The average influent soil gas hydrocarbon concentration of the seven samples taken throughout the third quarter was 2,883 ug/m<sup>3</sup> as summarized in **Table 5**.

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 third quarter are representative of hydrocarbon concentrations for the entire quarter of 2013. This assumption is based on the fact that the same air sparge wells (AS-2 thru AS-12) and extraction wells (V-2 thru V-4) were online when the system was operational. Operations at this Cell will continue to be evaluated in the future to improve system recovery rates.

# Coke Oven Area Interim Remedial Measures Progress Report

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## 3<sup>rd</sup> Quarter Groundwater Monitoring

Groundwater samples were collected on August 19, 2013 from the following wells (**Figure 1**):

- MW-CELL3-1 (downgradient of Cell 3),
- MW-CELL3-2 (upgradient of Cell 3),
- MW-CELL3-3 (upgradient of Cell 3), and
- CO30-PZM015 (downgradient of Cell 3).

The groundwater samples were submitted to Pace Analytical for the analyses shown in **Table 6**. These data indicate that benzene is the most prevalent VOC constituent. Since system startup on June 24, 2011, a generally decreasing VOC concentration trend is documented for some of the sampled wells. The trends for these monitoring wells will continue to be monitored and assessed during system operation in future months.

# Coke Oven Area Interim Remedial Measures Progress Report

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## Cell 4: In-Situ Anaerobic Bio-treatment Area

The in-situ anaerobic bio-treatment system at Cell 4 has been discontinued as of the end of third quarter 2013. The treatment area at Cell 4 has been incorporated into the design of Cell 5, which will be installed in the first quarter 2014.

## 3rd Quarter 2013 Groundwater Monitoring Results

Groundwater samples were collected on August 19, 2013. Groundwater samples were collected from the following wells (**Figure 7**):

- OBS-6 MW-CELL 4-3
- EXT-2 MW-CELL 4-5
- AS-2 MW-CELL 4-6
- MW-CELL 4-1
- MW-CELL 4-5
- MW-CELL 4-7

The groundwater samples were submitted to Pace Analytical for the analyses shown in **Table 7**. The data in Table 7 indicate naphthalene is the most prevalent VOC constituent. Figure 8 presents a graph of the total VOC and naphthalene concentrations in Cell 4 groundwater and indicates when each dosing event occurred. These trends for the Cell 4 monitoring wells will continue to be monitored and assessed in future months.

# Coke Oven Area Interim Remedial Measures Progress Report

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## Cell 6: LNAPL Extraction at the Former Benzol Processing Area

The Cell 6 LNAPL monitoring and recovery system was monitored weekly during the third quarter of 2013. **Table 8** summarizes; 1) LNAPL 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 LNAPL recovered since the beginning of the interim measure. **Figure 9** illustrates the well locations. An estimated 439 gallons (3,217 pounds) of LNAPL were recovered during the third quarter 2013, bringing the total recovered LNAPL to 10,124 gallons (74,175 pounds) as of September 30, 2013. The LNAPL was recovered from the following wells:

Well	LNAPL Recovery (gal/lbs)	
	3 <sup>rd</sup> Qtr 2013	Total thru 3 <sup>rd</sup> Qtr 2013
BP-MW-05	301/2,206	8,025/58,800
RW-04	0/0	1,116/8,178
BP-MW-08	138/1,011	954/6,983
BP-MW-11	0/0	8/57
RW-03	0/0	19/141
RW-01	0/0	1/10
RW-02	0/0	0.8/5.9

LNAPL thicknesses during the reporting period are summarized below (wells are not listed if LNAPL was not present):

- RW-04 (2.0 ft),
- BP-MW-05 (0.40 ft),
- BP-MW-08 (0.2 ft),
- BP-MW-11 (4.4 ft),
- BP-MW-10 (0.30 ft),
- RW-02 (0.20 ft),
- RW-03 (0.90 ft)
- RW-01 (0.30 ft), and
- BP-MW-07 (0.05 ft).

No LNAPL was observed in wells RW-05, BP-MW-06, BP-MW-09, or CO19-PZM004. For all wells in which LNAPL accumulated, **Table 9** provides well-specific details concerning the measured depths to LNAPL, the water table, and calculated LNAPL thicknesses. Additional measures are

## Coke Oven Area Interim Remedial Measures Progress Report

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planned to recover LNAPL from monitoring wells showing measurable product thicknesses in the next quarter.

# FIGURES

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**LEGEND**

- New Monitoring Well
- Existing Monitoring Well
- AS/SVE Treatment Area
- Special Study Area

**INTERIM MEASURES TREATMENT CELLS**

"Cell 1": Prototype AS/SVE System in Benzol Area

"Cell 2": AS/SVE and Dual Phase GW Treatment/Injection System in the Former Coal Storage Area

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

"Cell 4": In-Situ Anaerobic Bio-treatment System in the Coal Tar Area

"Cell 5": Groundwater Extraction/Treatment/Injection at the Turning Basin Area

"Cell 6": LNAPL Recovery at the Former Benzol Processing Area

APPROXIMATE SCALE



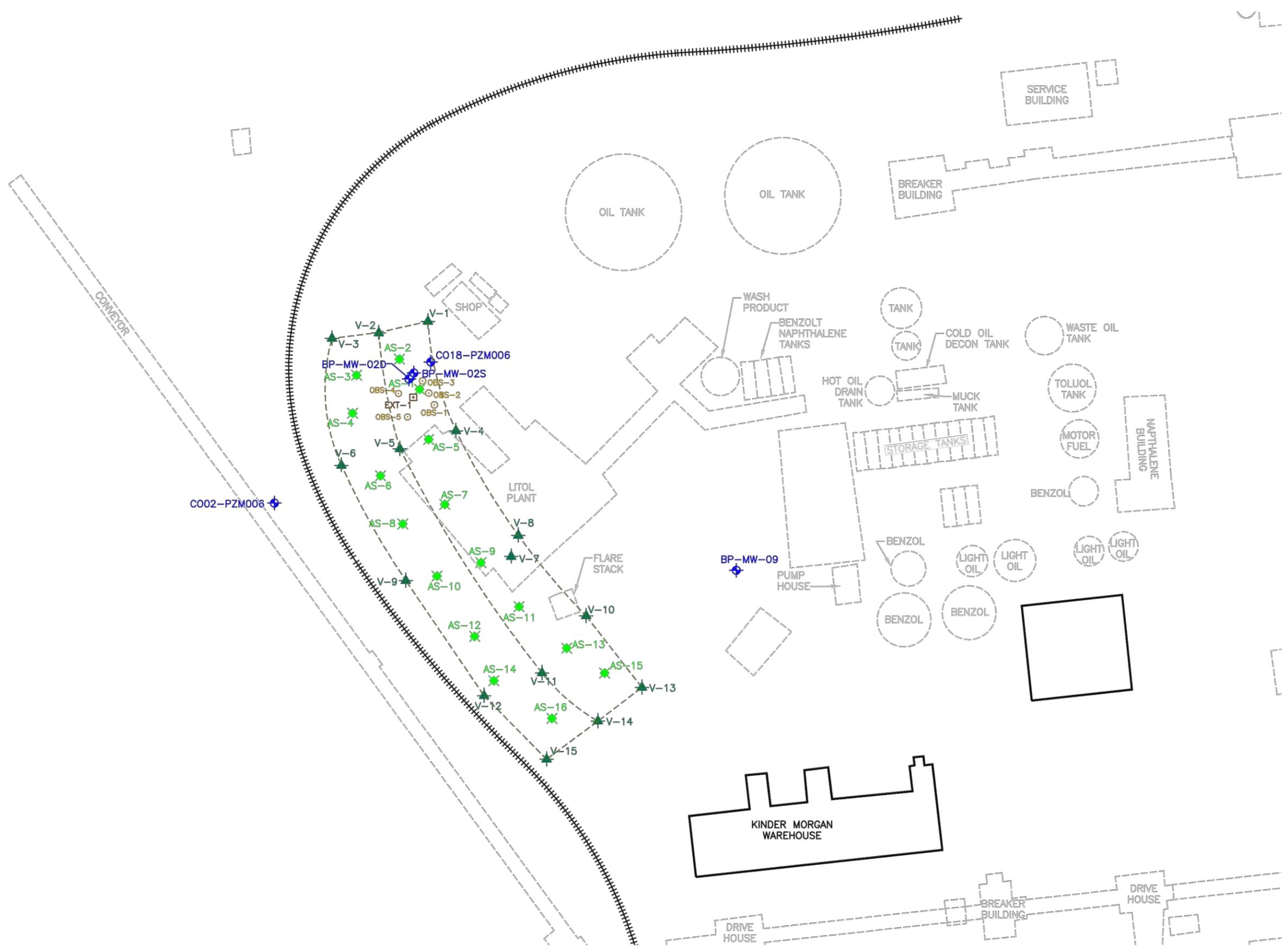
Project  
Sparrows Point, LLC  
Baltimore, Maryland

**INTERIM MEASURES TREATMENT AREAS**

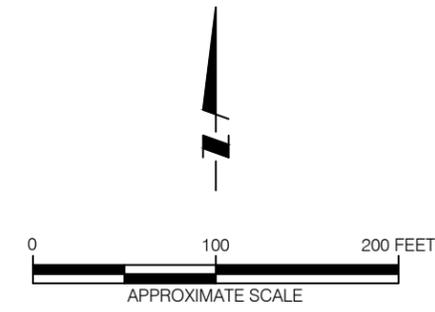
Project Number		File Number	
Date		Figure	
April 30, 2013		1	
PE/PG	PM	Drafter	

Image source: World Imagery, ESRI, GeoEye, 2009.

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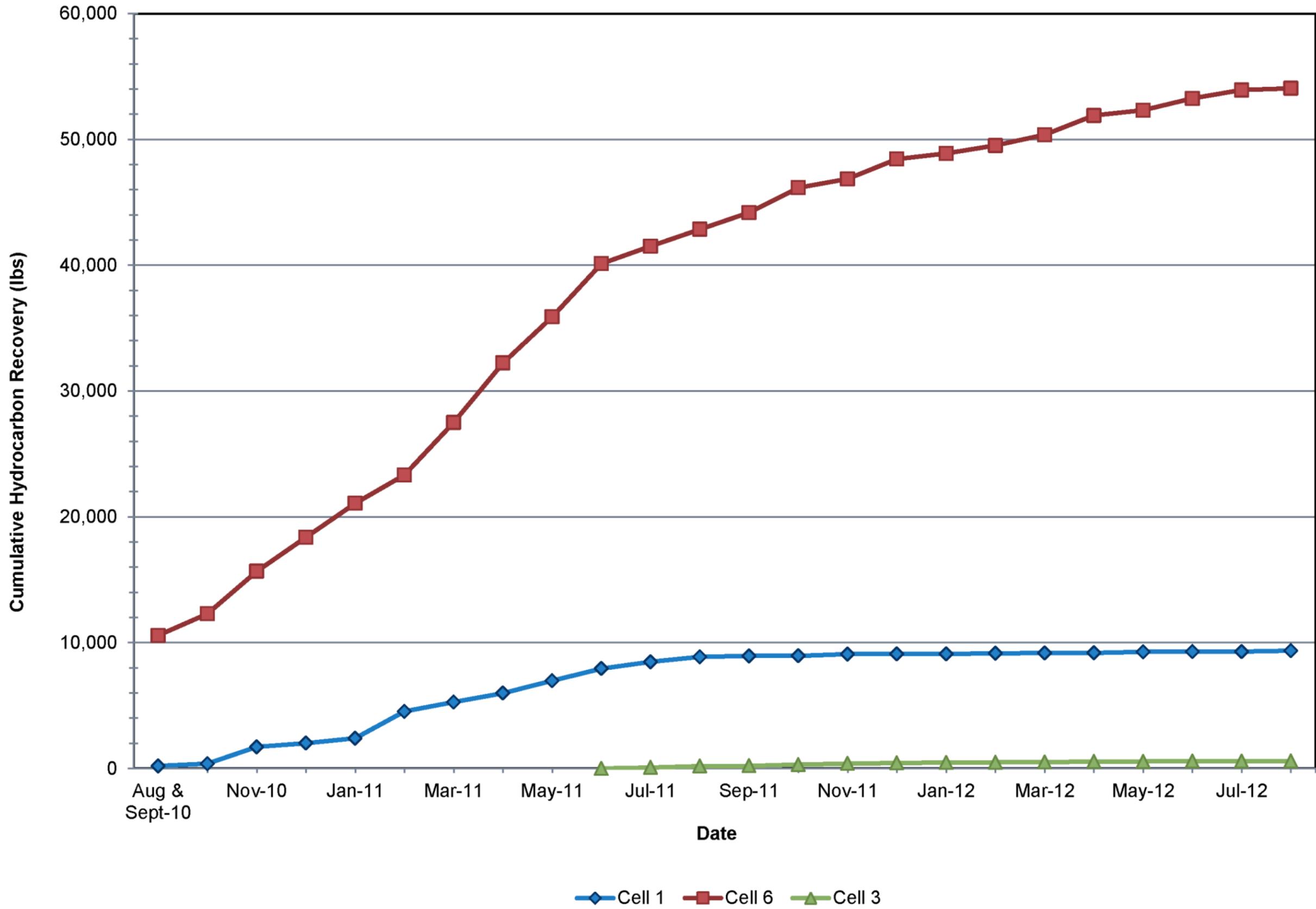
- LEGEND**
- V-1 TRENCH VAPOR EXTRACTION RISER
  - EXT-1 SVE PILOT TEST EXTRACTION WELL
  - OBS-1 SVE PILOT TEST OBSERVATION WELL
  - CO18-PZM006 EXISTING MONITORING WELL
  - AS-2 AIR SPARGE WELL
  - - - - - VAPOR COLLECTION TRENCHES
  - - - - - FORMER STRUCTURES (DEMOLISHED)



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**AS-BUILT LAYOUT PLAN**

Project Number		File Number	
Date	April 30, 2013		Figure
PE/PG	PM	Drafter	2



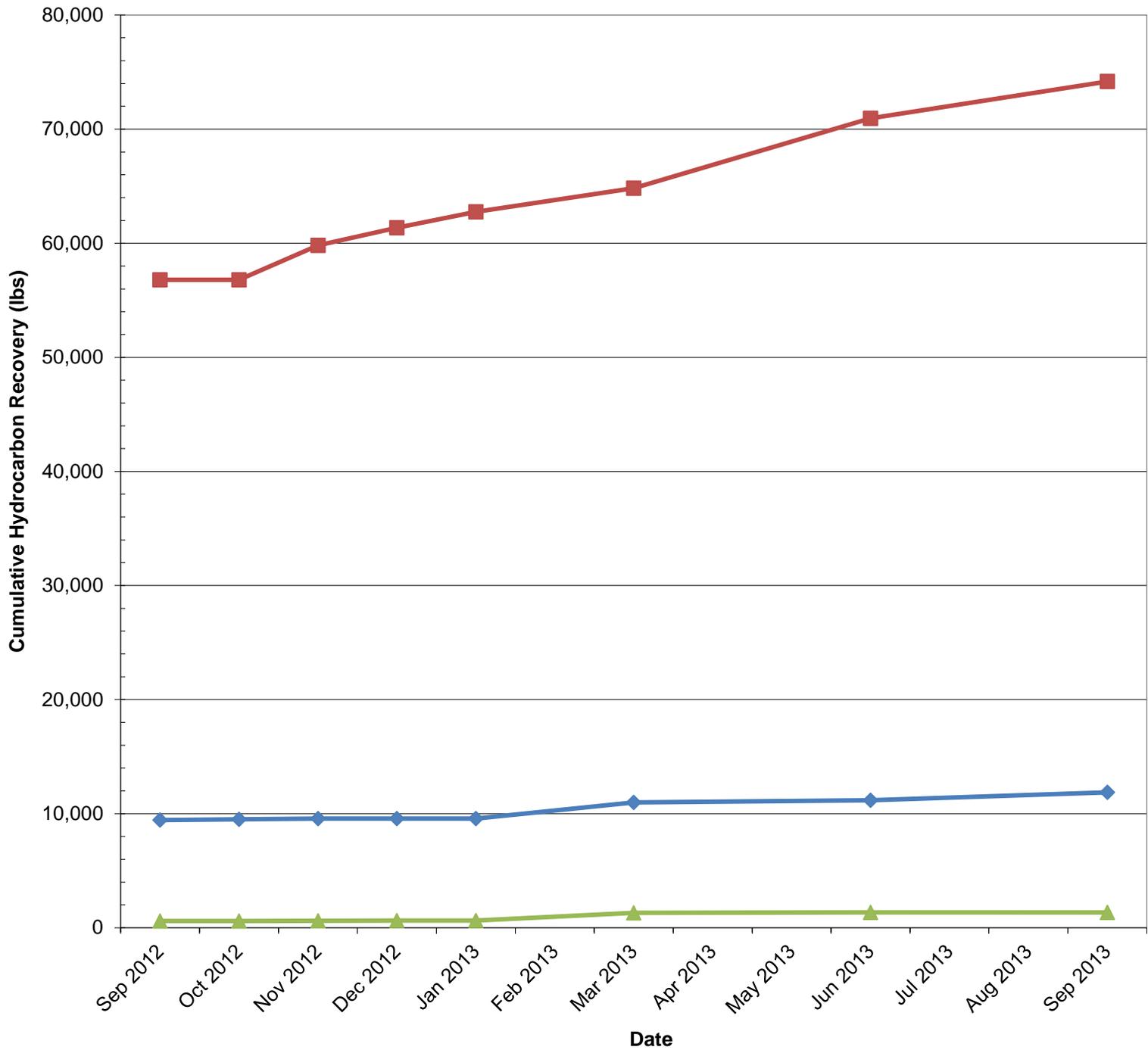
Project  
Sparrows Point, LLC  
Baltimore, Maryland

**CUMULATIVE SUMMARY OF ESTIMATED  
HYDROCARBON RECOVERY  
FORMER COKE OVEN AREA INTERIM  
REMEDIAL MEASURES  
AUGUST 2010 – AUGUST 2012**

Project Number \_\_\_\_\_ File Number \_\_\_\_\_

Date April 30, 2013 Figure

PE/RG PM DR **3**



**LEGEND**

- Cell 1
- Cell 3
- Cell 6



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Baltimore, Maryland

**CUMULATIVE SUMMARY OF ESTIMATED  
HYDROCARBON RECOVERY  
FORMER COKE OVEN AREA  
INTERIM REMEDIAL MEASURES  
SEPTEMBER 2012 AND BEYOND**

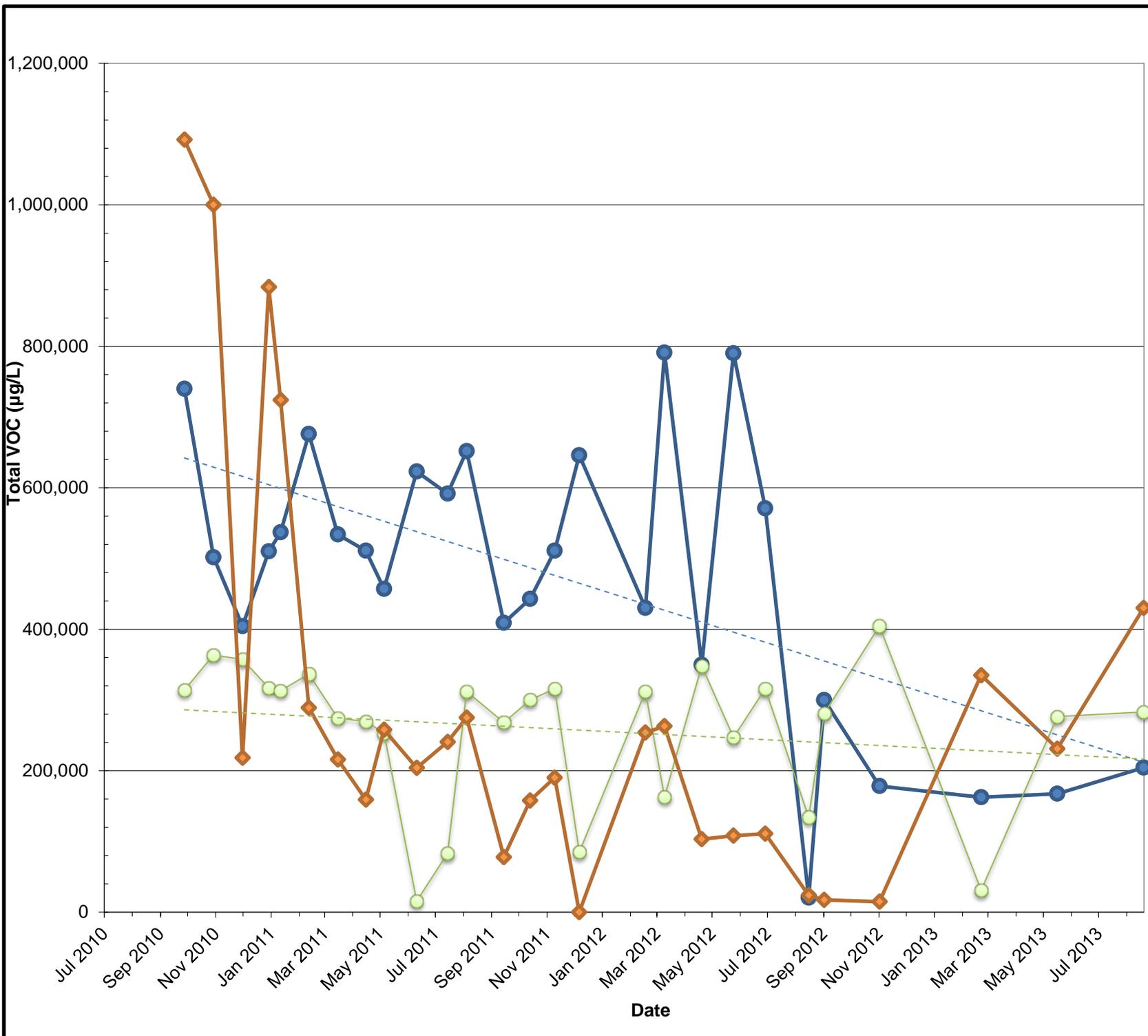
Project Number    File Number

Date  
October 31, 2013

Figure

PREPARED BY: E/REG PM DR

**3A**



**LEGEND**

- CO2-PZM006
- BP-MW-09
- CO18-PZM006



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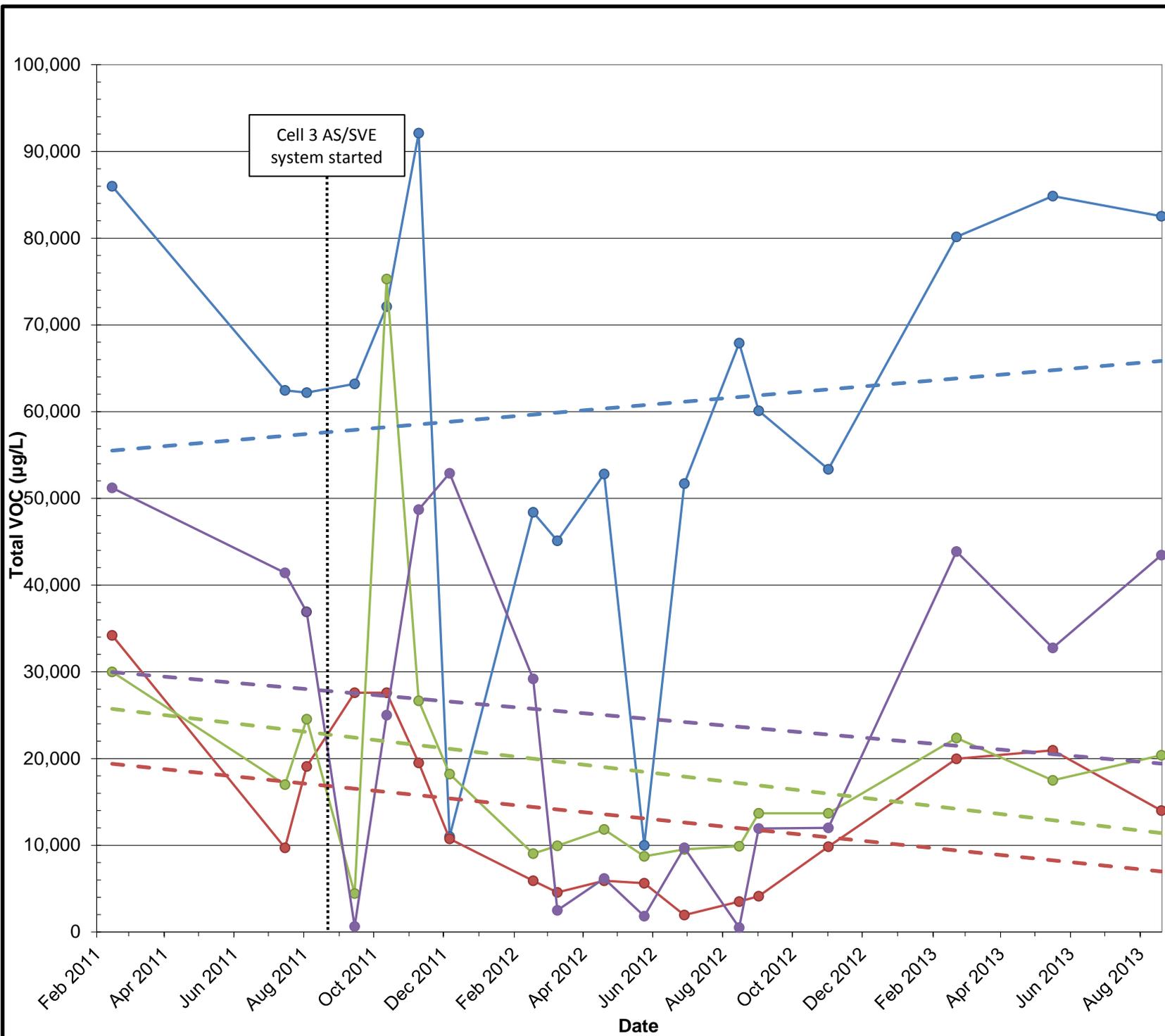
MEASURED GROUNDWATER VOC  
CONCENTRATION BY MONTH  
CELL 1: PROTOTYPE AS/SVE  
SYSTEM IN THE "COVE" AREA

Date  
October 31, 2013

Figure

E/RG PM DR

4



- LEGEND**
- CO30-PZM015
  - MW-CELL 3-1
  - MW-CELL 3-2
  - MW-CELL 3-3

Cell 3 AS/SVE system started



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Baltimore, Maryland

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

Date	Figure
October 31, 2013	5
E/RG PM DR	

# Cell 4

## In-Situ Anaerobic Bio-System



OBS-6  
 Cell 4-2  
 Cell 4-3  
 Cell 4-5  
 EXT-2  
 AS-2  
 OBS-7  
 OBS-10  
 Cell 4-1  
 Cell 4-6  
 OBS-9  
 Cell 4-4  
 Cell 4-7  
 OBS-8



Image source: World Imagery, ESRI, GeoEye, 2009.

### Legend

- Extraction Well (Existing)
- Extraction Well (New)
- Recirculation Well (Existing)
- Recirculation Well (New)
- ⊕ Monitoring Well (Existing)
- ⊕ Monitoring Well (New)
- ➔ Groundwater Flow Direction



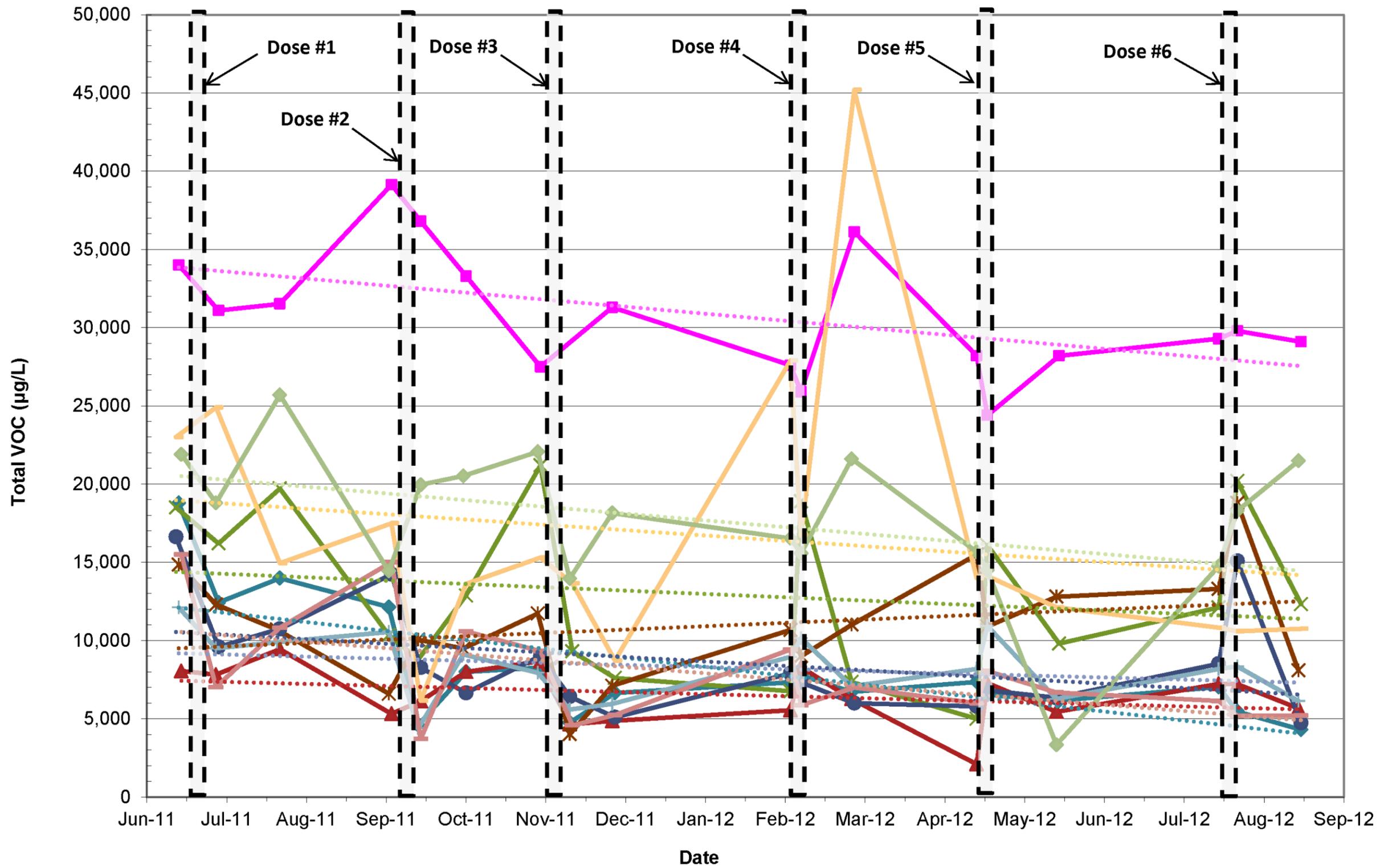
### CELL 4 WELLS

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 Baltimore, Maryland



Date	Drafter
April 30, 2013	

PE/PG	Project Number	Figure <b>7</b>
Project Manager	File	



AS-2    EXT-2    OBS-6    OBS-8    Cell 4-1    Cell 4-3    Cell 4-4    Cell 4-5    Cell 4-6    Cell 4-7



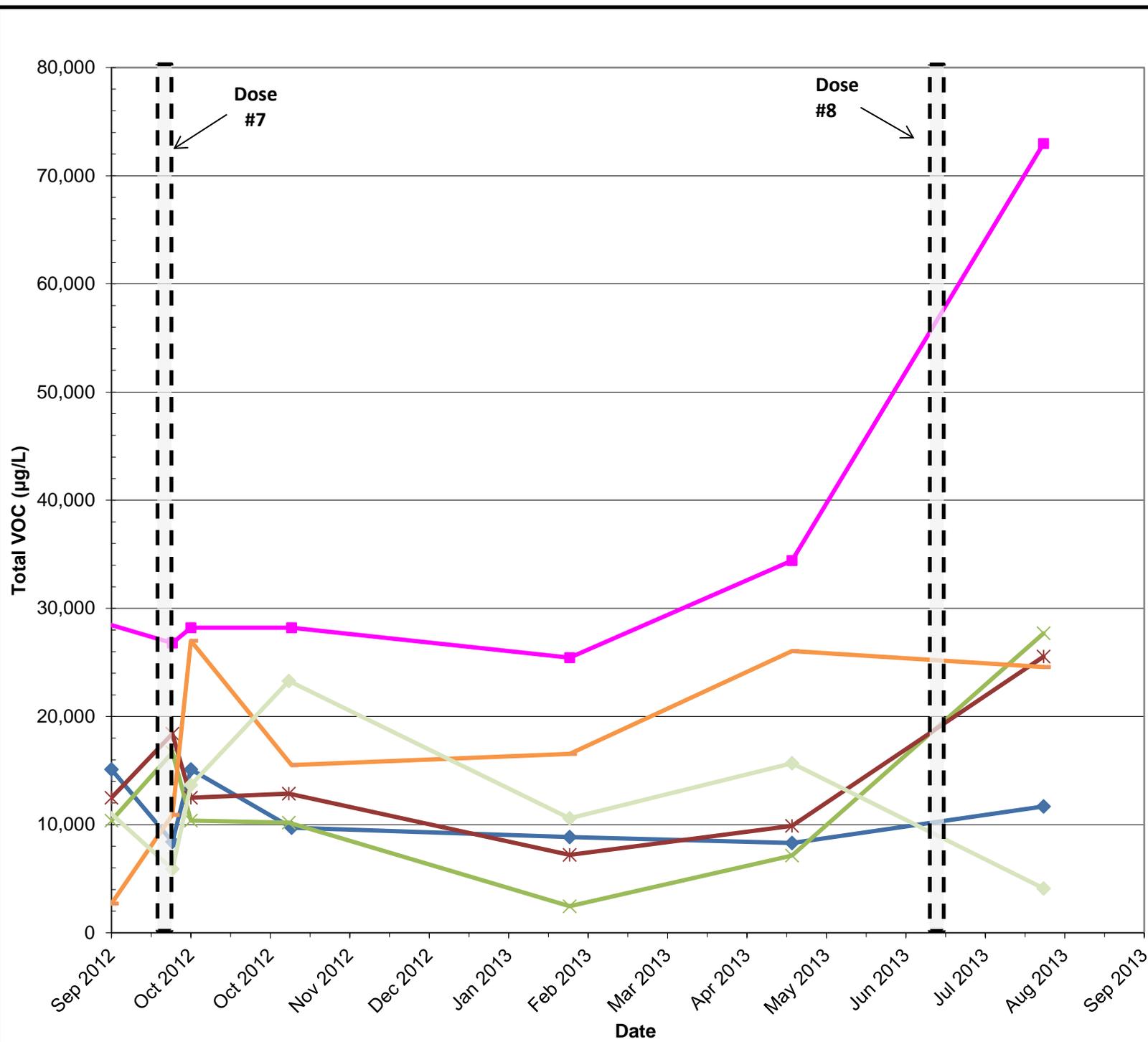
Project  
Sparrows Point, LLC  
Baltimore, Maryland

**MEASURED GROUNDWATER VOC  
CONCENTRATION BY MONTH  
CELL 4: IN-SITU ANAEROBIC BIO-  
TREATMENT AREA  
JUNE 2011 – AUGUST 2012**

Project Number    File Number

Date  
April 30, 2013    Figure

PE/RG    PM    DR    **8**



**LEGEND**

- AS-2
- EXT-2
- OBS-6
- Cell 4-1
- Cell 4-5
- Cell 4-7



project  
Sparrow Point, LLC  
Baltimore, Maryland

MEASURED GROUNDWATER VOC  
CONCENTRATION BY MONTH  
CELL 4: IN-SITU ANAEROBIC  
BIO-TREATMENT AREA  
SEPTEMBER 2012 AND BEYOND

Date	figure
October 31, 2013	8A
E/RG PM DR	

# TABLES

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**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, LLC**

**Cell 1 Third Quarter 2013 Estimated Hydrocarbon Recovery**

Parameter	Units	Quantity
Total CATOX Operating Time (July 1 - September 30, 2013)	hours	576
Overall CATOX Operational Time	%	26.4%
Estimated Total Hydrocarbons Destroyed	pounds	699.6
Estimated Hydrocarbon Removal Rate	pounds/hour	1.21

**Cell 1 Cumulative Summary of Estimated Hydrocarbon Recovery**

Parameter	Units	Quantity
Total ICE/CATOX Operating Time (August 3, 2010 - September 30, 2013)	hours	18,792
Overall CATOX Operational Time	%	71.7%
Estimated Total Hydrocarbons Destroyed	pounds	11,869
Estimated Hydrocarbon Removal Rate	pounds/hour	0.6

**Table 2**  
**Summary of Soil Gas Analytical Results (Third Quarter 2013)**  
**Cell 1: Prototype AS/SVE System in Former Benzol Processing Area**  
**Former Coke Oven Area Interim Remedial Measures**  
**Sparrows Point, LLC**

Analyte	Sample ID Date Time Dilution Factor Units	CATOX Influent Q3 2013
<b>TO-15 Volatile Organics</b>		
trans-1,3-Dichloropropene	ug/m <sup>3</sup>	ND
<b>Acetone</b>	ug/m <sup>3</sup>	<b>427</b>
<b>Ethylbenzene</b>	ug/m <sup>3</sup>	<b>390</b>
2-Hexanone	ug/m <sup>3</sup>	ND
Methylene Chloride	ug/m <sup>3</sup>	ND
<b>Benzene</b>	ug/m <sup>3</sup>	<b>906,200</b>
1,1,1,2-Tetrachloroethane	ug/m <sup>3</sup>	ND
<b>Tetrachloroethene</b>	ug/m <sup>3</sup>	<b>3,367</b>
<b>Toluene</b>	ug/m <sup>3</sup>	<b>9,710</b>
1,1,1-Trichloroethane	ug/m <sup>3</sup>	ND
1,1,2-Trichloroethane	ug/m <sup>3</sup>	ND
Trichloroethene	ug/m <sup>3</sup>	ND
Vinyl Chloride	ug/m <sup>3</sup>	ND
<b>o-Xylene</b>	ug/m <sup>3</sup>	<b>1,683</b>
<b>m-Xylene &amp; p-Xylene</b>	ug/m <sup>3</sup>	<b>3,947</b>
2-Butanone (MEK)	ug/m <sup>3</sup>	ND
4-Methyl-2-pentanone (MIBK)	ug/m <sup>3</sup>	ND
Bromoform	ug/m <sup>3</sup>	ND
<b>Carbon Disulfide</b>	ug/m <sup>3</sup>	<b>770</b>
Carbon tetrachloride	ug/m <sup>3</sup>	ND
Chlorobenzene	ug/m <sup>3</sup>	ND
Chloroethane	ug/m <sup>3</sup>	ND
Chloroform	ug/m <sup>3</sup>	ND
<b>1,1-Dichloroethane</b>	ug/m <sup>3</sup>	<b>533</b>
1,2-Dichloroethane	ug/m <sup>3</sup>	ND
1,1-Dichloroethene	ug/m <sup>3</sup>	ND
trans-1,2-Dichloroethene	ug/m <sup>3</sup>	ND
1,2-Dichloropropane	ug/m <sup>3</sup>	ND
cis-1,3-Dichloropropene	ug/m <sup>3</sup>	ND
<b>Total Volatile Organics</b>	ug/m <sup>3</sup>	<b>927,027</b>

**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<sup>3</sup> = micro grams per cubic meter

ND = Analyte not detected above laboratory reporting limit

**Table 3**  
**Summary of Groundwater Analytical Results (Third Quarter 2013)**  
**Cell 1: Prototype AS/SVE System in Former Benzol Processing Area**  
**Former Coke Oven Area Interim Remedial Measures**  
**Sparrows Point, LLC**

Analyte	Sample ID	CO02-PZM006	CO18-PZM006	BP-MW-09
	Date	8/19/2013	8/19/2013	8/19/2013
	Units			
<b>Volatile Organics</b>				
Vinyl Chloride	µg/L	ND	ND	ND
Chloroethane	µg/L	ND	ND	ND
1,1-Dichloroethene	µg/L	ND	ND	ND
<b>Acetone</b>	µg/L	ND	<b>37.9</b>	ND
Carbon Disulfide	µg/L	ND	ND	<b>16.8</b>
<b>Methylene Chloride</b>	µg/L	<b>8.6</b>	<b>5.4</b>	ND
trans-1,2-Dichloroethene	µg/L	ND	ND	ND
1,1-Dichloroethane	µg/L	ND	ND	ND
2-Butanone (MEK)	µg/L	ND	ND	ND
Chloroform	µg/L	ND	ND	ND
1,1,1-Trichloroethane	µg/L	ND	ND	ND
Carbon Tetrachloride	µg/L	ND	ND	ND
<b>Benzene</b>	µg/L	<b>200,000</b>	<b>410,000</b>	<b>185,000</b>
1,2-Dichloroethane	µg/L	ND	ND	ND
Trichloroethene	µg/L	ND	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND
Methyl Isobutyl Ketone (MIBK)	µg/L	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND
<b>Toluene</b>	µg/L	<b>1,960</b>	<b>17,300</b>	<b>56,100</b>
trans-1,3-Dichloropropene	µg/L	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND
2-Hexanone (MBK)	µg/L	ND	ND	ND
Tetrachloroethene	µg/L	ND	ND	ND
<b>Chlorobenzene</b>	µg/L	ND	ND	<b>15.2</b>
1,1,1,2-Tetrachloroethane	µg/L	ND	ND	ND
<b>Ethylbenzene</b>	µg/L	<b>445</b>	<b>86.2</b>	<b>2,820</b>
<b>Styrene</b>	µg/L	<b>37.4</b>	ND	<b>1,650</b>
Bromoform	µg/L	ND	ND	ND
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND
1,3,5-Trimethylbenzene	µg/L	ND	ND	ND
1,2,4-Trimethylbenzene	µg/L	ND	ND	ND
<b>Total Xylenes</b>	µg/L	<b>1,940</b>	<b>2,690</b>	<b>37,300</b>
<b>Total Volatile Organics</b>	µg/L	<b>204,391</b>	<b>430,120</b>	<b>282,902</b>

**Notes:**

Bold = Analyte Detected

ND = Analyte not detected above laboratory reporting limit

µg/L = Micrograms per liter

**Table 4**  
**Summary of Operation Conditions**  
**Cell 3: AS/SVE System in the "Cove" Area**  
**Former Coke Oven Area Interim Remedial Measures**  
**Sparrows Point, LLC**

**Cell 3 Third Quarter 2013 Estimated Hydrocarbon Recovery**

Parameter	Units	Quantity
Total CATOX Operating Time (July 1 - September 30, 2013)	hours	576
Overall CATOX Operational Time	%	26.4%
Estimated Total Hydrocarbons Destroyed	pounds	2.0
Estimated Hydrocarbon Removal Rate	pounds/hour	0.0035

**Cell 3 Cumulative Summary of Estimated Hydrocarbon Recovery**

Parameter	Units	Quantity
Total ICE/CATOX Operating Time (August 3, 2010 - September 30, 2013)	hours	13,511
Overall CATOX Operational Time	%	71.2%
Estimated Total Hydrocarbons Destroyed	pounds	1,344.5
Estimated Hydrocarbon Removal Rate	pounds/hour	0.10

**Table 5**  
**Summary of Soil Gas Analytical Results (Third Quarter 2013)**  
**Cell 3: AS/SVE System in the "Cove" Area**  
**Former Coke Oven Area Interim Remedial Measures**  
**Sparrows Point, LLC**

Analyte	Sample ID Date Time Dilution Factor Units	CATOX Influent Q3 2013
<b>TO-15 Volatile Organics</b>		
trans-1,3-Dichloropropene	ug/m <sup>3</sup>	ND
<b>Acetone</b>	ug/m <sup>3</sup>	<b>141</b>
<b>Ethylbenzene</b>	ug/m <sup>3</sup>	<b>2</b>
2-Hexanone	ug/m <sup>3</sup>	ND
<b>Methylene Chloride</b>	ug/m <sup>3</sup>	<b>426</b>
<b>Benzene</b>	ug/m <sup>3</sup>	<b>1,417</b>
1,1,1,2-Tetrachloroethane	ug/m <sup>3</sup>	ND
<b>Tetrachloroethene</b>	ug/m <sup>3</sup>	<b>1</b>
<b>Toluene</b>	ug/m <sup>3</sup>	<b>281</b>
1,1,1-Trichloroethane	ug/m <sup>3</sup>	ND
1,1,2-Trichloroethane	ug/m <sup>3</sup>	ND
Trichloroethene	ug/m <sup>3</sup>	ND
Vinyl Chloride	ug/m <sup>3</sup>	ND
<b>o-Xylene</b>	ug/m <sup>3</sup>	<b>2</b>
<b>m-Xylene &amp; p-Xylene</b>	ug/m <sup>3</sup>	<b>8</b>
2-Butanone (MEK)	ug/m <sup>3</sup>	ND
4-Methyl-2-pentanone (MIBK)	ug/m <sup>3</sup>	ND
Bromoform	ug/m <sup>3</sup>	ND
<b>Carbon Disulfide</b>	ug/m <sup>3</sup>	<b>450</b>
Carbon tetrachloride	ug/m <sup>3</sup>	ND
Chlorobenzene	ug/m <sup>3</sup>	ND
Chloroethane	ug/m <sup>3</sup>	ND
Chloroform	ug/m <sup>3</sup>	ND
<b>1,1-Dichloroethane</b>	ug/m <sup>3</sup>	<b>155</b>
1,2-Dichloroethane	ug/m <sup>3</sup>	ND
1,1-Dichloroethene	ug/m <sup>3</sup>	ND
trans-1,2-Dichloroethene	ug/m <sup>3</sup>	ND
1,2-Dichloropropane	ug/m <sup>3</sup>	ND
cis-1,3-Dichloropropene	ug/m <sup>3</sup>	ND
<b>Total Volatile Organics</b>	ug/m <sup>3</sup>	<b>2,883</b>

**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<sup>3</sup> = micro grams per cubic meter

ND = Analyte not detected above laboratory reporting limit

**Table 6**  
**Summary of Groundwater Analytical Results (Third Quarter 2013)**  
**Cell 3: Prototype AS/SVE System in the "Cove" Area**  
**Former Coke Oven Area Interim Remedial Measures**  
**Sparrows Point, LLC**

Sample ID	Date	CO30-PZM015	MW-CELL 3-1	MW-CELL 3-2	MW-CELL 3-3
		8/19/2013	8/19/2013	8/19/2013	8/19/2013
Analyte	Units				
<b>Volatile Organics</b>					
Vinyl Chloride	µg/L	ND	ND	ND	ND
Chloroethane	µg/L	ND	ND	ND	ND
1,1-Dichloroethene	µg/L	ND	ND	ND	ND
<b>Acetone</b>	µg/L	ND	ND	ND	<b>29.7</b>
Carbon Disulfide	µg/L	ND	ND	ND	ND
<b>Methylene Chloride</b>	µg/L	<b>8.3</b>	ND	<b>7.6</b>	<b>7.2</b>
trans-1,2-Dichloroethene	µg/L	ND	ND	ND	ND
1,1-Dichloroethane	µg/L	ND	ND	ND	ND
2-Butanone (MEK)	µg/L	ND	ND	ND	ND
Chloroform	µg/L	ND	ND	ND	ND
1,1,1-Trichloroethane	µg/L	ND	ND	ND	ND
Carbon Tetrachloride	µg/L	ND	ND	ND	ND
<b>Benzene</b>	µg/L	<b>76,300</b>	<b>13,100</b>	<b>19,200</b>	<b>39,300</b>
1,2-Dichloroethane	µg/L	ND	ND	ND	ND
Trichloroethene	µg/L	ND	ND	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND	ND
Methyl Isobutyl Ketone (MIBK)	µg/L	ND	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND	ND
<b>Toluene</b>	µg/L	<b>4,680</b>	<b>702</b>	<b>915</b>	<b>3,000</b>
trans-1,3-Dichloropropene	µg/L	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	µg/L	ND	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND	ND
2-Hexanone (MBK)	µg/L	ND	ND	ND	ND
Tetrachloroethene	µg/L	ND	ND	ND	ND
Chlorobenzene	µg/L	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	µg/L	ND	ND	ND	ND
<b>Ethylbenzene</b>	µg/L	<b>95.5</b>	<b>15.5</b>	<b>20.9</b>	<b>59.4</b>
<b>Styrene</b>	µg/L	<b>23.8</b>	<b>5.5</b>	<b>8.7</b>	<b>10.9</b>
Bromoform	µg/L	ND	ND	ND	ND
1,1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND	ND
1,3,5-Trimethylbenzene	µg/L	ND	ND	ND	ND
1,2,4-Trimethylbenzene	µg/L	ND	ND	ND	ND
<b>Total Xylenes</b>	µg/L	<b>1,430</b>	<b>185</b>	<b>219</b>	<b>1,060</b>
<b>Total Volatile Organics</b>	µg/L	<b>82,538</b>	<b>14,008</b>	<b>20,371</b>	<b>43,467</b>

**Notes:**

Bold = Analyte Detected

ND = Analyte not detected above laboratory reporting limit

µg/L = Micrograms per liter

**Table 7**  
**Summary of Groundwater Analytical Results (Third Quarter 2013)**  
**Cell 4: In-Situ Anaerobic Bio-Treatment Area**  
**Former Coke Oven Area Interim Remedial Measures**  
**Sparrows Point, LLC**

Sample ID	4-1	4-5	4-7	AS-2	EXT-2	OBS-6
Date	8/19/2013	8/19/2013	8/19/2013	8/19/2013	8/19/2013	8/19/2013
Time	12:05	14:03	11:15	12:10	13:40	13:08
Analyte	Units					
<b>Volatile Organics</b>						
Vinyl Chloride	µg/L	ND	ND	ND	ND	ND
Chloroethane	µg/L	ND	ND	ND	ND	ND
1,1-Dichloroethene	µg/L	ND	ND	ND	ND	ND
Acetone	µg/L	<b>50.8</b>	ND	ND	ND	ND
Carbon Disulfide	µg/L	ND	ND	ND	ND	ND
Methylene Chloride	µg/L	<b>10.5</b>	<b>8.5</b>	<b>7</b>	<b>7.2</b>	<b>9.1</b>
trans-1,2-Dichloroethene	µg/L	ND	ND	ND	ND	ND
1,1-Dichloroethane	µg/L	ND	ND	ND	ND	ND
2-Butanone (MEK)	µg/L	ND	ND	ND	ND	ND
Chloroform	µg/L	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	µg/L	ND	ND	ND	ND	ND
Carbon Tetrachloride	µg/L	ND	ND	ND	ND	ND
Benzene	µg/L	<b>1,630</b>	<b>1,340</b>	<b>803</b>	<b>5,630</b>	<b>681</b>
1,2-Dichloroethane	µg/L	ND	ND	ND	ND	ND
Trichloroethene	µg/L	ND	ND	ND	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND	ND	ND
Methyl Isobutyl Ketone (MIBK)	µg/L	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND
Toluene	µg/L	<b>1,010</b>	<b>932</b>	<b>513</b>	<b>4,980</b>	<b>405</b>
trans-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND	ND	ND
2-Hexanone (MBK)	µg/L	ND	ND	ND	ND	ND
Tetrachloroethene	µg/L	ND	ND	ND	ND	ND
Chlorobenzene	µg/L	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND
Ethylbenzene	µg/L	<b>31.9</b>	<b>35.9</b>	<b>33.3</b>	<b>72.4</b>	<b>25.1</b>
Styrene	µg/L	<b>255</b>	<b>205</b>	<b>192</b>	<b>920</b>	<b>23.9</b>
Bromoform	µg/L	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	µg/L	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	µg/L	ND	ND	ND	ND	ND
Xylenes, Total	µg/L	<b>754</b>	<b>751</b>	<b>832</b>	<b>2,080</b>	<b>505</b>
<b>Semi-Volatiles</b>						
Naphthalene	µg/L	<b>21,800</b>	<b>21,300</b>	<b>1,730</b>	<b>59,300</b>	<b>10,800</b>
<b>Total Volatile Organics</b>	<b>µg/L</b>	<b>25,542</b>	<b>24,572</b>	<b>4,110</b>	<b>72,990</b>	<b>11,676</b>

**Notes:**

Bold = Analyte Detected

ND = Analyte not detected above laboratory reporting limit

µg/L = Micrograms per liter



**Table 8**  
**LNAPL Occurrence and Recovery**  
**Cell 6: LNAPL Recovery System in Former Benzol Processing Area**  
**Former Coke Oven Area Interim Remedial Measures**  
**Sparrows Point, LLC**

Well	LNAPL Occurrence During Third Quarter 2013 (ft)	Total LNAPL Recovery Period		Cumulative Total LNAPL Recovered		Estimate LNAPL Recovered During Third Quarter 2013	
		Begin	End	(gal)	(lbs) (a)	(gal)	(lbs) (a)
RW-04	2	23-Jul-10	On-going (b)	1,116	8,178	0	0
BP-MW-05	0.4	28-Jan-10	On-going (b)	8,025	58,800	301	2,206
BP-MW-08	0.2	8-Sep-10	On-going (b)	954	6,983	138	1,011
BP-MW-11	4.4	23-Jul-10	9/8/2010	7.8	57	0	0
RW-02	0.2	28-Jan-11	On-going (c)	0.8	5.9	0	0
RW-03	0.9	24-Nov-10	On-going (c)	19.3	141	0	0
RW-01	0.3	28-Oct-11	On-going (c)	1.3	10	0	0
BP-MW-10	0.3	na	na	0	0	0	0
BP-MW-07	4.4	na	na	0	0	0	0
BP-MW-06	none	na	na	0	0	0	0
RW-05	none	na	na	0	0	0	0
BP-MW-09	none	na	na	0	0	0	0
CO19-PZM004	none	na	na	0	0	0	0
<b>Total Recovery:</b>				<b>10,124</b>	<b>74,175</b>	<b>439</b>	<b>3,217</b>

**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) 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.

**Table 9**  
**Depths (feet) to Water and LNAPL**  
**Cell 6: LNAPL Recovery System in Former Benzol Processing Area**  
**Former Coke Oven Area Interim Remedial Measures**  
**Sparrows Point, LLC**

Date	RW-01			RW-02			RW-03		
	Depth to LNAPL	Depth to Water	LNAPL Thickness	Depth to LNAPL	Depth to Water	LNAPL Thickness	Depth to LNAPL	Depth to Water	LNAPL Thickness
9/30/2013	12.3	12.6	0.3	11.6	11.8	0.2	10.3	11.2	0.9
Date	RW-04			BP-MW-05			BP-MW-07		
	Depth to LNAPL	Depth to Water	LNAPL Thickness	Depth to LNAPL	Depth to Water	LNAPL Thickness	Depth to LNAPL	Depth to Water	LNAPL Thickness
9/30/2013	10.5	12.5	2	12.2	12.6	0.4	11.95	12	0.05
Date	BP-MW-08			BP-MW-10			BP-MW-11		
	Depth to LNAPL	Depth to Water	LNAPL Thickness	Depth to LNAPL	Depth to Water	LNAPL Thickness	Depth to LNAPL	Depth to Water	LNAPL Thickness
9/30/2013	13.2	13.4	0.2	10.2	10.5	0.3	13.5	17.9	4.4

All measurement are presented in feet