UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION III

FINAL DECISION

F. BOWIE SMITH & SONS, INC.

BALTIMORE, MARYLAND

PURPOSE

The United States Environmental Protection Agency (EPA) is issuing this Final Decision and Response to Comments (FDRTC or Final Decision) selecting the Final Remedy for the F. Bowie Smith & Sons, Inc. facility located in Baltimore, MD (hereinafter referred to as the Facility). The Final Decision is issued pursuant to the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA) of 1976, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. Sections 6901, et seq. EPA issued a Statement of Basis (SB) in which it described the information gathered during environmental investigations at the Facility and proposed a Final Remedy for the Facility. The SB is hereby incorporated into this Final Decision by reference and made a part hereof as Attachment A.

This FDRTC selects the remedy that EPA proposed in the SB. Consistent with the public participation provisions under RCRA, EPA solicited public comment on its proposed Final Remedy. On July 7, 2016, notice of the SB was published on the EPA website: [https://www.epa.gov/aboutepa/public-notice-f-bowie-sons-inc-baltimore-md-mdd003100336] and in a local newspaper. The comment period ended on August 6, 2016.

EPA did not receive any comments on the SB; thus, the remedy proposed in the SB is the Final Remedy selected by EPA for the Facility.

FINAL REMEDY

EPA's Final Remedy for the Facility includes compliance with and maintenance of land and groundwater use restrictions, as described in the SB, to be implemented through an enforceable mechanism, such as a permit, order or environmental covenant.

DECLARATION

Based on the Administrative Record compiled for the corrective action at the F. Bowie Smith & Sons, Inc. facility, I have determined that the remedy selected in this Final Decision and Response to Comments, which incorporates the July 7, 2016 Statement of Basis, is protective of human health and the environment.

Date: 8.9.16

Armstead

John A. Armstead, Director
Land and Chemicals Division
U.S. Environmental Protection Agency, Region III

Attachment A: Statement of Basis (July 7, 2016)

Attachment A

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION III

STATEMENT OF BASIS

F. BOWIE SMITH & SONS, INC.
4500 EAST LOMBARD STREET

BALTIMORE, MARYLAND

EPA ID NO. MDD003100336

Prepared by
Office of Remediation
Land and Chemicals Division
July 2016

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List of Acronyms

AR	Administrative Record
AST	Above-Ground Storage Tank
COC	Contaminants of Concern
COMAR	Code of Maryland Regulations
EPA	Environmental Protection Agency
FDRTC	Final Decision Response to Comments
GPRA	Government Performance and Results Act
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
PAH	Polycyclic Aromatic Hydrocarbons
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RSL	Regional Screening Level
SB	Statement of Basis
VOC	Volatile Organic Compound

Section 1: Introduction

The United States Environmental Protection Agency (EPA) has prepared this Statement of Basis (SB) to solicit public comment on its proposed remedy for the F. Bowie Smith & Sons, Inc. (F. Bowie Smith) wood preserver facility, located in Baltimore, Maryland (hereinafter referred to as the Facility). EPA's proposed remedy for the Facility consists of the following components: 1) natural attenuation with continued monitoring until risk-based Remedial Action Objectives (RAOs) or background levels are met; 2) compliance with and maintenance of groundwater and land use restrictions to be implemented through institutional controls and 3) vapor intrusion control systems. This SB highlights key information relied upon by EPA in proposing its remedy for the Facility.

The Facility is subject to EPA's Corrective Action program under the Solid Waste Disposal Act, as amended, commonly referred to as the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 6901 et seq. The Corrective Action program requires that facilities subject to certain provisions of RCRA investigate and address releases of hazardous waste and hazardous constituents, usually in the form of soil or groundwater contamination, that have occurred at or from their property. Maryland is not authorized for the Corrective Action Program under Section 3006 of RCRA. Therefore, EPA retains primary authority in the State of Maryland for the Corrective Action Program.

EPA is providing a thirty (30) day public comment period on this SB. EPA may modify its proposed remedy based on comments received during this period. EPA will announce its selection of a final remedy for the Facility in a Final Decision and Response to Comments (Final Decision) after the public comment period has ended.

Information on the Corrective Action program as well as a fact sheet for the Facility can be found by navigating http://www.epa.gov/reg3wcmd/correctiveaction.htm.
The Administrative Record (AR) for the Facility contains all documents, including data and quality assurance information, on which EPA's proposed remedy is based. See Section 8, Public Participation, below, for information on how you may review the AR.

Section 2: Facility Background

2.1 Introduction

The Facility is an approximate 10 acre parcel of land located in a heavily industrialized mixed use area in the City of Baltimore, Maryland. The Facility currently is owned by Birchwood Realty Company, Inc. (Birchwood) and is currently an undeveloped parcel, containing foundations from some of the former F. Bowie Smith & Sons, Inc. operational facilities and used for parking.

The Facility is located approximately 0.2 miles west of the Lombard Street interchange with Interstate 895 (Harbor Tunnel Throughway). The Facility is bounded on the east, north and west by CSX railroad track rights of way and on the south by Lombard Street. Industrial properties are located north, northwest, east and south of the Facility. The nearest residences are row homes located on North Kressen Street approximately 500 feet west of the Facility.

The Facility property previously was used as a stove-, bathtub- and sink-foundry from the late 1800s to 1945. The foundry was converted into an aluminum extrusion plant during World War II. This plant never went into operation, however, and was closed when the war ended. In 1952, F. Bowie Smith purchased the Facility property and redeveloped it into a wood treatment facility. F. Bowie Smith operated on the Facility until the late 1980s.

F. Bowie Smith's wood preserving process at this Facility involved using pressure vessels to saturate wood with the preserving chemicals. Pentachlorophenol was used as the preserving chemical until 1961, fluorochrome arsenate phosphate was used until 1976, creosote was used until 1983 and copper chromate arsenate was used from 1976 until 1988.

Drip areas were located in the north-central portion of the Facility to allow excess preservatives to drain from the wood. Two concrete collection tanks were used to capture solution not absorbed during the treatment process. In 1983, a closed treatment system was installed, allowing reuse of excess solution. Several storage tanks for holding the treatment chemicals and diesel fuel, used as a solvent during the creosote treatment process, were also located on the Facility, including along the northwest Facility property boundary.

A hazardous waste permit for hazardous waste storage was issued by the Maryland Department of the Environment (MDE) to the Facility in 1982. On February 17, 1989, Birchwood bought the Facility property. On August 16, 1989, Birchwood and MDE entered into a Consent Order (CO-90-050) under which Birchwood was required to investigate and remediate the Facility. In April 2005, the Facility was entered into the EPA Facility Lead Program for corrective action.

Section 3: Summary of Environmental Investigations

3.1 Environmental Investigations

For all environmental investigations conducted at the Facility, groundwater concentrations were screened against Federal Maximum Contaminant Levels (MCLs) promulgated pursuant to the Safe Drinking Water Act, 42 U.S.C. §§ 300f et seq., and codified at 40 CFR Part 141, or, if there was no MCL, EPA Region III Screening Levels (RSLs) for tap water for chemicals. Soil concentrations were screened against EPA RSLs for residential soil and industrial soil. EPA also has RSLs to protect groundwater from contaminants leaching from the soil. Soil concentrations were also screened against these RSLs.

In 1986, F. Bowie Smith hired Geraghty & Miller, Inc. to evaluate the soil and groundwater conditions at the Facility. Contamination from wood treating chemicals and fuel oil were detected in the soil and groundwater at the Facility. Four contaminants were identified as exceeding the various screening levels at that time: arsenic, chromium, naphthalene and pentachlorophenol (PCP).

Four groundwater monitoring wells were installed during the initial Facility investigation in 1986. These wells are located on the Facility to the north, east, west and south of the contaminated areas and are identified as the North, East, West and South wells, respectively. Groundwater flow was determined to be towards the northwest. The South well became the upgradient well, or background well, for the analysis. The East and West wells have groundwater sampling results showing groundwater contaminated by arsenic, chromium, naphthalene and PCP.

An extensive soil investigation was performed at the Facility in August 1989. Samples were then collected from the surface level to a depth of three feet below ground level. The samples were analyzed for semi-volatile organic compounds (S-VOCs) and metals. The S-VOC analysis results showed some contamination at various locations on the Facility. The highest measured concentrations exceeded the MDE Non-residential cleanup standards for benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene.

Based upon these results, MDE requested that Birchwood perform additional soil sampling. Samples were collected at seven additional grid locations specified by MDE. These samples were collected on July 3, 1990. The results from these analyses are provided in **Table 1.**

Groundwater Monitoring Data

Twenty-one groundwater sampling events were performed at the Facility from August 13, 1986 through February 14, 2003. The data consisted of depth to groundwater measurements and concentrations of arsenic, chromium, naphthalene and PCP from the four monitoring wells.

The data review showed the depth to groundwater was between 20 and 25 feet below ground surface (BGS) at the North, East and West wells. The depth to groundwater was between 10 and 15 feet BGS in the South well. The data showed fluctuations in groundwater flow direction and gradient, although the predominant gradient appeared to be to the northwest.

Since 2006, four on-Facility groundwater sampling events and one off-Facility groundwater sampling event were performed. The on-Facility sampling was performed in July 2006, November 2007, May 2010 and December 2010. The off-Facility sampling was performed in May 2010. The November 2007 sampling event included installation and sampling of five temporary monitoring wells along the northwest Facility property boundary to better define the groundwater gradient and delineate the conditions along the downgradient property line. As described below, PCP and naphthalene were detected in one sample from these temporary wells, at boring GP-103. Based upon the results of these samples, a fifth groundwater monitoring well (MW-105) was installed at that location, along the northwest Facility property line in November 2008. Three above ground chemical storage tanks were operated by F. Bowie Smith at this location. A summary of all the groundwater sample analysis results for the concentrations of arsenic, chromium, naphthalene and PCP is contained in **Table 2.**

S-VOC and Polycyclic Aromatic Hydrocarbons (*PAH) Analyses*

In addition to analyses for the concentrations of arsenic, chromium, naphthalene and PCP, samples collected during the July 2006 groundwater sampling event were analyzed for selected PAH compounds, specifically benzo(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene. The samples collected in the November 2007 sampling event were analyzed for S-VOCs, which included the PAH compounds. The results of these analyses are summarized in **Table 3** for the July 2006 samples, **Table 4** for the November 2007 samples and **Table 5** for the December 2010 samples.

Additional Metals Analyses

Following discussions between EPA and the Facility, additional investigations and sampling have been performed at the Facility. In the November 2007 sampling events, the samples were analyzed for all of the Target Analyte List (TAL) metals (22 different metals). In the December 2010 sampling event, the samples were analyzed for RCRA metals (eight toxic metals). Additional samples collected in December 2010 were filtered and were analyzed for dissolved metals. The results of these analyses are summarized in **Table 6** for the November 2007 samples and in **Table 7** for the December 2010 samples.

Volatile Organic Compound (VOC) Analyses

Prior to the November 2007 sampling event, EPA requested that samples be collected for VOC analysis. VOCs were not considered Contaminants of Concern (COC) at the Facility, but since analyses had not previously been performed for VOCs at the Facility, these analyses would serve to verify that conclusion. The results of these analyses are summarized in **Table 8.** Only benzene at 6.6 ug/l (MCL of 5 ug/l) and trichloroethylene at 7.7 ug/l (MCL of 5 ug/l) were found in two different samples. Since they were not contaminants used at the Facility and the detected levels were only slightly greater than the MCL, they are not considered COCs.

Northwest Facility Property Line Groundwater Data

A direct push sampling investigation was performed in November 2007 to establish the extent of the contamination plume at the Northwest Facility property line. Four temporary groundwater monitoring wells were installed in the borings to collect groundwater samples. The samples were analyzed for TAL metals, S-VOCs and VOCs. The laboratory results are summarized in **Table 9** and **Table 10.** PCP, Naphthalene and S-VOCs were not found in the wells.

Off-Facility Groundwater Data

The nearest available point of access downgradient of the Facility was approximately 300 to 500 feet away at the public right-of-way along East Fayette Street. In 2010, temporary groundwater monitoring wells were installed in three borings to collect groundwater samples along the north side of the 4500 block of East Fayette Street. The samples were analyzed for TAL metals, S-VOCs and VOCs. The laboratory results are summarized in **Table 11** and **Table 12.** Although detected in these off-Facility wells, there is no indication that arsenic, chromium, naphthalene or PCP have migrated from the Facility to these off-Facility well locations.

Groundwater Sampling in 2015

A groundwater sampling event was performed on May 20, 2015 and consisted of collecting groundwater samples from the five existing monitoring wells on the Facility to determine current conditions of the groundwater. The samples were analyzed for TAL metals, and S-VOCs. The laboratory results are summarized in **Table 13.** Arsenic, mercury, PCP, 1,1-biphenyl, and naphthalene exceeded the MCLs or RSLs in the groundwater and are the COCs for the Facility.

EXTENT OF CONTAMINATION

Groundwater Flow Direction

In 2006, the Facility monitoring wells were surveyed to verify the casing elevations. The survey data was used to determine the relative elevation of the groundwater in each well and groundwater flow direction. The data shows that the groundwater flow direction on the Facility is towards the northwest towards Herring Run. One of the objectives of the direct push sampling investigation in November 2007 was to refine further the groundwater flow direction. The data showed that the groundwater flow direction on the Facility is also towards the north. It should be noted however that the data reported from the various temporary wells suggest that groundwater has more of a western component. The groundwater contour map, based upon the data in these tables is shown in **Figure 1.**

Horizontal Extent of Contamination

The groundwater contamination is located near the center of the Facility, between the East and West monitoring wells. Based upon the December 2010 sampling results, the highest concentrations of arsenic, chromium, naphthalene and PCP are summarized in **Table 14.** The sample results are shown graphically on the Facility layout in **Figure 2. Table 14** also shows the concentration in MW-105 at the downgradient, northwest Facility property line.

The concentrations in MW-105 are significantly lower than the highest concentrations measured on-Facility for all of the COCs. Both PCP and naphthalene were below the laboratory reporting limit in MW-105 in the December 2010 sampling event, although they were detected in the November 2007, May 2010 and May 2015 samples. The MW-105 data indicates that the contaminant concentrations are significantly lower at the northwest Facility property line than they are in the middle of the Facility. The May 2010 off-Facility sampling event was performed at the nearest accessible, downgradient off-Facility location. As was described in Section 3, three borings were installed along East Fayette Street, downgradient from the Facility. Arsenic and chromium were detected in the samples from these wells. These groundwater sample concentrations appear to be indicative of existing groundwater conditions in this historically highly industrialized area. The concentrations measured in GP-107 on East Fayette Street are significantly higher than the concentrations measured in MW-105 at the same time. The concentrations measured in MW-105 are below the MCL for arsenic. The concentrations measured for chromium are below the MCL for all Facility wells currently. Also, naphthalene and pentachlorophenol (PCP) were not detected in any of these off-Facility samples. There is no indication that these contaminants of concern have migrated from the Facility to these off-Facility locations.

The VOC contaminants benzene at 210 ug/l and trichloroethylene at 24 ug/l were detected in the off-Facility samples above their respective MCLs. These appear to be from a source other than the Facility, however, since these VOCs were detected in the Facility monitoring well at lower concentrations. Benzene was not detected and trichloroethylene was detected at 11 ug/l at temporary up gradient monitoring well GP-103. It also should be noted that trichloroethylene was not used at the Facility and was found in only one off-Facility well.

These data indicate that the extent of the Facility-related contamination does not extend to East Fayette Street, the nearest public access point. There are no known wells or other receptor locations between the Facility and these off-Facility sampling locations. See Figure 3.

Vapor Intrusion Pathway

Of the Facility-related contaminants only naphthalene and 1,1-biphenyl are the volatile constituents that have the potential to migrate through the subsurface into a building if one were to be constructed at the Facility in the future. Naphthalene is present at concentrations in the Facility groundwater (MW-04) that may pose an unacceptable risk for vapor intrusion. It is not detected at the downgradient well at the Facility property boundary (MW-105).

In accordance with the EPA "Technical Guide for Assessing and Mitigating The Vapor Intrusion Pathway From Subsurface Vapor Sources To Indoor Air (June 2015)" buildings 100 feet or less from a plume boundary may need to be considered when developing objectives for detailed vapor intrusion investigations and interpreting the resulting data. There currently are no buildings within 100 feet of the plume boundary. Based on the available data the current vapor intrusion boundary may go as far as the Baltimore and Ohio railroad tracks. See Figure 3. Therefore, under current conditions there is no unacceptable risk due to vapor intrusion.

Aboveground Storage Tanks at MW-105 Location

The Facility had three above ground storage tanks (AST) located along the northwest Facility property line in the current vicinity of MW-105. In 1986, F. Bowie Smith performed a soil and groundwater assessment. The three tanks were hazardous waste storage tanks. The PCP and naphthalene groundwater contamination in MW-105, identified during the November 2007 direct push sampling investigation and the May 2010 monitoring well sampling, may be the result of spills or releases from these ASTs. No records exist, however, regarding prior spills or releases.

Vertical Extent of Contamination

The COCs have been measured in the surface aquifer. Depth to groundwater on the Facility is generally 20 to 30 feet BGS. The soils in this aquifer have very slow infiltration rates because of the layers of fine grained materials and clay. These soil characteristics have been reflected during the sampling activities with the wells having very low yields and very slow recharge rates. Underlying the urban soils on this Facility is the Arundel Clay formation of the Potomac Group. Installation of MW-105 was used to investigate the depth to the Arundel Clay and to evaluate the vertical extent of the contamination. Samples of the clay from 39-40 feet

BGS and 41-42 feet BGS were retained. Both samples were classified as lean clay indicating that the Arundel Clay formation provides a confining layer that will limit the vertical migration of the contaminants to less than 40 feet BGS.

Data Trend Analysis

A trend analysis of the analytical data was performed for arsenic, chromium, naphthalene and pentachlorophenol (PCP) from the East and West Wells. Trend analyses were not performed on the data from the North and South Wells since, for the majority of the analyses, contaminants were not detected at the laboratory reporting limit. The data from MW-105 were not analyzed since there have only been three sampling events for that well and any trend analysis would not be statistically significant. To visualize the trends, time series plots were prepared for each contaminant of concern in the four wells with sufficient data to be statistically significant. The time series plots are contained in Attachment 1. The time series plot for chromium in the East Well shows an unusual spike that was caused by the December 2010 result of 0.79 mg/l. This concentration is an order of magnitude greater than the historical median concentration of 0.060 mg/l for chromium in this well. This sample result appears to be an outlier compared to the remainder of the data. Therefore, the December 2010 East Well chromium result was excluded from the following trend analyses which were performed using the Mann-Kendall Test. Mann-Kendall is a non-parametric method used to determine trends in data sets that does not require any particular distribution and allows missing data values. Using a 95% confidence limit, the trend of the data towards increasing or decreasing concentration, or no trend, was determined. The results show decreasing trends in the concentrations for naphthalene and PCP in the East Well, and no statistically significant change in concentration for arsenic in the East Well. No statistically significant change in concentration was identified for arsenic, chromium, naphthalene and pentachlorophenol (PCP) in the West Well. As can be seen from the plots in **Attachment 1**, with the exception of the one outlier described above, all of the concentrations of arsenic, chromium, naphthalene and pentachlorophenol (PCP) have decreased over the past several sampling events.

Remedial Action Objectives (RAOs)

EPA Region III prepared a risk-based concentration assessment for exposure to COCs in groundwater. Since the City and County of Baltimore prohibit the use of groundwater as a drinking water source in the area, the assessment was based upon exposure to a hypothetical construction worker. This assessment was performed for both cancer and non-cancer endpoints. For the cancer endpoint, concentrations in groundwater were estimated for incremental cancer risks of 1×10^{-5} and 1×10^{-4}. For the non-cancer endpoint, the concentrations in groundwater were estimated for a hazard quotient (HQ) of 1. Routes of exposure included both the ingestion and dermal pathways. Dermal exposure represented the larger portion of the total exposure.

Acceptable concentrations of COCs in groundwater were calculated based upon the applicable risk levels and several exposure frequencies. It also should be noted that groundwater at the Facility is over 20 feet deep and contact with groundwater is very unlikely during any construction.

The RAO relating to exposure to contaminated groundwater is to meet EPA's recommended calculated remedial goals, as follows:

Contaminant	Recommended Remedial Goal ug/l
Arsenic	2070
Chromium VI	289
Manganese	965,000
Mercury	2140
Naphthalene	735
1,1-Biphenyl	18,000
Pentachlorophenol	450

Another RAO relates to the Vapor Intrusion exposure scenarios involvingS-VOCs. If groundwater concentrations of naphthalene and 1,1 biphenyl exceed the recommended remedial goals, then vapor intrusion controls will be needed for any new construction. The recommended groundwater remedial goals for vapor intrusion are as follows.

Contaminant	Recommended Vapor Intrusion Remedial Goal ug/l
Naphthalene	460
1,1-Biphenyl	340

A more detailed explanation of the calculations is provided in Attachment 2.

3.2 Summary of Remedial Activities Completed

Facility Demolition Plan

In 1989, Birchwood and MDE entered into a consent order (CO-90-050) to continue the investigation and remediation of the Facility. The consent order required Birchwood to do the following:

1. Conduct additional soil sampling to delineate areas of the Facility that would need to be capped. This sampling was completed by 1991.

2. Prepare and submit a Facility Demolition Plan for the removal of contaminated equipment, structures, soil and other materials; capping of selected areas and a groundwater monitoring plan. The Plan was prepared in 1991 and the work was completed at the end of 2000.

3. Place a deed restriction on the Facility property to limit construction and excavation to ensure the integrity of the cap. The deed restriction was recorded on December 18, 1989.

The Facility Demolition Plan was submitted in July 1991. This plan addressed removal of contaminated buildings, tanks and piping from the Facility. The plan also called for placing geo-membrane caps over two areas of the Facility where analytical data indicated unacceptable risks due to soil contamination using non-residential screening levels

The plan also included a groundwater monitoring program using the four existing groundwater monitoring wells. Twenty-one groundwater sampling events were performed on the Facility from August 13, 1986 through February 14, 2003.

Birchwood performed removal and remedial activities on the Facility during the 1990s, including removing contaminated tanks, equipment, buildings and soil. A detailed soil investigation was performed to delineate the contaminated soil areas.

In July 2000, MDE approved the final phase of the remediation plan. Two areas, a 0.15 acre area and a 1.1 acre area, overlying the contaminated groundwater and soil were capped with compacted fill, covered by an MDE approved geo-membrane and topped with soil-cement. This work was completed by the end of 2000. No additional remedial action was planned following completion of the cap and Birchwood requested that MDE terminate the Consent Order

In a February 22, 2001 letter to Birchwood Realty's attorney, MDE stated the capping and remediation of contaminated soil was complete, but groundwater monitoring should continue

3.3 Environmental Indicators

Under the Government Performance and Results Act ("GPRA"), EPA has set national goals to address RCRA corrective action facilities. Under GPRA, EPA evaluates two key environmental clean-up indicators for each facility: (1) Current Human Exposures Under Control and (2) Migration of Contaminated Groundwater Under Control. The Facility met the first indicator on September 1, 2015 and met the second indicator on February 9, 2015.

Section 4: Corrective Action Objectives

EPA's Corrective Action Objectives for the specific environmental media at the Facility are the following:

1. Soils

EPA has determined that EPA's screening levels for direct contact with Facility soils are protective of human health and the environment under the current and reasonably anticipated future commercial/industrial use of the Facility. Concentrations of COCs in soils at the Facility, excluding those in the capped areas, currently are lower than the screening levels. The existing caps prevent direct contact with soils contaminated by COCs at levels which exceed the screening levels.

2. Groundwater

EPA expects final remedies to return groundwater to its maximum beneficial use within a timeframe that is reasonable given the particular circumstances of a project. For projects where aquifers are either currently used for water supply or have the potential to be used for water supply, EPA will use MCLs as the remediation goals.

At the Facility, the Patapsco formation and aquifer are known to exist above the Arundel clay. In these lower lying areas of the Coastal Plain, the Patapsco Aquifer would be classified as a Class IIB aquifer as defined by "Guidelines for Ground-Water Classification Under the 1984 EPA Ground-Water Protection Strategy, Final Draft" dated November, 1986. However, the Patapsco Aquifer contains chloride contamination resulting from salt water intrusion, in addition to industrial contamination resulting from historic industrial operations in the region. Consequently, Baltimore County Bill No. 17-13 and Baltimore City Revised Code § 2.19.1 require, in the vicinity of the Patapsco Aquifer, connection to a public water supply system where such a system is available within 500 feet of the owner's property line.

Groundwater monitoring has shown that there are no unacceptable exposures to groundwater by current and potential future receptors with the exception of potential direct contact by on-Facility construction/excavation workers and exposure via vapor intrusion into any buildings constructed on-Facility. Monitoring at the Facility has shown that the extent of contamination in groundwater attributable to the Facility is not increasing; concentrations of those contaminants are declining.

Therefore EPA's Corrective Action Objective is to meet the EPA-approved RAOs developed to prevent human exposure to contaminants in groundwater and potential unacceptable risk to occupants posed by vapor intrusion into any building(s) constructed in the future.

Section 5: Proposed Remedy

1. Introduction

Under this proposed remedy, some contaminants will remain in the soil and groundwater at the Facility above levels appropriate for residential uses. As a consequence, EPA's proposed remedy requires groundwater monitoring and the compliance with and maintenance of land and groundwater use restrictions. EPA proposes to implement the land and groundwater restrictions necessary to prevent human exposure to contaminants at the Facility through an enforceable mechanism such as a permit, order, or environmental covenant.

Additionally, EPA has identified the State of Maryland Well Construction Regulations, codified at Code of Maryland Regulations ("COMAR") 26.03.01.05, as prohibiting installation of individual water systems where adequate community systems are available. In addition, Baltimore County Bill No. 17-13 and Baltimore City Revised Code § 2.19.1 require connection to the public water supply system where such a system is available within 500 feet of the owner's property line. In this case, the Facility and surrounding area are already being provided with potable water from the City's public water supply system.

2. Soils

EPA's proposed remedy for Facility soils consists of compliance with and maintenance of land use restrictions. Under EPA's proposed remedy, the following use restrictions will be implemented for soils:

1. The Facility shall be restricted to commercial and/or industrial purposes and shall not be used for residential purposes unless the then current landowner demonstrates to EPA that such use will not pose a threat to human health or the environment or adversely affect or interfere with the selected remedy and the Facility obtains prior written approval from EPA for such use; and

2. The Facility shall not be used in any way that will adversely affect or interfere with the integrity and protectiveness of the capped areas unless the then current landowner demonstrates to MDE and EPA that such use will not pose a threat to human health or the environment, and MDE and EPA provide prior written approval for such disturbance. The then current landowner will also develop and implement a Cap Management Plan. The Cap Management Plan shall be submitted for EPA and MDE review and approval and, at a minimum, must include: the procedures to maintain the cap over the contaminated soil; a schedule for inspections to be performed as part of cap maintenance, no less frequent than once a year; and physical maintenance requirements of the capped areas to prevent degradation of the cap and unacceptable exposure to the underlying soil.

3. Groundwater

Monitoring at the Facility has shown that concentrations of COCs are declining over time. Therefore, the proposed remedy for groundwater consists of natural attenuation with continued monitoring until RAOs are met, and compliance with and maintenance of an EPA approved groundwater monitoring plan. In addition, the proposed remedy includes groundwater use restrictions to be implemented at the Facility to prevent exposure to contaminants while levels remain above RAO standards. If construction of new buildings is proposed, the proposed remedy shall require the installation of a vapor intrusion control system, the design of which shall be submitted to EPA for review and approval prior to any construction. A vapor intrusion control system shall be installed in new structures constructed above the contaminated groundwater plume or within 100-feet of the perimeter of the contaminated groundwater plume (100-foot VI buffer zone) up to the property boundary. See Figure 3. The vapor intrusion system shall be operated until it is demonstrated to EPA that vapor intrusion of contaminants at the Facility does not pose a threat to human health. For the relatively small area of the 100-foot VI buffer zone located beyond the Facility property boundary, since construction of a building there is unlikely, the proposed remedy shall require notification of the adjacent property owner of the potential risks due to vapor intrusion and recommendations for safely using the property.

EPA's proposed remedy includes the following groundwater use restrictions:

1. Groundwater at the Facility shall not be used for any purpose other than the operation, maintenance, and monitoring activities required by EPA, unless it is demonstrated to EPA that such use will not pose a threat to human health or the environment or adversely affect or interfere with the final remedy to be selected by EPA in the Final Decision and Response to Comments (FDRTC) and the then current property owner obtains prior written approval from EPA for such use;

2. No new wells shall be installed on Facility property unless the then current property owner demonstrates to EPA that such wells are necessary to implement the final remedy and the then current property owner obtains prior written approval from EPA to install such wells; and

3. Compliance with the EPA-approved groundwater monitoring program;

4. An EPA-approved vapor intrusion control system shall be installed in new structures constructed on the Facility property above the contaminated groundwater plume or within the 100-foot VI buffer zone. The vapor intrusion system shall be operated until it is demonstrated to EPA that vapor intrusion of contaminants at the Facility does not pose a threat to human health; and

5. Where the 100-foot VI buffer zone extends beyond the Facility property boundary, the owners of the affected property(ies) shall be given notification of the potential risks due to vapor intrusion and recommendations for safely using the affected property.

4. Other Requirements

1. On an annual basis and whenever requested by EPA, the then current property owner shall submit to EPA and MDE a written certification stating whether or not the groundwater and land use restrictions are in place and being complied with;

2. The then current property owner shall allow the EPA, MDE, and/or their authorized agents and representatives, access to the Facility property to inspect and evaluate the continued effectiveness of the final remedy and, if necessary, to conduct additional remediation to ensure the protection of the public health and safety and the environment based upon the final remedy to be selected by EPA in the FDRTC; and

3. The Facility shall provide EPA with a coordinate survey, as well as a metes and bounds survey, of the Facility boundary and capped areas. Mapping the extent of the land use restrictions will allow for presentation in a publicly accessible mapping program such as Google Earth or Google Maps.

Section 6: Evaluation of Proposed Remedy

This section provides a description of the criteria EPA used to evaluate the proposed remedy consistent with EPA guidance. The criteria are applied in two phases. In the first phase, EPA evaluates three decision threshold criteria as general goals. In the second phase, for those remedies which meet the threshold criteria, EPA then evaluates seven balancing criteria.

Threshold Criteria	Evaluation
1) Protect human health and the environment	EPA's proposed remedy for the Facility protects human health and the environment by eliminating, reducing, or controlling potential unacceptable risk through natural attenuation and the implementation and maintenance of use restrictions. EPA is proposing to restrict land use to commercial or industrial purposes at the Facility. With respect to groundwater, low levels of contaminants currently remain in the groundwater beneath the Facility. The concentrations of these contaminants, however, are decreasing through natural attenuation as shown by groundwater monitoring data. In addition, groundwater monitoring will continue until the RAOs for groundwater and vapor intrusion are met. The existing State of Maryland well construction regulations will aid in minimizing exposure to contaminated groundwater by prohibiting the installation of individual water systems where adequate community systems are already available. In addition, Baltimore County Bill No. 17-13 and Baltimore City Revised Code § 2.19.1 require connection to the public water supply system where such a system is available within 500 feet of the owner's property line. Consequently, the Facility and surrounding area are already being provided with potable water from the City's public water supply system. With respect to future uses, the proposed remedy requires groundwater use restrictions to minimize the potential for human exposure to contamination and protect the integrity of the remedy. In the event that future building construction is contemplated, the Facility shall include a vapor intrusion control system in order to prevent unacceptable exposure to S-VOCs. For the relatively small area of the 100-foot VI buffer zone located beyond the Facility property boundary, since construction of a building there is unlikely, the proposed remedy shall require

	notification of the adjacent property owner of the potential risks due to vapor intrusion and recommendations for safely using the property. The Facility will comply with a Cap Management Plan to be approved by EPA and MDE. The Cap Management Plan will include procedures to maintain the two existing caps which were installed over contaminated soils.
2) Achieve media cleanup objectives	EPA's proposed remedy meets the media cleanup objectives based on assumptions regarding current and reasonably anticipated future land and water resource use(s). The remedy proposed in this SB is based on the current and future anticipated land use at the Facility for commercial or industrial purposes. Contaminated soil was capped and the Facility will comply with a Cap Management Plan to be approved by EPA and MDE. The Cap Management Plan will include procedures to maintain the two caps which were installed over contaminated soils. The groundwater plume appears to be stable (not migrating); although contaminants currently are above RAOs, they have been declining over time. In addition, groundwater monitoring will continue until RAO groundwater clean-up standards are met. The Facility meets EPA risk guidelines for human health and the environment. EPA's proposed remedy also requires the implementation and maintenance of use restrictions to ensure that groundwater beneath Facility property is not used for any purpose except to conduct the operation, maintenance, and monitoring activities required by EPA.
3) Remediating the Source of Releases	In all proposed remedies, EPA seeks to eliminate or reduce further releases of hazardous wastes and hazardous constituents that may pose a threat to human health and the environment. The Facility already has met this objective.

	The source of contaminants has been removed from the soil at the Facility, thereby, eliminating, to the extent practicable, further releases of hazardous constituents from Facility soils as well as the source of the groundwater contamination. Contaminants in groundwater are declining through natural attenuation. There are no remaining large, discrete sources of waste from which constituents would be released to the environment. Groundwater is not used for potable purposes at the Facility or at neighboring facilities. In addition, groundwater monitoring will continue until RAO groundwater clean-up standards are met through natural attenuation. The existing State of Maryland well construction regulations will aid in minimizing exposure to contaminated groundwater by prohibiting the installation of individual water systems where adequate community systems are already available. Also, Baltimore County Bill No. 17-13 and Baltimore City Revised Code § 2.19.1 require connection to the public water supply system where such a system is available within 500 feet of an owner's property line. Consequently, the Facility and surrounding area are already being provided with potable water from the City's public water supply system. Contaminated soil was capped and the Facility must comply with a Cap Management Plan to be approved by EPA and MDE. The Cap Management Plan will include procedures to maintain the two caps which were installed over contaminated soils. In the event that future building construction is contemplated, the Facility shall include a vapor intrusion control system. For the relatively small area of the 100-foot VI buffer zone located beyond the Facility property boundary, since construction of a building there is unlikely, the proposed remedy shall require notification of the adjacent property owner of the potential risks due to vapor intrusion and recommendations for safely using the property. Therefore, EPA has determined that this criterion has been met.

Balancing Criteria	Evaluation
4) Long-term effectiveness	Groundwater is not used on the Facility for drinking water, and no down gradient users of off-Facility groundwater exist. Therefore, the proposed long term effectiveness of the remedy for the Facility will be maintained by the continuation of the groundwater monitoring program, the implementation of groundwater use restrictions, maintenance of the two caps over the contaminated soils and by implementation of land use restrictions.
5) Reduction of toxicity, mobility, or volume of the Hazardous Constituents	The reduction of toxicity, mobility and volume of hazardous constituents will continue by natural attenuation of the COCs in the groundwater at the Facility. Reduction has already been achieved, as demonstrated by the data from the groundwater monitoring. In addition, the existing EPA-approved groundwater monitoring program will continue until RAOs are achieved.
6) Short-term effectiveness	EPA anticipates that the land and groundwater use restrictions will be fully implemented shortly after the issuance of the Final Decision and Response to Comments. A groundwater monitoring program is already in place. EPA's proposed remedy takes into consideration future activities, such as construction or excavation that would pose short-term risks to workers, and the environment by requiring the Facility to implement and adhere to land and groundwater use restrictions.
7) Implementability	EPA's proposed remedy is readily implementable. The groundwater monitoring wells are already in place and operational. EPA proposes to implement the use restrictions through an enforceable mechanism such as an Environmental Covenant, permit or order.
8) Cost	EPA's proposed remedy is cost effective. The total costs associated with this proposed remedy, including the continuation of groundwater monitoring are minimal (estimated cost of $4,000 per year).
9) Community Acceptance	EPA will evaluate community acceptance of the proposed remedy during the public comment period, and it will be described in the Final Decision and Response to Comments.
10) State/Support Agency Acceptance	MDE has reviewed and concurred with the proposed remedy for the Facility.

Section 7: Financial Assurance

EPA has evaluated whether financial assurance for corrective action is necessary to implement EPA's proposed remedy at the Facility. Given that EPA's proposed remedy does not require any further engineering actions to remediate soil, groundwater, or indoor air contamination at this time and given that the costs of implementing land and groundwater use restrictions and groundwater monitoring costs (estimated cost of $4,000 per year) at the Facility will be minimal, EPA is proposing that no financial assurance be required.

Section 8: Public Participation

Interested persons are invited to comment on EPA's proposed remedy. The public comment period will last thirty (30) calendar days from the date that notice is published in a local newspaper. Comments may be submitted by mail, fax, or electronic mail to Mr. Leonard Hotham at the contact information listed below.

A public meeting will be held upon request. Requests for a public meeting should be submitted to Mr. Leonard Hotham in writing at the contact information listed below. A meeting will not be scheduled unless one is requested.

The Administrative Record contains all the information considered by EPA for the proposed remedy at this Facility. The Administrative Record is available at the following location:

U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103
Contact: Mr. Leonard Hotham (3LC20)
Phone: (215) 814-5778
Fax: (215) 814 - 3113
Email: hotham.leonard@epa.gov

Attachments:
Figure 1: Groundwater Contour Map
Figure 2: Groundwater Sampling Results from 2010
Figure 3: Groundwater Plume and Vapor Intrusion Boundaries
Table 1: Soil Sample Results for S-VOCs
Table 2: Groundwater Sample Results for COCs
Table 3: Groundwater Sample Results for PAH Compounds
Table 4: Groundwater Sample Results for S-VOCs Compounds from 2007
Table 5: Groundwater Sample Results for S-VOCs Compounds from 2010
Table 6: Groundwater Sample Results for Metals from 2007
Table 7: Groundwater Sample Results for Metals from 2010
Table 8: Groundwater Sample Results for VOCs Compounds from 2007
Table 9: Groundwater Sample Results for Metals from Northwest Property Line
Table 10: Groundwater Sample Results for S-VOCs and VOCs from Northwest Property Line
Table 11: Groundwater Sample Results for Metals from East Fayette Street
Table 12: Groundwater Sample Results for S-VOCs and VOCs from East Fayette Street
Table 13: Groundwater Sample Results for Metals, S-VOCs and VOCs from 2015
Table 14: Groundwater Sample Results for the highest concentrations of COCs from 2010
Attachment 1: Time Series Plots for Groundwater Sample Results
Attachment 2: Recommended Remedial Goals for Select Groundwater Contaminants

Date: 6-28-16

Catherine A. Libertz

John A. Armstead, Director
Land and Chemicals Division
US EPA, Region III

Section 9: Index to Administrative Record

Hazardous Waste Permit for hazardous waste storage issued by Maryland Department of the Environment, 1982.

Geraghty and Miller, Inc, *Assessment of Shallow Soil and Shallow Groundwater Quality at the F. Bowie Smith and Sons Wood Treatment Plant Baltimore*, February 1987

NUS Corporation Superfund Division, *Site Inspection Using Available Information of F. Bowie Smith and Sons, Incorporated Prepared Under TDD No. F3-8907-03, EPA No. MD-244, Contract No. 68-01-7346,* May 1, 1990.

Birchwood Realty Company, Inc., *Site Demolition Plan 4500 East Lombard Street*, July 30, 1991.

Maryland Department of the Environment, *MDE Fact Sheet for F. Bowie Smith & Sons, Inc. Baltimore, Maryland,* August 2000.

Birchwood Realty, *Cap Completion Certification for F. Bowie Smith & Sons, Inc. Baltimore, Maryland,* December 4, 2000

Maryland Department of the Environment, *Letter Approving Site Demolition and Cap Completion,* December 27, 2000

Maryland Department of the Environment, *Letter Approving Cap Completion and Site Remediation,* February 27, 2001

U.S. Army Corps of Engineers Philadelphia District, *Visualization of Groundwater Contamination F. Bowie Smith and Son Wood-Treatment Plant Baltimore, Maryland,* August 2005.

Quinn, B. A., Toxicologist U.S. EPA Region III, Memo entitled "*Risk-based Groundwater Concentrations for Construction Worker Exposures, F. Bowie Smith Site",* October 18, 2010

Geiger, W.A., Remedial Project Manager, U.S. EPA Region III, Email sent to Scott Peterson of Birchwood Realty entitled "*Pentachlorophenol Remedial Action Objective*", December 7, 2010.

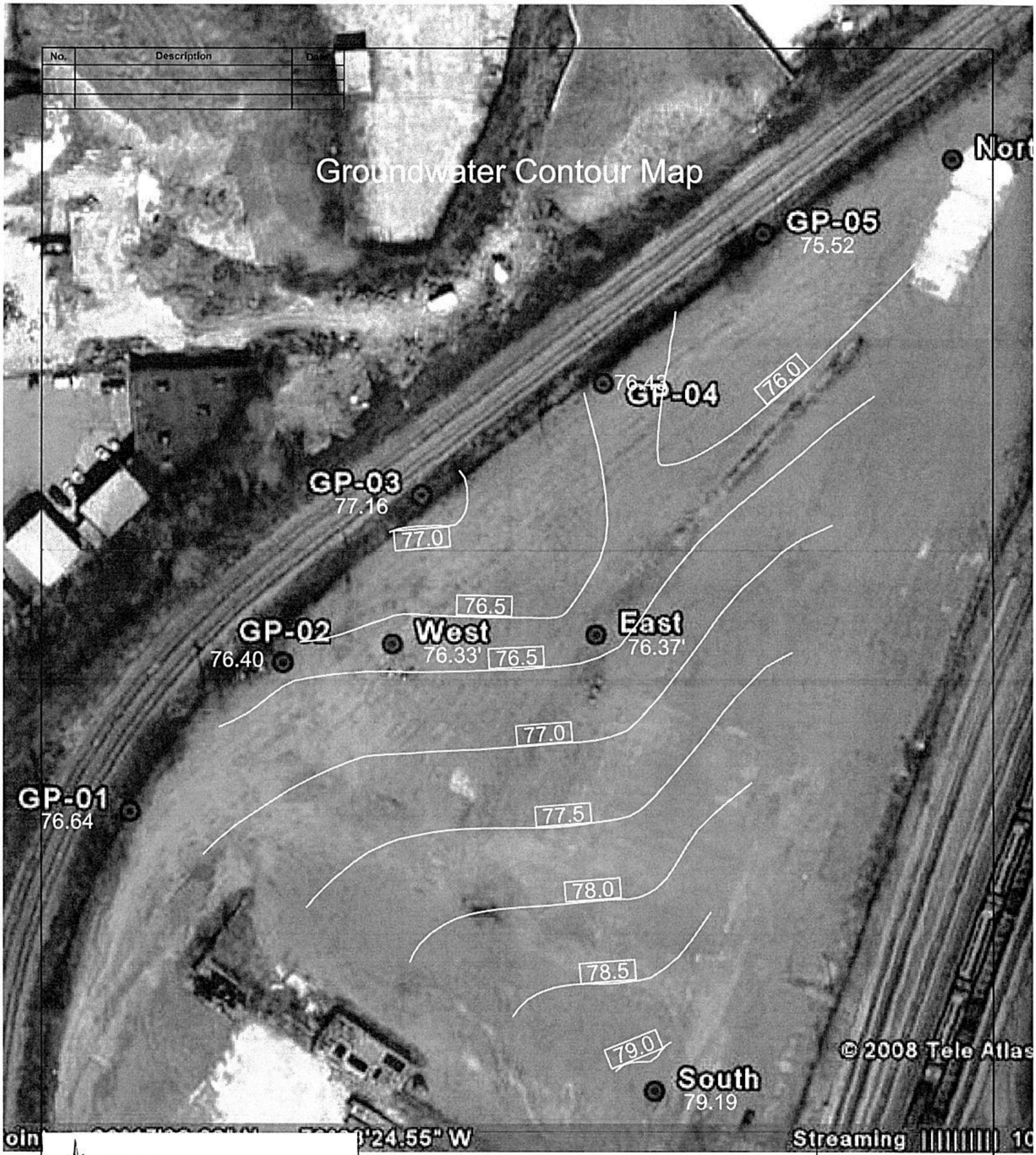
EastStar Environmental Group, Inc., *RCRA Facility Investigation – Corrective Measures Study 4500 E Lombard Street Site, Baltimore, Maryland*, December 4, 2012.

Geiger, W.A., Remedial Project Manager, U.S. EPA Region III, *RCRA Site Inspection Report,* April 15, 2005

EastStar Environmental Group, Inc., *Report of May 2015 Groundwater Sampling Event, 4500 E Lombard Street Site, Baltimore, Maryland,* August 31, 2015

Figure 1

No.	Description	Date



Groundwater Contour Map

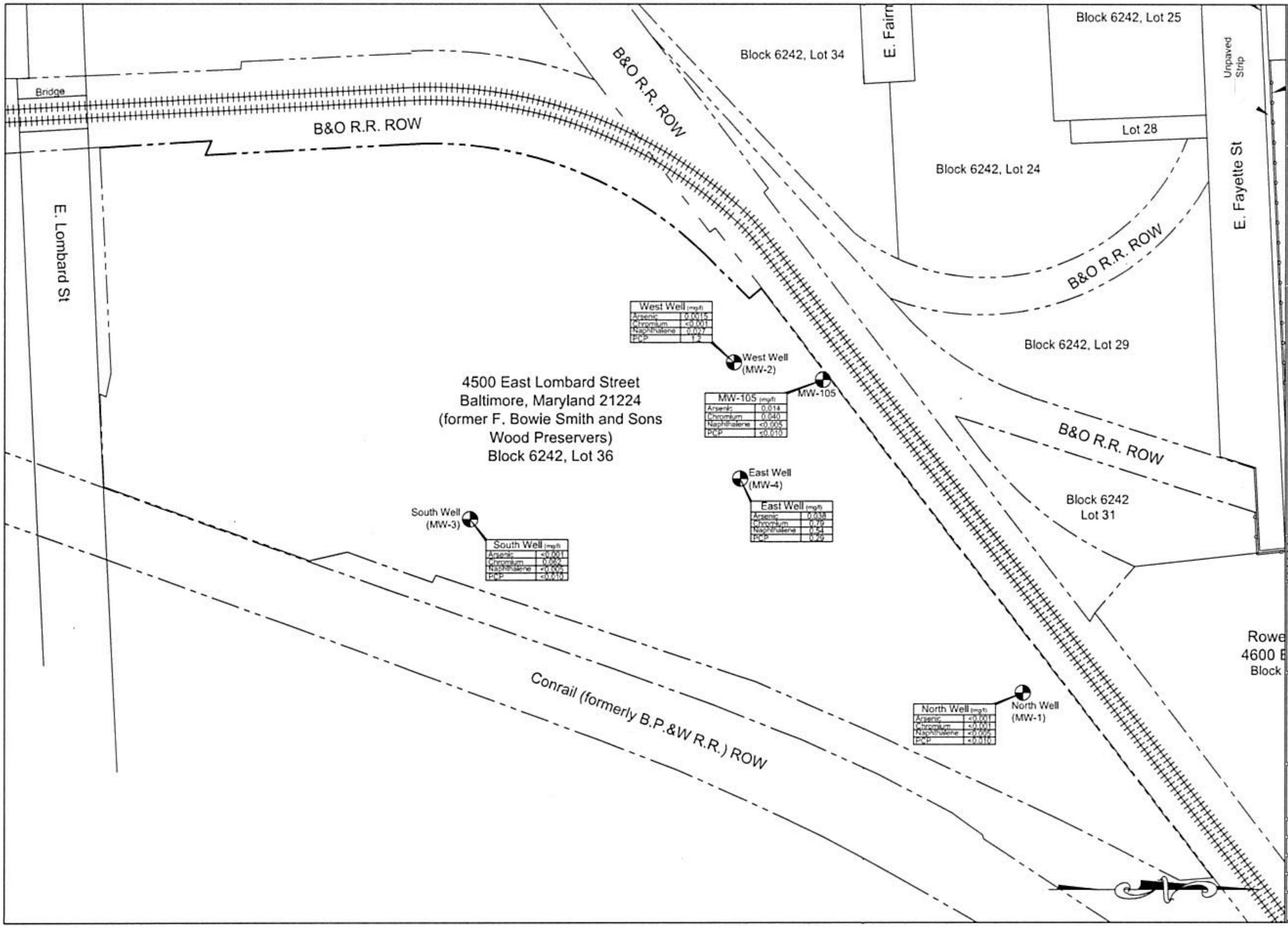
EastStar Environmental Group, Inc.
Consulting and Field Services

10280 Old Columbia Road, Suite 265
Columbia, MD 21046
Ph: (410) 290-8777 Fax: (410) 290-9055
www.EastStarEnv.com

Birchwood Development Site
4500 East Lombard Street
Baltimore, Maryland

Proj. No.:	D013
Drawn By:	MAY
Checked By:	APF
Date:	4/1/08
Scale:	1" = 200'

Figure 2



West Well (mg/l)	
Arsenic	0.0015
Chromium	<0.001
Naphthalene	0.027
PCP	1.2

MW-105 (mg/l)	
Arsenic	0.014
Chromium	0.040
Naphthalene	<0.005
PCP	<0.010

East Well (mg/l)	
Arsenic	0.038
Chromium	0.79
Naphthalene	0.54
PCP	0.29

South Well (mg/l)	
Arsenic	<0.001
Chromium	0.082
Naphthalene	<0.005
PCP	<0.010

North Well (mg/l)	
Arsenic	<0.001
Chromium	<0.001
Naphthalene	<0.005
PCP	<0.010

Birchwood Realty Co., Inc.
801 South Columbus Boulevard
Suite 200
Philadelphia, Pennsylvania 19147

4500 East Lombard Street Site
(former F. Bowie Smith and Sons Wood Treatment Facility)
4500 East Lombard Street
Baltimore, Maryland 21224

LEGEND

- Site Property Line
- CSX ROW Line
- Existing RR Tracks
- Property Lines
- Chain Link Fence
- ☒ Proposed Groundwater Sample Location

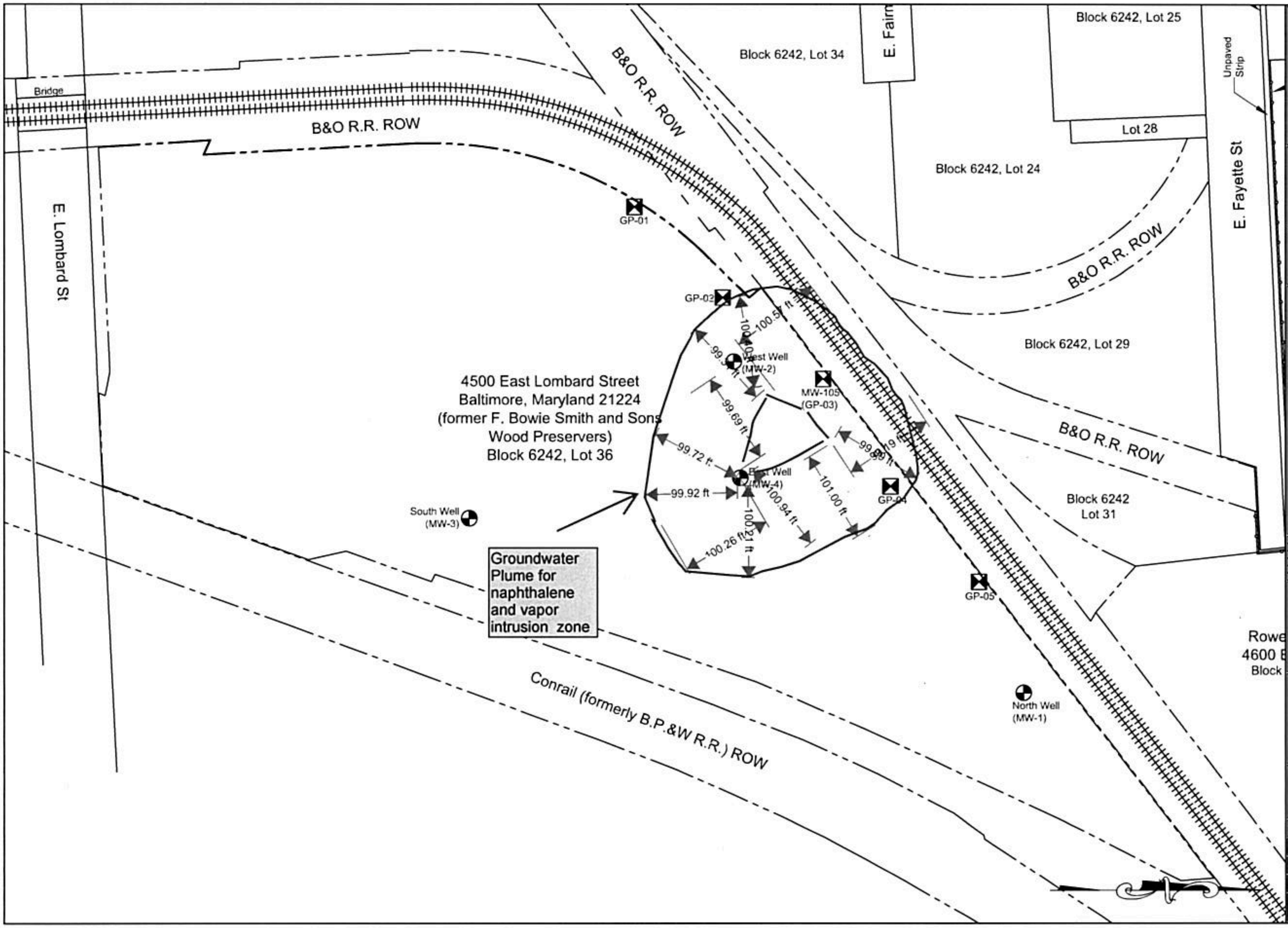
EastStar Environmental Group, Inc.
Consulting and Field Services
10632 Little Patuxent Parkway, Suite 106
Columbia, Maryland 21044
Phone: (410) 290-8777 Fax: (410) 290-9055
www.EastStarEnv.com

Figure 4.2 - View of Results from the December 2010 Groundwater Sampling

Fayette Samples.dwg	1 inch = 100 feet
October 19, 2012	D013
JAC	
APF	

Sheet 1 of 1 Sheets

Figure 3



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LEGEND

—·—·—	Site Property Line
—··—··	CSX ROW Line
┼┼┼┼┼┼	Existing RR Tracks
———	Property Lines
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10632 Little Patuxent Parkway, Suite 106
Columbia, Maryland 21044
Phone: (410) 290-8777 Fax: (410) 290-9055
www.EastStarEnv.com

Figure 3.1 - Location of Temporary Wells on Northwest Property Line

Fayette Samples.dwg	1 inch = 100 feet
October 19, 2012	D013
JAC	
APF	

Sheet 1 of 1 Sheets

Table 1

Table 3.3 - July 1990 Soil Samples – S-VOC Analysis Results

Sample ID	Sample Depth (ft)	Pentachloro-phenol (mg/kg)	Benz(a)-anthracene (mg/kg)	Benzo(a)-pyrene (mg/kg)	Indeno-(1,2,3c,d)-pyrene (mg/kg)	Dibenzo-(a,h)anthra-cene (mg/kg)
0330-1	1	ND	ND	ND	ND	ND
0330-3	3	ND	ND	ND	ND	ND
0225-1	1	ND	3	ND	ND	ND
0225-3	3	ND	ND	ND	ND	ND
0825-1	1	ND	ND	ND	ND	ND
0825-2	2	ND	ND	ND	ND	ND
1122-1	1	ND	6	5	ND	3
1122-3	3	93	6	ND	ND	ND
1426-1	1	ND	ND	ND	ND	ND
1426-3	3	ND	ND	ND	ND	ND
1824-1	1	ND	ND	ND	ND	ND
1824-3	3	ND	ND	ND	ND	ND
Highest Concentration		93	6	5	ND	3
Non-Residential Standard		240	3.9	0.39	3.9	0.39

Table 2

Table 3.4 - Summary of Groundwater Monitoring Data for Contaminants of Concern

Sample Date	East Well				North Well			
	Arsenic (mg/l)	Chromium (mg/l)	Naphthalene (mg/l)	PCP (mg/l)	Arsenic (mg/l)	Chromium (mg/l)	Naphthalene (mg/l)	PCP (mg/l)
8/13/86	0.0025	0.005	15	33	0.0025	0.005	0.005	0.025
9/3/86	0.005	0.005	15	33	0.005	0.005	0.00205	0.00145
12/12/91	0.035	0.005	420	210	0.0025	0.005	0.005	0.025
3/4/92								
6/17/92	0.027	0.005	61	18	0.0025	0.005	0.005	0.025
1/27/93	0.04	0.01	14	20	0.0025	0.002	0.005	0.025
1/27/93	0.04	0.01		20	0.0025	0.002		0.025
7/16/93					0.0025	0.002	0.005	0.025
12/22/93	0.019	0.005	22	25	0.0025	0.005	0.005	0.025
4/22/94	0.050	0.004	7.8	30	0.0025	0.005	0.005	0.025
1/13/95	0.082	0.24	53.9	37.3	0.005	0.016	0.0041	0.017
5/8/95	0.045	0.18	125	73.6	0.021	0.06	0.005	0.0045
12/7/95	0.343	0.155	7.18	3.66	0.185	0.376	0.005	0.0125
5/1/98	0.316	0.062	3.7	13	0.132	0.120	0.005	0.005
11/17/98	0.124	0.082	4.7	7.1	0.019	0.435	0.005	0.0125
3/26/99	0.008	0.052	5.8	6.1	0.024	0.288	0.005	0.0125
11/28/00	0.0175	0.005	6.7	16	0.0175	0.005	0.005	0.017
3/12/01	0.301	0.188	2.3	3.0	0.070	0.097	0.005	0.0125
6/21/01	0.031	0.032	1.7	6.8	0.0025	0.054	0.005	0.006
2/11/02	0.025	0.17	120	110	0.025	0.025	0.005	0.011
5/6/02	0.025	0.13	39	16	0.025	0.07	0.005	0.0125
10/7/02	0.005	0.59	120	6.5	0.025	0.015	0.005	0.0125
2/14/03	0.062	0.060	4.7	17	0.006	0.023	0.005	0.0125
7/27/06	0.28	0.16	7.5	12	0.025	0.081	0.005	0.025
11/27/07	0.15	0.057	3.2	9.7	0.001	0.001	0.005	0.025
5/10/10	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
12/2/10	0.038	0.79	0.54	0.29	0.0005	0.0005	0.0025	0.005

1. Blank cells indicate no data was reported for that event
2. n/s - The well was not sampled during that event
3. Sample results below quantitation limit are shaded and are reported as described above

Table 3.4 - Summary of Groundwater Monitoring Data for Contaminants of Concern

Sample Date	South Well				West Well			
	Arsenic (mg/l)	Chromium (mg/l)	Naphthalene (mg/l)	PCP (mg/l)	Arsenic (mg/l)	Chromium (mg/l)	Naphthalene (mg/l)	PCP (mg/l)
08/13/86	0.0025	0.005	0.005	0.025	0.0025	0.005	0.42	26
09/03/86	0.005	0.005	0.00205	0.00145	0.005	0.005	0.42	26
12/12/91	dry	dry	dry	dry	0.0025	0.001	0.15	10
03/04/92	0.0025	0.0071	0.005	0.025				
06/17/92	0.0025	0.005	0.005	0.025	0.0025	0.005	0.12	6.0
01/27/93	0.0025	0.19	0.005	0.025	0.0025	0.003	0.13	5.0
01/27/93	0.0025	0.19		0.025	0.0025	0.003		5.0
07/16/93	0.0025	0.075	0.005	0.025	0.0025	0.005	0.18	4.4
12/22/93	0.0025	0.047	0.005	0.025	0.0025	0.005	0.18	13
04/22/94	0.0025	0.068	0.005	0.025	0.0025	0.002	0.005	4.0
01/13/95	0.005	0.09	0.005	0.0125	0.005	0.011	0.131	10.6
05/08/95	0.025	0.21	0.005	0.0054	0.025	0.13	1.0	12
12/07/95	0.11	0.269	0.005	0.0125	0.183	0.129	1.0	9.62
05/01/98	dry	dry	dry	dry	0.081	0.052	0.50	6.2
11/17/98	0.061	0.353	0.005	0.0165	0.082	0.085	1.0	11
03/26/99	0.009	0.185	0.005	0.0125	0.003	0.0055	0.005	21
11/28/00	0.186	0.005	0.006	0.073	0.0175	0.005	0.20	23
03/12/01	0.127	0.272	0.005	0.005	0.025	0.057	0.65	8.4
06/21/01	0.007	0.0025	0.005	0.004	0.0025	0.104	1.25	14
02/11/02	0.025	0.09	0.005	0.011	0.025	0.025	0.05	26
05/06/02	0.18	0.19	0.013	0.023				
10/07/02					0.024	0.065	0.027	0.97
02/14/03	0.0025	0.037	0.005	0.025	0.0025	0.003	0.005	3.7
07/27/06	0.025	0.076	0.005	0.025	0.84	0.61	0.12	5.1
11/27/07	0.0024	0.027	0.005	0.097	0.81	0.40	0.026	3.0
5/10/10	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
12/2/10	0.0025	0.062	0.0025	0.005	0.0015	0.0005	0.027	1.2

1. Blank cells indicate no data was reported for that event
2. n/s - The well was not sampled during that event
3. Sample results below quantitation limit are shaded and are reported as described above

Table 3.4 - Summary of Groundwater Monitoring Data for Contaminants of Concern

Sample Date	MW-105			
	Arsenic (mg/l)	Chromium (mg/l)	Naphthalene (mg/l)	PCP (mg/l)
08/13/86	n/s	n/s	n/s	n/s
09/03/86	n/s	n/s	n/s	n/s
12/12/91	n/s	n/s	n/s	n/s
03/04/92	n/s	n/s	n/s	n/s
06/17/92	n/s	n/s	n/s	n/s
01/27/93	n/s	n/s	n/s	n/s
01/27/93	n/s	n/s	n/s	n/s
07/16/93	n/s	n/s	n/s	n/s
12/22/93	n/s	n/s	n/s	n/s
04/22/94	n/s	n/s	n/s	n/s
01/13/95	n/s	n/s	n/s	n/s
05/08/95	n/s	n/s	n/s	n/s
12/07/95	n/s	n/s	n/s	n/s
05/01/98	n/s	n/s	n/s	n/s
11/17/98	n/s	n/s	n/s	n/s
03/26/99	n/s	n/s	n/s	n/s
11/28/00	n/s	n/s	n/s	n/s
03/12/01	n/s	n/s	n/s	n/s
06/21/01	n/s	n/s	n/s	n/s
02/11/02	n/s	n/s	n/s	n/s
05/06/02	n/s	n/s	n/s	n/s
10/07/02	n/s	n/s	n/s	n/s
02/14/03	n/s	n/s	n/s	n/s
07/27/06	n/s	n/s	n/s	n/s
11/27/07	n/s	n/s	n/s	n/s
5/10/10	0.049	0.16	0.020	0.73
12/2/10	0.014	0.040	0.0025	0.005

1. Blank cells indicate no data was reported for that event
2. n/s - The well was not sampled during that event
3. Sample results below quantitation limit are shaded and are reported as described above

Table 3

Table 3.5 – July 2006 Analysis Results for Selected PAH Compounds

Analyte	North (ug/l)	South (ug/l)	East (ug/l)	West (ug/l)
Benz(a)anthracene	<10	<10	610	<20
Benzo(a)pyrene	<10	<10	230	<20
Indeno(1,2,3-c,d)pyrene	<10	<10	<100	<20
Dibenzo(a,h)anthracene	<10	<10	<100	<20

Table 4

Table 3.6 - November 2007 Analysis Results for S-VOCs

Parameter	North (ug/l)	East (ug/l)	West (ug/l)	South (ug/l)
2-Methylphenol	<10	38	<10	<10
4-Methylphenol,3-Methylphenol	<10	56	<10	<10
2,4-Dimethylphenol	<10	59	<10	<10
Naphthalene	<10	3,200	26	<10
2-Methylnaphthalene	<10	750	<10	<10
Acenaphthylene	<10	15	<10	<10
Acenaphthene	<10	600	<10	<10
Dibenzofuran	<10	450	<10	<10
Fluorene	<10	400	<10	<10
Pentachlorophenol	<50	9,700	3,000	97
Phenanthrene	<10	780	<10	<10
Anthracene	<10	96	<10	<10
Carbazole	<10	140	<10	<10
Fluoranthene	<10	310	<10	<10
Pyrene	<10	230	<10	<10
Benz(a)anthracene	<10	36	<10	<10
Chrysene	<10	31	<10	<10
Benzo(b)fluoranthene	<10	13	<10	<10
Benzo(k)fluoranthene	<10	12	<10	<10
Benzo(a)pyrene	<10	12	<10	<10

Notes:

1. Analyses performed by EPA Method 8270C
2. S-VOC compounds not listed above were not detected in any of the samples
3. Results with a less than sign were not detected at the listed laboratory reporting limit

Table 5

Table 3.7 – December 2010 Analysis Results for S-VOCs

Parameter	**North** (ug/l)	**East** (ug/l)	**West** (ug/l)	**South** (ug/l)	**MW-105** (ug/l)
Acenaphthene	<5	<5	<5	<5	<5
Acenaphthylene	<5	<5	<5	<5	<5
Anthracene	<5	8	<5	<5	<5
Biphenyl (Diphenyl)	<5	13	<5	<5	<5
Carbazole	<5	40	<5	<5	<5
Dibenzofuran	<5	42	<5	<5	<5
2,4-Dimethylphenol	<5	<5	<5	<5	<5
Fluoranthene	<5	20	<5	<5	<5
Fluorene	<5	34	<5	<5	<5
2-Methylnaphthalene	<5	98	<5	<5	<5
4-Methylphenol	<5	<5	<5	<5	<5
Naphthalene	<5	540	27	<5	<5
Pentachlorophenol	<10	290	1,200	<10	<10
Phenanthrene	<5	54	<5	<5	<5
Pyrene	<5	12	<5	<5	<5
All other compounds	<RL	<RL	<RL	<RL	<RL

Notes:

1. Analyses performed by EPA Method 8270C
2. S-VOC compounds not listed above were not detected in any of the samples
3. <RL – Results were less that the laboratory reporting limits for all of the samples
4. Results with a less than sign were not detected at the listed laboratory reporting limit

Table 3.8 - November 2007 Analysis Results for Metals

Parameter	North (mg/l)	East (mg/l)	West (mg/l)	South (mg/l)
Aluminum	1.4	13	41	2.9
Antimony	<0.0050	<0.0050	<0.0050	0.0087
Arsenic	<0.0020	0.15	0.81	0.0024
Barium	0.046	0.094	0.13	0.084
Beryllium	<0.0025	<0.0025	<0.0025	<0.0025
Cadmium	<0.00050	<0.00050	0.00062	0.00052
Calcium	72	99	49	120
Chromium	<0.020	0.06	0.40	0.027
Cobalt	<0.0050	<0.0050	0.012	<0.0050
Copper	0.0051	0.057	0.45	0.018
Iron	2.1	53	310	4.3
Lead	0.0061	0.012	0.083	0.019
Magnesium	18	33	6.7	23
Manganese	0.031	0.46	0.16	0.028
Mercury	<0.00020	<0.00020	0.00095	<0.00020
Nickel	0.0069	0.0084	0.027	0.042
Potassium	9.7	15	12	11
Selenium	<0.005	<0.005	0.012	<0.0050
Silver	<0.020	<0.020	<0.020	<0.020
Sodium	9.1	38	16	14
Thallium	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	<0.010	0.081	0.81	0.019

Notes:

1. Analyses performed by EPA Methods7470A, 6010B and 6020
2. Results with a less than sign were not detected at the listed laboratory reporting limit

Table 6

Table 3.8 - November 2007 Analysis Results for Metals

Parameter	North (mg/l)	East (mg/l)	West (mg/l)	South (mg/l)
Aluminum	1.4	13	41	2.9
Antimony	<0.0050	<0.0050	<0.0050	0.0087
Arsenic	<0.0020	0.15	0.81	0.0024
Barium	0.046	0.094	0.13	0.084
Beryllium	<0.0025	<0.0025	<0.0025	<0.0025
Cadmium	<0.00050	<0.00050	0.00062	0.00052
Calcium	72	99	49	120
Chromium	<0.020	0.06	0.40	0.027
Cobalt	<0.0050	<0.0050	0.012	<0.0050
Copper	0.0051	0.057	0.45	0.018
Iron	2.1	53	310	4.3
Lead	0.0061	0.012	0.083	0.019
Magnesium	18	33	6.7	23
Manganese	0.031	0.46	0.16	0.028
Mercury	<0.00020	<0.00020	0.00095	<0.00020
Nickel	0.0069	0.0084	0.027	0.042
Potassium	9.7	15	12	11
Selenium	<0.005	<0.005	0.012	<0.0050
Silver	<0.020	<0.020	<0.020	<0.020
Sodium	9.1	38	16	14
Thallium	<0.0020	<0.0020	<0.0020	<0.0020
Vanadium	<0.010	0.081	0.81	0.019

Notes:

1. Analyses performed by EPA Methods7470A, 6010B and 6020
2. Results with a less than sign were not detected at the listed laboratory reporting limit

Table 3.7 - December 2010 Analysis Results for S-VOCs

Parameter	North (ug/l)	East (ug/l)	West (ug/l)	South (ug/l)	MW-105 (ug/l)
Acenaphthene	<5	<5	<5	<5	<5
Acenaphthylene	<5	<5	<5	<5	<5
Anthracene	<5	8	<5	<5	<5
Biphenyl (Diphenyl)	<5	13	<5	<5	<5
Carbazole	<5	40	<5	<5	<5
Dibenzofuran	<5	42	<5	<5	<5
2,4-Dimethylphenol	<5	<5	<5	<5	<5
Fluoranthene	<5	20	<5	<5	<5
Fluorene	<5	34	<5	<5	<5
2-Methylnaphthalene	<5	98	<5	<5	<5
4-Methylphenol	<5	<5	<5	<5	<5
Naphthalene	<5	540	27	<5	<5
Pentachlorophenol	<10	290	1,200	<10	<10
Phenanthrene	<5	54	<5	<5	<5
Pyrene	<5	12	<5	<5	<5
All other compounds	<RL	<RL	<RL	<RL	<RL

Notes:

1. Analyses performed by EPA Method 8270C
2. S-VOC compounds not listed above were not detected in any of the samples
3. <RL - Results were less that the laboratory reporting limits for all of the samples
4. Results with a less than sign were not detected at the listed laboratory reporting limit

Table 7

Table 3.9 – December 2010 Analysis Results for Metals

Parameter	Monitoring Well				
	North (mg/l)	South (mg/l)	East (mg/l)	West (mg/l)	MW-105 (mg/l)
Total Metals (unfiltered samples)					
Arsenic	0.0034	0.0025	0.038	0.0016	0.014
Barium	0.053	0.063	0.068	0.029	0.058
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	0.0080	0.069	0.790	<0.001	0.040
Lead	0.0034	0.0040	<0.001	<0.001	0.014
Mercury	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Selenium	<0.001	0.0035	<0.001	0.0021	0.0015
Silver	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Metals (filtered samples)					
Arsenic	<0.001	0.0025	0.050	0.0015	<0.001
Barium	0.055	0.068	0.075	0.032	0.047
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.001	0.062	0.13	<0.001	<0.001
Lead	<0.001	0.0017	<0.001	<0.001	0.0016
Mercury	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Selenium	<0.001	0.0051	<0.001	0.0030	0.0018
Silver	<0.001	<0.001	<0.001	<0.001	<0.001

Notes:

1. Analyses performed by EPA Methods 7470A and 6010B
2. Results with a less than sign indicate that the parameter was not detected at the reported laboratory reporting limit.

Table 8

Table 3.10 - November 2007 Analysis Results for VOCs

Parameter	**North** (ug/l)	**East** (ug/l)	**West** (ug/l)	**South** (ug/l)
Acetone	<10	<10	15	<10
Benzene	<5.0	6.6	<5.0	<5.0
2-Butanone (MEK)	<10	12	<10	<10
cis-1,2-Dichloroethene	<5.0	<5.0	<5.0	<5.0
trans-1,2-Dichloroethene	<5.0	<5.0	<5.0	<5.0
Ethylbenzene	<5.0	31	5.6	<5.0
Styrene	<5.0	36	<5.0	<5.0
Toluene	<5.0	40	4.3	<5.0
Trichloroethylene	<5.0	<5.0	7.7	<5.0
o Xylene	<5.0	69	34	<5.0
m and p Xylenes	<5.0	103	36	<5.0

Notes:

1. Analyses performed by EPA Method 8260B
2. Compounds not listed above were not detected in any of the samples
3. Results with a less than sign were not detected at the listed laboratory reporting limit

Table 9

Table 3.11 - Northwest Property Line Groundwater Samples Results for Metals

Parameter	GP-01 (mg/l)	GP-02 (mg/l)	GP-03 (mg/l)	GP-04 (mg/l)	GP-05 (mg/l)
Aluminum	250	90	18	6.8	N/S
Antimony	<0.0050	<0.0050	0.0056	<0.0050	N/S
Arsenic	1.7	0.58	0.61	0.0028	N/S
Barium	0.76	0.29	0.071	0.082	N/S
Beryllium	0.018	<0.0025	<0.0025	<0.0025	N/S
Cadmium	0.0030	0.00052	<0.00050	<0.00050	N/S
Calcium	73	59	49	94	N/S
Chromium	1.0	0.51	0.21	0.032	N/S
Cobalt	0.22	0.025	<0.0050	0.0080	N/S
Copper	1.1	0.63	0.40	0.033	N/S
Iron	820	480	190	7.4	N/S
Lead	0.49	0.12	0.36	0.017	N/S
Magnesium	18	16	9.0	16	N/S
Manganese	1.8	0.45	0.098	0.079	N/S
Mercury	0.00530	0.00094	0.00040	<0.00020	N/S
Nickel	0.34	0.047	0.036	0.019	N/S
Potassium	18	17	6.6	8.0	N/S
Selenium	0.0056	0.024	0.011	0.0072	N/S
Silver	<0.020	<0.020	<0.020	<0.020	N/S
Sodium	11	49	8.0	21	N/S
Thallium	0.0022	<0.0020	<0.0020	<0.0020	N/S
Vanadium	1.4	1.3	0.40	0.077	N/S

Notes:

1. Analyses performed by EPA Methods7470A, 6010B and 6020
2. Results with a less than sign were not detected at the listed laboratory reporting limit
3. N/S - location not sampled because temporary well point did not recharge.

Table 10

Table 3.12 - Northwest Property Line Groundwater Samples Results for S-VOCs

Parameter	GP-01 (ug/l)	GP-02 (ug/l)	GP-03 (ug/l)	GP-04 (ug/l)	GP-05 (ug/l)
2-Methylphenol	<10	<10	<10	<10	N/S
4-Methylphenol,3-Methylphenol	<10	<10	<10	<10	N/S
2,4-Dimethylphenol	<10	<10	<10	<10	N/S
Naphthalene	<10	<10	270	<10	N/S
2-Methylnaphthalene	<10	<10	83	<10	N/S
Acenaphthylene	<10	<10	<10	<10	N/S
Acenaphthene	<10	<10	<10	<10	N/S
Dibenzofuran	<10	<10	<10	<10	N/S
Fluorene	<10	<10	<10	<10	N/S
Pentachlorophenol	<50	<50	6,900	<50	N/S
Phenanthrene	<10	<10	<10	<10	N/S
Anthracene	<10	<10	<10	<10	N/S
Carbazole	<10	<10	<10	<10	N/S
Fluoranthene	<10	<10	<10	<10	N/S
Pyrene	<10	<10	<10	<10	N/S
Benz(a)anthracene	<10	<10	<10	<10	N/S
Chrysene	<10	<10	<10	<10	N/S
Benzo(b)fluoranthene	<10	<10	<10	<10	N/S
Benzo(k)fluoranthene	<10	<10	<10	<10	N/S
Benzo(a)pyrene	<10	<10	<10	<10	N/S

Notes:

1. Analyses performed by EPA Method 8270C
2. Compounds not listed above were not detected in any of the samples
3. Results with a less than sign were not detected at the listed laboratory reporting limit
4. N/S - location not sampled because temporary well point did not recharge.

Table 3.13 - Northwest Property Line Groundwater Samples Results for VOCs

Parameter	GP-01 (ug/l)	GP-02 (ug/l)	GP-03 (ug/l)	GP-04 (ug/l)	GP-05 (ug/l)
Acetone	<10	<10	<100	<10	<10
Benzene	<5.0	<5.0	<5.0	<5.0	N/A
2-Butanone (MEK)	<10	<10	<100	<10	<10
cis-1,2-Dichloroethene	<5.0	<5.0	<5.0	6.5	N/A
trans-1,2-Dichloroethene	<5.0	<5.0	<5.0	5.4	N/A
Ethylbenzene	<5.0	<5.0	74	<5.0	N/A
Styrene	<5.0	<5.0	<5.0	<5.0	N/A
Toluene	<5.0	<5.0	20	<5.0	N/A
Trichloroethylene	<5.0	<5.0	11	31	N/A
o-Xylene	<5.0	<5.0	330	<5.0	N/A
m and p-Xylenes	<5.0	<5.0	470	<5.0	N/A

Notes:

1. Analyses performed by EPA Method 8260B
2. Compounds not listed above were not detected in any of the samples
3. Results with a less than sign were not detected at the listed laboratory reporting limit
4. N/S - location not sampled because temporary well point did not recharge

Table 11

Table 3.14 - East Fayette Street Sampling Results for Metals

Parameter	GP106 (mg/l)	GP107 (mg/l)	GP108 (mg/l)	GP109 (mg/l)
Aluminum	<10	<10.	7.3	N/S
Antimony	<0.001	0.0026	0.0017	N/S
Arsenic	0.015	0.14	0.045	N/S
Barium	0.088	0.18	0.11	N/S
Beryllium	0.0018	<0.001	<0.001	N/S
Cadmium	0.0012	<0.001	0.0089	N/S
Calcium	57.	55.	54.	N/S
Chromium	0.079	0.77	0.096	N/S
Cobalt	0.059	0.014	0.087	N/S
Copper	0.060	0.25	0.20	N/S
Iron	36.	160.	25.	N/S
Lead	0.020	0.30	0.093	N/S
Magnesium	16.	13.	12.	N/S
Manganese	0.380	0.26	0.55	N/S
Mercury	0.0051	0.0024	0.0006	N/S
Nickel	0.074	0.024	0.089	N/S
Potassium	3.2	11.	13.	N/S
Selenium	0.0024	0.0026	0.0038	N/S
Silver	<0.001	<0.001	<0.001	N/S
Sodium	68.	74.	71.	N/S
Thallium	<0.001	<0.001	<0.001	N/S
Vanadium	0.060	1.5	0.15	N/S
Zinc	1.1	<0.2	1.3	N/S

Notes:

1. Results with a less than sign indicate that the parameter was not detected at the laboratory reporting limit. The reporting limit is the number following the less than sign.
2. N/S: No sample was obtained.

Table 12

Table 3.15 - East Fayette Street Sampling Results for S-VOCs

Parameter	GP106 (ug/l)	GP107 (ug/l)	GP108 (ug/l)	GP109 (ug/l)
Naphthalene	<5	<5	<5	N/S
Pentachlorophenol	<10	<10	<10	N/S
All other compounds	<RL	<RL	<RL	N/S

Table 3.16 - East Fayette Street Sampling Results for VOCs

Parameter	GP106 (ug/l)	GP107 (ug/l)	GP108 (ug/l)	GP109 (ug/l)
Benzene	210	46	1	N/S
cis-1,2-Dichloroethene	<1	<1	3	N/S
trans-1,2-Dichloroethene	<1	<1	1	N/S
Methyl-t-butyl ether	75	<1	<1	N/S
Trichloroethylene	<1	<1	24	N/S
All other compounds	<RL	<RL	<RL	N/S

Notes:

1. Results with a less than sign indicate that the parameter was not detected at the laboratory reporting limit. The reporting limit is the number following the less than sign.
2. <RL - all compounds not detected at the laboratory reporting limit. Laboratory reporting limit varies by compound. Refer to the laboratory report for individual reporting limits.
3. N/S: No sample was obtained

Table 13

Table 4.1 - Summary of Analytical Results for Metals

Sample Date: May 20, 2015

Analytical Parameter	Units	Screening Levels		RAO	Monitoring Well						
		MCL	Tap Water		North	South	East	West		MW-105	
								Sample	Duplicate	Shallow	Deep
Total Metals EPA Method 6020A											
Aluminum	ug/l	none	20,000		370	310	<100	700	700	670	2,000
Antimony	ug/l	6.0	7.8		<5.0	3.9 J	<5.0	<5.0	<5.0	<5.0	<5.0
Arsenic	ug/l	10	0.052	TBD	1.4	2.1	41	2.4	2.4	3.1	4.3
Barium	ug/l	2,000	3,800		48	71	170	26	27	53	55
Beryllium	ug/l	4.0	25		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	ug/l	5.0	9.2		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calcium	ug/l	none	none		72,000	110,000	160,000	33,000	34,000	58,000	62,000
Chromium	ug/l	100	22,000	TBD	2.6	37	2.2	1.7	1.8	5.2	12
Cobalt	ug/l	none	6.0		<1.0	<1.0	<1.0	1.0	1.1	1.5	1.8
Copper	ug/l	1,300	800		2.1	4.1	1.9	23	23	5.1	7.6
Iron	ug/l	none	14,000		600	390	20,000	1,600	1,700	1,500	2,600
Lead	ug/l	15	15		1.3	1.5	<1.0	0.82 J	0.86 J	2.0	4.0
Magnesium	ug/l	none	none		28,000	26,000	40,000	7,400	7,600	13,000	14,000
Manganese	ug/l	none	430		24	4.0	490	50	51	56	64
Mercury	ug/l	2.0	0.63		<0.20	<0.20	<0.20	2.2	2.2	<0.20	<0.20
Nickel	ug/l	none	390		2.2	5.5	0.71 J	2.5	2.6	2.2	3.3
Potassium	ug/l	none	none		9,700	7,500	18,000	4,400	4,600	7,500	7,400
Selenium	ug/l	50	100		1.7	4.0	<1.0	1.8	1.8	1.2	1.2
Silver	ug/l	none	94		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sodium	ug/l	none	none		5,400	3,200	20,000	22,000	23,000	49,000	48,000
Thallium	ug/l	2.0	0.2		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium	ug/l	none	86		2.7	4.1	2.9	2.3	2.3	5.7	11
Zinc	ug/l	none	6,000		50	110	12 J	71	72	35	36

Notes:

1. Results with a less than sign indicate that the parameter was not detected at the laboratory reporting limit. The reporting limit is the number following the less than sign.
2. <LOD - all compounds not detected at the laboratory limit of detection. Laboratory limit of detection varies by compound. Refer to the laboratory report for individual limits.
3. MCL - Maximum Contaminant Level (Primary Drinking Water Standards)
4. Tap Water - EPA Region 3 Risck Based Concentration for Tap Water, June 2015
5. TBD - To Be Determined
6. RAO - Site Specific Remedial Action Objective

Table 4.2 - Summary of Analytical Results for Semi-Volatile Organic Compounds

Sample Date: May 20, 2015

Analytical Parameter	Units	Screening Levels		RAO	Monitoring Well						
		MCL	Tap Water		North	South	East	West		MW-105	
								Sample	Duplicate	Shallow	Deep
SVOCs EPA Method 8270											
1,1-Biphenyl	ug/l	none	0.83		<5.0	<5.0	14	<5.0	<5.0	<5.0	<5.0
2,4-Dimethylphenol	ug/l	none	360		<5.0	<5.0	6.9	4.1 J	4.0 J	<5.0	<5.0
2-Methylnaphthalene	ug/l	none	36		<5.0	<5.0	<1,000	23	22	4.7 J	5.3
Acenaphthene	ug/l	none	530		<5.0	<5.0	<1,000	11	10	<5.0	<5.0
Acenaphthylene	ug/l	none	none		<5.0	<5.0	10	<5.0	<5.0	<5.0	<5.0
Anthracene	ug/l	none	1,800		<5.0	<5.0	21	<5.0	<5.0	<5.0	<5.0
Carbazole	ug/l	none	none		<5.0	<5.0	<1,000	15	16	<5.0	<5.0
Dibenzofuran	ug/l	none	none		<5.0	<5.0	<1,000	8.9	8.8	<5.0	<5.0
Fluoranthene	ug/l	none	800		<5.0	<5.0	22	<5.0	<5.0	<5.0	<5.0
Fluorene	ug/l	none	290		<5.0	<5.0	<1,000	6.4	8.1	<5.0	<5.0
Naphthalene	ug/l	none	0.17	TBD	<5.0	<5.0	1,600	<2,500	<2,500	21	23
Pentachlorophenol	ug/l	1.0	0.04	450	<5.0	<5.0	10,000	12,000	6,000	1,100	2,400
Phenanthrene	ug/l	none	none		<5.0	<5.0	<1,000	7.6	7.6	<5.0	<5.0
Pyrene	ug/l	none	120		<5.0	<5.0	12	<5.0	<5.0	<5.0	<5.0
All other compounds	ug/l				<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Notes:

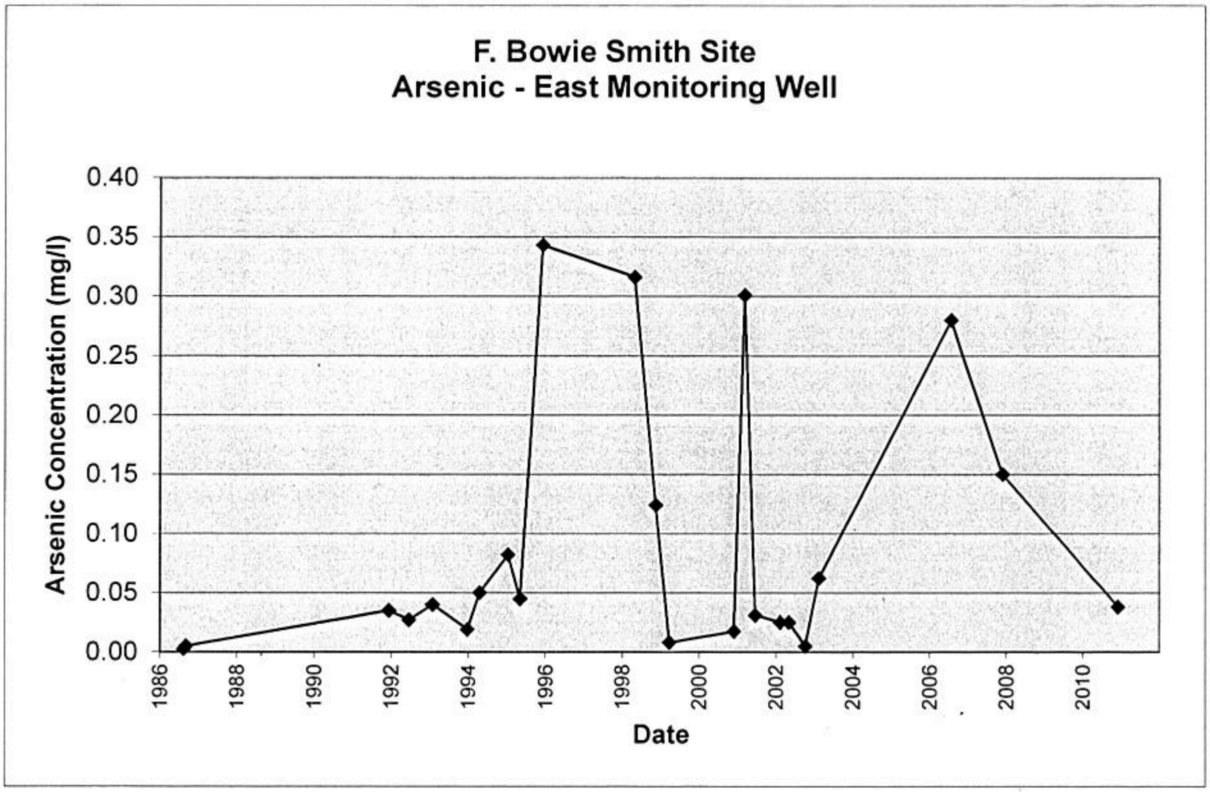
1. Results with a less than sign indicate that the parameter was not detected at the laboratory reporting limit. The reporting limit is the number following the less than sign.
2. <LOD - all compounds not detected at the laboratory limit of detection. Laboratory limit of detection varies by compound. Refer to the laboratory report for individual limits.
3. J - estimated value
4. MCL - Maximum Contaminant Level (Primary Drinking Water Standards)
5. Tap Water - EPA Region 3 Risck Based Concentration for Tap Water, June 2015
6. TBD - To Be Determined
7. RAO - Site Specific Remedial Action Objective

Table 14

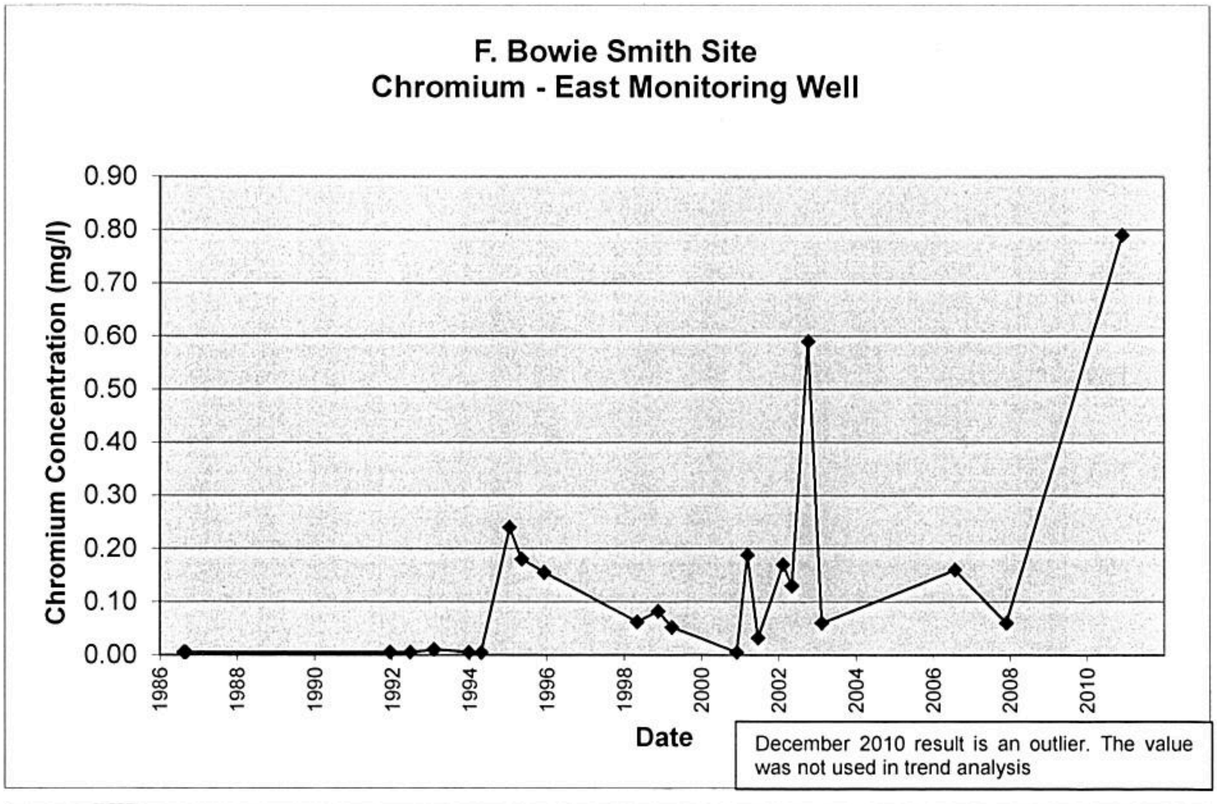
Table 4.5 –Highest Concentrations of Contaminants of Concern in December 2010

Contaminant of Concern	Highest Concentration (mg/l)	Location of Highest Concentration	MW-105 Concentration (mg/l)
Arsenic	0.038	East Well	0.014
Chromium	0.79	East Well	0.040
Naphthalene	0.54	East Well	<0.005
Pentachlorophenol	1.2	West Well	<0.010

Attachment 1

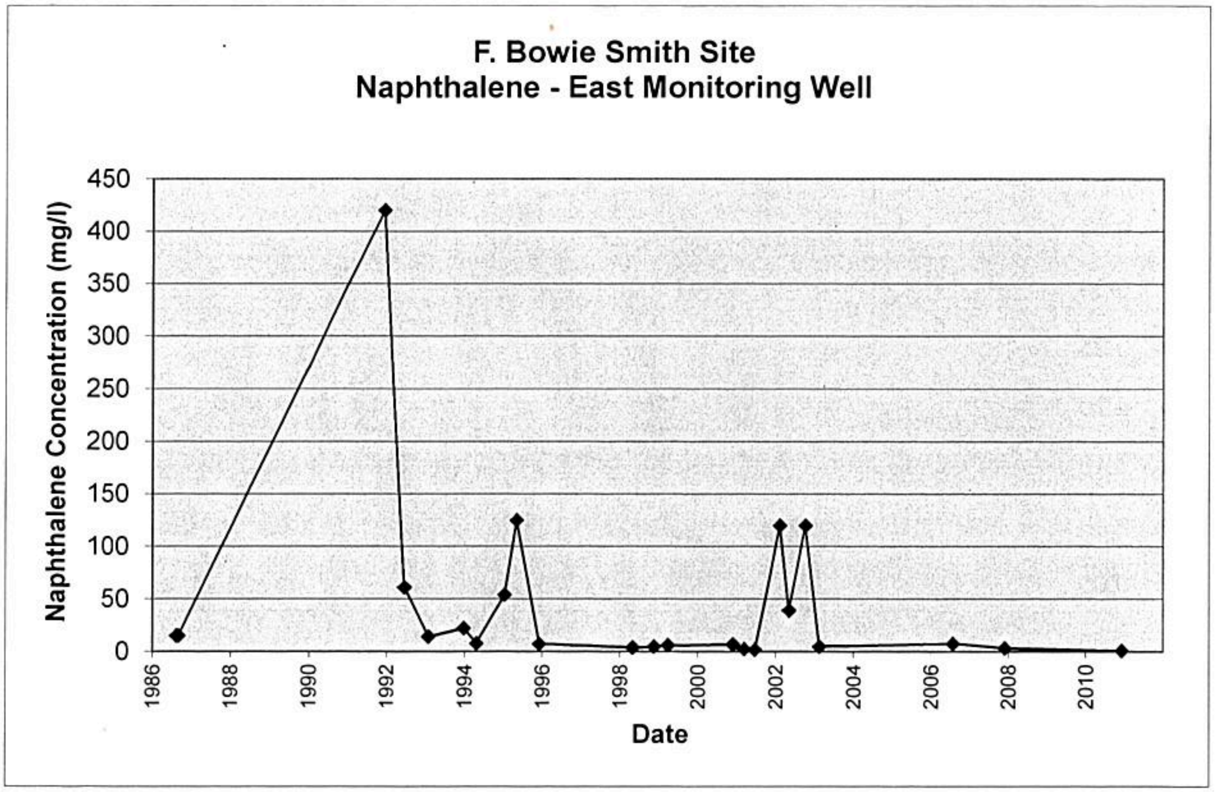


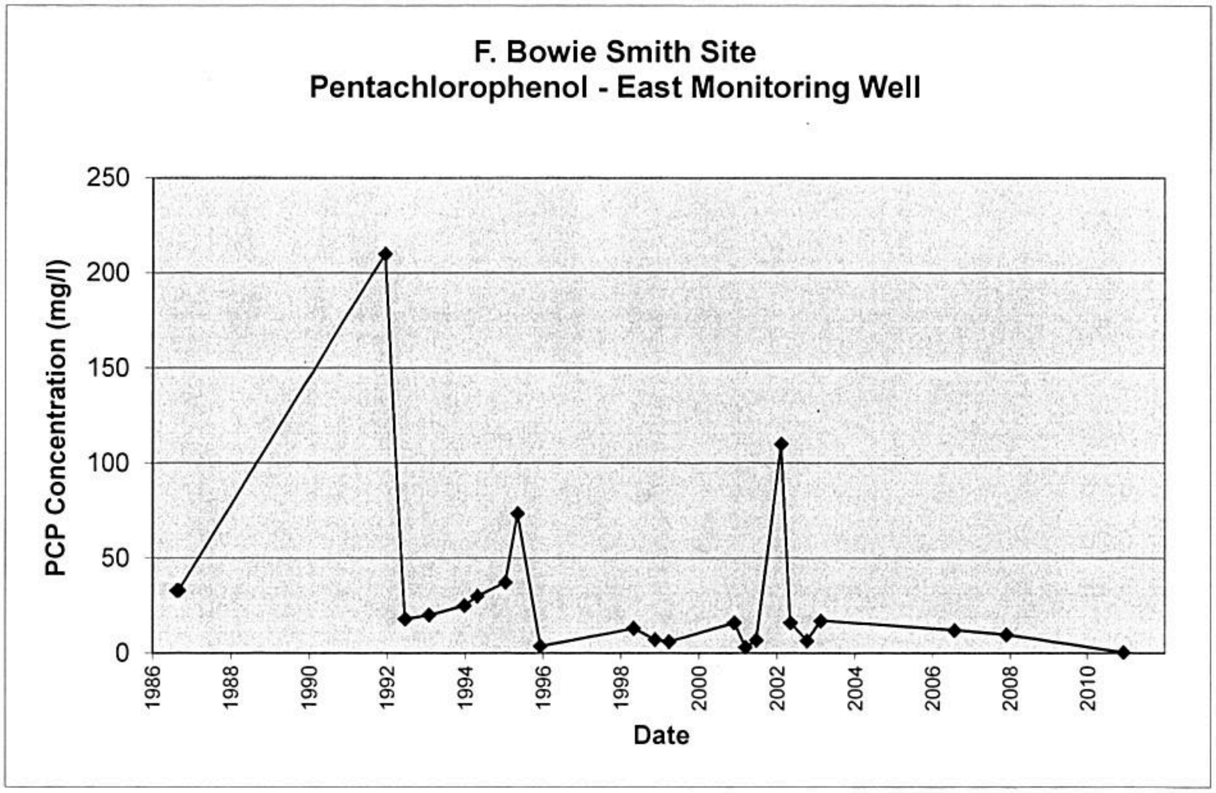
F. Bowie Smith Site
Arsenic - East Monitoring Well

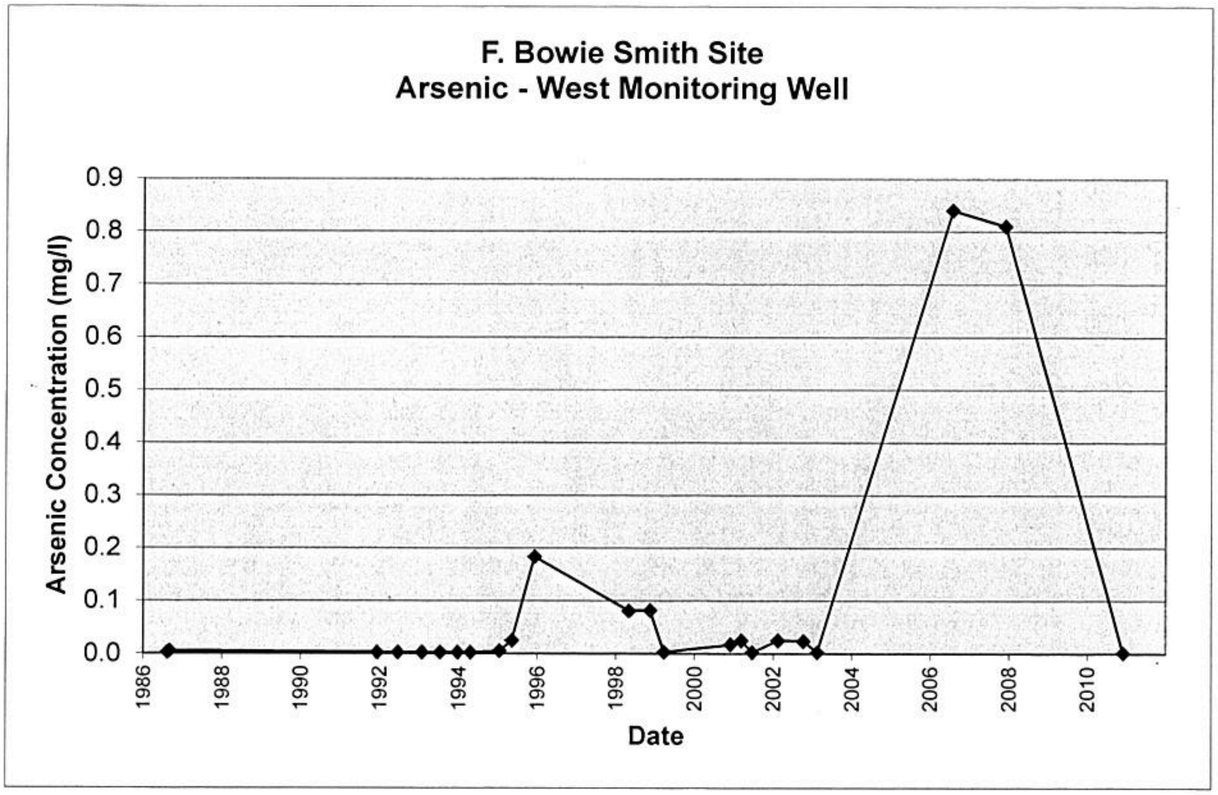


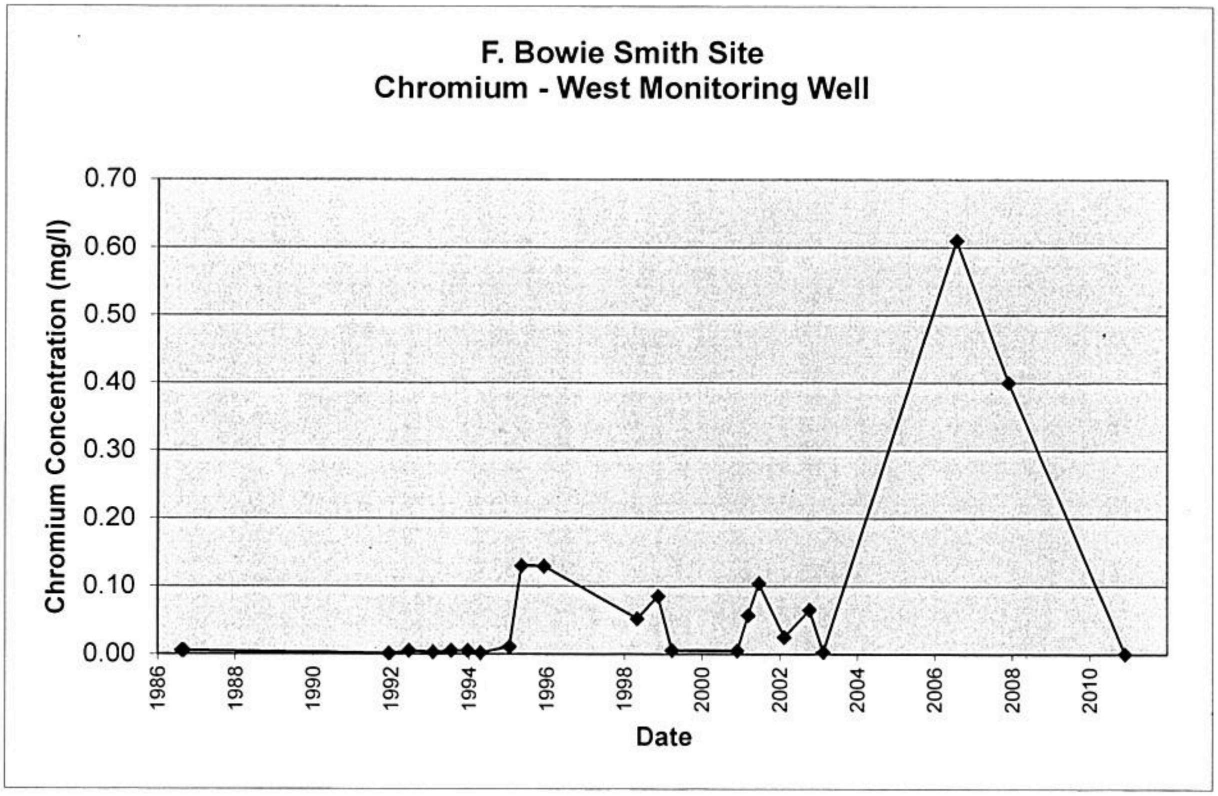
F. Bowie Smith Site
Chromium - East Monitoring Well

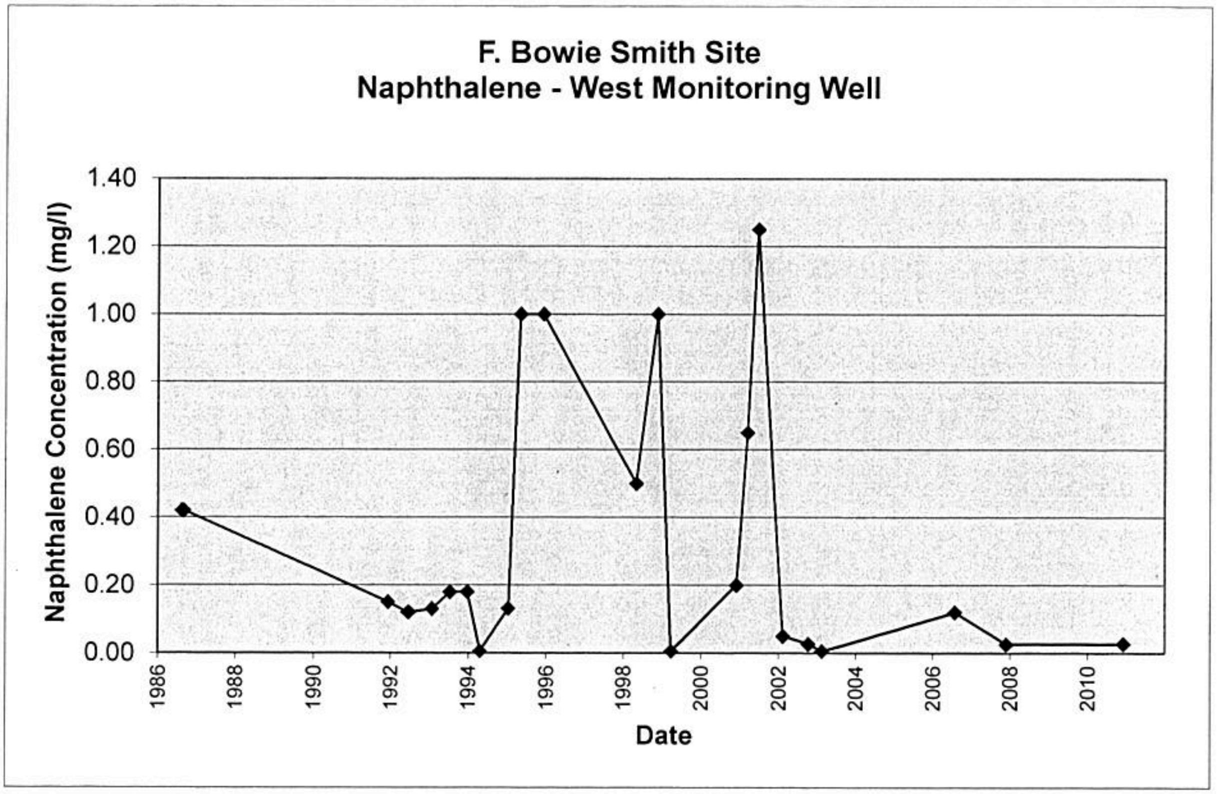
December 2010 result is an outlier. The value was not used in trend analysis


F. Bowie Smith Site
Naphthalene - East Monitoring Well
Naphthalene Concentration (mg/l)
450
400
350
300
250
200
150
100
50
0
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Date


F. Bowie Smith Site
Pentachlorophenol - East Monitoring Well
PCP Concentration (mg/l)
250
200
150
100
50
0
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Date


F. Bowie Smith Site
Arsenic - West Monitoring Well
Arsenic Concentration (mg/l)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Date


F. Bowie Smith Site
Chromium - West Monitoring Well
Chromium Concentration (mg/l)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Date


F. Bowie Smith Site
Naphthalene - West Monitoring Well
Naphthalene Concentration (mg/l)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1986
1988
1990
1992
1994
1996
1998
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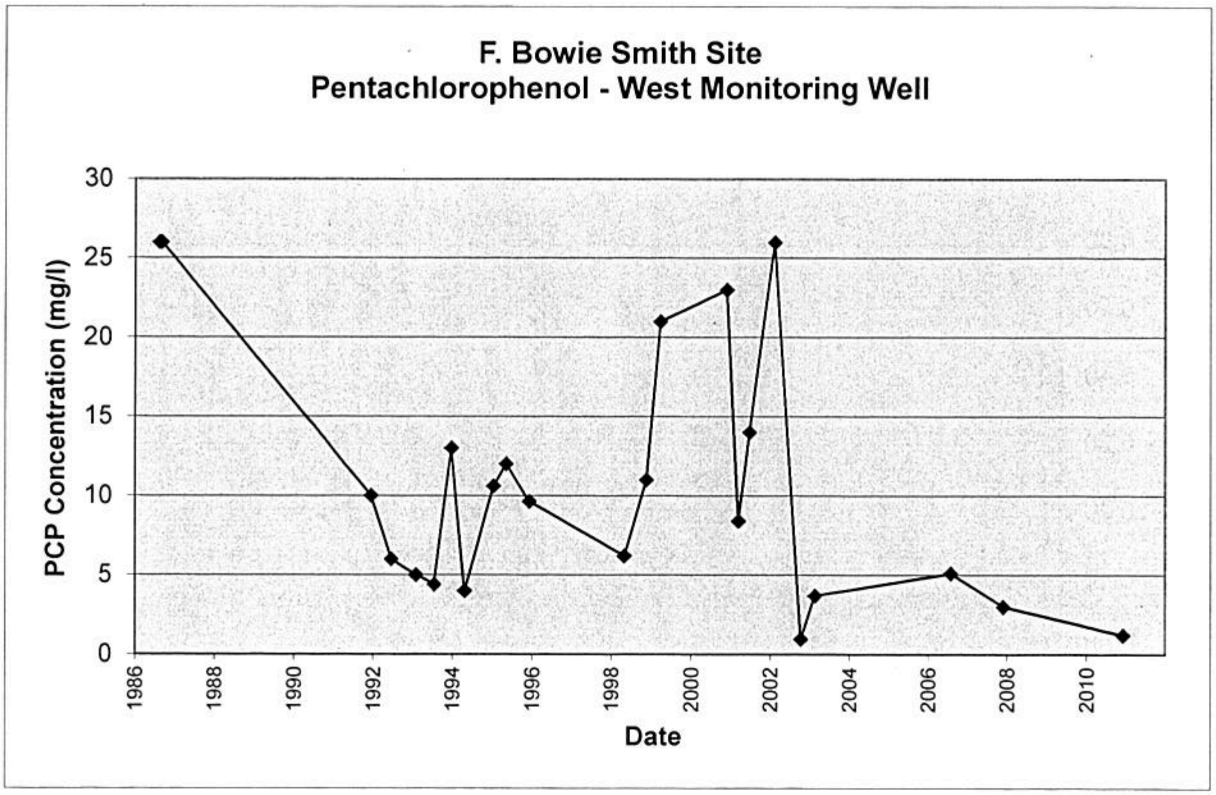
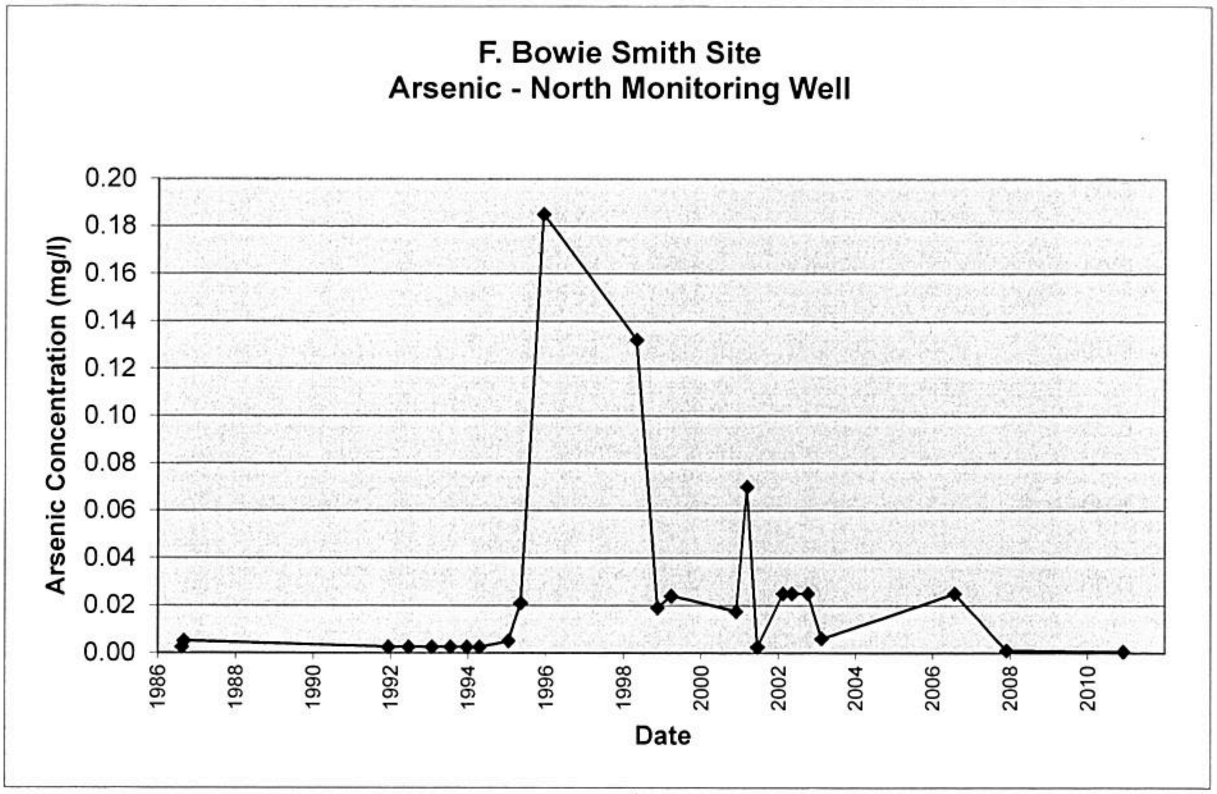
2006
2008
2010
Date


F. Bowie Smith Site
Pentachlorophenol - West Monitoring Well
PCP Concentration (mg/l)
30
25
20
15
10
5
0
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Date


F. Bowie Smith Site
Arsenic - North Monitoring Well
Arsenic Concentration (mg/l)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1986
1988
1990
1992
1994
1996
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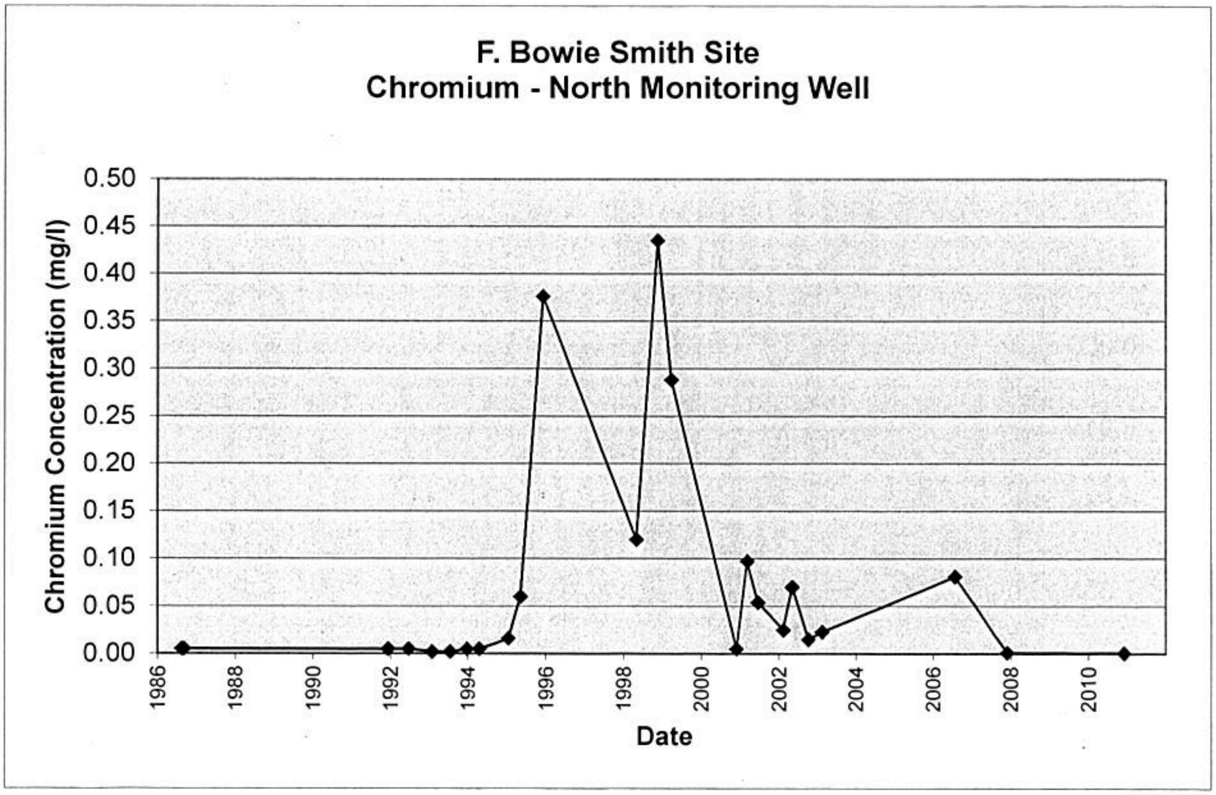
2002
2004
2006
2008
2010
Date


F. Bowie Smith Site
Chromium - North Monitoring Well
Chromium Concentration (mg/l)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1986
1988
1990
1992
1994
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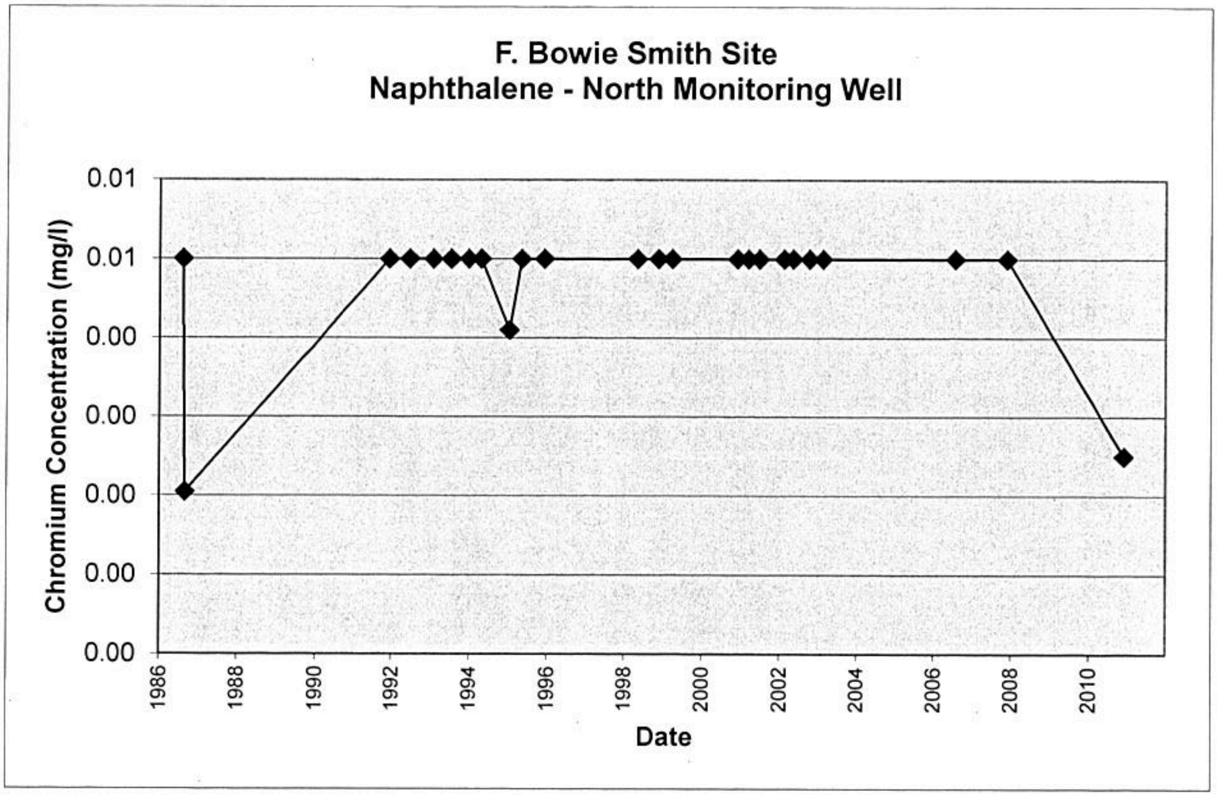
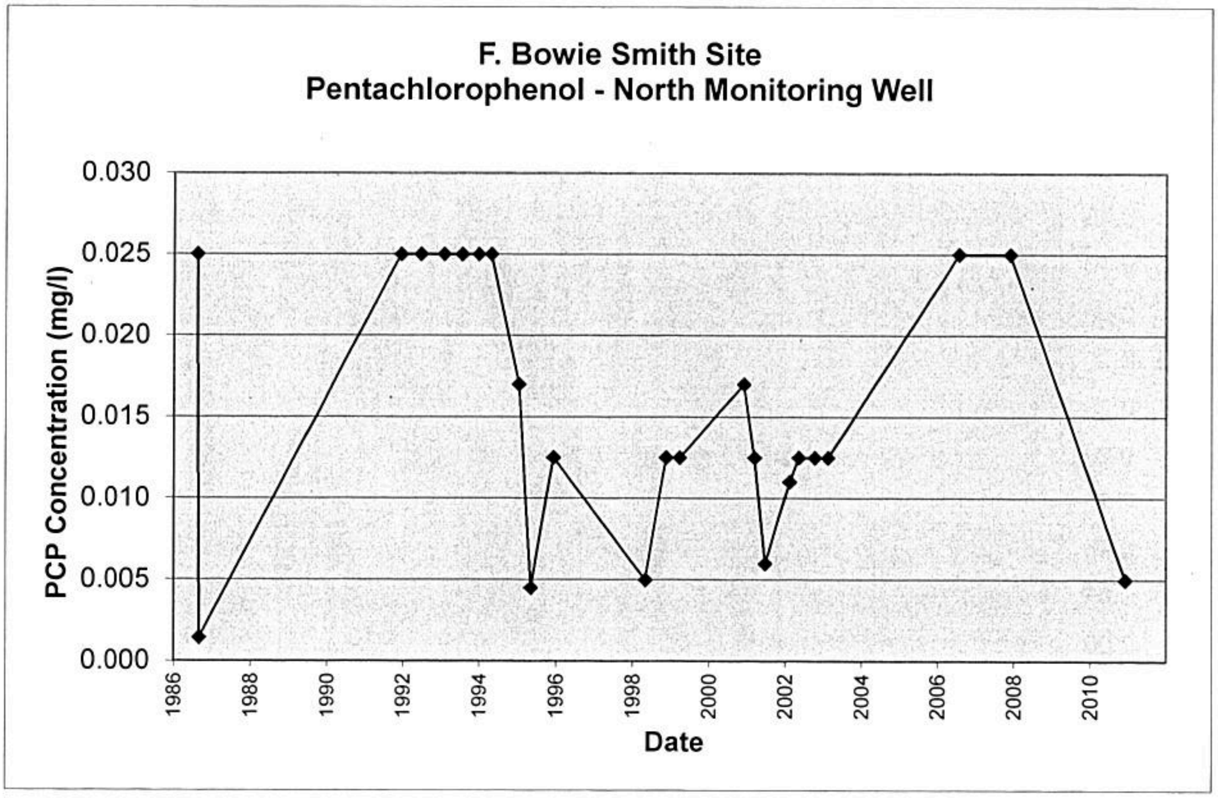
Date


F. Bowie Smith Site
Naphthalene - North Monitoring Well
Chromium Concentration (mg/l)
0.01
0.01
0.00
0.00
0.00
0.00
0.00
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Date


F. Bowie Smith Site
Pentachlorophenol - North Monitoring Well
PCP Concentration (mg/l)
0.030
0.025
0.020
0.015
0.010
0.005
0.000
1986
1988
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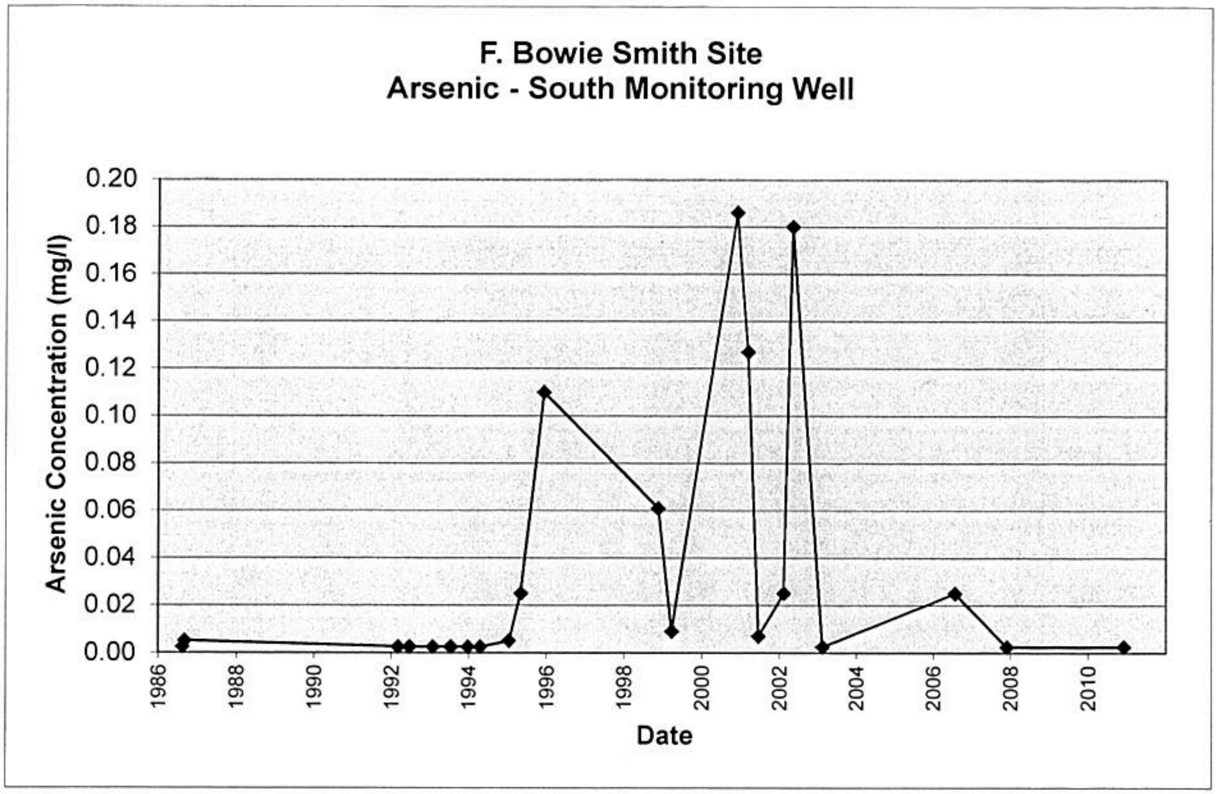
Date


F. Bowie Smith Site
Arsenic - South Monitoring Well
Arsenic Concentration (mg/l)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1986
1988
1990
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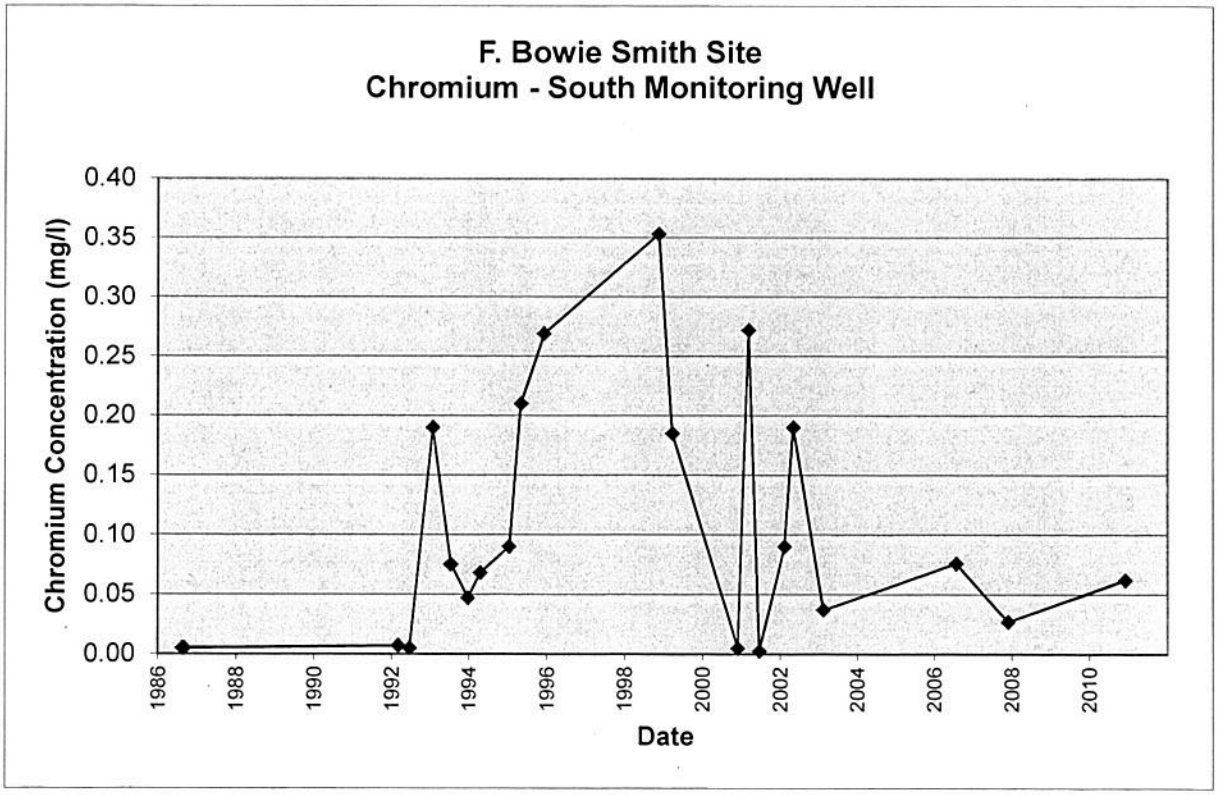
Date


F. Bowie Smith Site
Chromium - South Monitoring Well
Chromium Concentration (mg/l)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1986
1988
1990
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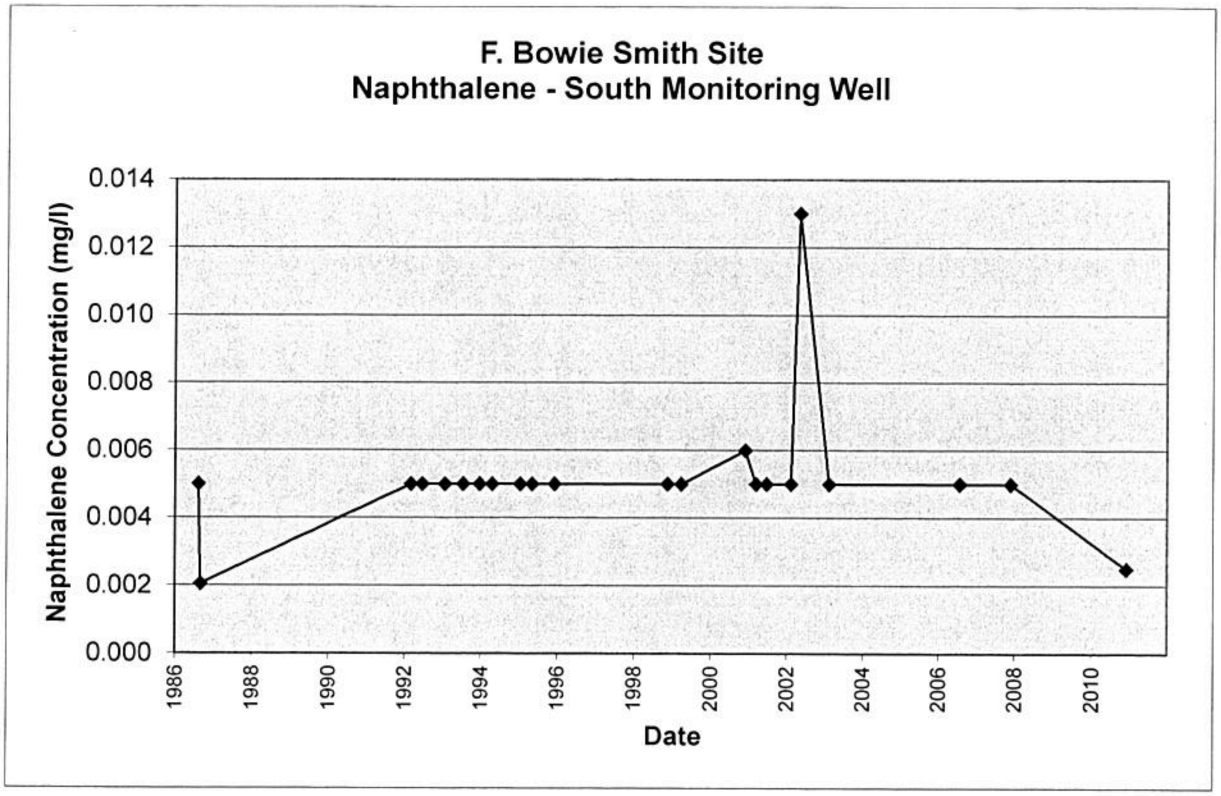
Date


F. Bowie Smith Site
Naphthalene - South Monitoring Well
Naphthalene Concentration (mg/l)
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
1986
1988
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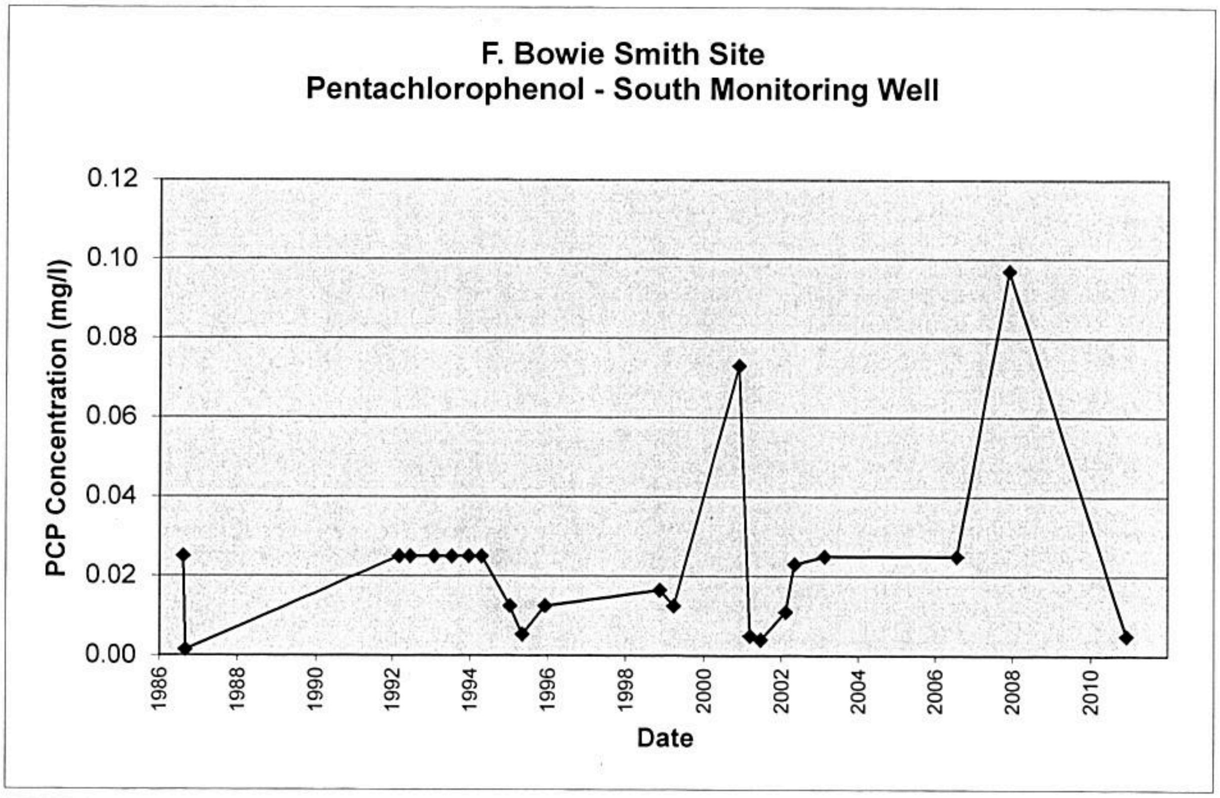
Date


F. Bowie Smith Site
Pentachlorophenol - South Monitoring Well
PCP Concentration (mg/l)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
1986
1988
1990
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1994
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1998
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Date

Attachment 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

SUBJECT: Recommended remedial goals for select groundwater contaminants at the 4500 E. Lombard Street site

DATE: January 6, 2016

FROM: Betty Ann Quinn, Toxicologist

TO: Ed Hotham, Project Manager

This memorandum presents potential remedial action goals for contaminants reported in groundwater at concentrations of concern at the 4500 E. Lombard Street (former F. Bowie Smith) site in Baltimore, MD. Because there is a prohibition on use of groundwater for potable purposes and the drilling of wells in Baltimore, use of groundwater beneath the site as drinking water is unlikely, and remedial goals based on domestic use of groundwater were not developed. Exposure to groundwater by construction workers is possible, as is migration of volatile chemicals from groundwater to future buildings on the site. Therefore two sets of remedial goals are proposed: one based on direct exposure by construction workers, and the second addressing vapor intrusion of volatile chemicals to a future onsite building.

Contaminants of potential concern (COPCs) for groundwater at the site have historically included pentachlorophenol, arsenic, chromium, and naphthalene. Two additional COPCs—manganese (up to 490 ug/l and 1800 ug/l) and mercury (up to 2.6 ug/l (USACE data) and 5.3 ug/l)---have been reported in groundwater in several samples at concentrations exceeding health-based screening concentrations, and are also included in this memo. Remedial goals for pentachlorophenol were addressed previously (memorandum dated 10/18/2010). Potential remedial goals are estimated for COPCs arsenic, chromium, mercury, manganese, and naphthalene in this memorandum.

Construction workers:

The primary means for exposure by construction workers to site groundwater would be while performing excavation activities. In an excavation trench, exposure to shallow groundwater may occur through incidental ingestion, direct (dermal) contact, and inhalation. The Virginia state Department of Environmental Quality (DEQ) Voluntary Remediation Program has developed a model that provides estimates of risk and potential remedial goals for construction workers working in an excavation trench. Remedial goals listed below were obtained from the VA DEQ trench model website (note that the state of Maryland has no comparable guidance). For shallow groundwater (< 15 ft deep), exposures via incidental ingestion, direct contact, and inhalation are possible. For groundwater greater than 15 feet deep, inhalation is the sole exposure route of concern.

The tables below list potential groundwater remedial goals for site COPCs for cancer and non-cancer health endpoints. The VA DEQ Voluntary Remediation Program utilizes a risk of 1E-05 as a point of departure for remedial goals based on cancer endpoints. Non-cancer risks are based on a Hazard Quotient of 1. Since naphthalene is the only COPC that is volatile, the deep groundwater remedial goals include only this contaminant.

Chromium remedial goals are based on toxicity criteria for the hexavalent chromium species (Cr VI). Groundwater samples at the site were analyzed for total chromium, and the possible proportion of trivalent (III) to hexavalent (VI) chromium in groundwater is not known. Because hexavalent chromium is far more soluble in water and is more toxic than trivalent chromium, the concentration of total chromium reported is conservatively assumed to exist as the hexavalent species.

<u>Remedial Goals for groundwater less than 15 feet deep (construction worker: ingestion, dermal, and inhalation exposure):</u>

Contaminant	ug/l at Cancer Risk of 1E-05	ug/l at non-Cancer HQ of 1	Recommended Remedial Goal
Arsenic	3220	2070	2070
Chromium VI[a]	289	4130	289
Manganese	na	965,000	965,000
Mercury	na	2140	2140
Naphthalene	49.5	7.21	7.21

[a] See text for explanation for use of CrVI for remedial goal calculation

<u>Remedial Goals for groundwater greater than 15 feet deep (construction worker: assumes inhalation exposure only):</u>

Contaminant	ug/l at Cancer Risk of 1E-05	ug/l at non-Cancer HQ of 1	Recommended Remedial Goal
Arsenic	na	na	na
Chromium VI[a]	na	na	na
Manganese	na	na	na
Mercury	na	na	na
Naphthalene	5040	735	735

[a] See text for explanation for use of CrVI for remedial goal calculation

Of the COPCs listed above, chromium and naphthalene are the only contaminants reported in groundwater at concentrations exceeding conservative proposed remedial goals. Remedial goals assumed worker exposure to groundwater in a trench for four hours per day, 125 days per year, for a total of one year. Because the 4500 E. Lombard Street site is relatively small, these exposure estimates may be overprotective. Therefore, the above remedial goals for chromium and naphthalene were further refined.

Construction projects on a smaller property are likely to be smaller in scope, and may not take place over a full year. If an exposure duration of 25 days per year is assumed for construction work in an onsite trench at the site, potential remedial goals for groundwater would be proportionately higher. The tables below list possible remedial goals assuming 25 days of construction worker exposure in a trench to groundwater (both < 15 feet deep and > 15 feet deep).

Groundwater less than 15 feet deep:

	Exposure Frequency Days/yr	**ug/l at Cancer Risk of 1E-05**	**ug/l at Cancer Risk of 1E-04**	**ug/l at non-Cancer HQ of 1**	**Recommended Remedial Goal**
Chromium VI[a]	125	289	2890	4130	289
	25	1425	14,450	20,650	1425
Naphthalene	125	49.5	495	7.21	7.21
	25	248	2480	36	36

[a] See text for explanation for use of CrVI for remedial goal calculation

Groundwater greater than 15 feet deep:

	Exposure Frequency Days/yr	**ug/l at Cancer Risk of 1E-05**	**ug/l at Cancer Risk of 1E-04**	**ug/l at non-Cancer HQ of 1**	**Recommended Remedial Goal**
Chromium VI[a]	125	na	na	na	Na
	25	na	na	na	Na
Naphthalene	125	5040	5040	735	735
	25	25,200	25,200	3675	3675

[a] See text for explanation for use of CrVI for remedial goal calculation

Vapor Intrusion to a Future Onsite Building:

No currently occupied buildings exist on the E. Lombard Street site. It is possible that a future structure or building may be erected and vapor migration into such a building is possible. Of the COPCs addressed in this memorandum, only naphthalene is volatile and may migrate through the subsurface into a future onsite building.

Potential remedial goals for groundwater assuming possible migration of naphthalene to indoor air were developed using the EPA Vapor Intrusion Screening Level (VISL) calculator, and are listed on the table below. A commercial worker was the assumed receptor, and the groundwater temperature was changed from the default value of 25 ° C to a value of 14 ° C, which is the average groundwater temperature reported in the Baltimore, MD, vicinity.

Contaminant	**ug/l at Cancer Risk of 1E-05**	**ug/l at Cancer Risk of 1E-04**	**ug/l at non-Cancer HQ of 1**	**Recommended Remedial Goal**
Naphthalene	460	4600	1700	460

It is important to note that, an alternative to implementing a remedial goal for groundwater based on possible vapor intrusion could be an enforceable requirement for inclusion of vapor barriers or other vapor mitigation measures for future construction. Another possible strategy to address vapor intrusion concerns would be to evaluate a new building for the presence of significant contamination that has migrated from contaminated groundwater, along with associated risks.