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**FOURTH FIVE-YEAR REVIEW REPORT
FOR
CHEM-DYNE SUPERFUND SITE
BUTLER COUNTY, OHIO**



Prepared by

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9-21-15

Date

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LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BGS	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIC	Community Involvement Coordinator
DCE	Dichloroethylene
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
EPA	United States Environmental Protection Agency
Fe ⁺²	Ferrous Iron
FYR	Five-Year Review
IC	Institutional Control
ICIAP	Institutional Control Implementation and Assurance Plan
LTS	Long-term Stewardship
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
µg/L	Microgram per Liter
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
Ohio EPA	Ohio Environmental Protection Agency
ORP	Oxidation-Reduction Potential
OU	Operable Unit
P & T	Pump and Treat
PCE	Tetrachloroethene
PRP	Potentially Responsible Party
ROD	Record of Decision
RPM	Remedial Project Manager
SVE	Soil Vapor Extraction
TCE	Trichloroethylene
TOC	Total Organic Carbon
Trust	Chem-Dyne Site Trust
UECA	Uniform Environmental Covenants Act
UU/UE	Unlimited Use and Unrestricted Exposure
VOCS	Volatile Organic Compounds

EXECUTIVE SUMMARY

This is the fourth Five-Year Review (FYR) for the Chem-Dyne Superfund Site (Chem-Dyne or Site) located in Hamilton, Ohio. The purpose of this FYR is to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this statutory FYR was the signing of the previous FYR on September 23, 2010.

The Chem-Dyne Site is located at 500 Joe Nuxhall Boulevard (formerly Ford Boulevard). The Site was used for the processing and storage of chemical wastes including waste oils, plastics, and resins. Site operations resulted in the contamination of soils and groundwater with volatile organic compounds (VOCs).

A Record of Decision (ROD) was signed on July 5, 1985. The major components of the remedy for the Chem Dyne Site included the demolition of Site buildings, excavation of contaminated soil, installation of a groundwater pump and treat (P & T) extraction system, installation of a cap with an infiltration barrier layer, and groundwater monitoring. The remedy was enhanced by the addition of a soil vapor extraction (SVE) system in 2008 and optimized in 2011 by including additional SVE system extraction wells. Much of the Site groundwater has met the 100 micrograms per liter ($\mu\text{g/L}$) total VOC cleanup goal. The Site currently operates under an approved Monitored Natural Attenuation (MNA) Pilot Study which began in June 2015.

The remedy at the Chem-Dyne Superfund Site currently protects human health and the environment and it was constructed in accordance with the requirements of the 1985 ROD. The groundwater treatment system, the SVE systems, and other remedy components such as the cap function as intended by the ROD. Exposure pathways that could result in unacceptable risks are being controlled by preventing exposure to, or the ingestion of, contaminated groundwater. However, in order for the remedy to be protective in the long term, the following actions need to be taken: institutional controls (ICs) need to be implemented; an Institutional Control Implementation and Assurance Plan (ICIAP) needs to be developed; long-term stewardship (LTS) procedures need to be developed and implemented via an LTS Plan or amendment to the Operation and Maintenance (O&M) Plan; and the remedy decision document needs to be modified to incorporate ICs as a component of the remedy.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Chem-Dyne Superfund Site		
EPA ID: OH		
Region: 5	State: OH	City/County: City of Hamilton/ Butler County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	Has the site achieved construction completion? Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): L. Hill		
Author affiliation: EPA		
Review period: 03/23/2015 to 9/23/2015		
Date of site inspection: 5/21/2015		
Type of review: Statutory		
Review number: 4		
Triggering action date: 9/23/2010		
Due date (five years after triggering action date): 09/23/2015		

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:

None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): Sitewide	Issue Category: Institutional Controls			
	Issue: ICs are not fully implemented at the Site.			
	Recommendation: Implement ICs at the Site.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRPs	EPA/State	09/30/2016

OU(s): Sitewide	Issue Category: Institutional Controls			
	Issue: ICs requirements need to be evaluated.			
	Recommendation: Develop an ICIAP.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRPs	EPA/State	09/30/2016

OU(s): Sitewide	Issue Category: Institutional Controls			
	Issue: LTS procedures are needed.			
	Recommendation: Develop an LTS Plan or amend the O&M Plan to incorporate LTS procedures.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRPs	EPA/State	09/30/2016

OU(s): Sitewide	Issue Category: Institutional Controls			
	Issue: Remedy decision document needs to be updated to incorporate ICs as a component of the remedy.			
	Recommendation: Modify remedy decision document to incorporate ICs.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	EPA	EPA/State	09/30/2016

Sitewide Protectiveness Statement

Protectiveness Determination:

Short-term Protective

The remedy at the Chem-Dyne Superfund Site currently protects human health and the environment because it was constructed in accordance with the requirements of the 1985 ROD. The groundwater treatment system, the SVE systems, and other remedy components such as the cap function as intended by the ROD. Exposure pathways that could result in unacceptable risks are being controlled by preventing exposure to, or the ingestion of, contaminated groundwater. However, in order for the remedy to be protective in the long term, the following actions need to be taken: ICs need to be implemented; an ICIAP needs to be developed; LTS procedures need to be developed and implemented via an LTS Plan or amendment to the O&M Plan; and the remedy decision document needs to be modified to incorporate ICs as a component of the remedy.

I. INTRODUCTION

The purpose of a FYR is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The United States Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). CERCLA Section 121 states:

"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."

EPA interpreted this requirement further in the NCP at 40 Code of Federal Regulations Section 300.430(f)(4)(ii), which states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

EPA conducted a FYR on the remedy implemented at the Chem-Dyne Site in Hamilton, Ohio. EPA is the lead agency for developing and implementing the remedy for the Site. The Ohio Environmental Protection Agency (Ohio EPA), as the support agency representing the State of Ohio, has reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the fourth FYR for the Chem-Dyne Site. The triggering action for this statutory review is the completion date of the previous FYR. The FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE). The Chem-Dyne Site consists of one Operable Unit (OU), which is addressed in this FYR. Background information about the Site is provided in Appendix A.

II. PROGRESS SINCE THE LAST REVIEW

Table 1: Protectiveness Determinations/Statements from the 2010 FYR

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Short-Term	The site remedy currently protects human health and the environment because the excavation and removal of contaminated soils, the groundwater monitoring and the extraction system, and the site cap with impermeable infiltration barrier are functioning as designed and are protective of human health and the environment in the short term. Once all groundwater remedial action cleanup goals are achieved and the institutional controls are fully implemented, the remedy should provide long-term protection.

Table 2: Status of Recommendations from the 2010 FYR

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Party	Original Milestone Date	Current Status	Completion Date (if applicable)
Sitewide	Institutional controls are not fully implemented at the Site.	An IC work plan and draft IC Action plan should be prepared by the PRPs.	PRPs	EPA and Ohio EPA	March 2011	Under Discussion	n/a

The above issue and recommended action is discussed in the *Institutional Controls* section below.

The 2010 FYR identified several additional issues and recommended actions for the Site. They were summarized on page "v" and discussed in more detail on pages 15 through 19 of the 2010 FYR. Those 2010 FYR issues, recommended actions, and their current status are presented below, in italics.

***Issue #1.** The groundwater P & T system has experienced a significant reduction in the cumulative VOC mass removal from the start-up of the system (in February 1987) to 2009. This indicates that the system no longer provides the treatment necessary for attaining groundwater performance goals in a time efficient manner. Mass removal is still significant, but has steadily declined with time. Because the bulk of remaining source mass is probably bound to low permeability on-site soils in the unsaturated zone and the aquifer matrix, rather than being distributed in the dissolved phase, future groundwater extraction will prove effective primarily for hydraulic containment.*

***Issue #2.** Northern plume delineation, as reported in the 2009 Annual Report, is currently jeopardized by an absence of shallow monitoring wells in the northern portion of the Site. Vertical aquifer sampling results from October 2007 indicate that the 2009 Annual Report interpretation is incomplete. The October 2007 residual source investigation identified a northern plume emanating from the Site through vertical aquifer sampling. Onsite vertical aquifer sample locations VP-1 and VP-2 which detected elevated chlorinated hydrocarbons,*

were sampled in an area of the Site formerly absent of monitoring wells. Potential source areas north of VP-1 and VP-2, within the footprint of the former Chem-Dyne building, and the former tank farm immediately west of the Site, are also absent of monitoring wells. In the absence of shallow monitoring well data, the 2009 Annual Report, Figures 10, 12, 14, and 16, depicts the shallow plume as being isolated off-site at the power plant with no on-site plume.

Issue #3. Significant challenges to drilling and well installation in support of plume and source delineation include subsurface heterogeneity, buried utilities, and drilling refusal in on-site areas where concrete building foundations and basements were buried in-place under the cap as part of approved removal actions. Subsurface building structures have made recent characterization attempts difficult. For example in January 2009, drilling within the footprint of the former Ford Motor plant building encountered approximately eight continuous feet of solid concrete, to a depth of 15 feet below ground surface (bgs) at MW-41.

If plume and source delineation in support of attaining performance goals is not undertaken, operational and maintenance costs associated with the aging P & T system are expected to out-pace investigative costs.

The longer the groundwater system operates, the greater the expected frequency of costly repairs needed to keep the system running. During the span of this five-year review, the total annual operating and administrative expenses increased from \$514,151 in 2005 to \$896,815 in 2009. Expenses in 2009 were greater than previous years due to the installation of new monitoring wells and extraction well IE-8, and the expansion of the SVE system. Operation and maintenance expenses in 2009 included replacement pumps for nine extraction wells due to fouling and mechanical failure (Table 5, 2009 Annual Report). According to an Ohio EPA interview of the Chem-Dyne plant operations manager, Mr. Ron Holt, each replacement pump costs \$400 to \$500. Additional system repairs in 2009 included the replacement of three extraction well flow transmitters, with a unit cost of \$1,950 each. Also last year, the discharge pump to the Ford Hydraulic Canal required new seals, costing approximately \$700. Power required to run the current remedial systems (P & T and soil vapor extraction combined) costs approximately \$3,000 to \$4,000 per month.

Issue #4. With pump and treat being primarily effective for maintaining hydraulic containment, and with SVE mass removal rates beginning to decline, an expedited attainment of groundwater performance goals for MW-15 and additional wells is not anticipated (groundwater flow velocities range from 0.5 to 1.5 feet/day, with time of travel from the northern SVE system to the power plant being on the range of one year). As of March 2009, eight of the site's 68 wells within the limits of the current plume were above the 100 µg/L total VOC performance goal. Among these, the most elevated well is consistently shallow monitoring well MW-15, located down-gradient of Chem-Dyne at the Hamilton Power Plant. Total VOCs in MW-15 have been above the 100 µg/L performance goal since 1983. The concentration trend since 1991 appears to be constant.

Issue #5. No shallow monitoring wells are in place upgradient of MW-15 at an equivalent screen depth for representative plume delineation. Shallow monitoring of the northern, on-site water table smear zone, at depths equivalent to MW-15 appears possible. Installation of northern Chem-Dyne site, intermediate depth wells MW-37 through 41 occurred during a seasonal water table low, in January 2009. During drilling, a lack of saturation to depths of 49

to 40 feet bgs respectively seemed to suggest that shallow monitoring wells screened above the observed zone of saturation would be dry. However, subsequent water level measurements were considerably shallower, ranging from 30.99 to 35.48 feet bgs.

Section line A-A' depicted in map view in Figure 4 and cross-sectional profile in Figure 6, three-dimensionally illustrates monitoring data gaps hampering meaningful interpretation of the northern plume. In each figure, the section line extends parallel to the northwesterly groundwater flow path, extending from the Chem-Dyne site to the Hamilton Power Plant. The map view in Figure 4 depicts a 1980 aerial photographic base map, overlain by the spatial distribution of shallow wells (screen intervals from 30 to 50 feet bgs) shown in yellow and intermediate depth wells (screen intervals from 49 to 69 feet bgs) shown in red. As shown, no monitoring wells currently exist within the foot print of the former Chem-Dyne building or former tank farm immediately west to its west. With down-gradient monitoring well MW-15 consistently having the most elevated groundwater concentrations above performance goals, the lack of upgradient monitoring for plume delineation poses a problem.

The cross-sectional view in Figure 6 superimposes total VOC concentrations from the most recent water table high sampling event of March 2010, with the corresponding screen intervals. As shown, the maximum total VOC concentration of 3,509 µg/L occurs off-site at shallow monitoring well MW-15, screened from 28.5 to 38.5 feet bgs. Monitoring wells upgradient of MW-15 are not screened at an equivalent depth, but are screened deeper as follows: MW-37 (49 to 59'); MW-38 (40 to 50'); MW-41 (50 to 60'); MW-39 (40 to 50'). If the source affecting MW-15 is located in the shallow zone beneath the former Chem-Dyne building or the former tank farm, groundwater may migrate undetected, until reaching MW-15.

Recommendation #1. In order to expedite attainment of groundwater performance goals established by the Consent Decree, the Agency recommends a phased approach for groundwater plume delineation. First, we recommend vertical aquifer sampling during the spring water table high to further delineate the nature and extent of the northern and southern groundwater plumes. As recommended, this phase would be followed by monitoring well design and installation. The purpose of new monitoring wells is to fill current plume delineation data gaps, and to measure improvements in groundwater quality with time. The delineation of the northern plume is the highest priority, to address the intermediate depth extraction wells IE-1 and IE-8, and shallow monitoring well MW-15.

In order to address the monitoring gap upgradient of MW-15, shallow monitoring wells are recommended for the northwestern portion of the Chem-Dyne site, screened at elevations equivalent to MW-15. The resulting total VOCs and dominant compounds identified should be contoured in both map and cross-sectional profile, to identify source area currently prohibiting attainment of groundwater performance goals.

Recommendation #2. Completion of the plume delineation phase will help identify the general location of source areas. The Agency then recommends that the horizontal and vertical extent of potential source areas be delineated through discrete interval soil and groundwater sampling, to assist evaluation of in-situ remedial technologies for expediting attainment of groundwater performance goals.

Current data indicates that the northwestern portion of the Site, in the vicinity of the former Chem-Dyne building, and the former tank farm immediately west are potential chlorinated hydrocarbon source areas affecting shallow monitoring well MW-15 and intermediate extraction wells IE-1 and IE-8. Figure 7 illustrates that the same compounds present in MW-15, are also present in upgradient, intermediate depth extraction well IE-8, located less than 100 feet south of the former Chem-Dyne building. The October 2007 residual source investigation revealed a similar set of compounds in the northwestern site area, at vertical aquifer sample locations VP-1 and VP-2.

The Agency suggests that a localized dense non-aqueous phase liquid (DNAPL) source affecting MW-15 is not probable. In March 2010, the dominant chlorinated hydrocarbon at MW-15 was tetrachloroethene (PCE), with a concentration of 1,010 µg/L. Historic concentrations of tetrachloroethene at MW-15 are well below the 1% of solubility concentration generally regarded as indicative of a local DNAPL source (Dense Chlorinated Solvents and other DNAPLs in Groundwater, Pankow and Cherry, 1996). The solubility of tetrachloroethene is 200,000 µg/L (The Soil Chemistry of Hazardous Materials, second edition, J. Dragun, 1998).

The fact that MW-15 is a shallow well, screened from 28.5 to 38.5 feet bgs, suggests that an upgradient shallow source is present. The historic cyclical nature of VOC Influent groundwater concentrations to the air stripper, with maximum concentrations of PCE and TCE being coincident with a spring time water table high suggests the presence of a residual, shallow source or sources in the water table smear zone. Monitoring well data in Table 2 of the 2009 Annual report indicate that the smear zone, or water table fluctuation in the northern portion of the site was approximately 3 feet near monitoring wells MW-37, MW-38, MW-39, and MW-41, over 6 feet at extraction well IE-8, and approximately 9 feet at extraction well SE-10.

Status of the Additional 2010 FYR Recommendations

The additional Issues and Recommendations described above focus primarily on the following: the delineation of source plumes in the Northern and Southern Site areas; data gaps due to the absence of shallow monitoring wells in the northern portion of the Site; and expediting the attainment of all remedial cleanup goals in light of the escalating maintenance and repair costs associated with the aging P & T system. The Chem-Dyne Site Trust (Trust) performed some limited Geoprobe work to delineate the Northern and Southern plumes and additional SVE wells were installed in March 2011. This work, although useful, was not done in response to the 2010 FYR recommendations and did not completely address the Issues and Recommendations made by the Agencies in the 2010 FYR. Instead, the Trust requested approval to complete an MNA Pilot Study. (This Study is discussed in the *Remedy Implementation Activities* section below). The Trust obtained approval from the Agencies to begin the MNA Pilot Study in June 2015. Should this pilot study prove to be unsuccessful, the Trust will be directed by the Agencies to revisit and address the additional 2010 FYR Recommendations.

Remedy Implementation Activities

During this review period, the Trust explored opportunities to optimize the groundwater extraction and SVE systems. In March 2011, the Trust enhanced the SVE system by expanding the North Plume system to include an additional line of SVE wells (wells 33 through

38) along the westernmost extent of the cap. This modification to the system resulted in 2.54 pounds per day of VOCs being removed from the newly installed wells (only) on March 8, 2011. Data collected for all of the North Plume SVE wells (from March, April, and May 2011) showed VOC removal rates of 1.37, 2.40, and 1.15 pounds per day, respectively. The VOC removal rate for the North Plume SVE system had decreased to 1.11 pounds per day prior to this enhancement.

Monitored Natural Attenuation Pilot Study

After the March 2011 North Plume area SVE system expansion, the Trust continued to examine alternate remedial technologies to achieve Site cleanup goals at all compliance points at the Site. The Trust was challenged with the escalating operating and repair costs associated with the 27-year old groundwater P & T system. The groundwater extraction system piping was restricted with mineral deposits, wells were fouled, and wells were pumping at less than the initial design rates. The system maintained hydraulic containment; however, it became quite apparent to the Trust and to the Agencies that the remedy termination criteria would not be attained in the North Plume area with the current remedy although SVE well enhancements had occurred. After an evaluation of remedial alternatives, the Trust submitted an MNA Pilot Study for Agency review. Both Ohio EPA and EPA approved the MNA Pilot Study in 2015.

The first round of the MNA Pilot Study data was collected in June and July 2015. The results of the groundwater potentiometric surface data indicate that groundwater conditions are restored to natural gradients across the Site. For example, significant drawdown (greater than 15 feet) is observed in the vicinity of the operational recovery wells in the June 8, 2015 potentiometric surface maps. The system was then shut down upon completion of the collection of water levels on June 8, 2015. As observed on the potentiometric surface maps from July 15, 2015, there is no longer any observable drawdown in the vicinity of the recovery wells. (See Appendix D for more details of the June 2015 monitoring event including sampling data, MNA parameters and maps.)

Maps for selected MNA parameters were prepared for dissolved oxygen (DO), oxidation-reduction potential (ORP), ferrous iron (Fe^{+2}), methane, ethane, ethene, and total organic carbon (TOC) in the shallow aquifer zone. The MNA parameters indicate that conditions are favorable for natural attenuation. For example, there is strong evidence of reduction in terminal electron acceptors (DO, nitrate); increases in metabolic byproducts (Fe^{+2} , methane), and elevated concentrations of ultimate chloroethene daughter compounds (ethene and ethane). Overall, the MNA data indicate that natural attenuation processes are occurring.

Institutional Controls

ICs are required to ensure the protectiveness of the remedy. ICs are non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for exposure to contamination and that protect the integrity of the remedy. ICs are required to assure long-term protectiveness for those areas that do not allow for UU/UE. ICs are also required to maintain the integrity of the remedy.

A summary of the implemented and planned ICs for the Site is listed in Table 3 and is further discussed below. A map which depicts the current conditions of the Site and areas which do not allow for UU/UE will be developed during the IC evaluation activities discussed below.

Table 3: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
On-Site groundwater	Yes	No	Area defined as the Site. See Site Map Figure 1 in Appendix B.	Prohibit use of groundwater at the Site	Ohio Administrative Code (OAC) 3745-9-04; Environmental Covenant (planned)
Off-Site groundwater	Yes	No	Area defined as Off-Site. See Site Map Figure 1 in Appendix B.	Prohibit use of groundwater off-Site	Ohio Administrative Code (OAC) 3745-9-04; Environmental Covenant (under consideration)
Chem-Dyne Site	Yes	No	Area defined as the Site. See Site Map Figure 1 in Appendix B.	Prohibit residential use and prevent damage to remedy components	Environmental Covenant (planned)

Status of ICs:

The decision document for the Site does not require ICs. ICs in the form of groundwater use restrictions are required in the Consent Decree. Section VII, Paragraph E of the Consent Decree states that "the State agrees to use its statutory and regulatory authority to prohibit the installation of wells into contaminated groundwater at or near the Chem-Dyne Site with the area marked on Appendix 5, or as it may be enlarged or reduced by Ohio EPA following consultation with U.S. EPA." This stipulation is consistent with Ohio Administrative Code (OAC) 3745-9-04, which regulates the location of new wells and does not allow installation of wells in areas where contamination may be drawn into the well.

In order to comply with Ohio EPA's obligations under the Consent Decree, Ohio EPA sent letters in the spring of 2002 to the owners of the major industrial and municipal groundwater pumping wells near Chem-Dyne. The letters informed them of the State of Ohio's obligation to use its authority to prohibit pumping which could adversely affect the groundwater extraction system at Chem-Dyne. These letters were sent to the City of Hamilton, International Paper Co. (owner of the former Beckett Paper Co.), and Smart Paper Co. (formerly Champion Paper Co.).

In November of 2002, the City of Hamilton informed Ohio EPA of its intention to install two new production wells, north of the Chem-Dyne Site, approximately 1,500 feet south of the North Well field. The purpose of the wells was to provide coolant water to the Hamilton power plant. Upon learning of the proposal Ohio EPA facilitated communication between the city and the Trust for the purpose of identifying means of assuring the groundwater extraction system at

Chem-Dyne would not be adversely affected. The City of Hamilton proposed that their current wellhead protection model was not refined enough to address the potential effect on the Chem-Dyne groundwater contaminant plume and extraction network. Later, all parties agreed that a network of groundwater monitoring wells located along the Ford Hydraulic Canal would be helpful in evaluating hydraulic containment at Chem-Dyne, should the proposal move forward. In November 2003, the Ohio EPA Division of Drinking and Ground Waters met with the City of Hamilton to review their proposal for three monitoring wells along the Ford Hydraulic Canal. These wells were installed. To date, the proposed municipal production wells have not been installed.

Current Compliance:

There are no known uses of the Site that would be considered inconsistent with the goals to be achieved by the ICs. The remedy appears to be functioning as intended.

IC Evaluation and Follow-up Actions Needed:

ICs are needed for the Site for those areas not meeting UU/UE. The use of governmental controls and an environmental covenant pursuant to the State of Ohio Uniform Environmental Covenants Act (UECA) will be evaluated. In addition, the need for ICs for the area of the off-Site groundwater plume needs to be evaluated, and ICs implemented if needed. Since there is no decision document requiring ICs, a decision document needs to be completed adding ICs as a component of the Site remedy. LTS procedures are also lacking.

An ICIAP will be developed. The purpose of the ICIAP is to conduct IC evaluation activities to ensure that effective ICs are implemented, maintained, monitored, and enforced.

Long-term protectiveness requires continued compliance with the land and groundwater use restrictions to ensure that the remedy continues to function as intended. LTS will ensure that the ICs are maintained, monitored and enforced by the potentially responsible parties (PRPs). A Plan incorporating LTS procedures (e.g., an LTS Plan or amendment to the O&M Plan) should be developed and include the mechanisms and procedures for inspecting and monitoring compliance with the ICs as well as communications procedures. An annual report should be submitted by the PRPs to EPA to demonstrate that the Site was inspected to ensure no inconsistent uses have occurred; that ICs remain in place and are effective; and that any necessary contingency actions have been executed. Results of IC reviews should be provided to EPA in an annual ICs report and include a certification that the ICs remain in place and are effective.

IC evaluation activities will also include, as needed, developing maps depicting current conditions in areas that do not allow for UU/UE, and conducting a review to ensure that no prior-in-time encumbrances exist on the Site that are inconsistent with the ICs.

Long-Term Stewardship:

Since compliance with ICs is necessary to assure the protectiveness of the remedy, planning for LTS is required to ensure that the ICs are maintained, monitored and enforced so that the remedy continues to function as intended. LTS involves assuring effective procedures are in

place to properly maintain and monitor the Site. As part of the IC follow-up actions, an LTS Plan will be developed by the Trust (or the O&M Plan updated) that includes procedures for LTS.

System Operations/Operation and Maintenance Activities

During this review period, operations at the Site consisted primarily of the operation of the SVE system, groundwater extraction and monitoring, and cap maintenance. The fence around the Site is adequately maintained and restricts access to the Site. The groundwater treatment system experienced minimal downtime with an available operating time from 94% to 100%. Minor downtime was experienced because of equipment replacement (pumps and motors) and occasional electrical power interruptions due to storms. A force main replacement caused the system to go offline for 50.5 hours in May 2014.

The SVE system continued to experience a significant decline in VOC removal (with a limited exception). The decline in VOC removal is primarily a result of the aging infrastructure of the treatment system and biological and mineralogical fouling which creates reduced efficiency in pumping. The decline in VOC removal rate was discussed in the 2012 Annual Report (dated May 2013) and during a meeting with the PRPs, Ohio EPA, and EPA on July 23, 2014. A formal request to terminate SVE operations was submitted to both Agencies on July 30, 2014. Ohio EPA approved the request to terminate SVE operations in a letter dated October 21, 2014. EPA approved the Trust's request but required that the Northern Zone SVE wells remain in operation for the purpose of mass removal (October 23, 2014). Southern Zone wells were suspended on September 29, 2014. (Modifications to the groundwater treatment system are permitted in accordance with the Consent Decree. This is discussed in more detail in the *Remedial Actions* section of Appendix A).

Subsequently, the PRPs petitioned the Agencies to allow a trial shutdown of all wells related to the groundwater extraction system and the SVE system at the Site due to the fact that contaminant levels could not be further reduced with pumping alone of the current system without expensive modifications. The Trust wanted the opportunity to evaluate whether the introduction of anaerobic conditions at the Site would potentially cause an accelerated degradation of contaminants in groundwater. With the assistance of its contractor, EarthCon Consultants, Inc., the Trust presented and submitted Power Point presentations which included the Site groundwater plume analytics, the shutdown recovery wells analytics, and the shutdown recovery evaluation (October 2014 to January 2015). The Trust submitted an MNA Pilot Study Work Plan to EPA and Ohio EPA on February 23, 2014. EPA's National Risk Management Research Laboratory Ground Water and Ecosystems Restoration Division in Ada, Oklahoma, assisted in the review of the Trust's work plan. After a series of Agency comments and revisions to the work plan, both Ohio EPA and EPA evaluated the information and approved the MNA Pilot Study Work Plan in May 2015 and June 2015, respectively. EPA approved this work plan because the Agency believes that there are strong indications that ongoing microbial activity will be able to prevent the off-Site migration of contaminants over much of the Site (although there are no guarantees that MNA alone will be sufficient to adequately reduce concentrations in potential source areas near MW-15).

All active groundwater and soil remediation was suspended in June 2015 as part of the MNA Pilot Study. However, the groundwater extraction and SVE system infrastructure will remain in

place should the systems require reactivation. Implementation of the MNA Pilot Study will run for a two-year period and will consist of quarterly sampling of wells. As stated earlier, MNA parameters evaluated during this period will consist of DO, ORP, Fe^{+2} , methane, ethane, ethene, and TOC. Evaluation of these parameters will assist in determining whether natural attenuation is occurring at the Site and the extent of natural attenuation. Semi-annual progress reports will be submitted to the Agencies. Annual progress reports will be submitted at the end of each year and will include, among other things, plume stability analysis, trend analysis, and recommendations.

III. FIVE-YEAR REVIEW PROCESS

Administrative Components

The State was notified of the initiation of the FYR on March 23, 2015. The Chem-Dyne Site FYR was led by Lolita Hill of the EPA, Remedial Project Manager (RPM) for the Site, and Sue Pastor, the Community Involvement Coordinator (CIC). Charles Melon of the Ohio EPA assisted in the review as the representative for the support agency.

The review, which began on March 23, 2015, consisted of the following components:

- Community Notification and Involvement;
- Document Review;
- Data Review;
- Site Inspection;
- Interviews; and
- FYR Report Development and Review.

Community Notification and Involvement

Activities to involve the community in the FYR process were initiated on April 29, 2015 between the RPM and CIC for the Site. A notice was published in the Hamilton Journal News, a local newspaper, on April 29, 2015, stating that there was a FYR and inviting the public to submit any comments to EPA. (See Appendix C.) The final FYR Report will be made available at the Site information repository located at the Site, at 500 Joe Nuxhall Boulevard in Hamilton, Ohio.

Document Review

This FYR consisted of a review of relevant documents including monitoring data and applicable groundwater cleanup standards, including monthly operating reports and annual reports. Appendix E contains data from 2014, including trends and plume maps.

Data Review

The Site remedy includes the operation of a groundwater P & T system and an SVE system. The P & T system has operated since 1987. The initial SVE system has operated since 2008 with subsequent modifications in 2011. The SVE system is comprised of Northern SVE wells and Southern SVE wells. The Northern wells consist of SVE-1 thru SVE-8 and SVE-33 thru SVE-38. The Southern SVE wells are divided into 2 zones – Zone A (SVE-9 thru SVE-21) and

Zone B (SVE-22 thru SVE-32). The total VOC mass removals for the P & T and SVE systems are provided in Table 4. The cumulative mass removal from both systems through 2014 is 38,777 pounds.

Table 4: Total VOC Mass Removal from Remedial Systems¹

Year	P&T System (Pounds)	Cumulative P & T System (Pounds)	SVE Systems only (Pounds)	Total VOCs Removed from SVE and P & T Systems (Pounds)
2008	240	34,813 ^a	593	35,406
2009	103	34,916	1,361	36,870
2010	104	35,020	435	37,409
2011	82	35,102	638	38,129
2012	63	35,165	368	38,560
2013	44	35,209	224	38,828
2014	47	35,256	495	38,777

Note: a = includes 240 pounds VOCs removed from the P & T system in 2008 plus the cumulative amount of 34,573 pounds VOCs (removed from the P & T system from 1987 to 2007) = 34,813 pounds VOC cumulative (from the P & T system from 1987 to 2008).

The April 2009 Long-Term Monitoring and Optimization Plan requires biennial sampling (during even-numbered years for VOCs only) for compliance wells G-16, G-17, G-19, G-20, G-21, G-22, G-23, G-24, G-25, MW-19, MW-20, MW-21, MW-22, and MW-32. Compliance wells G-19, G-20, G-23, G-25, and MW-32 were decommissioned and taken out of service in December 2011 after the Trust received approval from Ohio EPA in October 2010. Well G-19 was taken out of service sometime thereafter. Sampling results from 2012 showed trichloroethylene (TCE) detected in G-17 and MW-16 at concentrations below the 5.0 µg/L Maximum Contaminant Level (MCL) and below the 100 µg/L total priority pollutant cleanup standard, as shown in Table 5. TCE was the only priority pollutant detected in any compliance well (MW-16) during 2014, at 3 µg/L.

Table 5: Summary of VOCs (µg/L) in Compliance Wells 2012

Well	TCE		cis-1,2-DCE		Other VOCs		Total VOC	
	March	Sept	Mar	Sept	Mar	Sept	Mar	Sept
G-16	ns	<1	ns	<1	ns	<1	ns	<1
G-17	ns	1.27	ns	<1	ns	<1	ns	1.27*
G-19	ns	<1	ns	<1	ns	<1	ns	<1
G-21	ns	<1	ns	<1	ns	<1	ns	<1
G-22	ns	<1	ns	<1	ns	<1	ns	<1
G-24	ns	<1	ns	<1	ns	<1	ns	<1
MW-16	2.55	<1	<1	<1	<1	<1	2.55	<1
MW-19	ns	<1	ns	<1	ns	<1	ns	<1
MW-20	ns	<1	ns	<1	ns	<1	ns	<1
MW-21	ns	<1	ns	<1	ns	<1	ns	<1
MW-22	ns	<1	ns	<1	ns	<1	ns	<1

Notes: ns = not sampled; <1 = not detected

¹ From 2014 Annual Report for the Chem-Dyne Superfund Site, April 2015

Table 6: Summary of VOCs (µg/L) in Compliance Wells 2014

Well	TCE		cis-1,2-DCE		Other VOCs		Total VOC	
	March	Sept	Mar	Sept	Mar	Sept	Mar	Sept
G-16	<1	ns	<1	ns	<1	Ns	<1	ns
G-17	<1	ns	<1	ns	<1	Ns	<1	ns
G-21	<1	ns	<1	ns	<1	Ns	<1	ns
G-22	<1	ns	<1	ns	<1	Ns	<1	ns
G-24	<1	ns	<1	ns	<1	Ns	<1	ns
MW-16	3	3	<1	<1	<1	<1	3	3
MW-19	<1	ns	<1	ns	<1	Ns	<1	ns
MW-20	<1	<1	<1	<1	<1	<1	<1	<1
MW-21	<1	<1	<1	<1	<1	<1	<1	<1
MW-22	<1	ns	<1	ns	<1	Ns	<1	ns

Notes: ns = not sampled; <1 = not detected

Groundwater monitoring has been performed by the PRPs on a quarterly basis with groundwater levels recorded on a monthly basis. The number of monitoring wells which exceed the cleanup goal for the Site has decreased from 51 wells (in 1988) to 8 wells (in 2010) to 6 wells (in 2014). The 100 µg/L total VOC cleanup level was exceeded in December 2014 for the following wells MW-15 (2,802.5 µg/L), MW-27 (575.8 µg/L), IE-1 (311.5 µg/L), and IE-8 (162.7 µg/L). Although concentrations in these wells (MW-15, MW-27, IE-1, and IE-8) are above the cleanup criteria, vapor intrusion is not an issue of concern. Residents are located to the south of the Site while groundwater flow is generally to the west of the Site. Hydraulic containment of the plume has prevented releases to the south area residents. There is another residential area to the west of the Site. However, these residents are separated from the Site by Third Street (Highway 127) and industrial facilities (mostly concrete or gravel areas), coal stockpiles, the City of Hamilton's electric plant, and a railroad, located immediately on the western edge of the Site. Ten wells and numerous piezometers are located in this residential area (bordered by Third Street on the East, by Second Street on the West/North, and by Black Street on the South). These wells are sampled once or twice a year. The 2014 sampling results showed that most of these wells were non-detect for total VOCs and none of the wells exceeded the 100 µg/L total VOC cleanup criteria. Specifically, wells IE-4 and IE-5 exhibited concentrations ranging from 1.7 to 2.0 µg/L total VOCs (cis-1,2-dichloroethylene (DCE) only) during the April/September 2014 events. Total VOCs in wells G-1 and G-9 consisted of 2 µg/L and 4.7 µg/L (cis-1,2-DCE only) in March/April 2014. Only wells SE-2 and SE-17 exhibited higher levels of total VOCs at 12.4 µg/L (April 2014) and 5.0/5.6 µg/L (April/September 2014), which are below the cleanup criteria.

With respect to the South Plume area, sampling data indicated that all of the sampled wells in the South Plume were less than the Site cleanup level in December 2014. The Trust attributes the South Plume area success in contaminant reductions and attainment of the performance cleanup goal to the operation of the southern SVE system reducing the VOC flux from the vadose zone during times of high water table elevation. Most of the North Plume wells (33 of 37) in 2014 achieved the cleanup level. Overall, contaminant concentrations have shown a decreasing trend for the North Plume wells. Refer to Figures 1, 2, and 3 ("Site Plan," "Extraction Well VOC Data," and "Monitoring Well VOC Data") of the 2014 Annual Report; these figures are provided in Appendix B.

The shallow Site plume has been reduced by 92% from 31 acres to 2.4 acres since 1987. The intermediate plume has been reduced by 96% from 10 acres to 0.4 acres since 1987. The chloroethene plume and the chloroethane plume have decreased in area substantially by more than 82% and 89%, respectively, and have decreased in mass by 99% since 1987. The extracted groundwater concentrations from the P & T system no longer require treatment prior to surface water discharge.

Site Inspection

The inspection of the Chem-Dyne Site was conducted on May 21, 2015. In attendance were Lolita Hill of U.S. EPA, Charles Mellon of Ohio EPA, Ron Holt, Chem-Dyne Site Engineer, and Chuck Hanson of the Chem-Dyne Trust (who participated in the pre- and post-inspection meetings only). The purpose of the inspection was to assess the protectiveness of the remedy. Monitoring wells appeared to be good condition. The cap was in good condition. There were no signs of erosion or penetration through the cover. Maintenance records show that monthly cap inspections found no significant cap-related issues. There were no new sources at the Site that would interfere with the remedy. Overall, the inspector observed that the Site was in good condition and the remedy appeared to be functioning as designed. See the Site Inspection Checklist and photographs in Appendix F for additional details.

Interviews

Persons interviewed during the Site visit included Mr. Chuck Hanson and Mr. Ron Holt. Discussions with these gentlemen focused on the Site operations and the remedy. There were no other persons interviewed for this FYR.

IV. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, applicable or relevant and appropriate requirement (ARARs), risk assumptions, and the results of the Site inspection indicate that the remedy is functioning as intended by the ROD. There has been a decline in VOC concentrations on the South area of the Site due to the addition of the SVE systems. All of the wells in the South Plume area have reached the Site cleanup goals. Many of the North Plume area wells have reached the Site cleanup goals. Overall, contaminant concentrations in monitoring and extraction wells on the North area of the Site are showing decreasing trends. There are no issues with the cap or Site security.

ICs are needed to ensure the long-term protectiveness of the remedy. Governmental ICs are in place. There are currently no known uses of the Site that would be considered inconsistent with the goals to be achieved by the ICs. The PRPs need to evaluate the ICs and the appropriate ICs need to be implemented. LTS procedures are needed and an LTS Plan developed by the PRPs. An ICIAP should be developed by the PRPs. The purpose of the ICIAP is to conduct IC evaluation activities to ensure that effective ICs are implemented, maintained, monitored, and enforced. The remedy decision document should be modified by EPA to incorporate ICs as a component of the remedy.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Yes. All Site-related risks (including ecological risks) were reduced or eliminated through the implementation of the remedy. There have been no changes in the physical condition of the Site that would affect the protectiveness of the remedy.

Changes in Standards and Things to be Considered

There have been no major changes in the ARARs and no new standards affecting the protectiveness of the remedy have been promulgated since the 2010 FYR.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

The exposure assumptions used to develop the Human Health Risk Assessment included both current exposures and potential future exposures. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment. These assumptions are considered to be conservative and reasonable in evaluating risk and developing risk-based cleanup levels. Change is not warranted from these assumptions or the cleanup levels developed from them. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There has been no change in the physical Site conditions that could affect the protectiveness of the remedy.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. There has been no information generated during this FYR process or other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and the Site inspection, the remedy is functioning as intended by the ROD. There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 7: Issues and Recommendations/Follow-up Actions

OU	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
						Current	Future
Sitewide	ICs are not fully implemented at the Site.	Implement ICs at the Site.	PRPs	EPA/State	09/30/2016	No	Yes
Sitewide	ICs requirements need to be evaluated.	Develop an ICIAP.	PRPs	EPA/State	09/30/2016	No	Yes
Sitewide	LTS procedures are needed.	Develop an LTS Plan or amend the O&M Plan to incorporate LTS procedures.	PRPs	EPA/State	09/30/2016	No	Yes
Sitewide	Remedy decision document needs to be updated to incorporate ICs as a component of the remedy.	Modify remedy decision document to incorporate ICs.	EPA	EPA/State	09/30/2016	No	Yes

VI. PROTECTIVENESS STATEMENT

OU1 & Sitewide Protectiveness Statement

Protectiveness Determination:

Short-term Protective

The remedy at the Chem-Dyne Superfund Site currently protects human health and the environment because it was constructed in accordance with the requirements of the 1985 ROD. The groundwater treatment system, the SVE systems, and other remedy components such as the cap function as intended by the ROD. Exposure pathways that could result in unacceptable risks are being controlled by preventing exposure to, or the ingestion of, contaminated groundwater. However, in order for the remedy to be protective in the long term, the following actions need to be taken: ICs need to be implemented; an ICIAP needs to be developed; LTS procedures need to be developed and implemented via an LTS Plan or amendment to the O&M Plan; and the remedy decision document needs to be modified to incorporate ICs as a component of the remedy.

VII. NEXT REVIEW

The next FYR report for the Chem-Dyne Superfund Site is required five years from the completion date of this review.

APPENDIX A

Existing Site Information

APPENDIX A – EXISTING SITE INFORMATION

A. SITE CHRONOLOGY

Event	Date
Initial discovery of problem or contamination	1976 to 1979
Final National Priorities List (NPL) listing	September 8, 1983
Removal actions	1982
Remedial Investigation (RI) complete	May 22, 1984
Feasibility Study (FS) complete	November 19, 1984
Remedial Action Plan	May 1985
Record of Decision (ROD)	July 5, 1985
Consent Decree lodged	October 9, 1985
Remedial action approved (Groundwater Extraction System)	January 1, 1988
Soil Vapor Extraction (SVE) System (North)	2008
SVE System (South)	2009
SVE System Enhancements (North)	March 2011
Previous Five-Year Reviews (FYRs)	
1 st FYR	September 8, 2000
2 nd FYR	September 27, 2005
3 rd FYR	September 23, 2010
Site Inspection for 4 th FYR	May 21, 2015
Monitored Natural Attenuation (MNA) Pilot Testing	June 2015

B. BACKGROUND

Physical Characteristics

The Chem-Dyne Superfund Site is located at 500 Joe Nuxhall Boulevard in Hamilton, Ohio, east of the Great Miami River. The Site is 21 acres and is bordered to the north by the Ford Hydraulic Canal, which flows westerly into the Great Miami River. Immediately west of the Site lie industrial properties including the City of Hamilton Municipal Power Plant, Anchor Metals (formerly Ransohoff) and a CSX rail corridor.

Geology and Hydrology

Topography in the Site vicinity is relatively flat. Average depth to water is approximately 25 feet below ground surface (bgs). Groundwater flow beneath the Site is westerly toward the Great Miami River. The RI, completed in 1984, concluded that groundwater flow velocities ranged from 0.5 to 1.5 feet per day. Groundwater flow is heavily influenced by the stage of the Great Miami River and localized pumping. The geology of the Hamilton, Ohio, area is dominated by glacial valley fill deposits that overlie bedrock of Ordovician-age limestones and shales. In the Hamilton area, glacial deposits are thickest where they fill the bedrock valleys of the ancient Teays River System. The modern-day Great Miami River follows these valleys for much of its course, including the vicinity of Hamilton. Deposits filling the valleys are approximately 150 to 200 feet thick. Most of these deposits are coarse-grained sands and gravels saturated with

water. The saturated deposits constitute a prolific aquifer known as the Miami Valley Sole Source Aquifer System.

Land Use

Current land uses surrounding the Site are industrial and residential. Public softball fields are located adjacent to the Site. The Site is completely encompassed by security fencing which restricts access. A secured entrance is located at the northeast corner of the property with access along Joe Nuxhall Boulevard. Active pumping centers operate near the Site, including the Hamilton North well field and the Hamilton Power Plant wells.

History of Contamination

Ford Motor Company operated a factory at the Site; the factory ceased operations in the late 1950s. Later, between 1974 and 1979, the Chem-Dyne Corporation used the Site for the processing and storage of chemical wastes. During this time, the Site accepted an estimated 112,000 drums of waste from approximately 200 generators. Materials handled included pesticides, chlorinated and un-chlorinated solvents, waste oils, plastics and resins, polychlorinated biphenyls, acids and caustics, metal and cyanide sludges, and laboratory wastes. Over 30,000 drums and 300,000 gallons of bulk materials were on Site when operations ended in 1980.

Following closure of the facility, Site investigations determined that facility operations had contaminated the soil beneath the Site and groundwater both on and off Site within the shallow and intermediate horizons of the underlying aquifer.

Initial Response

Most of the materials left on Site in 1980 were removed under the supervision of a state court-appointed receiver between 1980 and 1981. Subsequent waste removal actions began in 1982. The remaining wastes were removed during a surface cleanup under EPA removal authority in 1983. The Site was proposed for inclusion on the NPL on October 21, 1981, and finalized on September 8, 1983.

Basis for Taking Action

The RI, completed May 22, 1984, identified extensive volatile organic compound (VOC) unsaturated soil contamination. The highest VOC concentrations were located 3 to 6 feet bgs. Elevated concentrations extended as deep as 25 feet bgs. Structures and utilities on Site were found to be contaminated with a variety of materials. The FS, released on November 19, 1984, contained an Endangerment Assessment. The assessment concluded that direct contact with soil contaminants presented an unacceptable risk.

The RI defined a groundwater plume. The plume, comprised predominantly of chlorinated ethenes and chlorinated ethanes, was found to emanate from the Site. In 1986, this plume was confirmed to be approximately 1,000 feet wide, 1,800 feet long, and up to 50 feet deep. The Endangerment Assessment concluded that groundwater contamination presented an

unacceptable risk for potable use. It also concluded that continued migration of the groundwater plume could present an unacceptable risk to downgradient water supplies.

C. REMEDIAL ACTIONS

Remedy Selection

A Remedial Action Plan (RAP) was developed for the Site on May 1985. On July 5, 1985, a ROD was signed for the Site. The major objective of the ROD was to prevent contact with or migration of contaminated groundwater and soils at the Chem-Dyne Site. The selected remedy for the Site required the following:

- Demolition of all Site buildings;
- Removal of "hot spot" soil;
- Installation of a cap over remaining contaminated soils; and
- Installation of a groundwater extraction-injection system.

The Consent Decree allowed for modifications to the system that would improve system performance. As provided in Paragraph V.B.2.5 of the Consent Decree,

- *The performance of the System shall be evaluated annually by the Plaintiffs and the Settling Defendants in view of the design criteria set forth in Subparagraph 2.1.*
- *The System shall be adjusted or modified if the Plaintiffs and the Settling Defendants agree that the System is not performing acceptably in view of the design criteria in Subparagraph 2.1 and that adjustments or modifications would be cost-effective and could be expected to improve performance.*
- *Adjustments or modifications can include but need not be limited to relocation or addition of extraction wells or changes of pumping rates as agreed to by the Plaintiffs and the Settling Defendants.*

Therefore, the Chem-Dyne Site Trust (Trust) and the Agencies agreed to numerous changes to improve the performance of the system. Among other things, pumping rate modifications were made to the groundwater extraction system in 2004 and the system was modified to include a SVE system in 2008/2009 (with enhancements in 2011). The SVE system consisted of a South SVE system and a North SVE system.

Remedy Implementation

The RAP (dated May 1985) was developed for the Site following negotiations with the potentially responsible parties (PRPs). The RAP was incorporated as part of the Consent Decree between EPA, Ohio EPA, and 173 PRPs. The Consent Decree was lodged in U.S. District Court for the Southeastern District of Ohio, Western Division, on October 8, 1985. Under the Consent Decree, the PRPs agreed to form the Trust for the purpose of overseeing implementation of the requirements of the Consent Decree. The Consent Decree is administered jointly by EPA and Ohio EPA.

The selected remedy for the Site required the demolition of all Site buildings, the removal of "hot spot" soil, the installation of a cap over remaining contaminated soils, and the installation of a groundwater extraction-injection system.

Soil "hot spots" were removed and disposed at an approved off-site facility in an expedited action in the spring of 1985. A total of eight buildings were demolished. A perimeter utility cutoff trench approximately 4,000 feet in length and 15 feet deep was excavated around the Site and all intercepted utilities were sealed. A storm sewer system for draining the capped Site was installed.

Monitoring wells were installed to further define the boundaries of the migrating groundwater plume. Groundwater remediation activities began in February 1987 with completion of a groundwater extraction-injection system. A total of 25 extraction wells and eight injection wells were installed. After several modifications, the Trust proposed that the groundwater extraction system be considered fully operational on January 1, 1988.

The ex-situ groundwater treatment system consists of an air stripper. Approximately 10,000 feet of piping were installed to connect water pumped from extraction wells to the air stripper. Off-gas from the air stripper was directed to three activated carbon beds for treatment. Treated water was either injected into the aquifer in order to flush VOCs from subsurface soils or discharged to the Ford Hydraulic Canal in accordance with the National Pollutant Discharge Elimination System (NPDES) permit issued by Ohio EPA.

From 1989 to 1992, the Site experienced occasional exceedances of the NPDES permit limits for 1,1,2,2-tetrachloroethane and 1,2-transdichloroethylene. The discharge permit limit was modified to an achievable permit limit in October 1992 to prevent future exceedances.

In 1989, data from groundwater monitoring began showing VOCs present in the southern compliance wells. The Agencies required the Trust to investigate the source of the VOCs and, if necessary, implement a corrective action as specified in the Consent Decree. The results of the investigation showed that there were several areas of contamination in the unsaturated zone off Site within the study area but there was no correlation between the contaminants in these areas and those found in groundwater. The study also showed that the compliance wells were within the area under hydraulic control from the extraction system and the groundwater in question originated off Site from an unknown source.

In November 1998, Ohio EPA issued a letter to the Trust indicating that emissions from the air stripper were considered minimal, thereby discontinuing air monitoring of the air stripper effluent.

On several occasions, the Agencies requested the Trust to update the groundwater model associated with the Site in order to increase understanding of the hydraulic control and enable sound decision-making about the groundwater extraction system. From 2001 to 2004, the Trust and the Agencies held numerous meetings and exchanged emails related to developing, refining, and calibrating the Site groundwater model. The Trust contracted S. S. Papadopoulos to assist in the model exercise efforts. The EPA National Risk Management Research Laboratory, Ground Water and Ecosystems Restoration Division, assisted EPA Region 5 in

this effort. The conceptual groundwater model was developed in June 2003 and calibrated in 2004.

In October 2007, the Trust conducted residual VOC investigations (vertical aquifer sampling and soil gas sampling) in the northern portion of the Site, and in the adjacent, down-gradient Hamilton Power Plant property to the west. Soil gas concentrations beneath the Site cap were orders of magnitude higher than off-Site soil gas concentrations, indicating the presence of an on-Site source. The on-Site vertical aquifer sample location with the highest groundwater concentrations was VP-3, located approximately 50 feet northeast of the Ransohoff building. Shallow groundwater at VP-3 was non-detect, while intermediate depth groundwater contained elevated concentrations of primarily ethylbenzene and xylene compounds. These compounds were either absent or present in minor concentrations at shallow monitoring well MW-15 and intermediate depth extraction wells IE-1 and IE-8. Chlorinated solvents were dominant in intermediate depth on-site groundwater north of VP-3, at locations VP-1 and VP-2. These sample locations had the same distribution of chlorinated VOCs as down-gradient monitoring well MW-15 and extraction wells IE-1 and IE-8.

As a result of the October 2007 vertical aquifer sampling and soil gas sampling, the Trust expanded the Site treatment system and installed a soil vapor extraction system in the northern portion of the Site in November 2008. This northern SVE system (consisted of SVE-1 thru SVE-8) was successful in removing 955 pounds of VOCs from the unsaturated zone by the end of March 2009. (The Northern SVE system was enhanced to include wells SVE-33 thru SVE-38 in 2011). The Trust expanded the Site characterization efforts, and subsequently installed two more SVE systems in the southern portion of the Site in late September 2009. The Southern SVE wells are divided into 2 zones: Zone A (SVE-9 thru SVE-21) and Zone B (SVE-22 thru SVE-32). Within five months, the two southern systems removed a total of 165.32 pounds of VOCs. The combined mass removal from all three SVE systems for year 2009 was 1,361 pounds compared to mass removal of 103 pounds of VOCs from the groundwater P & T system.

On October 2, 2009, the Trust applied for an NPDES permit modification to discontinue treating the groundwater extracted from the P & T system via the air stripper, and discharge it directly to the canal. The Ohio EPA approved this modification on November 25, 2009, stating that the groundwater influent to the air stripper had been in compliance with both the daily maximum and monthly average permit limitations since November 2008. The Trust agreed to properly maintain the air stripper for future treatment if compliance sampling indicated treatment was warranted. EPA granted approval of this modification in March 2010, and the stripper was subsequently deactivated on April 12, 2010.

With the air stripper deactivated, the remedial system no longer generated hazardous waste and RCRA compliance evaluations were not required by Ohio EPA. The last RCRA compliance evaluation occurred on June 7, 2005 and Ohio EPA found the Site to be in compliance with the terms of a RCRA permit to operate as a generator of RCRA regulated off-Site shipments of waste produced from the air stripper.

In May 2010, Ohio EPA and EPA approved the Trust's proposal to deactivate the SVE influent carbon treatment vessels. As SVE data indicated, air emissions have never exceeded the 10

pounds per day *de minimis* limit. Declining VOC mass removal trends continued for the northern SVE system and both the A and B southern SVE systems.

Consent Decree Requirements for the Groundwater System Operation

Paragraph V.B.2.6 of the Consent Decree states that the groundwater extraction system shall be operated for a minimum of ten years and terminated:

- If the 100 total priority pollutant VOC goal is reached for each monitoring and extraction well within the defined plume boundary; and,
- The concentration of total priority VOCs is effectively constant in each monitoring and extraction well within the defined plume boundary.

The groundwater treatment system at the Site has operated for 27 years with approved system optimizations and enhancements. As discussed earlier, most monitoring and extraction wells have achieved the termination criteria while a few wells have not achieved the termination criteria. MW-15 has the highest documented total VOC level throughout the Site. Both Agencies and the Trust recognize that additional investigations may be needed to reduce the concentrations in this well. As well, both Agencies and the Trust recognize that it may not be possible to reach the termination criteria for each monitoring well and each extraction well without a significant monetary investment for this aged system. Paragraph V.B.2.9 of the Consent Decree states the following:

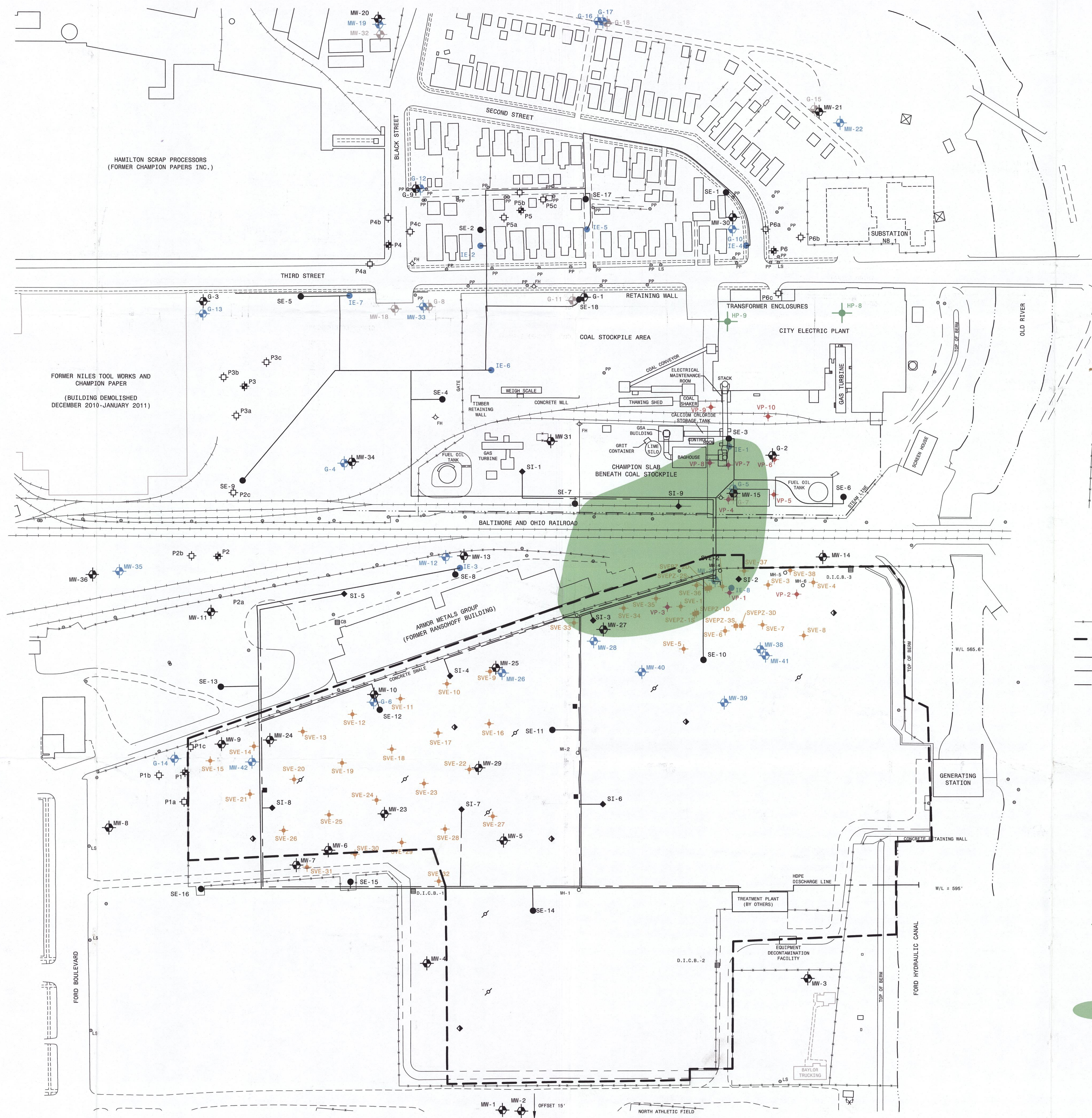
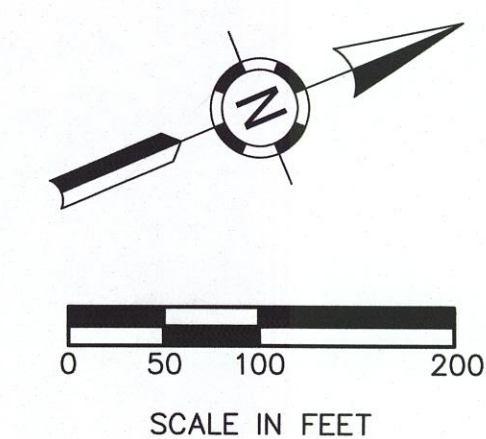
- If at the commencement of the twentieth year of operation of the system, both performance goals are not met, the Plaintiffs and the Settling Defendants shall determine whether further operation and modification would be cost effective. If the Plaintiffs and the Settling Defendants agree that further operation would not be cost effective, the system may be terminated.

The Trust would then be subject to the requirements of Paragraph V.2.10 of the Consent Decree which specifies that concentrations of total priority pollutant VOCs within the Site and the plume boundary must be maintained effectively at or below the levels reached at the termination of the extraction system for a period of five years after termination.

In the 2011 and 2012 Annual Reports, the Trust included recommendations to suspend pumping from shallow extraction wells SE-11 and SE-12 since monitoring data demonstrated that the South Plume complied with the Site termination criterion. A formal request, dated July 30, 2014, was submitted to the Agencies petitioning the Agencies to allow the Trust to terminate groundwater pumping operations in the South Plume area, as well as to suspend sitewide SVE operations since removal recoveries were approaching asymptotic conditions (reached its removal limit with the current system). Ohio EPA approved the Trust's request to terminate all SVE operations on October 21, 2014. EPA approved the termination of only the South Plume SVE system on October 23, 2014, and requested that the Trust continue to operate the North Plume SVE system to remove mass from the North Plume area. The operation of SE-11 and SE-12 were suspended on November 3, 2014. The North Plume SVE system continued to operate. The Trust later submitted an MNA work plan proposal to the Agencies, proposing the suspension of all groundwater extraction and SVE wells at the Site for the next 2 years. The Agencies approved this proposal in 2015.

APPENDIX B

Site Maps



- LEGEND**
- FENCE LINE
 - - - CHEM-DYNE SITE BOUNDARY (REMEDIAL ACTION PLAN 1985, CONESTOGA-ROVERS)
 - INJECTION MAIN
 - EXTRACTION MAIN
 - DISCHARGE LINE
 - IE-# INTERMEDIATE EXTRACTION WELL
 - SE-# SHALLOW EXTRACTION WELL
 - SI-# SHALLOW INJECTION WELL
 - SVE-# SOIL VAPOR EXTRACTION WELL
 - SVEPZ-# SOIL VAPOR EXTRACTION PIEZOMETER
 - MW-# GROUNDWATER MONITORING WELL (SHALLOW)
 - MW-# GROUNDWATER MONITORING WELL (SHALLOW)
 - MW-# GROUNDWATER MONITORING WELL (INTERMEDIATE)
 - MW-# GROUNDWATER MONITORING WELL (INTERMEDIATE)
 - MW-# DECOMMISSIONED MONITORING WELL (DECEMBER 2010)
 - P-# PIEZOMETER CLUSTER
 - P1a SINGLE PIEZOMETER
 - HP-# CITY OF HAMILTON POWER PLANT WELLS
 - NEUTRON ACCESS TUBE
 - CATHODIC PROTECTION TEST TUBE
 - GAS VENT
 - D.I.C.B. DITCH INLET CATCH BASIN
 - MH-# STORM SEWER MANHOLE
 - APPROXIMATE LIMITS OF NORTH PLUME

- NOTES:**
- 1) EXTRACTION WELL IE-8 AND MONITORING WELLS MW-37 THROUGH MW-42 WERE INSTALLED JANUARY 2009.
 - 2) DEEP PIEZOMETERS OF PIEZOMETER CLUSTERS P1 THROUGH P6 WERE DECOMMISSIONED IN DECEMBER 2010.

SOURCE: SITE PLAN DIGITIZED FROM CBA CONSULTING ENGINEERS DRAWINGS
EXTRACTION AND INJECTION SYSTEM GENERAL FOREMAN LAYOUT (DRAWING NUMBER 84, PLAN 3, DATED MARCH 1985) AND GENERAL LAYOUT OF REMEDIAL SYSTEMS (DRAWING NUMBER 77, PLAN 2, DATED MARCH 1985).

Professional Seal: _____

Name: _____

Date: _____

Project Title: _____

**2014 ANNUAL REPORT
CHEM-DYNE FACILITY
HAMILTON, OHIO**

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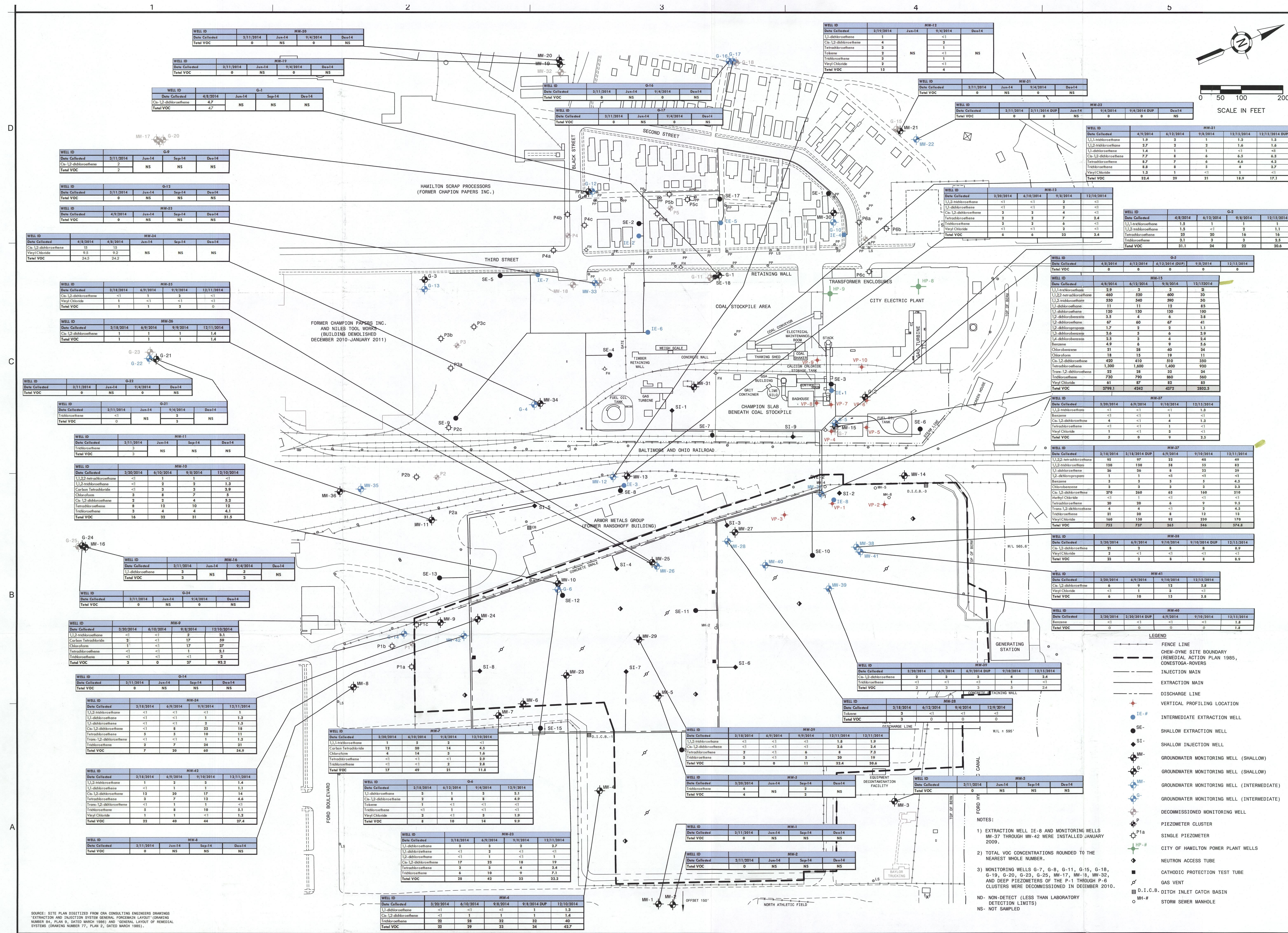
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Mark	Description	Date

Project No.:	DY1009
CAD DWG File:	DY1009.200.0005
Plot Date:	3/31/15
Layout By:	SS
Drawn By:	JS
Check By:	TE
Scale:	1"=100'
Issue Date:	MARCH 2015
Sheet Title:	

SITE PLAN



APPENDIX C

Newspaper Ad

FROM PAGE ONE

Ohioans on hand for hearing

Gay marriage brings
hundreds outside
U.S. Supreme Court

By Jessica Wiersma
and Tina Maxwell
Washington, D.C.

Derrick Streettamer of Chiffchaff has an "amazing" job and lives close to friends and family, but there's something missing that he is not able to have because he lives in Ohio.

A marriage.
Secretaries in gay.
And on Tuesday, he led
into court, Marjorie Post,
were among the hundreds
gathered in front of the
U.S. Supreme Court as the
court took up the issue of
gay marriage.

"I said I liked to be here," said Skowbarner as a woman holding a bull-horn shouted about children teasing a mother and a father. "This is my right. This is something I've wanted since I was young."

The two were part of a large and raucous crowd outside the court, all waiting for word on how the



front of the Supreme Court before the court hears arguments about how states can add businesses.

There were protests as well. One case proved to be a heartbreak, comparing men to "animals." Another held up a placard, "Perverts are an abomination to God." "History is our best

teachers," said Courtney Hayes, a Jefferson, Ohio, resident who is an elementary school teacher who lives in Washington, D.C. "Homosexuality is not going to stand the test of time."

"I believe our country was founded on the Bible," said Robert Israel, 55, a Los Angeles contractor, who said every example of marriage in the Bible was "male and female."

But the majority of the crowd supported gay marriage, many saying they wanted to see the "gay rights" equality they were handing out.



press/Court. The nine justices began hearing arguments in the three workmen's cases, which are being argued on a

"Oh, it's exhilarating," said Michael Roberts of 4410 E. 12th Ave. in south-
east Ohio. "His per-
formance was perfect."
The 39-year-old's wife performed the
wedding ceremony at the
lead witness platform. His
brother, John, and his sister
Christina, and his nephew
John Albert, who married
one of A.L.S. Roberts' wait-
resses, were outside while his wife
said her vows.

"As gay people come
out, people realize that
they're already gay, and
they're not going to need
any," Roberts said.

Gaydon Sander, 481, an
actor, singer and dancer
by avocation, is director of
the Franklin County Women's

Infants & Children, was married in 2000 in Washington, D.C. After he was married, he said his husband tried to change their last name to his, but he stated their reasoning for changing their names was not to be a manipulative move and they couldn't change their research for that reason. The couple hit it hard, and was.

"I mean Chris has a lot of work, but he's the first person I've said, 'Honey, I'm on your side. At one time women were allowed to vote. Black people weren't allowed to drink out of the same wa-

are fascists, and women allowed to marry white people, and we demonstrated through history that we were not." "And this is just another step in history that we are going to take. I'm not worried. I think that Cuba is going even farther up the road of just catch up with the rest of the world," said Castro.

Reflections on Castro
Gregory Duncan and his wife, Barbara, arrived from New York City where the two now live 16 years ago. They were married in 1962.

They arrived in a state where it legal for gays to work in the military. "I came to Cuba, Gregory Duncan worries that if the military is not allowed to be with him in the hospital it is among the many reasons 'they' don't want to let him in. He said, 'I don't think I should have to worry about,' he said.

"I don't think I should have to worry about," said Gregory.

"Calling him my husband was such a moment," he said. "Growing up, when you're raised that you're not allowed to be gay, I think you'll never be able to do that."

Marriage

questioned what he called the "pretense that only copious sexual intercourse is the basis of a bonding with the child. That was very interesting, but it's just a superstition."

As one gay marriage exponent erupted with an outburst in the chambers, the judge responded by the low, hoarse rumble of the canon with stinging clarity: "I object because I think you obviously have a deep bias against the gay as well as to the nation."

At issue is whether state laws brand authority by the state in marriage laws even if those laws prohibit same-sex couples from marrying.

U.S. Solicitor General Donald E. Verrill, Jr. argued against the Ohio law for both of the Obama cases, but he also pointed out a constitutional right to same-sex marriage, gay couples in Ohio and "a right to privacy."

He "helped in dissuading second-class status."

According to *Book of the Week*, which noted the criticism of the gay mar-

Credit review

UNIV) zombified Democrats inside the architecture of the U.S. Supreme Court for one day, says the *Washington Post*. The group was to lobby for a new Supreme Court decision on the constitutionality of the federal ban on gay, lesbian, and transgender service members. The group was to lobby for a new Supreme Court decision on the constitutionality of the federal ban on gay, lesbian, and transgender service members. The group was to lobby for a new Supreme Court decision on the constitutionality of the federal ban on gay, lesbian, and transgender service members.

[illegible]

DAY EIGHTS TIME LINE

TOP-10 NEWS & TRENDS
1 **Agribusiness** The American Soybean Association's *U.S. Soybean Yearbook* is the U.S. Soybean Export Council's (USEC) top priority. The USEC, a Washington, D.C.-based trade association, is the U.S. Soybean Export Council's (USEC) top priority. The USEC, a Washington, D.C.-based trade association, is the U.S. Soybean Export Council's (USEC) top priority.

[illegible]

congressmen. The U.S. & FIC are the main copyright clearinghouses in the U.S. Copyright Clearance Center, Inc., is the largest, with more than 100,000 members who can clear copyright on-line. The Copyright Clearance Center is a not-for-profit organization that provides a service to the music industry by clearing copyright for the use of music in various media. The Copyright Clearance Center is a not-for-profit organization that provides a service to the music industry by clearing copyright for the use of music in various media. The Copyright Clearance Center is a not-for-profit organization that provides a service to the music industry by clearing copyright for the use of music in various media.

death in the EZSOs, Verrelli is worried that if states can continue to lose pay raise requests, the United States' economic future will be "at risk" similar to what "we had with de jure racial segregation." He added that he did not "know why we would want to reopen that history."

Just prior Barack, a special meeting was held for new justices for the state of Michigan, convened. "This case isn't about how to define marriage - it's about who gets to decide that question."

Verrelli was reacting through the electronic procedure or is it federal courts' search asked, "We're asking you to do for every individual's fundamental liberty interest is deciding the meaning of marriage."

Verrelli is asking every state to be a part of the

But there was a seismic shift in public opinion. In November 2004, 61.7 percent of Ohio voters approved a constitutional amendment that prohibited same-sex marriages. But between 2003 and 2004, 19 states and the District of Columbia legitimized same-sex marriages and today—after thirteen legislative sessions—21 states and the District of Columbia recognize same-sex marriages.

Just two years ago, in United States v. Windsor, Kennedy presided over the oral arguments and decided in favor of the case that struck down a 2006 federal law defining marriage as between a man and a woman.

The case has given celebrity status to Justice O'Connor, who was named the lead dissenter along with Justice Alito, and has been cited along with the landmark 1967 case of *Loving v. Virginia*.

What the people can do."

By contrast, Justice Santorum's dissent declared: "Suppose we rule in your favor in this case and then after a just trial consisting of two men and two women, apply for a marriage license? Would there be any ground for denying them a license?"

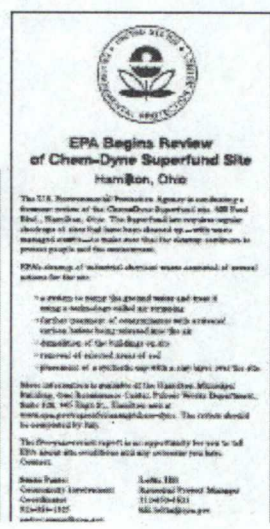
Chief justice John Roberts summed things up by stating that the court would have the last word on whether

OF SUNDAY-MORNING TEACHING is usually held to state after state. "If you prevail here, there will be no more debate" in the states about SUNDAY-MORNING TEACHING, insists Rosecrance, adding that "closing of schools can cause church, state & civil society a considerable loss. We know this new institution is accepted."

**EPA Begs
of Chem-Dyn**

The U.S. Environmental Protection Agency of the Chemical Industry, American Chemical Society, and the American Petroleum Institute, are asking the Chemical Industry to help pay for the costs of the new Superfund program. The program is designed to help pay for the costs of cleaning up hazardous waste sites. The program is designed to help pay for the costs of cleaning up hazardous waste sites. The program is designed to help pay for the costs of cleaning up hazardous waste sites.

Superfund Site
in Ohio



APPENDIX D

Monitored Natural Attenuation Pilot Study



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
GROUND WATER AND ECOSYSTEMS RESTORATION DIVISION
PO BOX 1198 • ADA, OK 74821

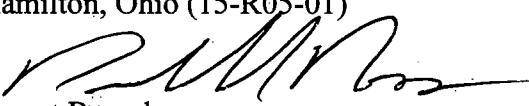
Appendix D

April 4, 2015

MEMORANDUM

OFFICE OF
RESEARCH AND DEVELOPMENT

SUBJECT: Review Comments for Monitored Natural Attenuation (MNA) Pilot Test Work Plan, Chem-Dyne Superfund Site, Hamilton, Ohio (15-R05-01)

FROM: Randall Ross, Ph.D., Hydrologist 
Applied Research and Technical Support Branch

TO: Lolita Hill, Project Manager
U.S. EPA, Region 5

Per your request for technical assistance, the Monitored Natural Attenuation (MNA) Pilot Test Work Plan, Chem-Dyne Superfund Site, Hamilton, Ohio, was reviewed by Drs. Daniel Pope (CSS-Dynamac Corporation), Milovan Beljin (subcontractor to CSS-Dynamac Corporation) and me. CSS-Dynamac Corporation provides technical assistance to the Technical Support Program. The following Powerpoint presentations were also reviewed:

Groundwater Plume Analytics. 2014. EarthCon Consultants, Inc.
Chem-Dyne Plume Analytics Presentation 1-15-15.pptx

Shutdown Recovery Wells Analytics. 2014. EarthCon Consultants, Inc.
Shutdown Recovery Wells Eval.pptx

The following comments are provided for your consideration. If you would like to discuss these comments, please do not hesitate to contact me at your convenience (580-436-8611).

GENERAL COMMENTS

MNA has been widely used at chlorinated solvents sites since the 1990s, and has been shown to be capable of making substantial contributions to meeting remedial goals for such sites. The general outlines of the degradative processes of major importance for control of the chlorinated solvents and their daughter products are well established (e.g., Pivetz et al. 2013), and numerous tools for their characterization and evaluation have been developed. However, because MNA is not in itself an active, engineered remedial approach (although it is commonly used in combination with one or more engineered remedial approaches), it is generally understood that MNA may require more intensive site characterization and monitoring than other remedial approaches (USEPA 1999). Further, MNA is not viewed as a viable remedial option for areas impacted by residual source material, which may be present in the vicinity of MW-15, as

indicated by persistent elevated VOC concentrations. The following comments discuss particular aspects of the Workplan that should be addressed to provide for a robust and accurate assessment of the potential for using MNA as part of the remedial approach at the Site.

Plume Stability Analysis

Numerous methods have been proposed for analyzing plume stability and center of mass changes, and such approaches have been widely used for evaluation of plume behavior (e.g., Dupont et al., 1998, Looney et al., 2006, Wiedemeier et al., 1999, Pivetz et al., 2012). The Workplan indicates (page 7) that plume stability analysis will be done using the Ricker Method (Ricker, 2008), and indicates that *“The Ricker Method® plume stability analysis compares relative changes in contaminant plume characteristics over time, including area, average concentration, and mass indicator.”* While the Ricker Method may have some use as part of the plume behavior analysis, it is important to note that this method is based on assumptions and smoothing techniques (e.g., average contaminant concentration) that will mask the heterogeneity of the site subsurface conditions reflected in the individual well data.

The calculated plume mass in the case study example given in Ricker (2008) is indicated as *“not necessarily ... an indication of the actual mass of the plume”* (Ricker, 2008, page 89) because there was no measured vertical contaminant data used; only aquifer thickness and porosity was used, and a uniform concentration of contaminants was assumed throughout the thickness of the aquifer. This appears to be the approach planned for the Pilot Test, as the Workplan indicates *“Note that the term ‘mass indicator’ does not necessarily represent the entire mass in the subsurface, but rather an expression of it based on a fixed assumption of aquifer thickness and porosity.”* That is, the calculated ‘mass indicator’ bears an unknown relationship to the actual mass in the plume. The contaminant mass in the grid block is computed by multiplying the assumed uniform pore volume in the block by an assumed uniform contaminant concentration value. These assumptions are not realistic, since pore volume may not be constant across the Site or by depth, the plume thickness varies in different locations, and the contaminant concentrations vary with depth.

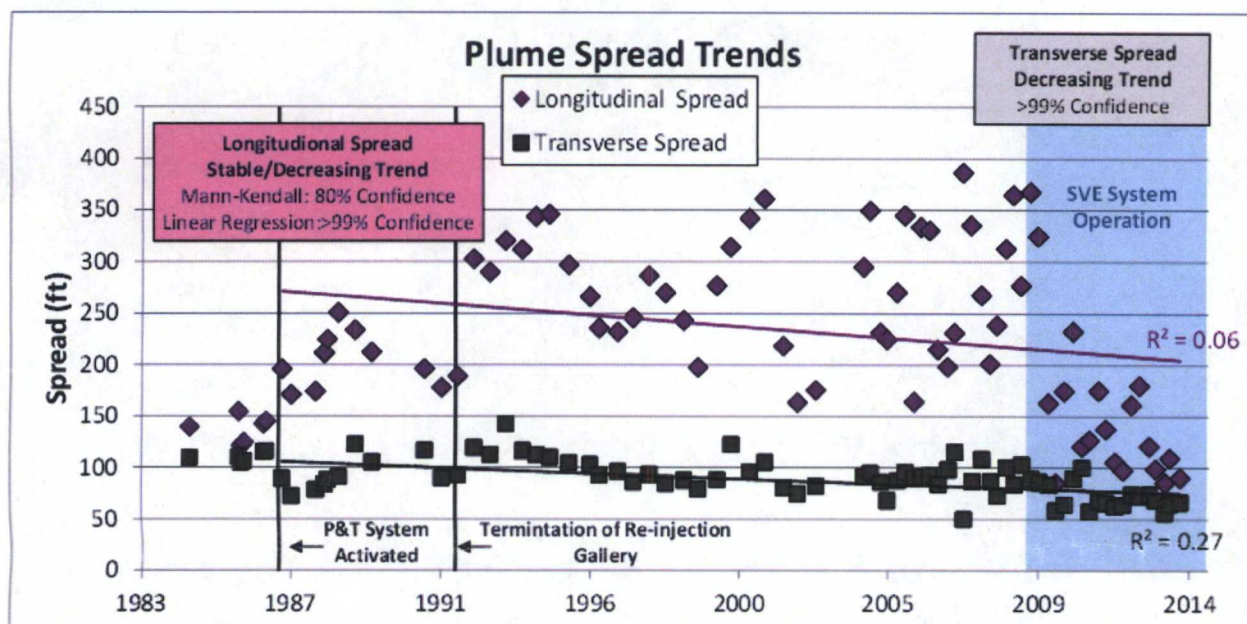
It is not clear that the mass indicator value calculated by the Ricker Method would be any more useful than the value of the plume area, since the additional data in the mass indicator value calculation is only the previously-mentioned assumed vertically-uniform contaminant concentration. Vertically-discrete contaminant concentration data are not provided in the Workplan to support this assumption. If contaminant mass, or mass indicators, are to be used as part of the MNA evaluation, the mass should be calculated based on 3D data (i.e., actual measurements by depth, not assumptions) for the plume.

While the proposed analytical approach (the Ricker Method) may have some limited usefulness in order to provide generalized overall values for plume behavior, it tends to obscure the differences in contaminant concentrations, geochemistry, and trends for individual sampling locations, may be misleading (e.g., a “mass indicator” that is not really mass, and uses assumptions about the 3D extent of the plume), and so should not be an important part of the approach to evaluating plume behavior. It is important that the data from individual wells be carefully examined in light of well screening, hydrogeologic complexity and other factors to determine details about the plume behavior, such as different trends in different parts of the Site, or for different contaminants (see the trichloroethene plume spread trends figure on page 27 of

the Groundwater Plume Analytics document) that may be significant in assessing the applicability of MNA as part of the Site remedy, and perhaps for assessing the success of source removal/control efforts. See Newell et al. (2002) and Pope et al. (2004) for more detailed information on appropriate monitoring and data analysis for MNA studies and remedies.

Obscuring the differences in contaminant concentrations, geochemistry, and trends for individual sampling locations masks the variability of the base data (e.g., the individual sampling/analysis results for each contaminant), which tends to make the results of analysis seem more certain than actually may be the case. It is useful to carefully examine the base data together with the calculated trends in a graphical context to have a visual assessment of the strength of a trend. For instance, the figure below, found on page 22 of the Groundwater Plume Analytics document shows trend lines and statistics (e.g., Mann-Kendall and linear regression for the trends, with associated confidence values and R^2). It should be noted that Mann-Kendall statistical analysis approaches are likely more appropriate for groundwater contaminant concentration data than linear regression. The trend line for longitudinal spread indicates a decrease, but note that the individual data points are quite scattered and the R^2 value is very low, so it is questionable how much dependence should be placed on the notion of a decreasing trend in terms of evaluating MNA. It should be noted that the decrease, if any, appears to be driven by the soil vacuum extraction [SVE] system; i.e., source removal rather than biodegradation or other components of natural attenuation. Certainly any projection of the trend line in the figure to indicate achievement of particular contaminant concentrations at some future time would be highly uncertain.

It is important to choose carefully the data set to be used in a trend analysis. For example, if the contaminant source changes or groundwater flow patterns change during the time span covered by a set of data, these changes could affect the trend results and lead to a false understanding of contaminant concentration trends and viability of MNA as part of the Site remedy. Note that the linear regression results would vary just by selecting sets of data from different time intervals (e.g., by selecting early high concentration values, the slope of the line is steeper than when other periods are considered). For the MNA evaluation of contaminant trends, it is important to use only data taken during the MNA evaluation period, so that the analysis considers only the trends occurring while the MNA evaluation is being conducted, and confounding influences are minimized.



Plume Spread Trends. Figure from *Groundwater Plume Analytics*. 2014. EarthCon Consultants, Inc.

In order to present an accurate picture of Site conditions and clearly communicate uncertainty, all modeling and statistical approaches should be clearly shown to meet USEPA data quality objectives, and should incorporate uncertainty analyses (USEPA 2009), including sensitivity analyses, confidence limits on predicted values, etc. The uncertainty analyses should clearly indicate the variability of the base Site data, and how that variability influences assessment (i.e., understanding of current Site conditions, including hydrogeology, contamination, geochemistry, and microbiology) and predictions of contamination nature (e.g., parent/daughter products), contaminant extent (three dimensional location) and contaminant degree (concentration/mass, including attenuation rates), and of future changes in Site conditions (hydrology, geochemistry, microbiology, etc.).

Data analyses, and predictions of contaminant and geochemistry values, extent, and changes, should be presented in narrative, tabular, and graphical form to enhance communication of the current and expected conditions, and the associated uncertainty of measurements and predictions. Generally the data analyses and predictions are updated at least annually for the life of the remedy, to generate updated attenuation rate constants, time-frame predictions, etc., using the latest data.

The grid contaminant concentration values are obtained by using contouring software. In order to facilitate comparison of results from different sampling events, it is important to use the same monitoring network for all future monitoring, and the same contouring method (e.g., kriging) must be applied for each sampling data set.

Frequency of MNA Performance Monitoring Parameter Analysis

According to the Workplan (Table 1), data for important MNA assessment parameters (nitrate, sulfate, sulfide, alkalinity, total organic carbon [TOC], and dissolved gases [methane, ethane, ethene]) will only be collected once yearly, and only at a few sampling points. These parameters

should be collected at each sampling event (quarterly), in all the wells used for MNA performance monitoring.

Longevity of Suitable Geochemical Conditions

The Workplan does not include any discussion relating to the expected longevity of the geochemical conditions suitable for the anticipated biodegradation to take place for the life of the MNA portion of the Site remedy. For example, reductive dechlorination is driven not only by supplies of labile organic carbon (electron donor) for the dechlorinators to degrade contaminants, but also to produce and maintain the low ORP conditions necessary for the dechlorinators to maintain effective populations. It would be useful to identify the sources of electron donor and evaluate their availability and longevity, particularly if changes in the groundwater flow regime are expected (e.g., cessation of extraction), and if any of the carbon source materials are anthropogenic.

Hydrologic Monitoring

The Workplan (page 4) indicates that "Groundwater will continue to be monitored in accordance with the Long Term Monitoring and Optimization Plan (LTMOP)." There is no mention of monitoring for hydrogeologic parameters in the Workplan. The contaminant and MNA monitoring parameters specified in the Workplan cannot be usefully interpreted without a full historical and current understanding of Site hydrogeological conditions (i.e., an understanding of historical hydrogeological conditions based on extensive historical Site data, and also an understanding of current hydrogeological conditions based on measurements taken at the same time in each of the same wells as the contaminant and geochemical samples).

Pivetz et al. (2012) and Pope et al. (2004) can be consulted to determine the hydrogeologic parameters to be monitored for MNA tests and remedies (e.g., the parameter list under the Hydrogeologic Variables heading in Table 2, in Pivetz et al. 2012; Figure 2 and the Hydrogeology section in Pope et al. 2004). The hydrogeologic parameters to be monitored should be specified in the Workplan. Note that in addition to hydraulic head, etc., all groundwater recharge/discharge/extraction should be monitored; this should include recording pumping rates and times when pumps are on for any wells area, including municipal supply wells.

It is important to obtain a complete hydrologic data set during the MNA evaluation because the proposed termination of the extraction system will change the groundwater flow regime at the Site, and because seasonal changes in groundwater flow may occur. The groundwater flow regime will be somewhat different under the new conditions, and it should not be assumed that the old flow regime is representative of the new conditions. Changes in flow direction (vertical and horizontal hydraulic gradients) and groundwater velocity should be evaluated, and incorporated in discussions of contaminant trends. Water level maps should be presented for each sampling event. As far as possible, the complete set of wells used for previous monitoring should be sampled during the MNA evaluation (i.e., no wells should be removed from the monitoring program). The use of pressure transducers in selected wells should be considered to evaluate changes in the local groundwater flow regime when the extraction wells are turned off.

Extraction System Shut-Down

The Workplan indicates that the current extraction system (i.e., the pump and treat [P&T] system) will be shut down during implementation of the Workplan, and (page 3) that it is expected that "the cessation of the groundwater extraction system may enhance the biotic degradation component..." There is evidence that the current configuration of the P&T system has reached its asymptote in terms of its efficiency, so it may be appropriate to consider changes in the system. However, given that the extraction system is pumping at relatively small rates from a highly productive aquifer, it is not clear that stopping the extraction system would make any significant change related to enhancing biotic degradation.

SPECIFIC COMMENTS

MNA as Part of the Site Remedy

The Workplan appears to indicate that MNA is being evaluated as a possible sole remedy for groundwater at the Site:

"The objective of the Pilot Test is to evaluate the efficacy of MNA as the sole remedial technology for addressing the remaining groundwater plume at the Chem-Dyne Superfund Site." (Page 3)

However, USEPA guidance indicates that MNA is not generally to be considered as a sole remedy:

"In the majority of cases where MNA is proposed as a remedy, its use may be appropriate as one component of the total remedy, that is, either in conjunction with active remediation or as a follow-up measure. MNA should be used very cautiously as the sole remedy at contaminated sites." (USEPA 1999, page 2)

"However, EPA expects that reliance on MNA as the sole remedy will only be appropriate at relatively few contaminated sites." (USEPA 1999, page 10)

Therefore it is recommended that additional clarification be provided to show why MNA would be appropriate as a sole remedy for contaminated groundwater, especially considering that it appears that there may be source material remaining that supplies contaminants to Site groundwater, as indicated by the persistent high concentrations of VOCs in the vicinity of MW-15.

Source Quantitation, Removal and Control

Contaminant concentrations at some sampling locations are high enough to indicate that source materials are likely still present, as indicated in the previous comment, and will probably contribute contaminants to the dissolved plume for an indefinite period. Note that the USEPA MNA Directive (USEPA 1999) makes the following statements about contaminant sources and MNA remedies:

"Use of MNA does not signify a change in OSWER's remediation objectives. These objectives... include control of source materials..." (Page 2).

"EPA expects that source control and long-term performance monitoring will be fundamental components of any MNA remedy." (Page 3).

"Site characterizations for natural attenuation generally warrant a quantitative understanding of source mass..." (Page 13).

"In determining whether MNA is an appropriate remedy for soil or groundwater at a given site, EPA or other regulatory authorities should consider the following... The nature and distribution of sources of contamination and whether these sources have been, or can be, adequately controlled..." (Page 18).

Site contaminant source materials should be characterized and removed/controlled so that source materials no longer contribute significant mass to the groundwater plume. MNA is not considered to be a source control remedy.

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cc: Ed Gilbert (5203P)
Charles Maurice, Region 5
David Wilson, Region 5



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**Chem-Dyne Trust Site
MNA Pilot Test Data
June-July 2015**

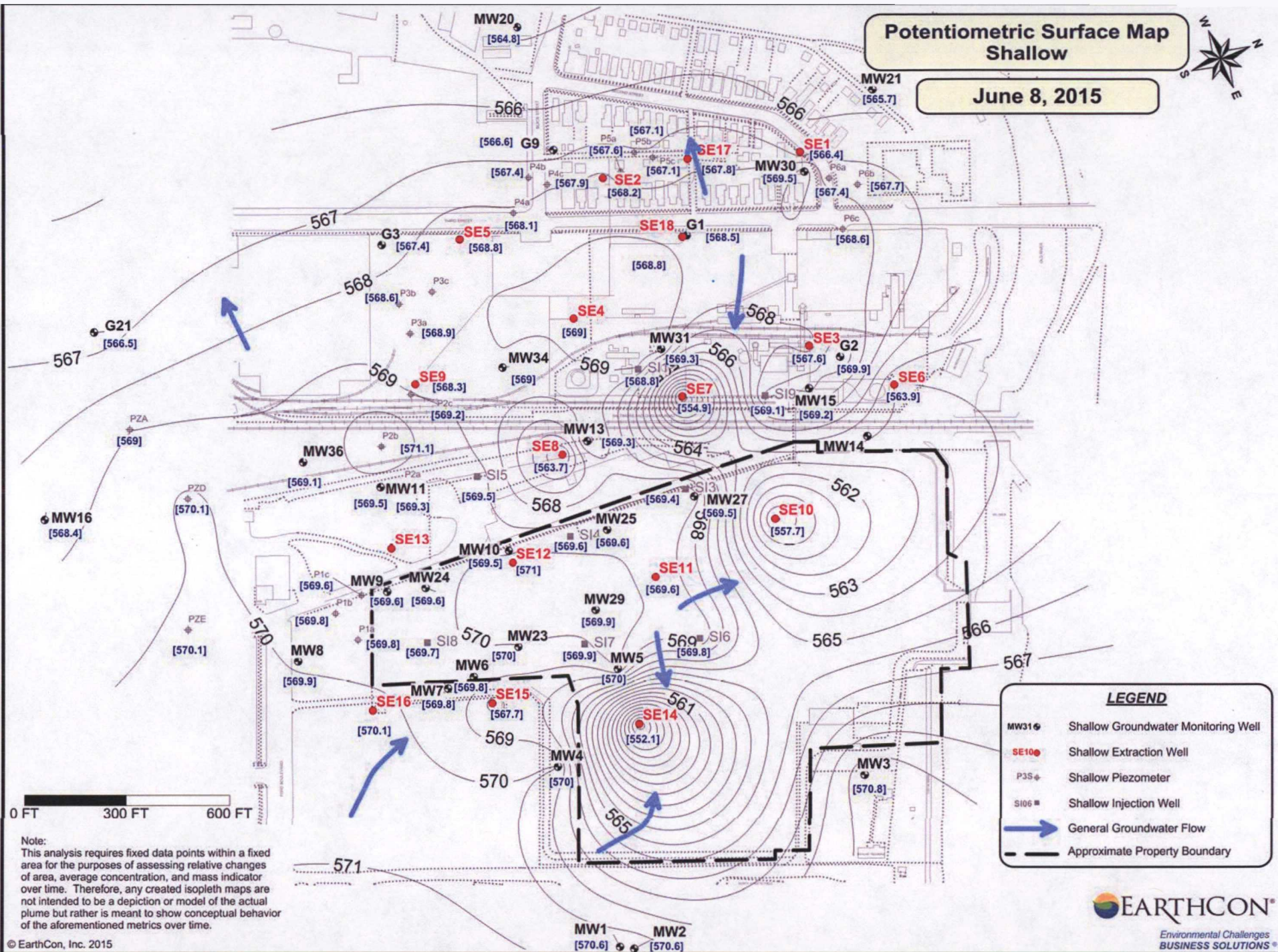
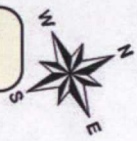
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Potentiometric Surface Maps Prior to and Post Shutdown

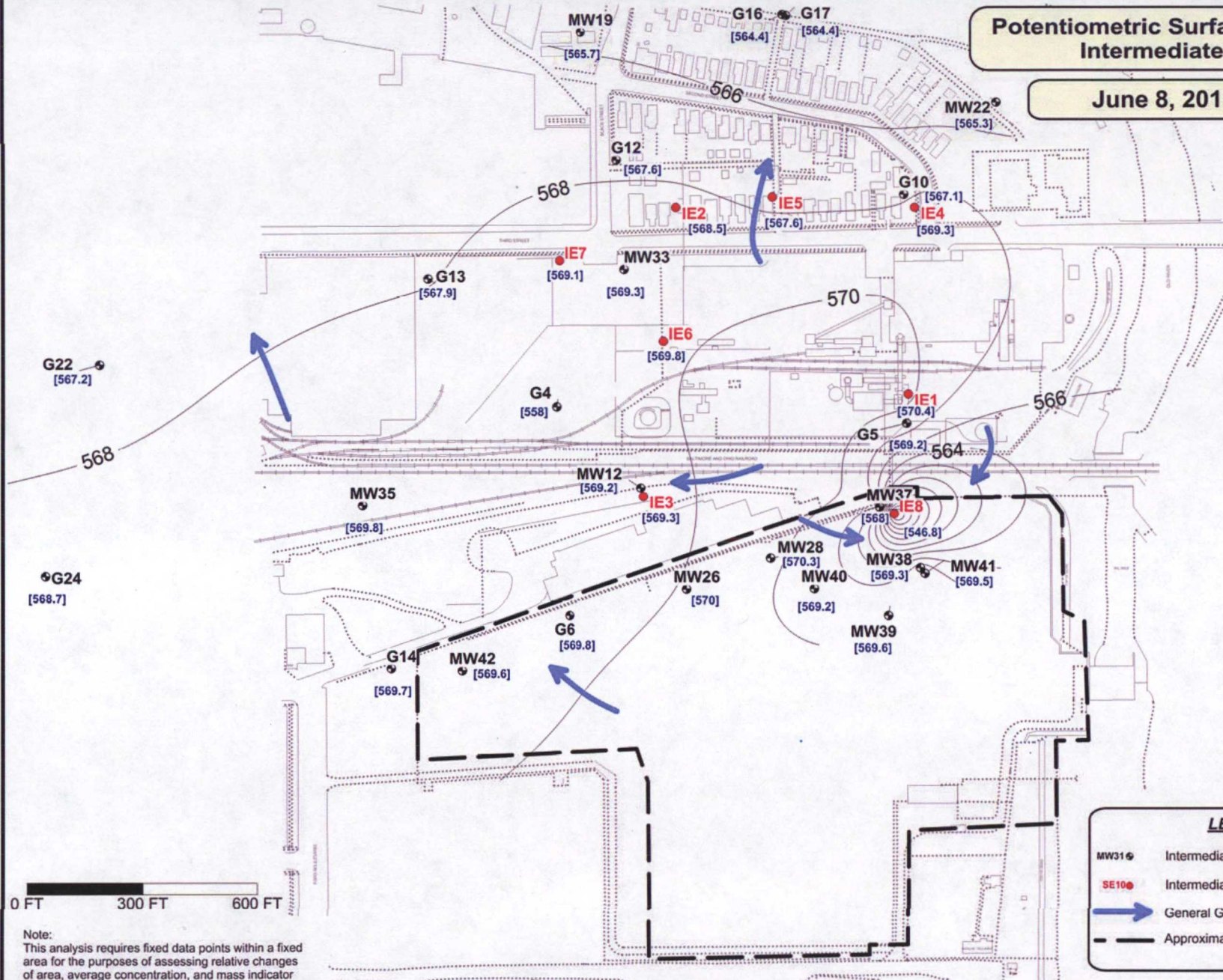
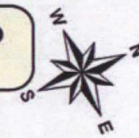
Potentiometric Surface Map Shallow

June 8, 2015



Potentiometric Surface Map Intermediate

June 8, 2015



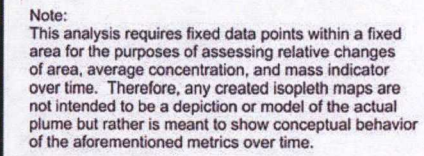
LEGEND

- MW31 ● Intermediate Groundwater Monitoring Well
- SE10 ● Intermediate Extraction Well
- ➔ General Groundwater Flow
- - - Approximate Property Boundary

Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

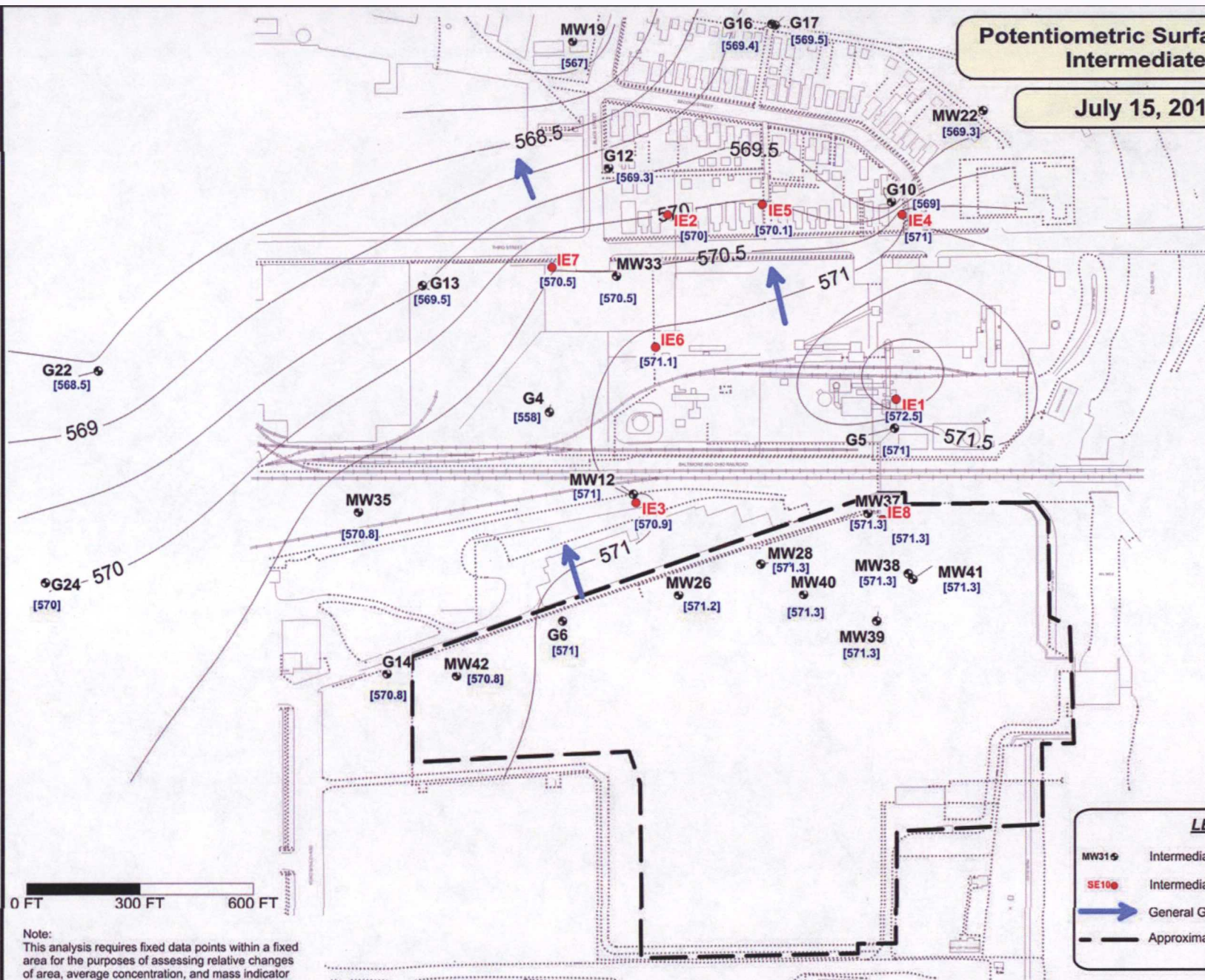
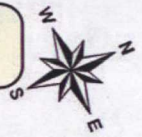
Note:
G4 water level excluded from analysis due to an anomalous value.

July 15, 2015



Potentiometric Surface Map Intermediate

July 15, 2015



0 FT 300 FT 600 FT

Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

Note:
G4 water level excluded from analysis due to an anomalous value.

LEGEND

- MW31 Intermediate Groundwater Monitoring Well
- IE10 Intermediate Extraction Well
- Blue Arrow General Groundwater Flow
- Dashed Line Approximate Property Boundary

MNA Data Collected June 2015

MNA Parameters – Shallow Zone

June 2015

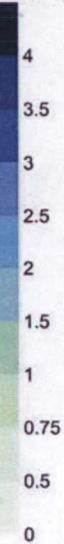
Well	pH	Specific Conductivity (mS/cm)	Temperature (C)	Dissolved Oxygen (DO) (mg/L)	Oxidation-Reduction Potential (ORP) (mv)	Ferrous Iron (Fe ²⁺) (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Sulfide (mg/L)	Chloride (mg/L)	Alkalinity (mg/L)	Total Organic Carbon (TOC) (mg/L)	Dissolved Methane (µg/L)	Dissolved Ethane (µg/L)	Dissolved Ethene (µg/L)
G-1	7.36	1.854	15.2	0.72	-234.8	2.95	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
G-2	6.77	1.263	15.6	1.38	66.2	0.02	4	190	<1.0	89	420	1 or 1.7 (G2/G5)	<5.0	<5.0	<5.0
G-9	7.08	0.900	15.2	1.06	12.0	0.47	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-2	7.16	0.799	14.1	3.70	35.1	0.20	3.4	45	<1.0	40	360	1	<5.0	<5.0	<5.0
MW-3	7.15	0.780	12.8	5.72	60.4	0.19	5.4	41	<1.0	30	360	1	6.3	<5.0	<5.0
MW-5	7.17	0.768	14.2	1.39	85.2	0.16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-7	7.38	0.548	13.2	1.38	30.0	0.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-8	7.21	0.971	15.1	0.50	-151.1	2.44	<0.10	26	<1.0	26	490	2.8	810	6.7	<5.0
MW-9	7.15	1.145	14.9	6.60	1.2	0.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-11	6.89	0.872	17.1	2.75	43.1	0.10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-13	7.13	0.885	16.2	5.61	36.1	0.14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-15	7.35	0.966	14.7	0.64	-162.1	3.08	<0.10	120	<1.0	15	410	2.5	41	9.7	10
MW-16	8.42	0.513	15.0	0.96	-136.0	0.27	0.15	21	<1.0	63	160	<1.0	6.4	<5.0	<5.0
MW-23	7.11	0.806	13.5	1.20	22.5	0.06	<0.10	64	6	49	350	<1.0	<5.0	<5.0	<5.0
MW-24	7.21	0.899	14.4	6.40	48.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-25	7.40	0.633	14.0	2.31	-27.1	0.08	<0.10	38	<1.0	19	330	1.9	47	<5.0	<5.0
MW-27	7.14	0.822	14.2	0.49	-158.0	1.97	<0.10	<1.0	<1.0	36	410	2.1	6400	36	40
MW-29	7.13	0.808	14.4	0.60	-8.8	0.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-31	7.21	1.221	15.8	0.47	-168.2	3.16	<0.10	340	<1.0	14	420	1.5	70	<5.0	<5.0
MW-34	6.97	1.139	15.2	0.82	-78.5	2.73	<0.10	130	<1.0	90	410	1.6	43	<5.0	<5.0
SE-1	7.32	0.795	15.4	0.79	17.3	0.21	<0.10	71	<1.0	71	290	1.2	6.7	<5.0	<5.0
SE-2	7.31	0.754	14.5	1.18	20.7	0.16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SE-3	7.07	0.907	15.2	0.65	-71.0	1.75	<0.10	130	<1.0	32	350	1.5	20	<5.0	6.6
SE-4	6.93	0.869	14.7	0.76	62.9	0.80	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SE-5	7.19	0.811	15.8	0.72	-111.6	3.05	<0.10	70	<1.0	42	320	1.4	6.3	<5.0	<5.0
SE-6	7.08	0.863	15.0	0.70	-56.2	1.43	<0.10	65	<1.0	35	371	1.8	850	9	<5.0
SE-8	7.22	0.774	15.2	1.44	4.6	0.19	1.9	48	<1.0	54	310	1.4	<5.0	<5.0	<5.0
SE-9	6.90	1.116	15.0	1.76	134.5	0.03	0.64	84	<1.0	6.8	600	1.4	<5.0	<5.0	<5.0
SE-11	7.27	0.821	14.1	0.78	-144.4	2.42	<0.10	65	<1.0	40	370	1.2	350	5.1	<5.0
SE-12	7.19	0.824	14.4	0.94	-98.9	2.58	<0.10	69	<1.0	44	360	1	<5.0	<5.0	<5.0
SE-13	7.53	0.598	14.6	6.92	55.5	0.06	1.4	13	<1.0	22	290	1.6	<5.0	<5.0	<5.0
SE-14	7.21	0.810	13.6	1.24	-10.9	0.08	<0.50	58	<1.0	35	360	1.2	<5.0	<5.0	<5.0
SE-15	7.14	0.801	14.5	0.89	-57.8	1.16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SE-16	6.86	0.900	13.6	0.86	89.7	0.16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SE-17	7.34	1.039	14.7	3.43	103.3	0.10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SE-18	7.72	0.907	17.7	0.45	-150.1	1.09	<0.10	250	<1.0	28	260	1.3	<5.0	<5.0	<5.0

Shallow Dissolved Oxygen

June 2015



Concentration (mg/L)



IDEAL



Extent of 2014
Chloroethene
Plume

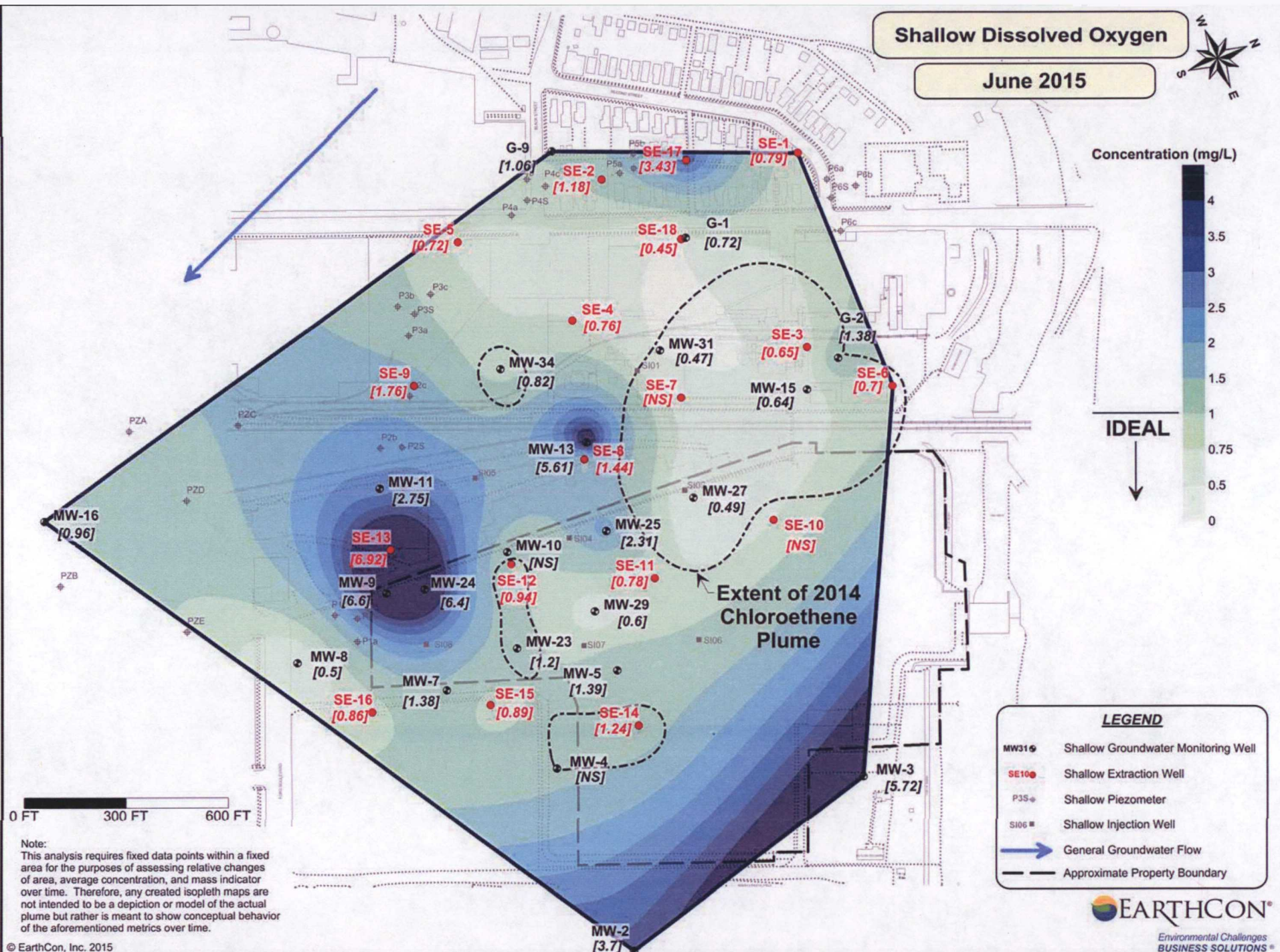
LEGEND

- MW319 Shallow Groundwater Monitoring Well
- SE10 Shallow Extraction Well
- P3S Shallow Piezometer
- SI06 Shallow Injection Well
- General Groundwater Flow
- Approximate Property Boundary

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Environmental Challenges
BUSINESS SOLUTIONS

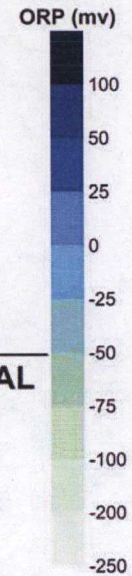
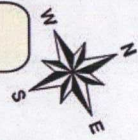
Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

0 FT 300 FT 600 FT

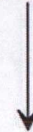


Shallow ORP

June 2015



IDEAL



0 FT 300 FT 600 FT

Note:
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Extent of 2014
Chloroethene
Plume

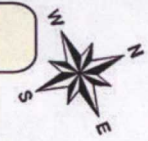
LEGEND

- MW31 ● Shallow Groundwater Monitoring Well
- SE10 ● Shallow Extraction Well
- P3S ● Shallow Piezometer
- SI06 ■ Shallow Injection Well
- ➡ General Groundwater Flow
- - - Approximate Property Boundary

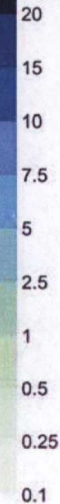
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Shallow Ferrous Iron

June 2015



Concentration (mg/L)



IDEAL

Extent of 2014
Chloroethene
Plume

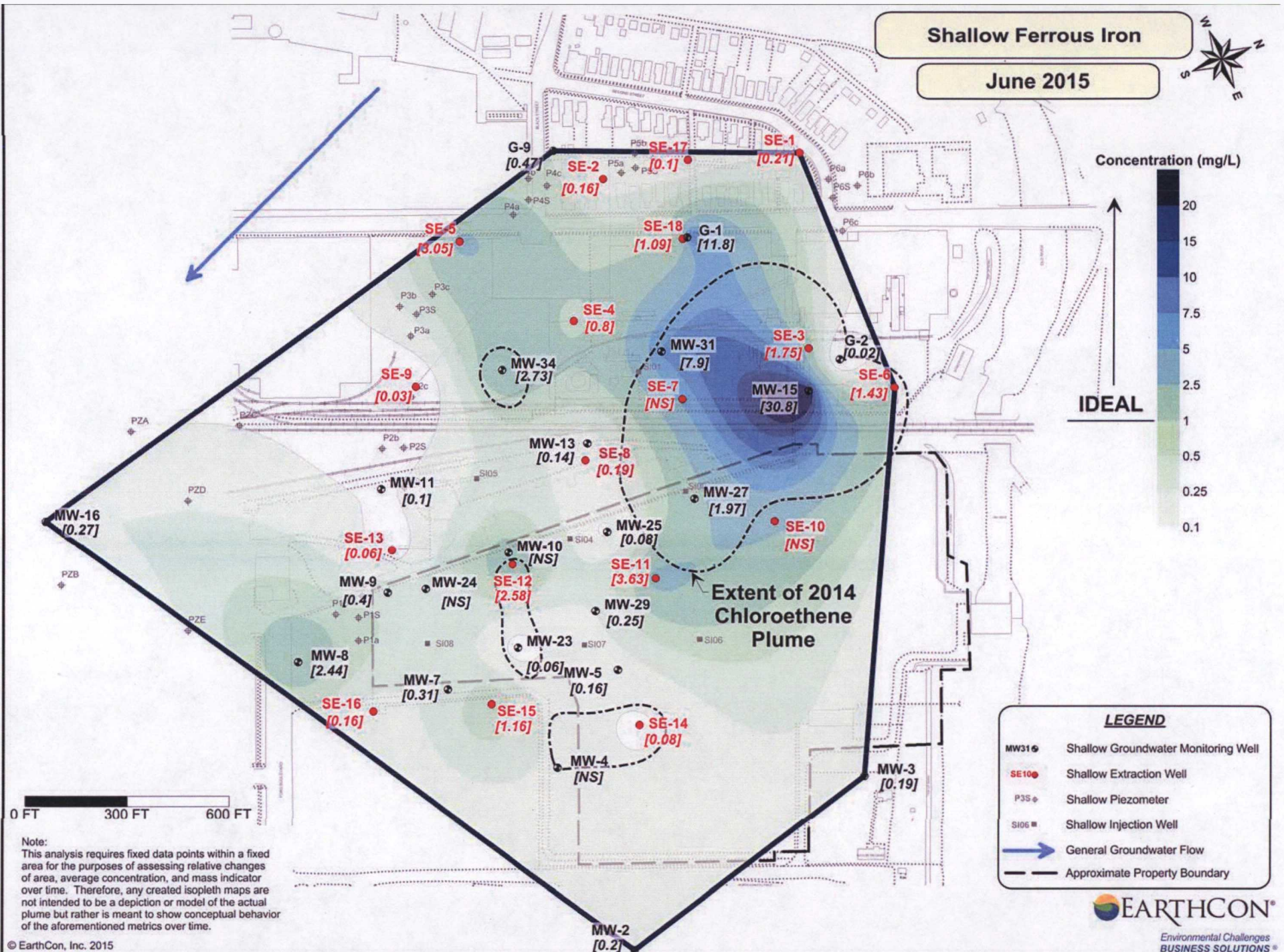
LEGEND

- MW316 Shallow Groundwater Monitoring Well
- SE10 Shallow Extraction Well
- P3S Shallow Piezometer
- SI06 Shallow Injection Well
- General Groundwater Flow
- Approximate Property Boundary

EARTHCON
Environmental Challenges
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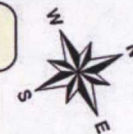
Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

0 FT 300 FT 600 FT



Shallow Methane

June 2015



Concentration (µg/L)



IDEAL

0 FT 300 FT 600 FT

Note:
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Extent of 2014
Chloroethene
Plume

LEGEND

- MW31 ● Shallow Groundwater Monitoring Well
- SE10 ● Shallow Extraction Well
- P3S ● Shallow Piezometer
- SI06 ■ Shallow Injection Well
- ➔ General Groundwater Flow
- Approximate Property Boundary

EARTHCON
Environmental Challenges
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Shallow Ethane

June 2015



Concentration (µg/L)

25
20
15
12
10
9
8
7
6
5

IDEAL

Extent of 2014
Chloroethene
Plume

LEGEND

- MW31● Shallow Groundwater Monitoring Well
- SE10● Shallow Extraction Well
- P3S+ Shallow Piezometer
- SI06■ Shallow Injection Well
- ➡ General Groundwater Flow
- - - Approximate Property Boundary

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Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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0 FT 300 FT 600 FT

MW-16
[<5]

SE-5
[<5]

SE-1
[<5]

SE-18
[<5]

SE-9
[<5]

MW-31
[<5]

SE-7
[NS]

MW-15
[9.7]

G-2
[<5]

SE-6
[9]

SE-8
[<5]

SE-13
[<5]

MW-25
[<5]

SE-11
[5.1]

SE-12
[<5]

MW-10
[NS]

SE-14
[<5]

MW-4
[NS]

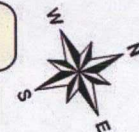
MW-3
[<5]

MW-2
[<5]

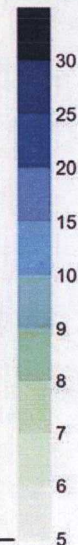
MW-8
[6.7]

Shallow Ethene

June 2015



Concentration (µg/L)



IDEAL

0 FT 300 FT 600 FT

Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

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Extent of 2014
Chloroethene
Plume

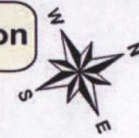
LEGEND

- MW319 ● Shallow Groundwater Monitoring Well
- SE100 ● Shallow Extraction Well
- P3S ● Shallow Piezometer
- SI06 ■ Shallow Injection Well
- ➡ General Groundwater Flow
- Approximate Property Boundary

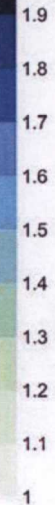
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Shallow Total Organic Carbon

June 2015



Concentration (mg/L)



IDEAL

Extent of 2014
Chloroethene
Plume

LEGEND

- MW31● Shallow Groundwater Monitoring Well
- SE10● Shallow Extraction Well
- P3S● Shallow Piezometer
- SI06■ Shallow Injection Well
- General Groundwater Flow
- - - Approximate Property Boundary

0 FT 300 FT 600 FT

Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

MNA Parameters – Intermediate Zone

June 2015

Well	pH	Specific Conductivity (mS/cm)	Temperature (F)	Dissolved Oxygen (DO) (mg/L)	Oxidation-Reduction Potential (ORP) (mv)	Ferrous Iron (Fe ²⁺) (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Sulfide (mg/L)	Chloride (mg/L)	Alkalinity (mg/L)	Total Organic Carbon (TOC) (mg/L)	Dissolved Methane (µg/L)	Dissolved Ethane (µg/L)	Dissolved Ethene (µg/L)
G-5	7.37	0.824	14.2	0.53	-168.7	2.59	<0.10	84	<1.0	32	330	1 or 1.7 (G2/G5)	32	<5.0	<5.0
G-6	7.55	0.686	14.3	0.84	-209.3	2.74	<0.10	49	8.5	43	320	<1.0	90	<5.0	<5.0
G-12	7.50	0.209	17.9	0.69	-179.4	0.76	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
G-14	7.13	0.803	14.6	0.98	-96.2	2.36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-12	7.47	0.032	15.2	4.15	-125.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-26	7.14	0.696	14.1	0.91	-83.1	1.50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-28	7.22	0.684	13.9	1.00	-101.9	1.68	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-33	7.25	0.504	20.9	0.43	-258.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-37	7.31	0.754	14.3	0.74	-115.0	2.33	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-38	7.13	0.818	14.3	1.00	-90.2	2.27	<0.10	49	<1.0	29	380	1.2	190	<5.0	<5.0
MW-39	7.19	0.730	14.1	1.03	-43.5	0.84	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-40	7.24	0.774	14.5	0.83	-110.5	1.24	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-41	7.25	0.786	14.3	1.20	-98.3	2.33	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MW-42	6.98	0.903	15.3	0.90	-72.9	1.37	<0.10	76	1.8	31	410	1.3	7.9	<5.0	<5.0
IE-1	7.17	0.849	15.6	1.01	-118.3	2.17	<0.10	81	<1.0	45	320	1.6	6.4	<5.0	<5.0
IE-2	7.59	0.738	14.4	1.51	-144.2	0.83	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IE-3	7.28	0.762	14.8	1.00	-108.3	2.20	<0.10	62	<1.0	29	320	<1.0	<5.0	<5.0	<5.0
IE-4	8.96	0.474	15.5	1.89	24.6	0.43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IE-6	7.25	0.720	14.1	1.22	130.9	2.43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IE-7	7.31	0.742	16.1	0.79	-171.1	2.98	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IE-8	7.23	0.790	13.5	1.01	-101.6	2.05	<0.10	110	<1.0	31	330	<1.0	<5.0	<5.0	<5.0

APPENDIX E

Site Monitoring Data, Trend Analysis Data, and Plume Maps

CHEM-DYNE TRUST
CHEM-DYNE SUPERFUND SITE
HAMILTON, OHIO
2014 ANNUAL REPORT

TABLE 14

SUMMARY OF TOTAL VOC CONCENTRATIONS IN MONITORING, EXTRACTION, AND PRODUCTION WELLS - 2014

Inside-Plume Wells				
Shallow	Mar-14	Jun-14	Sep-14	Dec-14
G-1	5	NS	NS	NS
G-2	31	24	22	21
MW-4	22	29	34	43
MW-5	4	NS	2	NS
MW-7	17	49	21	12
MW-9	3	0	37	93
MW-10	16	32	31	32
MW-13	6	6	23	2
MW-15	3799	4242	4372	2803
MW-23	28	42	33	32
MW-24	7	20	60	55
MW-25	1	1	2	0
MW-27	755	265	546	575
MW-29	5	0	11	32
MW-31	32	29	21	19
MW-34	25	NS	NS	NS
Intermediate				
G-4	NS	NS	NS	NS
G-5	0	0	0	0
G-6	8	10	14	10
G-10	NS	NS	NS	NS
G-11	NS	NS	NS	NS
MW-12	15	NS	4	NS
MW-26	0	0	1	1
MW-28	3	0	0	0
MW-33	0	NS	NS	NS
MW-37	5	0	9	3
MW-38	23	2	8	9
MW-39	2	3	5	2
MW-40	0	0	0	2
MW-41	6	10	15	6
MW-42	22	40	44	27

Extraction Wells				
Shallow	Mar-14	Jun-14	Sep-14	Dec-14
SE-1	0	NS	16	NS
SE-2	12	NS	NS	NS
SE-3	284	24	50	29
SE-4	0	NS	0	NS
SE-5	0	NS	NS	NS
SE-6	31	32	37	49
SE-7	340	67	47	51
SE-8	30	21	32	47
SE-9	0	NS	NS	NS
SE-10	4	6	3	3
SE-11	11	13	7	23
SE-12	33	36	34	36
SE-13	13	12	6	2
SE-14	31	41	35	35
SE-15	11	10	6	5
SE-16	0	0	0	0
SE-17	6	NS	5	NS
SE-18	0	NS	NS	NS
Intermediate				
IE-1	NS	338	383	312
IE-2	1	NS	0	NS
IE-3	0	19	32	24
IE-4	2	NS	2	NS
IE-5	2	NS	2	NS
IE-6	8	NS	0	NS
IE-7	0	NS	NS	NS
IE-8	213	204	187	163

Outside-Plume Wells				
Shallow	Mar-13	Jun-13	Sep-13	Dec-13
G-3	NS	NS	NS	NS
G-9	2	NS	NS	NS
MW-1	0	NS	NS	NS
MW-2	0	NS	NS	NS
MW-3	0	NS	NS	NS
MW-8	0	NS	NS	NS
MW-11	3	NS	NS	NS
MW-16	3	NS	3	NS
MW-20	0	NS	0	NS
MW-21	0	NS	0	NS
MW-36	NS	NS	NS	NS
Intermediate				
G-12	0	NS	NS	NS
G-13	NS	NS	NS	NS
G-14	0	NS	NS	NS
G-16	0	NS	0	NS
G-17	0	NS	0	NS
G-21	0	NS	0	NS
G-22	0	NS	0	NS
G-24	0	NS	0	NS
MW-19	0	NS	0	NS
MW-22	0	NS	0	NS
MW-35	NS	NS	NS	NS

Production Well				
	Mar-13	Jun-13	Sep-13	Dec-13
HAM-8	NS	0	NS	NS

Notes:

NS - Well Not Sampled

Bolded values indicate the concentration of Total VOC detected in a sample.

Shaded values indicate analytical results with Total VOCs greater than clean-up criteria.

Total VOC values have been rounded to the nearest whole number value. A value of zero (0) indicates that COCs were not detected at concentrations greater than the method detection limits.

Total VOC values do not include Acrolein detections.

Historically sampled monitoring wells MW-17, MW-18, MW-32, G-7, G-8, G-11, G-15, G-18, G-19, G-20, G-23, and G-25 were decommissioned in December 2010.

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		Extraction Wells					
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-49915-22	490-49915-26	490-49915-6	490-49915-15	490-49915-14	490-49915-7
WELL ID	NA	SE-1	SE-2	SE-3	SE-4	SE-5	SE-6
Date Collected	NA	4/2/2014	4/2/2014	4/1/2014	4/1/2014	4/1/2014	4/1/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	29	<1	<1	<1
1,1,2-trichloroethane		<1	2	31	<1	<1	1
1,1-dichloroethane		<1	<1	1.3	<1	<1	<1
1,1-dichloroethene		<1	1.4	10	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	5.3	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	6	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		<1	6.8	67	<1	<1	20
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	<1	79	<1	<1	1.5
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	3.3	<1	<1	<1
Trichloroethene		<1	2.2	32	<1	<1	5.7
Vinyl Chloride		<1	<1	20	<1	<1	2.8
Total		0	12.4	283.9	0	0	31

		ANALYTICAL RESULTS (ug/l)					
PARAMETER / SAMPLE NUMBER	Cleanup Level	490-49915-5	490-49915-8	490-49915-12	490-49915-13	490-49915-1	490-49915-2
		SE-7	SE-8	SE-9	SE-9 Dup	SE-10	SE-11
Date Collected	NA	4/1/2014	4/1/2014	4/1/2014	4/1/2014	4/1/2014	4/1/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		58	1.2	<1	<1	<1	<1
1,1,2-trichloroethane		78	2.2	<1	<1	<1	<1
1,1-dichloroethane		1.8	<1	<1	<1	<1	<1
1,1-dichloroethene		13	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		4.3	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<50	<1	<1	<50	2.1	3.4
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	2.9	<1	<1	<1	<1
Cis-1,2-dichloroethene		1.4	3.7	<1	<1	2	4.4
Ethyl Benzene		100	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		31	12	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		5.3	<1	<1	<1	<1	<1
Trichloroethene		37	7.5	<1	<1	<1	<1
Vinyl Chloride		9.7	<1	<1	<1	<1	2.9
Total		340	30	0	0	4.1	10.7

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PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-49915-3	490-49915-16	490-49915-4	490-49915-18	490-49915-17	490-49915-25
WELL ID	NA	SE-12	SE-13	SE-14	SE-15	SE-16	SE-17
Date Collected	NA	4/1/2014	4/1/2014	4/1/2014	4/1/2014	4/1/2014	4/2/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	1.3
1,1-dichloroethane		1.2	1.1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		2.1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		12	11	22	4.7	<1	2.9
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		12	<1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		3.1	1.1	9.2	6	<1	1.4
Vinyl Chloride		2.9	<1	<1	<1	<1	<1
Total		33.3	13.2	31.2	10.7	0	5.6

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-49915-30	490-49915-27	490-49915-10	490-49915-23	490-49915-24	490-49915-21
WELL ID	NA	SE-18	IE-2	IE-3	IE-4	IE-5	IE-6
Date Collected	NA	4/2/2014	4/2/2014	4/1/2014	4/2/2014	4/2/2014	4/2/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		<1	1.1	<1	1.7	1.8	2.9
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	<1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		<1	<1	<1	<1	<1	5.3
Vinyl Chloride		<1	<1	<1	<1	<1	<1
Total		0	1.1	0	1.7	1.8	8.2

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PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)		
		490-49915-28	490-49915-29	490-49915-9
WELL ID	NA	IE-7	IE-7 Dup	IE-8
Date Collected	NA	4/2/2014	4/2/2014	4/1/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	3.4
1,1,2,2-tetrachloroethane		<1	<1	11
1,1,2-trichloroethane		<1	<1	10
1,1-dichloroethane		<1	<1	4.3
1,1-dichloroethene		<1	<1	5.3
1,2-dichlorobenzene		<1	<1	1.9
1,2-dichloroethane		<1	<1	8.5
1,2-dichloropropane		<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1
Benzene		<1	<1	4.8
Carbon Tetrachloride		<1	<1	<1
Chlorobenzene		<1	<1	18
Chloroform		<1	<1	<1
Cis-1,2-dichloroethene		<1	<1	60
Ethyl Benzene		<1	<1	22
Methyl Chloride		<1	<1	<1
Tetrachloroethene		<1	<1	3.7
Toluene		<1	<1	3.8
Trans-1,2-dichloroethene		<1	<1	11
Trichloroethene		<1	<1	4.8
Vinyl Chloride		<1	<1	40
Total		0	0	212.5

Contaminated Wells

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-50558-1	490-50558-2	490-50558-3	490-48954-1	490-48954-3	490-48954-2
WELL ID	NA	G1	G2	G5	MW4	MW5	MW7
Date Collected	NA	4/8/2014	4/8/2014	4/8/2014	3/20/2014	3/20/2014	3/20/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	1.5	<1	<1	<1	1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	1.5	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	12
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	4
Cis-1,2-dichloroethene		4.7	<1	<1	<1	<1	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	25	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		<1	3.1	<1	22	4	<1
Vinyl Chloride		<1	<1	<1	<1	<1	<1
Total		4.7	31.1	0	22	4	17

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PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-48954-5	490-48954-4	490-48954-6	490-50558-4	490-50558-7	490-50558-8
WELL ID	NA	MW9	MW10	MW13	MW15	MW31	MW33
Date Collected	NA	3/20/2014	3/20/2014	3/20/2014	4/8/2014	4/9/2014	4/9/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	2.9	1.9	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	460	<1	<1
1,1,2-trichloroethane		<1	<1	<1	550	2.7	<1
1,1-dichloroethane		<1	<1	<1	11	<1	<1
1,1-dichloroethene		<1	<1	<1	120	1.4	<1
1,2-dichlorobenzene		<1	<1	<1	3.5	<1	<1
1,2-dichloroethane		<1	<1	<1	67	<1	<1
1,2-dichloropropane		<1	<1	<1	1.7	<1	<1
1,3-dichlorobenzene		<1	<1	<1	3.6	<1	<1
1,4-dichlorobenzene		<1	<1	<1	2.5	<1	<1
Benzene		<1	<1	<1	4.9	<1	<1
Carbon Tetrachloride		2	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	21	<1	<1
Chloroform		1	3	<1	18	<1	<1
Cis-1,2-dichloroethene		<1	2	2	420	7.7	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	8	2	1,300	8.7	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	22	<1	<1
Trichloroethene		<1	3	2	730	8.8	<1
Vinyl Chloride		<1	<1	<1	61	1.2	<1
Total		3	16	6	3799.1	32.4	0

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)	
		490-50558-5	490-50558-6
WELL ID	NA	MW34	MW34-DUP
Date Collected	NA	4/8/2014	4/8/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1
1,1,2,2-tetrachloroethane		<1	<1
1,1,2-trichloroethane		<1	<1
1,1-dichloroethane		<1	<1
1,1-dichloroethene		<1	<1
1,2-dichlorobenzene		<1	<1
1,2-dichloroethane		<1	<1
1,2-dichloropropane		<1	<1
1,3-dichlorobenzene		<1	<1
1,4-dichlorobenzene		<1	<1
Benzene		<1	<1
Carbon Tetrachloride		<1	<1
Chlorobenzene		<1	<1
Chloroform		<1	<1
Cis-1,2-dichloroethene		15	15
Ethyl Benzene		<1	<1
Methyl Chloride		<1	<1
Tetrachloroethene		<1	<1
Toluene		<1	<1
Trans-1,2-dichloroethene		<1	<1
Trichloroethene		<1	<1
Vinyl Chloride		9.5	9.2
Total		24.5	24.2

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Outside Plume Monitoring Wells							
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-48303-12	490-48303-13	490-48303-14	490-48303-18	490-48303-17	490-48303-19
WELL ID	NA	G9	G12	G14	MW1	MW2	MW3
Date Collected	NA	3/11/2014	3/11/2014	3/11/2014	3/11/2014	3/11/2014	3/11/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		2	<1	<1	<1	<1	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	<1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		<1	<1	<1	<1	<1	<1
Vinyl Chloride		<1	<1	<1	<1	<1	<1
Total		2	0	0	0	0	0

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)	
		490-48303-15	490-48303-16
WELL ID	NA	MW8	MW11
Date Collected	NA	3/11/2014	3/11/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1
1,1,2,2-tetrachloroethane		<1	<1
1,1,2-trichloroethane		<1	<1
1,1-dichloroethane		<1	<1
1,1-dichloroethene		<1	<1
1,2-dichlorobenzene		<1	<1
1,2-dichloroethane		<1	<1
1,2-dichloropropane		<1	<1
1,3-dichlorobenzene		<1	<1
1,4-dichlorobenzene		<1	<1
Benzene		<1	<1
Carbon Tetrachloride		<1	<1
Chlorobenzene		<1	<1
Chloroform		<1	<1
Cis-1,2-dichloroethene		<1	<1
Ethyl Benzene		<1	<1
Methyl Chloride		<1	<1
Tetrachloroethene		<1	<1
Toluene		<1	<1
Trans-1,2-dichloroethene		<1	<1
Trichloroethene		<1	3
Vinyl Chloride		<1	<1
Total		0	3

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Compliance Wells							
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-48303-7	490-48303-8	490-48303-3	490-48303-4	490-48303-2	490-48303-1
WELL ID	NA	G16	G17	G21	G22	G24	MW16
Date Collected	NA	3/11/2014	3/11/2014	3/11/2014	3/11/2014	3/11/2014	3/11/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	<1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		<1	<1	<1	<1	<1	3
Vinyl Chloride		<1	<1	<1	<1	<1	<1
Total		0	0	0	0	0	3

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-48303-5	490-48303-6	490-48303-9	490-48303-10	490-48303-11	
WELL ID	NA	MW19	MW20	MW21	MW22	MW22-Dup	
Date Collected	NA	3/11/2014	3/11/2014	3/11/2014	3/11/2014	3/11/2014	
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	
1,1,2-trichloroethane		<1	<1	<1	<1	<1	
1,1-dichloroethane		<1	<1	<1	<1	<1	
1,1-dichloroethene		<1	<1	<1	<1	<1	
1,2-dichlorobenzene		<1	<1	<1	<1	<1	
1,2-dichloroethane		<1	<1	<1	<1	<1	
1,2-dichloropropane		<1	<1	<1	<1	<1	
1,3-dichlorobenzene		<1	<1	<1	<1	<1	
1,4-dichlorobenzene		<1	<1	<1	<1	<1	
Benzene		<1	<1	<1	<1	<1	
Carbon Tetrachloride		<1	<1	<1	<1	<1	
Chlorobenzene		<1	<1	<1	<1	<1	
Chloroform		<1	<1	<1	<1	<1	
Cis-1,2-dichloroethene		<1	<1	<1	<1	<1	
Ethyl Benzene		<1	<1	<1	<1	<1	
Methyl Chloride		<1	<1	<1	<1	<1	
Tetrachloroethene		<1	<1	<1	<1	<1	
Toluene		<1	<1	<1	<1	<1	
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	
Trichloroethene		<1	<1	<1	<1	<1	
Vinyl Chloride		<1	<1	<1	<1	<1	
Total		0	0	0	0	0	

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Inside Uncontaminated and Production Wells					
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)			
WELL ID	NA	490-48822-10	490-48822-11	490-48822-9	
Date Collected	NA	3/18/2014	3/19/2014	3/18/2014	
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	
1,1,2,2-tetrachloroethane		<1	<1	<1	
1,1,2-trichloroethane		<1	<1	<1	
1,1-dichloroethane		3	<1	<1	
1,1-dichloroethene		<1	1	<1	
1,2-dichlorobenzene		<1	<1	<1	
1,2-dichloroethane		<1	<1	<1	
1,2-dichloropropane		<1	<1	<1	
1,3-dichlorobenzene		<1	<1	<1	
1,4-dichlorobenzene		<1	<1	<1	
Benzene		<1	<1	<1	
Carbon Tetrachloride		<1	<1	<1	
Chlorobenzene		<1	<1	<1	
Chloroform		<1	<1	<1	
Cis-1,2-dichloroethene		2	4	<1	
Ethyl Benzene		<1	<1	<1	
Methyl Chloride		<1	<1	<1	
Tetrachloroethene		<1	3	<1	
Toluene		1	2	3	
Trans-1,2-dichloroethene		<1	<1	<1	
Trichloroethene		<1	3	<1	
Vinyl Chloride		2	2	<1	
Total		8	15	3	

Inside Contaminated Wells							
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
WELL ID	NA	490-48822-2	490-48822-3	490-48822-5	490-48822-6	490-48822-8	490-48822-13
Date Collected	NA	3/18/2014	3/18/2014	3/18/2014	3/18/2014	3/18/2014	3/18/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	95	97
1,1,2-trichloroethane		<1	<1	<1	<1	130	130
1,1-dichloroethane		3	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	36	36
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	1	1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	5	5
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	3	3
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		17	<1	<1	1	270	260
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	1
Tetrachloroethene		2	5	<1	<1	20	20
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	4	4
Trichloroethene		6	2	<1	<1	31	30
Vinyl Chloride		<1	<1	1	<1	160	150
Total		28	7	1	0	755	737

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PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-48822-1	490-48954-9	490-48954-8	490-48954-12	490-48954-10	490-48954-11
WELL ID	NA	MW29	MW37	MW38	MW39	MW40	MW40-DUP
Date Collected	NA	3/18/2014	3/20/2014	3/20/2014	3/20/2014	3/20/2014	3/20/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		<1	4	21	2	<1	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		2	<1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		3	<1	<1	<1	<1	<1
Vinyl Chloride		<1	1	2	<1	<1	<1
Total		5	5	23	2	0	0

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)	
		490-48954-7	490-48822-4
WELL ID	NA	MW41	MW42
Date Collected	NA	3/20/2014	3/18/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1
1,1,2,2-tetrachloroethane		<1	<1
1,1,2-trichloroethane		<1	1
1,1-dichloroethane		<1	<1
1,1-dichloroethene		<1	<1
1,2-dichlorobenzene		<1	<1
1,2-dichloroethane		<1	<1
1,2-dichloropropane		<1	<1
1,3-dichlorobenzene		<1	<1
1,4-dichlorobenzene		<1	<1
Benzene		<1	<1
Carbon Tetrachloride		<1	<1
Chlorobenzene		<1	<1
Chloroform		<1	<1
Cis-1,2-dichloroethene		6	12
Ethyl Benzene		<1	<1
Methyl Chloride		<1	<1
Tetrachloroethene		<1	3
Toluene		<1	<1
Trans-1,2-dichloroethene		<1	<1
Trichloroethene		<1	5
Vinyl Chloride		<1	1
Total		6	22

Notes:

All analytes tested using U.S. EPA Method 8260B.

e. < indicates a concentration less than the reporting limit.

BOLD indicates detected parameter.

SHADED totals indicate a well exceeding action levels.

Total VOC values have been rounded to the nearest whole number value; acrolein detections are excluded from these values.

NS = Not sampled

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Extraction Wells							
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-55705-4	490-55705-2	490-55705-1	490-55705-15	490-55705-6	490-55705-7
		SE-3	SE-6	SE-7	SE-8	SE-10	SE-11
WELL ID		6/17/2014	6/17/2014	6/17/2014	6/17/2014	6/17/2014	6/17/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		2	<1	6	<1	<1	<1
1,1,2-trichloroethane		2	<1	8	1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	2	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		1	<1	1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	2	4
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	1	<1	<1	<1
Chloroform		<1	<1	<1	2	<1	<1
Cis-1,2-dichloroethene		8	23	18	2	2	5
Ethyl Benzene		<1	<1	<1	<1	2	<1
Tetrachloroethene		9	1	15	11	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	2	<1	<1	<1
Trichloroethene		2	7	8	5	<1	<1
Vinyl Chloride		<1	1	6	<1	<1	4
Total		24	32	67	21	6	13

ANALYTICAL RESULTS (ug/l)							
PARAMETER / SAMPLE NUMBER	Cleanup Level	490-55705-8	490-55705-14	490-55705-9	490-55705-10	490-55705-12	490-55705-13
		SE-12	SE-13	SE-14	SE-15	SE-16	SE-16 DUP
		6/17/2014	6/17/2014	6/17/2014	6/17/2014	6/17/2014	6/17/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethane		1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		2	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		15	12	29	4	<1	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		9	<1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	1	<1	<1	<1
Trichloroethene		3	<1	11	6	<1	<1
Vinyl Chloride		5	<1	<1	<1	<1	<1
Total		36	12	41	10	0	0

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PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)		
		490-55705-3	490-55705-16	490-55705-17
		IE-1	IE-3	IE-8
WELL ID		6/17/2014	6/17/2014	6/17/2014
Date Collected				
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	3
1,1,2,2-tetrachloroethane		32	<1	17
1,1,2-trichloroethane		47	<1	20
1,1-dichloroethane		2	<1	4
1,1-dichloroethene		20	<1	5
1,2-dichlorobenzene		2	<1	2
1,2-dichloroethane		9	<1	8
1,2-dichloropropane		<1	<1	<1
1,3-dichlorobenzene		1	<1	<1
1,4-dichlorobenzene		<1	<1	<1
Benzene		1	<1	4
Carbon Tetrachloride		<1	<1	<1
Chlorobenzene		14	<1	15
Chloroform		1	<1	2
Cis-1,2-dichloroethene		110	15	45
Ethyl Benzene		<1	<1	20
Tetrachloroethene		38	<1	7
Toluene		<1	<1	3
Trans-1,2-dichloroethene		6	<1	10
Trichloroethene		32	<1	8
Vinyl Chloride		23	4	31
Total		338	19	204

Inside Contaminated Wells

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-55420-1	490-55029-18	490-55029-19	490-55029-17	490-55029-16	490-55029-15
		G-2	MW-4	MW-7	MW-9	MW 10	MW13
WELL ID		6/12/2014	6/10/2014	6/10/2014	6/10/2014	6/10/2014	6/10/2014
Date Collected							
1,1,1-trichloroethane	100 ug/L Total VOCs	1	<1	5	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	2	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	30	<1	3	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	14	<1	8	<1
Cis-1,2-dichloroethene		<1	1	<1	<1	2	2
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		20	<1	<1	<1	12	2
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		3	28	<1	<1	4	2
Vinyl Chloride		<1	<1	<1	<1	<1	<1
Total		24	29	49	0	32	6

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		490-55420-4	490-55029-4	490-55029-5	490-55029-1	490-55029-2	490-55029-13
WELL ID		MW15	MW 23	MW 24	MW-25	MW 26	MW-27
Date Collected		6/12/2014	6/9/2014	6/9/2014	6/9/2014	6/9/2014	6/9/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	3	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		520	<1	<1	<1	<1	22
1,1,2-trichloroethane		540	<1	<1	<1	<1	58
1,1-dichloroethane		11	3	<1	<1	<1	<1
1,1-dichloroethene		130	2	<1	<1	<1	8
1,2-dichlorobenzene		4	<1	<1	<1	<1	<1
1,2-dichloroethane		60	1	<1	<1	<1	<1
1,2-dichloropropane		2	<1	<1	<1	<1	<1
1,3-dichlorobenzene		5	<1	<1	<1	<1	<1
1,4-dichlorobenzene		3	<1	<1	<1	<1	<1
Benzene		6	<1	<1	<1	<1	5
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		28	<1	<1	<1	<1	3
Chloroform		15	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		410	23	8	1	1	63
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		1,600	3	5	<1	<1	6
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		28	<1	<1	<1	<1	<1
Trichloroethene		790	10	7	<1	<1	8
Vinyl Chloride		87	<1	<1	<1	<1	92
Total		4242	42	20	1	1	265

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-55029-3	490-55420-3	490-55029-9	490-55029-8	490-55029-10	490-55029-11
WELL ID		MW 29	MW31	MW37	MW38	MW39	MW-39-DUP
Date Collected		6/9/2014	6/12/2014	6/9/2014	6/9/2014	6/9/2014	6/9/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	2	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	2	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		<1	8	<1	2	3	3
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	7	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		<1	8	<1	<1	<1	<1
Vinyl Chloride		<1	1	<1	<1	<1	<1
Total		0	29	0	2	3	3

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PARAMETER / SAMPLE NUMBER		Cleanup Level	490-55029-12	490-55029-7	490-55029-6		
WELL ID	MW40		MW41	MW42			
Date Collected			6/9/2014	6/9/2014	6/9/2014		
1,1,1-trichloroethane	100 ug/L Total VOCs		<1	<1	<1		
1,1,2,2-tetrachloroethane		<1	<1	<1			
1,1,2-trichloroethane		<1	<1	2			
1,1-dichloroethane		<1	<1	<1			
1,1-dichloroethene		<1	<1	1			
1,2-dichlorobenzene		<1	<1	<1			
1,2-dichloroethane		<1	<1	<1			
1,2-dichloropropane		<1	<1	<1			
1,3-dichlorobenzene		<1	<1	<1			
1,4-dichlorobenzene		<1	<1	<1			
Benzene		<1	<1	<1			
Carbon Tetrachloride		<1	<1	<1			
Chlorobenzene		<1	<1	<1			
Chloroform		<1	<1	<1			
Cis-1,2-dichloroethene		<1	9	20			
Ethyl Benzene		<1	<1	<1			
Tetrachloroethene		<1	<1	7			
Toluene		<1	<1	<1			
Trans-1,2-dichloroethene		<1	<1	1			
Trichloroethene		<1	<1	8			
Vinyl Chloride		<1	1	1			
Total			0	10	40		
Inside Uncontaminated Wells							
PARAMETER / SAMPLE NUMBER		Cleanup Level	490-55420-2	490-55420-9	490-55420-7	490-55420-6	
WELL ID	G5		G-5 DUP	G6	MW28		
Date Collected			6/12/2014	6/12/2014	6/12/2014	6/12/2014	
1,1,1-trichloroethane	100 ug/L Total VOCs		<1	<1	<1	<1	
1,1,2,2-tetrachloroethane		<1	<1	<1	<1		
1,1,2-trichloroethane		<1	<1	<1	<1		
1,1-dichloroethane		<1	<1	1	<1		
1,1-dichloroethene		<1	<1	<1	<1		
1,2-dichlorobenzene		<1	<1	<1	<1		
1,2-dichloroethane		<1	<1	<1	<1		
1,2-dichloropropane		<1	<1	<1	<1		
1,3-dichlorobenzene		<1	<1	<1	<1		
1,4-dichlorobenzene		<1	<1	<1	<1		
Benzene		<1	<1	<1	<1		
Carbon Tetrachloride		<1	<1	<1	<1		
Chlorobenzene		<1	<1	<1	<1		
Chloroform		<1	<1	<1	<1		
Cis-1,2-dichloroethene		<1	<1	8	<1		
Ethyl Benzene		<1	<1	<1	<1		
Tetrachloroethene		<1	<1	<1	<1		
Toluene		<1	<1	<1	<1		
Trans-1,2-dichloroethene		<1	<1	<1	<1		
Trichloroethene		<1	<1	1	<1		
Vinyl Chloride		<1	<1	<1	<1		
Total			0	0	10	0	

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PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)	
		490-55705-11	
WELL ID		Power Plant #8	
Date Collected		6/17/2014	
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	
1,1,2,2-tetrachloroethane		<1	
1,1,2-trichloroethane		<1	
1,1-dichloroethane		<1	
1,1-dichloroethene		<1	
1,2-dichlorobenzene		<1	
1,2-dichloroethane		<1	
1,2-dichloropropane		<1	
1,3-dichlorobenzene		<1	
1,4-dichlorobenzene		<1	
Benzene		<1	
Carbon Tetrachloride		<1	
Chlorobenzene		<1	
Chloroform		<1	
Cis-1,2-dichloroethene		<1	
Ethyl Benzene		<1	
Tetrachloroethene		<1	
Toluene		<1	
Trans-1,2-dichloroethene		<1	
Trichloroethene		<1	
Vinyl Chloride		<1	
Total		0	

Notes:

All analytes tested using U.S. EPA Method 8260B.

a. < Indicates a concentration less than the reporting limit.

BOLD Indicates detected parameters.

SHADED Totals indicate a well exceeding action levels.

Total VOC values have been rounded to the nearest whole number value; acrolein detections are excluded from these values.

NS = Not sampled

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Extraction Wells							
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-61721-6	490-61721-14	490-61721-4	490-61721-18	490-61721-16	490-61721-19
WELL ID		SE-1	SE-3	SE-4	SE-6	SE-7	SE-8
Date Collected		9/16/2014	9/16/2014	9/16/2014	9/17/2014	9/17/2014	9/17/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	3	<1	1	3	<1
1,1,2-trichloroethane		<1	3	<1	3	5	1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	2	<1	<1	2	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	6	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	2	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		4	18	<1	23	15	15
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	7	<1	1	10	9
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	1	<1
Trichloroethene		12	3	<1	7	4	3
Vinyl Chloride		<1	6	<1	2	7	4
Total		16	50	0	37	47	32

ANALYTICAL RESULTS (ug/l)							
PARAMETER / SAMPLE NUMBER	Cleanup Level	490-61721-20	490-61721-21	490-61721-22	490-61721-3	490-61721-23	490-61721-24
		SE-10	SE-11	SE-12	SE-13	SE-14	SE-14 DUP
Date Collected		9/17/2014	9/17/2014	9/17/2014	9/16/2014	9/17/2014	9/17/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	2	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		1	2	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		2	3	14	6	23	24
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	<1	9	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		<1	<1	3	<1	11	11
Vinyl Chloride		<1	2	5	<1	<1	<1
Total		3	7	34	6	34	35

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PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-61721-2	490-61721-1	490-61721-9	490-61721-17	490-61721-11	490-61721-5
		SE-15	SE-16	SE-17	IE-1	IE-2	IE-3
WELL ID		9/16/2014	9/16/2014	9/16/2014	9/17/2014	9/16/2014	9/16/2014
Date Collected							
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	41	<1	<1
1,1,2-trichloroethane		<1	<1	1	52	<1	<1
1,1-dichloroethane		<1	<1	<1	2	<1	<1
1,1-dichloroethene		<1	<1	<1	17	<1	<1
1,2-dichlorobenzene		<1	<1	<1	2	<1	<1
1,2-dichloroethane		<1	<1	<1	7	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	1	<1	<1
Benzene		<1	<1	<1	1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	13	<1	<1
Chloroform		<1	<1	<1	1	<1	<1
Cis-1,2-dichloroethene		2	<1	3	130	<1	22
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	<1	<1	59	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	4	<1	<1
Trichloroethene		4	<1	1	23	<1	<1
Vinyl Chloride		<1	<1	<1	29	<1	10
Total		6	0	5	383	0	32

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)				
		490-61721-7	490-61721-8	490-61721-12	490-61721-13	490-61721-15
		IE-4	IE-5	IE-6	IE-6 DUP	IE-8
WELL ID		9/16/2014	9/16/2014	9/16/2014	9/16/2014	9/17/2014
Date Collected						
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	3
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	12
1,1,2-trichloroethane		<1	<1	<1	<1	9
1,1-dichloroethane		<1	<1	<1	<1	3
1,1-dichloroethene		<1	<1	<1	<1	4
1,2-dichlorobenzene		<1	<1	<1	<1	2
1,2-dichloroethane		<1	<1	<1	<1	7
1,2-dichloropropane		<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	4
Carbon Tetrachloride		<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	16
Chloroform		<1	<1	<1	<1	2
Cis-1,2-dichloroethene		2	2	<1	<1	46
Ethyl Benzene		<1	<1	<1	<1	20
Methyl Chloride		<1	<1	<1	<1	<1
Tetrachloroethene		<1	<1	<1	<1	5
Toluene		<1	<1	<1	<1	3
Trans-1,2-dichloroethene		<1	<1	<1	<1	10
Trichloroethene		<1	<1	<1	<1	6
Vinyl Chloride		<1	<1	<1	<1	35
Total		2	2	0	0	187

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Inside Contaminated and Uncontaminated Wells							
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-61113-1	490-61113-3	490-60809-15	490-61113-8	490-61113-9	490-61113-7
		G2	G5	G6	MW4	MW4 DUP	MW5
WELL ID		9/8/2014	9/8/2014	9/4/2014	9/8/2014	9/8/2014	9/8/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		2	<1	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	3	<1	1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		<1	<1	8	1	1	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		16	<1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		3	<1	<1	32	32	2
Vinyl Chloride		<1	<1	3	<1	<1	<1
Total		22	0	14	33	34	2

ANALYTICAL RESULTS (ug/l)							
PARAMETER / SAMPLE NUMBER	Cleanup Level	490-61113-11	490-61113-18	490-61113-10	490-60809-13	490-61113-2	490-61113-4
		MW7	MW9	MW-10	MW12	MW13	MW15
		9/8/2014	9/8/2014	9/8/2014	9/4/2014	9/8/2014	9/8/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	2	<1	<1	<1	<1	3
1,1,2,2-tetrachloroethane		<1	<1	1	<1	<1	600
1,1,2-trichloroethane		<1	2	2	<1	2	590
1,1-dichloroethane		<1	<1	<1	<1	<1	12
1,1-dichloroethene		<1	<1	<1	<1	2	130
1,2-dichlorobenzene		<1	<1	<1	<1	<1	6
1,2-dichloroethane		<1	<1	<1	<1	<1	67
1,2-dichloropropane		<1	<1	<1	<1	<1	2
1,3-dichlorobenzene		<1	<1	<1	<1	<1	6
1,4-dichlorobenzene		<1	<1	<1	<1	<1	4
Benzene		<1	<1	<1	<1	<1	9
Carbon Tetrachloride		14	17	3	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	40
Chloroform		3	17	7	<1	<1	19
Cis-1,2-dichloroethene		<1	<1	4	2	4	510
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	1	10	1	7	1,400
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	32
Trichloroethene		2	<1	4	1	6	860
Vinyl Chloride		<1	<1	<1	<1	2	82
Total		21	37	31	4	23	4372

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PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-60809-5	490-60809-6	490-60809-10	490-60809-11	490-60809-12	490-61113-15
WELL ID		MW19	MW20	MW21	MW22	MW22 DUP	MW 23
Date Collected		9/4/2014	9/4/2014	9/4/2014	9/4/2014	9/4/2014	9/9/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	2
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		<1	<1	<1	<1	<1	18
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	<1	<1	<1	<1	4
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethane		<1	<1	<1	<1	<1	9
Vinyl Chloride		<1	<1	<1	<1	<1	<1
Total		0	0	0	0	0	33

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-61113-16	490-61113-14	490-61113-13	490-61158-8	490-60809-14	490-61113-12
WELL ID		MW 24	MW25	MW 26	MW27	MW28	MW 29
Date Collected		9/9/2014	9/9/2014	9/9/2014	9/10/2014	9/4/2014	9/9/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	48	<1	<1
1,1,2-trichloroethane		<1	<1	<1	55	<1	<1
1,1-dichloroethane		1	<1	<1	<1	<1	<1
1,1-dichloroethene		2	<1	<1	22	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	5	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	3	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		22	2	1	160	<1	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		10	<1	<1	9	<1	6
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		1	<1	<1	2	<1	<1
Trichloroethane		24	<1	<1	12	<1	5
Vinyl Chloride		<1	<1	<1	230	<1	<1
Total		60	2	1	546	0	11

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TABLE 18

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PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-61113-5	490-61158-7	490-61158-5	490-61158-6	490-61158-3	490-61158-2
WELL ID		MW31	MW 37	MW 38	MW 38 DUP	MW 39	MW 40
Date Collected		9/8/2014	9/10/2014	9/10/2014	9/10/2014	9/10/2014	9/10/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		2	<1	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		6	4	8	8	4	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		6	1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		5	<1	<1	<1	1	<1
Vinyl Chloride		<1	3	<1	<1	<1	<1
Total		21	9	8	8	5	0

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)	
		490-61158-4	490-61158-1
WELL ID		MW 41	MW 42
Date Collected		9/10/2014	9/10/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1
1,1,2,2-tetrachloroethane		<1	<1
1,1,2-trichloroethane		<1	3
1,1-dichloroethane		<1	<1
1,1-dichloroethene		<1	1
1,2-dichlorobenzene		<1	<1
1,2-dichloroethane		<1	<1
1,2-dichloropropane		<1	<1
1,3-dichlorobenzene		<1	<1
1,4-dichlorobenzene		<1	<1
Benzene		<1	<1
Carbon Tetrachloride		<1	<1
Chlorobenzene		<1	<1
Chloroform		<1	<1
Cis-1,2-dichloroethene		12	17
Ethyl Benzene		<1	<1
Methyl Chloride		<1	<1
Tetrachloroethene		<1	12
Toluene		<1	<1
Trans-1,2-dichloroethene		<1	1
Trichloroethene		<1	10
Vinyl Chloride		3	<1
Total		15	44

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DETECTED COMPOUNDS ONLY

		Compliance Wells					
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-60809-1	490-60809-9	490-60809-3	490-60809-4	490-60809-2	490-60809-1
WELL ID	NA	G16	G17	G21	G22	G24	MW16
Date Collected	NA	9/4/2014	9/4/2014	9/4/2014	9/4/2014	9/4/2014	9/4/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Methyl Chloride		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	<1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		<1	<1	3	<1	<1	3
Vinyl Chloride		<1	<1	<1	<1	<1	<1
Total		0	0	3	0	0	3

Notes:

All analytes listed above were tested using U.S. EPA Method 8260B.

a. < indicates a concentration less than the reporting limit.

BOLD indicates detected parameter.

SHADED totals indicate a well exceeding action levels.

Total VOC values have been rounded to the nearest whole number value; acrolein detections are excluded from these values.

NS = not sampled

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TABLE 8

MONTHLY SUMMARY OF OPERATING HOURS AND VOLUME PUMPED BY ACTIVE EXTRACTION WELLS - 2014

Well	January			February			March			April			May			June		
	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped
IE-01	336	8	158,680	0	0	0	0	0	0	0	0	0	565	9	291,940	678	12	489,780
IE-08	744	41	1,834,860	666	37	1,489,980	744	37	1,660,510	720	38	1,638,290	654	39	1,531,520	690	40	1,650,240
Sum IE	1,080	49	1,993,540	666	37	1,489,980	744	37	1,660,510	720	38	1,638,290	1,219	48	1,823,460	1,367	52	2,140,020
SE-03	744	3	116,830	666	3	118,750	744	3	113,380	720	2	86,440	147	2	17,860	0	0	0
SE-06	744	11	511,310	666	11	431,980	744	10	438,920	720	10	411,320	654	9	341,830	702	10	432,560
SE-07	744	22	987,920	666	26	1,032,350	744	25	1,111,680	720	24	1,038,960	650	11	446,730	702	9	391,720
SE-08	744	9	406,850	666	6	235,550	744	10	442,400	720	10	412,220	654	10	406,350	702	13	532,340
SE-10	744	31	1,400,670	666	23	905,710	744	20	896,670	720	21	890,830	587	18	647,430	580	11	476,110
SE-11	744	9	418,000	666	10	417,000	744	10	465,000	720	10	425,280	587	12	447,980	650	11	455,110
SE-12	744	7	333,120	666	8	306,500	744	8	341,000	719	11	486,000	654	32	1,268,140	702	29	1,218,660
SE-14	744	8	335,190	666	10	389,000	743	11	473,740	720	39	1,691,220	654	40	1,580,960	626	24	978,040
Sum SE	5,952	100	4,509,890	5,328	97	3,836,820	5,951	97	4,282,790	5,759	127	5,442,270	4,587	134	5,157,280	4,661	107	4,484,540
Sum IE+SE	7,032	149	6,503,430	5,994	134	5,326,800	6,695	134	5,943,300	6,479	165	7,080,560	5,805	182	6,980,740	6,028	159	6,624,560

Well	July			August			September			October			November			December		
	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped	OP Hours	GPM	Gallons Pumped
IE-01	719	12	503,900	744	9	386,770	720.0	8	362,670	744	8	353,860	720	9	375,270	730	10	454,670
IE-08	727	41	1,731,590	744	41	1,848,730	720.0	41	1,769,690	744	42	1,884,930	720	41	1,790,060	730	42	1,826,470
Sum IE	1,446	53	2,235,490	1,488	50	2,235,500	1,440	50	2,152,360	1,488	50	2,238,790	1,440	50	2,165,330	1,459	52	2,281,140
SE-03	0	0	0	0	0	0	14.0	5	3,500	0	0	0	0	0	0	0	0	250
SE-06	730	8	354,240	744	9	411,270	720.0	10	415,210	744	6	285,030	720	6	247,980	730	1	53,510
SE-07	730	12	519,870	744	11	487,800	720.0	10	420,560	743	11	473,590	720	11	466,760	744	10	452,350
SE-08	717	10	418,150	744	9	420,450	720.0	10	422,790	743	8	340,690	720	10	420,460	730	10	418,350
SE-10	730	15	666,150	648	12	465,040	621.0	17	634,340	744	14	606,350	720	13	566,260	730	12	538,550
SE-11	717	10	431,860	744	6	262,760	720.0	8	343,500	744	7	299,330	0	0	0	0	0	0
SE-12	717	21	865,570	724	16	696,680	720.0	22	946,210	696	15	630,330	0	0	0	0	0	0
SE-14	717	21	884,810	744	17	759,380	720.0	13	580,630	744	14	643,220	720	15	652,110	730	16	705,420
Sum SE	5,058	96	4,140,650	5,092	80	3,503,380	4,955	94	3,766,740	5,158	75	3,278,540	3,600	54	2,353,570	3,662	49	2,168,430
Sum IE+SE	6,504	149	6,376,140	6,580	130	5,738,880	6,395	144	5,919,100	6,646	125	5,517,330	5,040	105	4,518,900	5,121	102	4,449,570

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SUMMARY OF ANALYTICAL RESULTS FOR THE DECEMBER 2014 QUARTERLY SAMPLING EVENT
DETECTED COMPOUNDS ONLY

Extraction Wells							
PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-68297-18	490-68297-5	490-68297-3	490-68297-6	490-68297-1	490-68297-12
WELL ID	NA	SE-3	SE-6	SE-7	SE-8	SE-10	SE-11
Date Collected	NA	12/9/2014	12/8/2014	12/8/2014	12/8/2014	12/8/2014	12/8/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	2.8	2.5	<1	<1	<1
1,1,2-trichloroethane		<1	4.9	4.6	1.6	<1	8.5
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		1.1	<1	2	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		5.7	<1	<1	<1	<1	1.4
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	1.2	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		1.2	<1	1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		15	25	20	22	1.8	7.6
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		2.2	5.1	8.2	11	<1	2.2
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	1.6	<1	<1	<1
Trichloroethene		1.1	10	4.4	3.8	<1	1.4
Vinyl Chloride		2.6	1.3	6.8	9	<1	2.2
Total		28.9	49.1	51.1	47.4	3	23.3

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-68297-13	490-68297-14	490-68297-8	490-68297-2	490-68297-10	490-68297-11
WELL ID	NA	SE-12	SE-12 DUP	SE-13	SE-14	SE-15	SE-16
Date Collected	NA	12/8/2014	12/8/2014	12/8/2014	12/8/2014	12/8/2014	12/8/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethane		1.3	1.4	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		2.6	2.8	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		13	13	1.8	24	1.9	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		11	11	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		2.5	2.8	<1	11	2.7	<1
Vinyl Chloride		5.2	5.4	<1	<1	<1	<1
Total		35.6	36.4	1.8	35	4.6	0

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DETECTED COMPOUNDS ONLY

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)			
		490-68297-4	490-68297-7	490-68297-9	
WELL ID	NA	IE-1	IE-3	IE-8	
Date Collected	NA	12/8/2014	12/8/2014	12/8/2014	
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	2.2	
1,1,2,2-tetrachloroethane		32	<1	7.3	
1,1,2-trichloroethane		39	<1	31	
1,1-dichloroethane		1.5	<1	2.6	
1,1-dichloroethene		13	<1	2.8	
1,2-dichlorobenzene		1.7	<1	1.7	
1,2-dichloroethane		6.2	<1	6	
1,2-dichloropropane		<1	<1	<1	
1,3-dichlorobenzene		1.2	<1	<1	
1,4-dichlorobenzene		<1	<1	<1	
Benzene		<1	<1	3.5	
Carbon Tetrachloride		<1	<1	<1	
Chlorobenzene		12	<1	13	
Chloroform		<1	<1	1.6	
Cis-1,2-dichloroethene		110	18	36	
Ethyl Benzene		<1	<1	15	
Tetrachloroethene		51	<1	5	
Toluene		<1	<1	1.8	
Trans-1,2-dichloroethene		3.9	<1	6.9	
Trichloroethene		19	<1	4.3	
Vinyl Chloride		21	5.8	22	
Total		311.5	23.8	162.7	

Inside Contaminated and Uncontaminated Wells

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-68830-1	490-68830-7	490-68297-17	490-68558-3	490-68558-4	490-68558-1
WELL ID	NA	G2	G5	G6	MW-4	MW-7	MW-9
Date Collected	NA	12/15/2014	12/15/2014	12/9/2014	12/10/2014	12/10/2014	12/10/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	1	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		1.1	<1	<1	<1	<1	3.1
1,1-dichloroethane		<1	<1	3.1	1.3	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	4.5	59
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	1.6	27
Cis-1,2-dichloroethene		<1	<1	4.9	1.4	<1	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		16	<1	<1	<1	2.9	2.1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		2.5	<1	<1	40	2.8	2
Vinyl Chloride		<1	<1	1.9	<1	<1	<1
Total		20.6	0	9.9	42.7	11.8	93.2

TABLE CONTINUES

CHEM-DYNE TRUST
CHEM-DYNE SUPERFUND SITE
HAMILTON, OHIO
2014 ANNUAL REPORT

TABLE 19

SUMMARY OF ANALYTICAL RESULTS FOR THE DECEMBER 2014 QUARTERLY SAMPLING EVENT
DETECTED COMPOUNDS ONLY

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-68558-2	490-68558-5	490-68830-8	490-68558-8	490-68558-6	490-68558-11
WELL ID	NA	MW-10	MW-13	MW15	MW-23	MW-24	MW-25
Date Collected	NA	12/10/2014	12/10/2014	12/15/2014	12/11/2014	12/11/2014	12/11/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	2.2	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	310	<1	<1	<1
1,1,2-trichloroethane		1.3	<1	340	<1	1	<1
1,1-dichloroethane		<1	<1	8.5	2.7	1.2	<1
1,1-dichloroethene		<1	<1	100	<1	1.5	<1
1,2-dichlorobenzene		<1	<1	3.8	<1	<1	<1
1,2-dichloroethane		<1	<1	41	1	<1	<1
1,2-dichloropropane		<1	<1	1.1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	3.9	<1	<1	<1
1,4-dichlorobenzene		<1	<1	2.4	<1	<1	<1
Benzene		<1	<1	5.6	<1	<1	<1
Carbon Tetrachloride		3.9	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	24	<1	<1	<1
Chloroform		5	<1	11	<1	<1	<1
Cis-1,2-dichloroethene		5.2	<1	350	19	18	<1
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		12	2.4	930	2.4	11	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	24	<1	1.2	<1
Trichloroethene		4.1	<1	560	7.1	21	<1
Vinyl Chloride		<1	<1	85	<1	<1	<1
Total		31.5	2.4	2802.5	32.2	54.9	0

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-68558-12	490-68558-13	490-68297-16	490-68558-9	490-68558-10	490-68830-10
WELL ID	NA	MW-26	MW27	MW-28	MW-29	MW-29 DUP	MW31
Date Collected	NA	12/11/2014	12/11/2014	12/9/2014	12/11/2014	12/11/2014	12/15/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	<1	<1	<1	<1	1.2
1,1,2,2-tetrachloroethane		<1	49	<1	<1	<1	<1
1,1,2-trichloroethane		<1	82	<1	1.8	1.9	1.6
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	29	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	4.5	<1	<1	<1	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	3.3	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		1.4	210	<1	2.6	2.4	6.5
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		<1	9.5	<1	8	7.3	4.6
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	4.5	<1	<1	<1	<1
Trichloroethene		<1	13	<1	20	19	4
Vinyl Chloride		<1	170	<1	<1	<1	1
Total		1.4	574.8	0	32.4	30.6	18.9

TABLE CONTINUES

CHEM-DYNE TRUST
CHEM-DYNE SUPERFUND SITE
HAMILTON, OHIO
2014 ANNUAL REPORT

TABLE 19

SUMMARY OF ANALYTICAL RESULTS FOR THE DECEMBER 2014 QUARTERLY SAMPLING EVENT
DETECTED COMPOUNDS ONLY

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)					
		490-68830-11	490-68830-4	490-68830-3	490-68830-6	490-68830-5	490-68830-2
WELL ID	NA	MW31-DUP	MW37	MW38	MW39	MW40	MW41
Date Collected	NA	12/15/2014	12/15/2014	12/15/2014	12/15/2014	12/15/2014	12/15/2014
1,1,1-trichloroethane	100 ug/L Total VOCs	1.3	<1	<1	<1	<1	<1
1,1,2,2-tetrachloroethane		<1	<1	<1	<1	<1	<1
1,1,2-trichloroethane		1.6	1.3	<1	<1	<1	<1
1,1-dichloroethane		<1	<1	<1	<1	<1	<1
1,1-dichloroethene		<1	<1	<1	<1	<1	<1
1,2-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,2-dichloroethane		<1	<1	<1	<1	<1	<1
1,2-dichloropropane		<1	<1	<1	<1	<1	<1
1,3-dichlorobenzene		<1	<1	<1	<1	<1	<1
1,4-dichlorobenzene		<1	<1	<1	<1	<1	<1
Benzene		<1	<1	<1	<1	1.8	<1
Carbon Tetrachloride		<1	<1	<1	<1	<1	<1
Chlorobenzene		<1	<1	<1	<1	<1	<1
Chloroform		<1	<1	<1	<1	<1	<1
Cis-1,2-dichloroethene		6.3	1.2	8.9	2.4	<1	5.8
Ethyl Benzene		<1	<1	<1	<1	<1	<1
Tetrachloroethene		4.2	<1	<1	<1	<1	<1
Toluene		<1	<1	<1	<1	<1	<1
Trans-1,2-dichloroethene		<1	<1	<1	<1	<1	<1
Trichloroethene		3.7	<1	<1	<1	<1	<1
Vinyl Chloride		<1	<1	<1	<1	<1	<1
Total		17.1	2.5	8.9	2.4	1.8	5.8

PARAMETER / SAMPLE NUMBER	Cleanup Level	ANALYTICAL RESULTS (ug/l)	
		490-68558-7	
WELL ID	NA	MW-42	
Date Collected	NA	12/11/2014	
1,1,1-trichloroethane	100 ug/L Total VOCs	<1	
1,1,2,2-tetrachloroethane		<1	
1,1,2-trichloroethane		1.4	
1,1-dichloroethane		<1	
1,1-dichloroethene		1.1	
1,2-dichlorobenzene		<1	
1,2-dichloroethane		<1	
1,2-dichloropropane		<1	
1,3-dichlorobenzene		<1	
1,4-dichlorobenzene		<1	
Benzene		<1	
Carbon Tetrachloride		<1	
Chlorobenzene		<1	
Chloroform		<1	
Cis-1,2-dichloroethene		14	
Ethyl Benzene		<1	
Tetrachloroethene		4.6	
Toluene		<1	
Trans-1,2-dichloroethene		<1	
Trichloroethene		5.1	
Vinyl Chloride		1.2	
Total		27.4	

Notes:

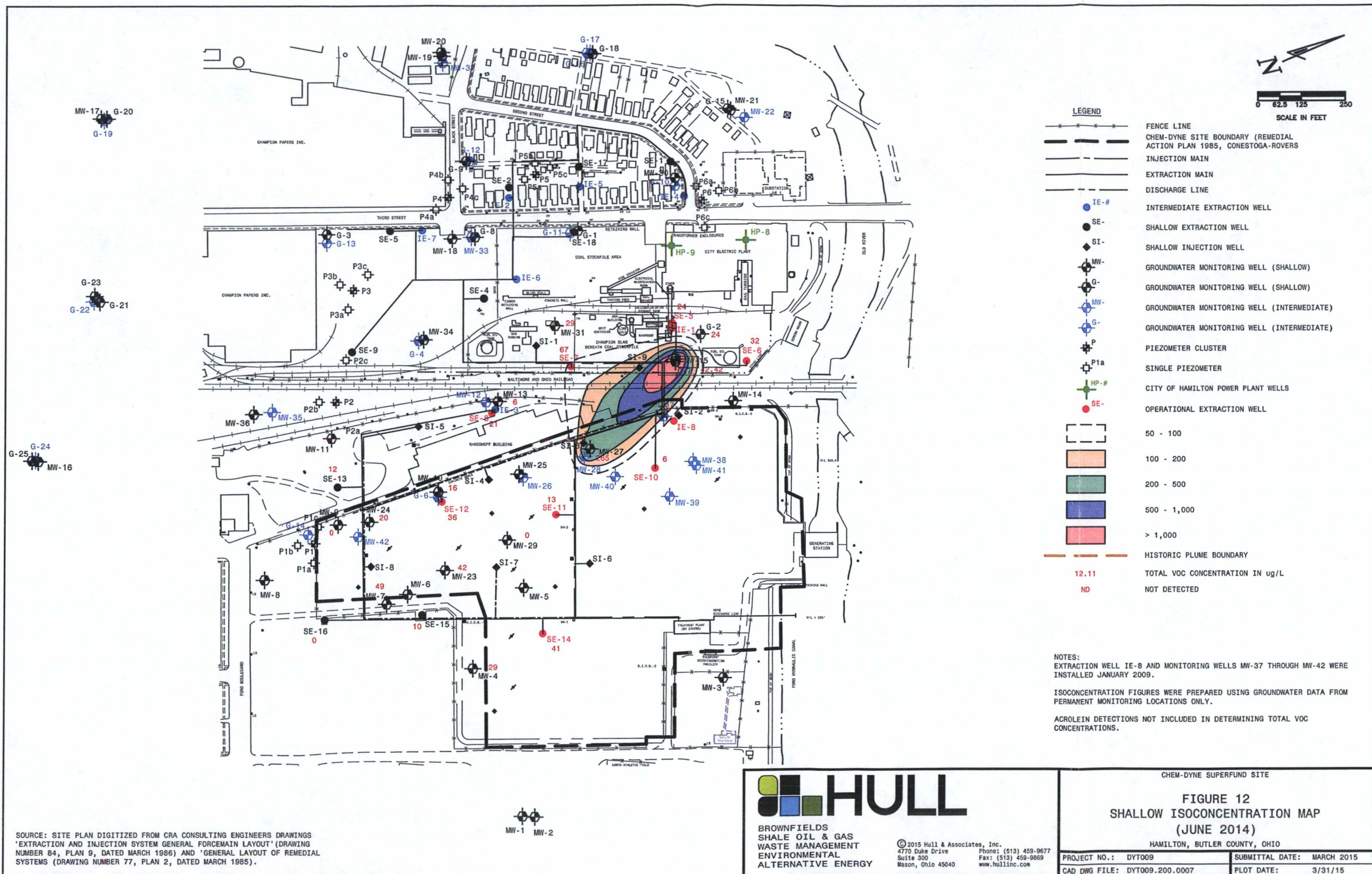
All analytes listed above were tested using U.S. EPA Method 8260B.

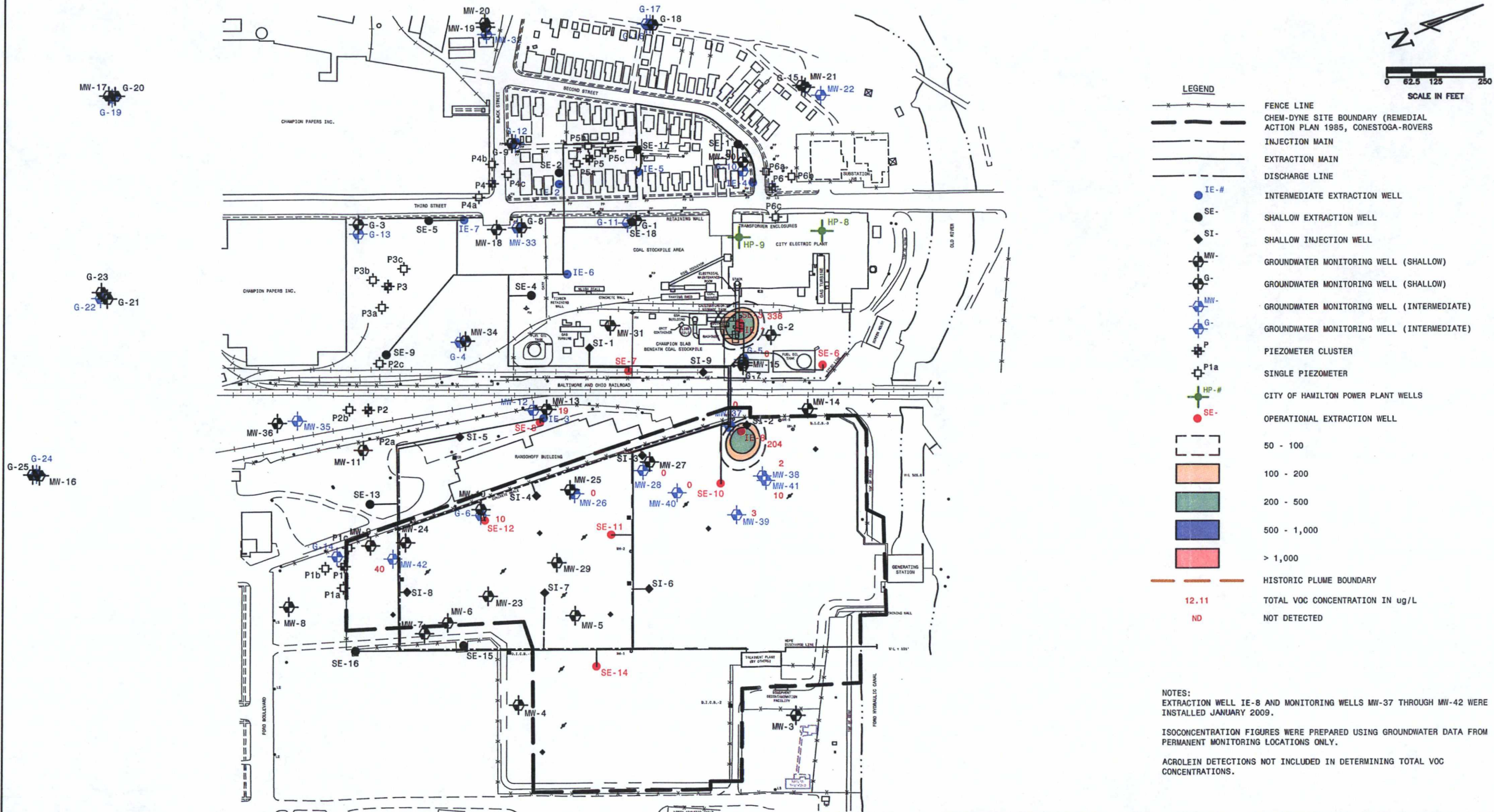
a. < Indicates a concentration less than the reporting limit.

BOLD indicates detected parameter.

SHADED totals indicate a well exceeding action levels.

Total VOC values have been rounded to the nearest whole number value; acetone detections are excluded from these values.





NOTES:
 EXTRACTION WELL IE-8 AND MONITORING WELLS MW-37 THROUGH MW-42 WERE INSTALLED JANUARY 2009.

ISOCONCENTRATION FIGURES WERE PREPARED USING GROUNDWATER DATA FROM PERMANENT MONITORING LOCATIONS ONLY.

ACROLEIN DETECTIONS NOT INCLUDED IN DETERMINING TOTAL VOC CONCENTRATIONS.

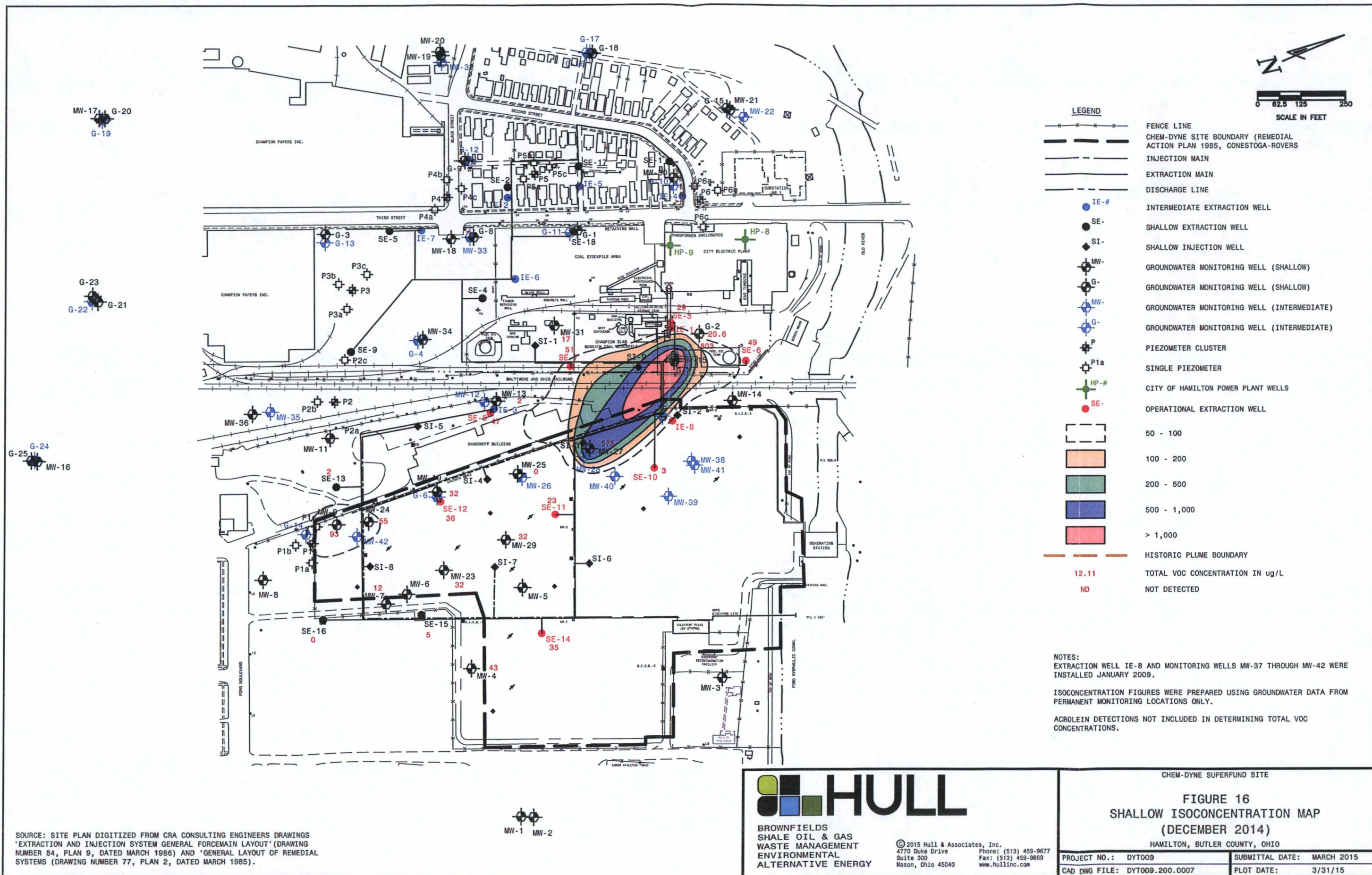
SOURCE: SITE PLAN DIGITIZED FROM CRA CONSULTING ENGINEERS DRAWINGS 'EXTRACTION AND INJECTION SYSTEM GENERAL FORCEMAIN LAYOUT' (DRAWING NUMBER 84, PLAN 9, DATED MARCH 1986) AND 'GENERAL LAYOUT OF REMEDIAL SYSTEMS (DRAWING NUMBER 77, PLAN 2, DATED MARCH 1985).

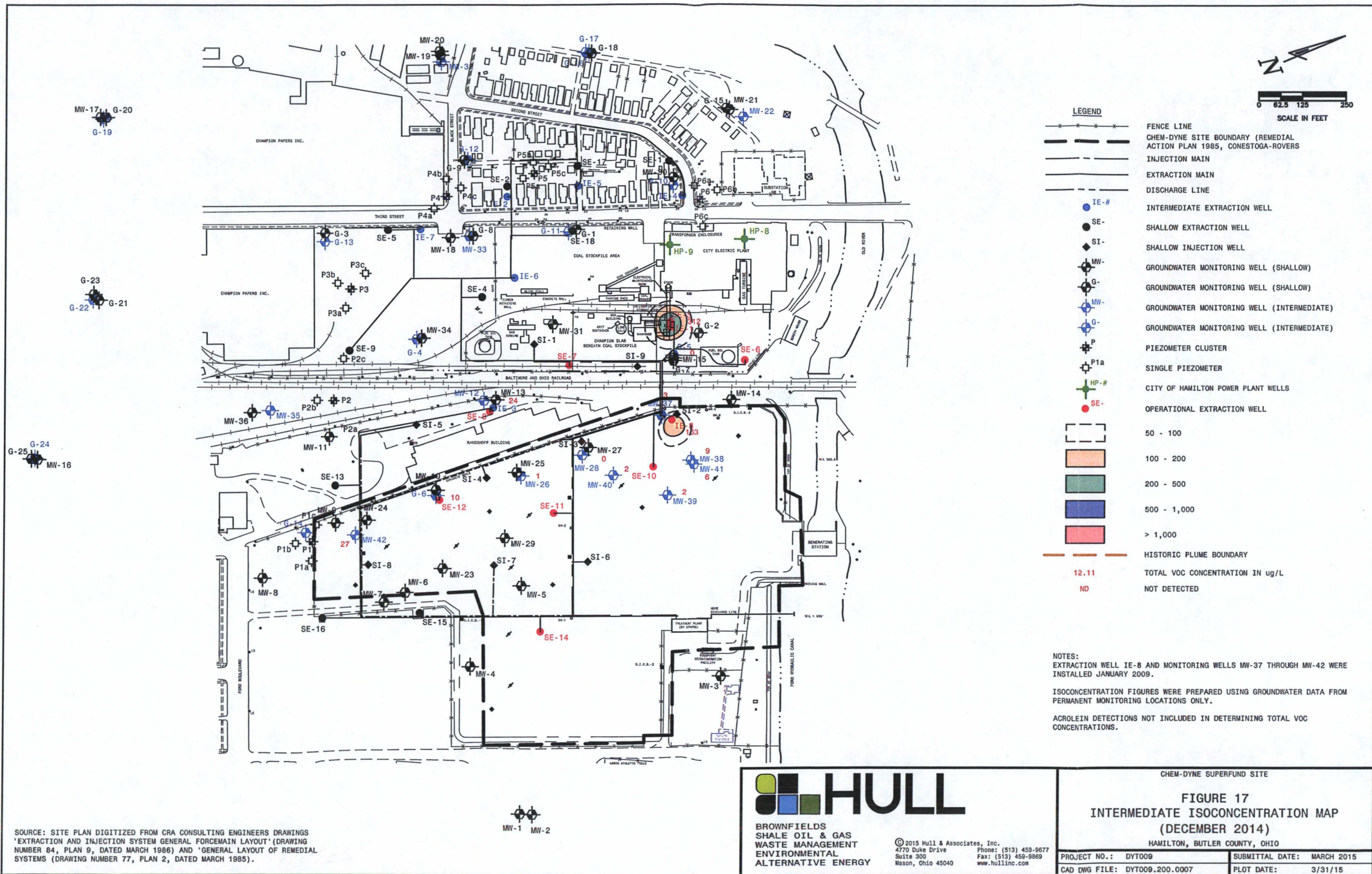
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CHEM-DYNE SUPERFUND SITE			
FIGURE 13			
INTERMEDIATE ISOCONCENTRATION MAP			
(JUNE 2014)			
HAMILTON, BUTLER COUNTY, OHIO			
PROJECT NO.:	DYT009	SUBMITTAL DATE:	MARCH 2015
CAD DWG FILE:	DYT009.200.0007	PLOT DATE:	3/31/15







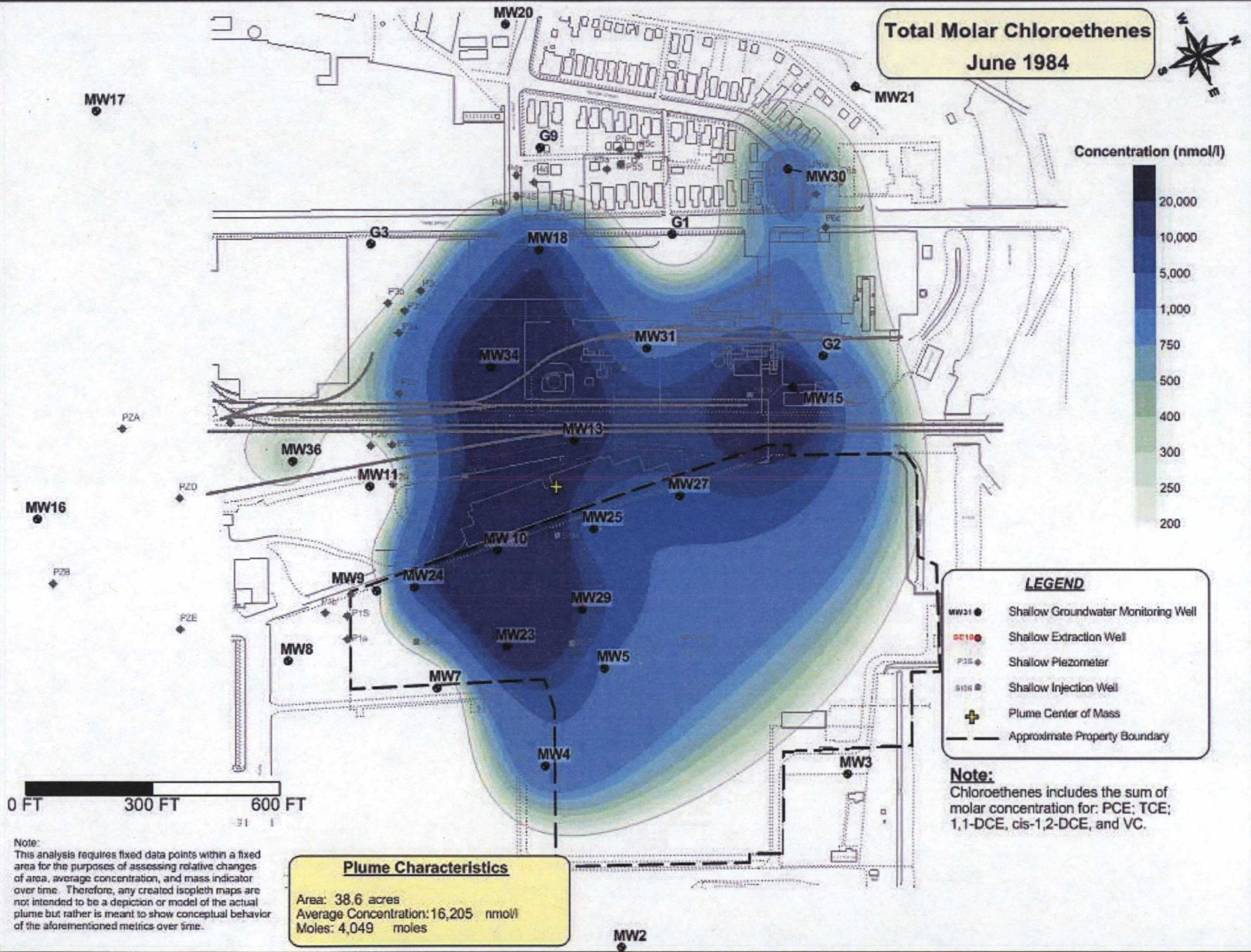
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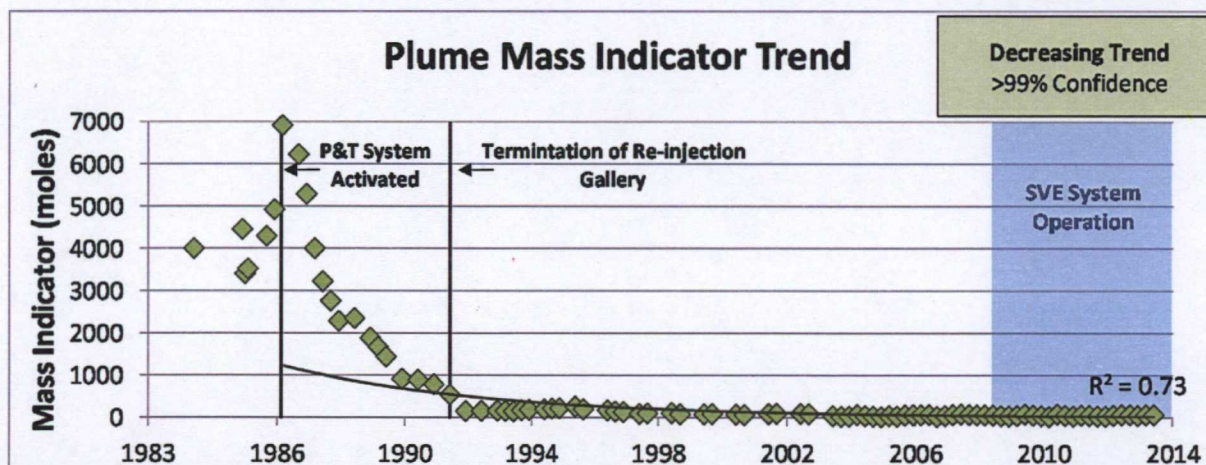
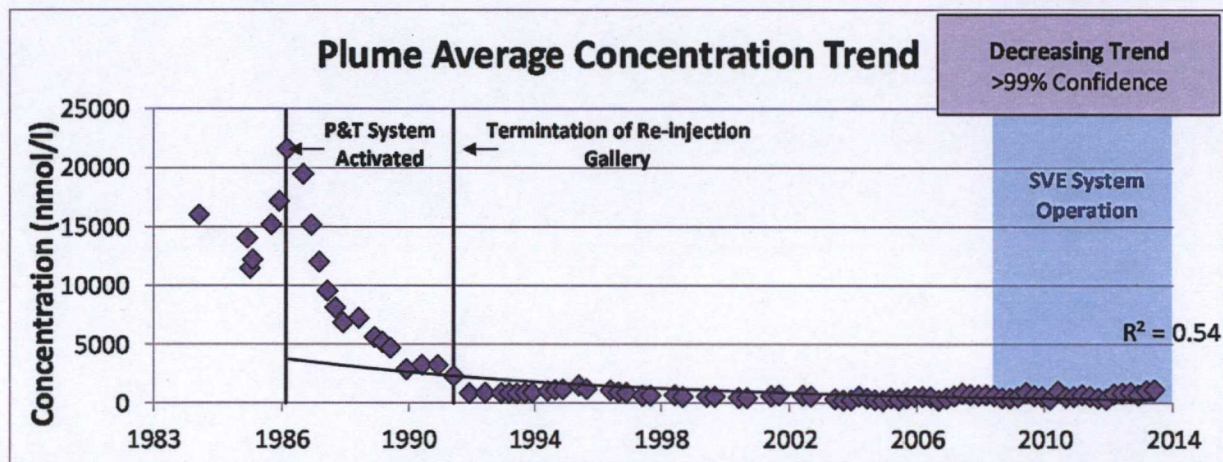
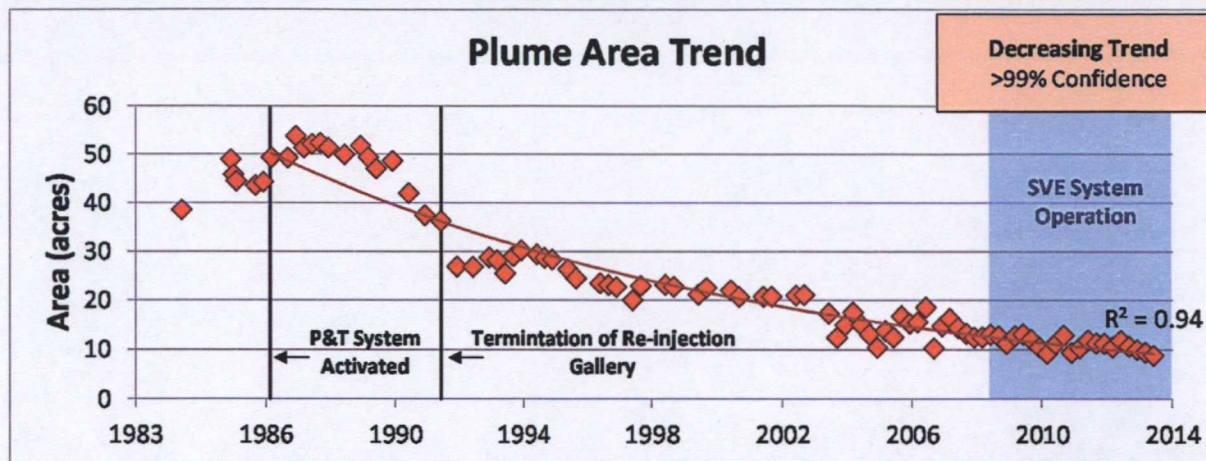
Total Molar Chloroethenes **June 1984**



Concentration (nmol/l)

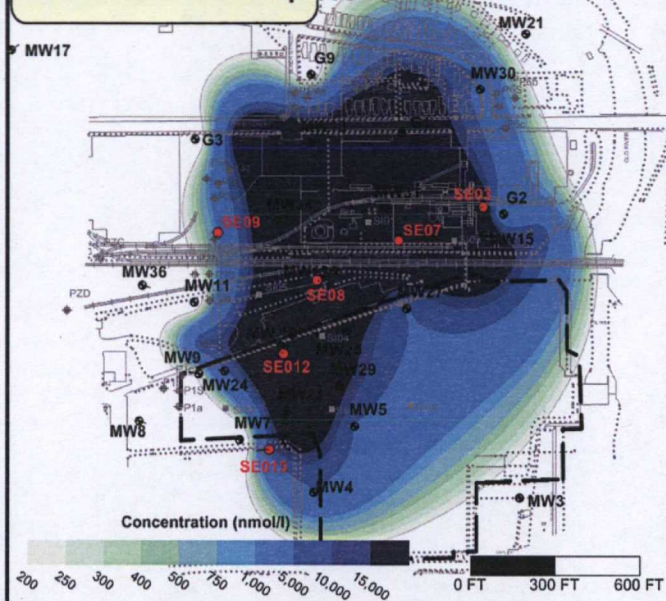


**Total Chloroethenes
PSA Summary Figures**

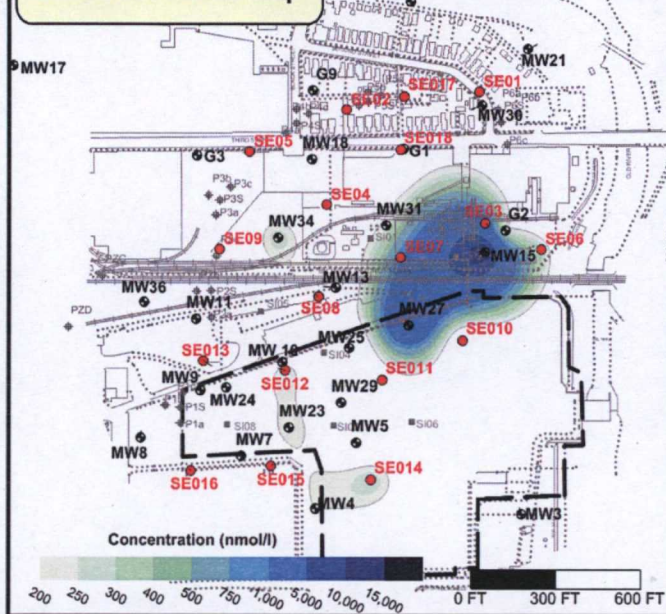


Note:
Chloroethenes includes the sum of molar concentration for: PCE; TCE; 1,1-DCE, cis-1,2-DCE, and VC.

March 1987 Plume Map

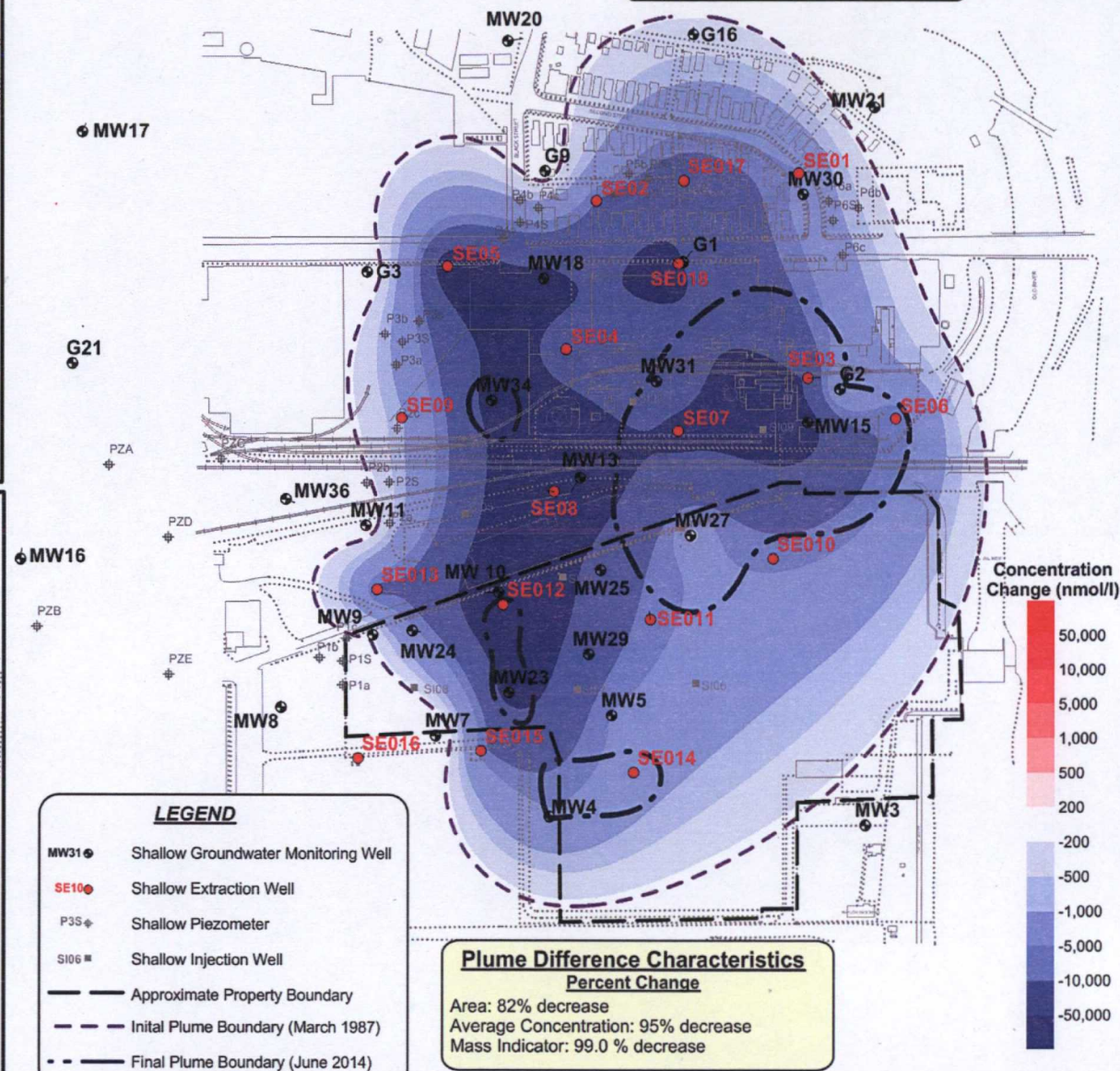


June 2014 Plume Map



Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

Total Chloroethenes
Plume Difference Map
1987 vs. 2014



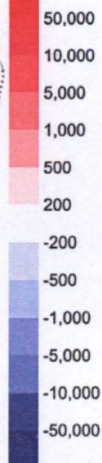
LEGEND

- MW31 ● Shallow Groundwater Monitoring Well
- SE10 ● Shallow Extraction Well
- P3S ● Shallow Piezometer
- SI06 ■ Shallow Injection Well
- Approximate Property Boundary
- - - Initial Plume Boundary (March 1987)
- · · Final Plume Boundary (June 2014)

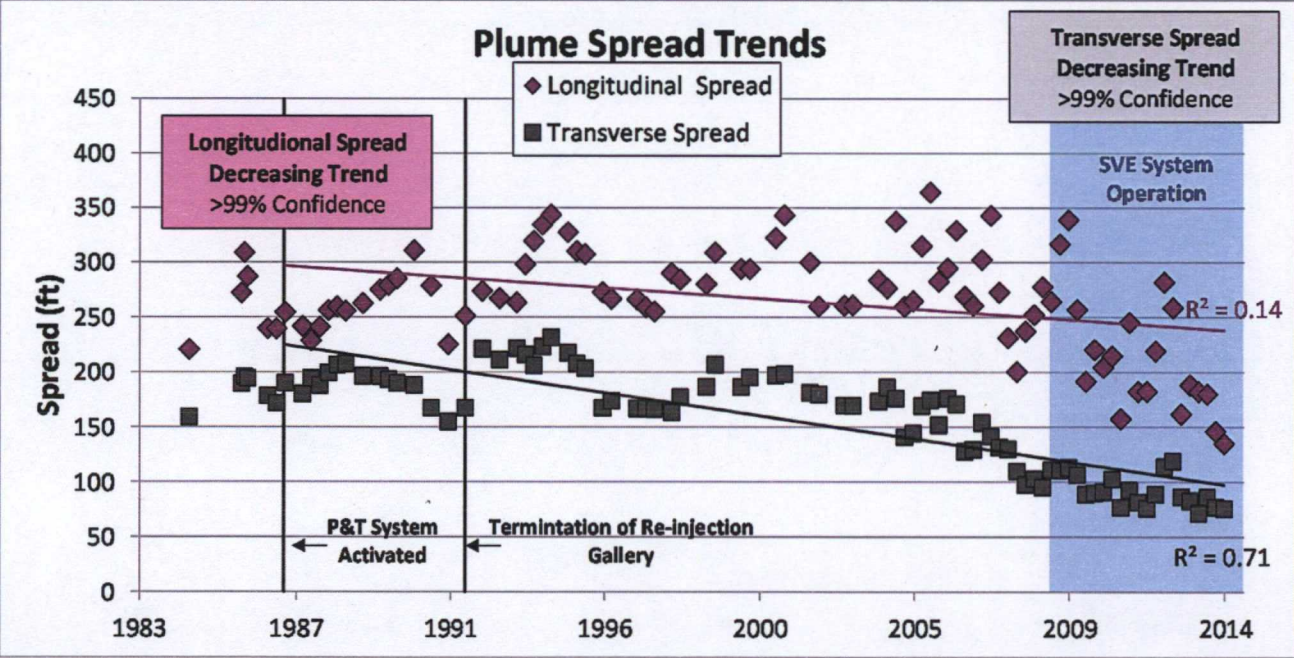
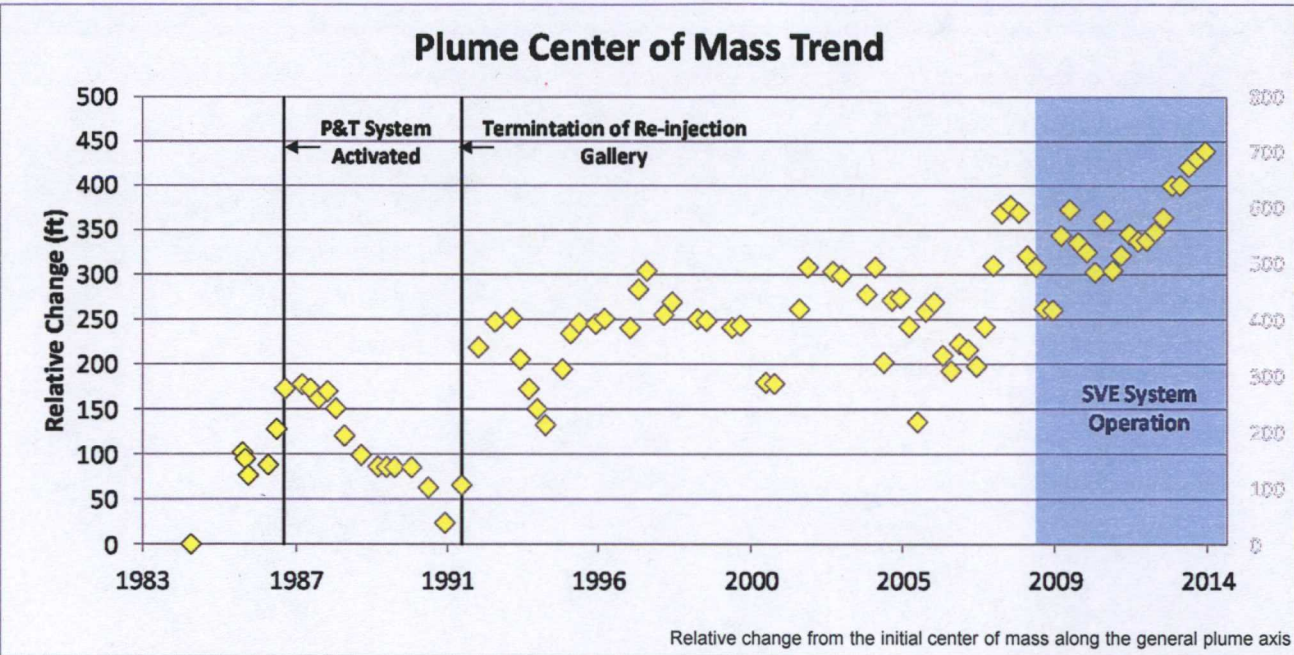
Plume Difference Characteristics Percent Change

Area: 82% decrease
Average Concentration: 95% decrease
Mass Indicator: 99.0 % decrease

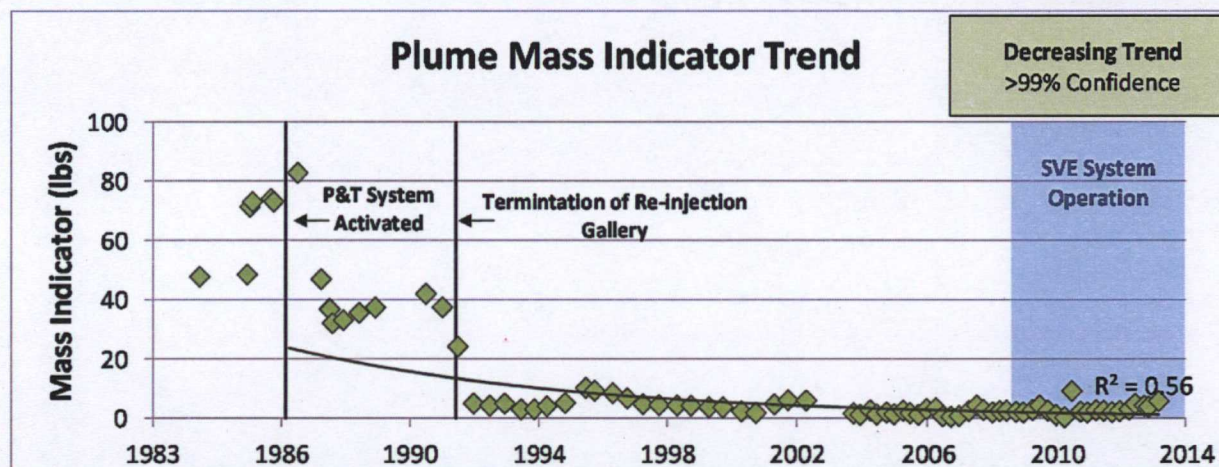
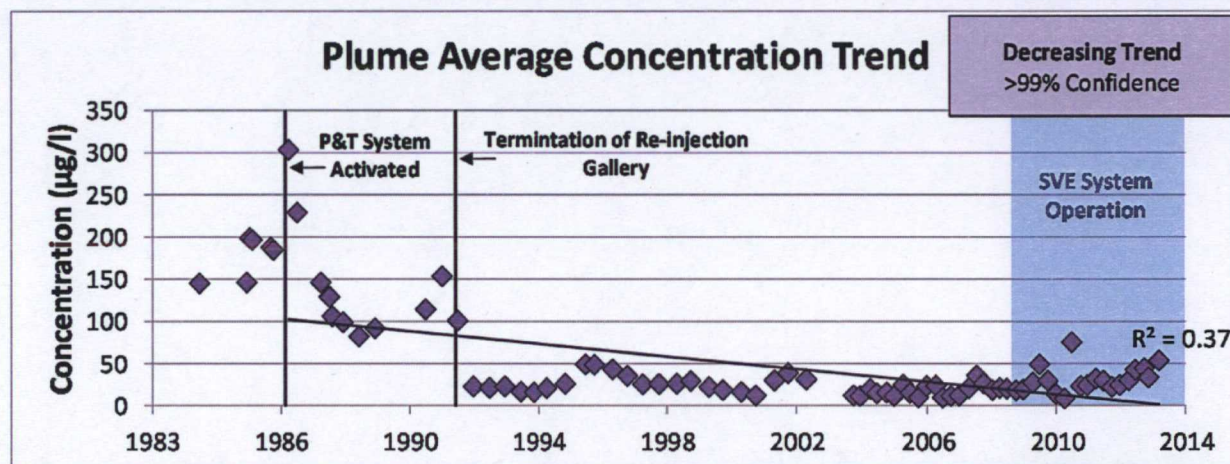
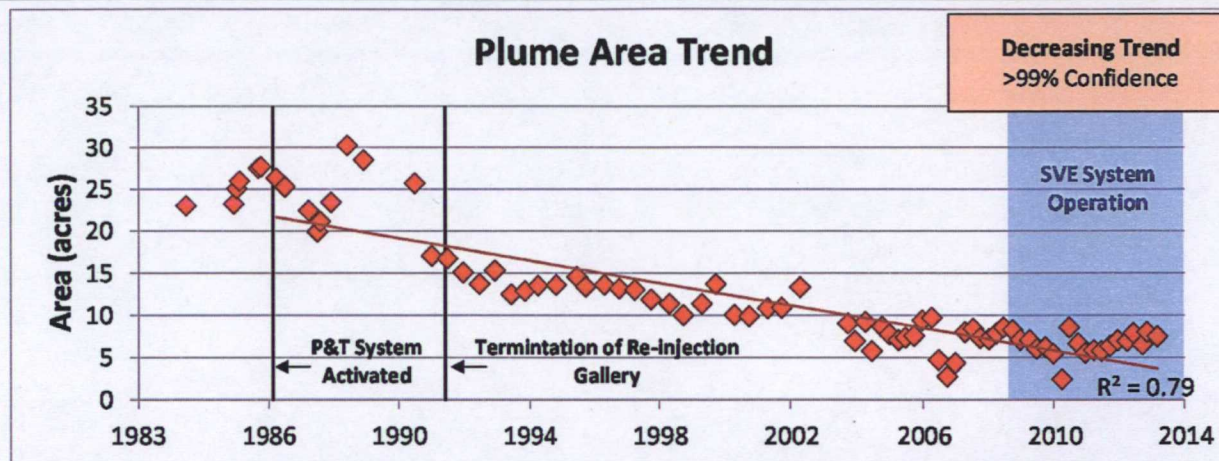
Concentration
Change (nmol/l)



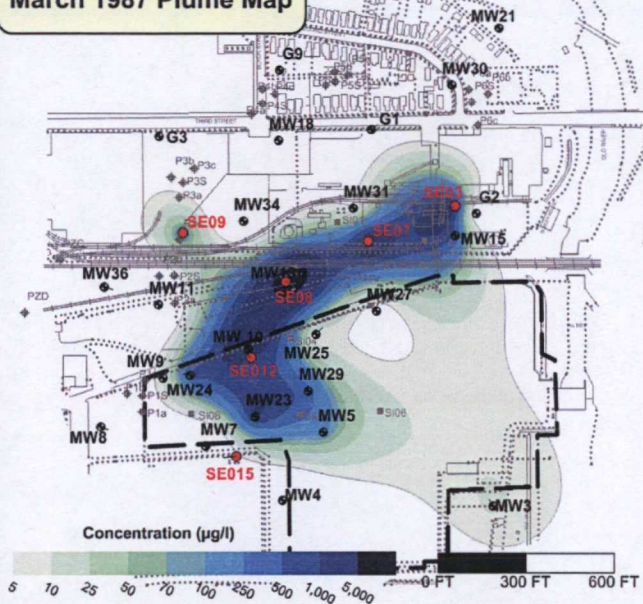
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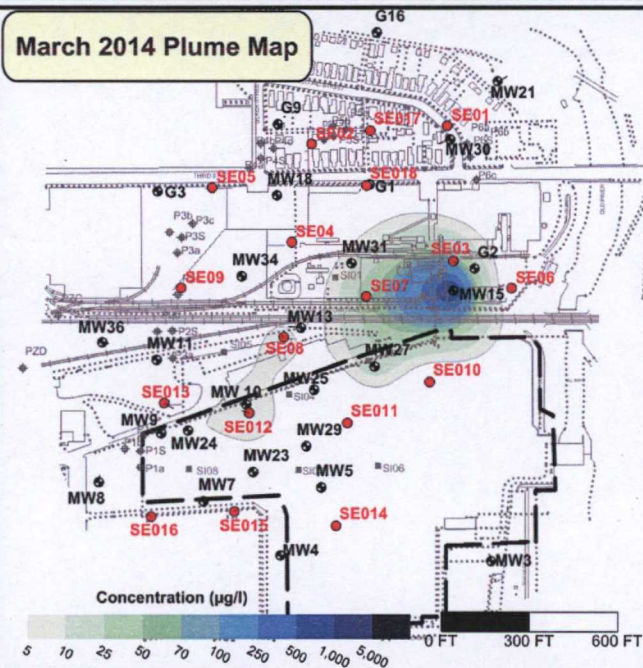
Note:
Chloroethenes includes the sum of molar concentration for: PCE; TCE; 1,1-DCE, cis-1,2-DCE, and VC.



March 1987 Plume Map

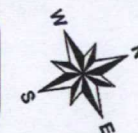


March 2014 Plume Map



Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

Tetrachloroethene
Plume Difference Map
1987 vs. 2014



MW17

G21

PZA

MW16

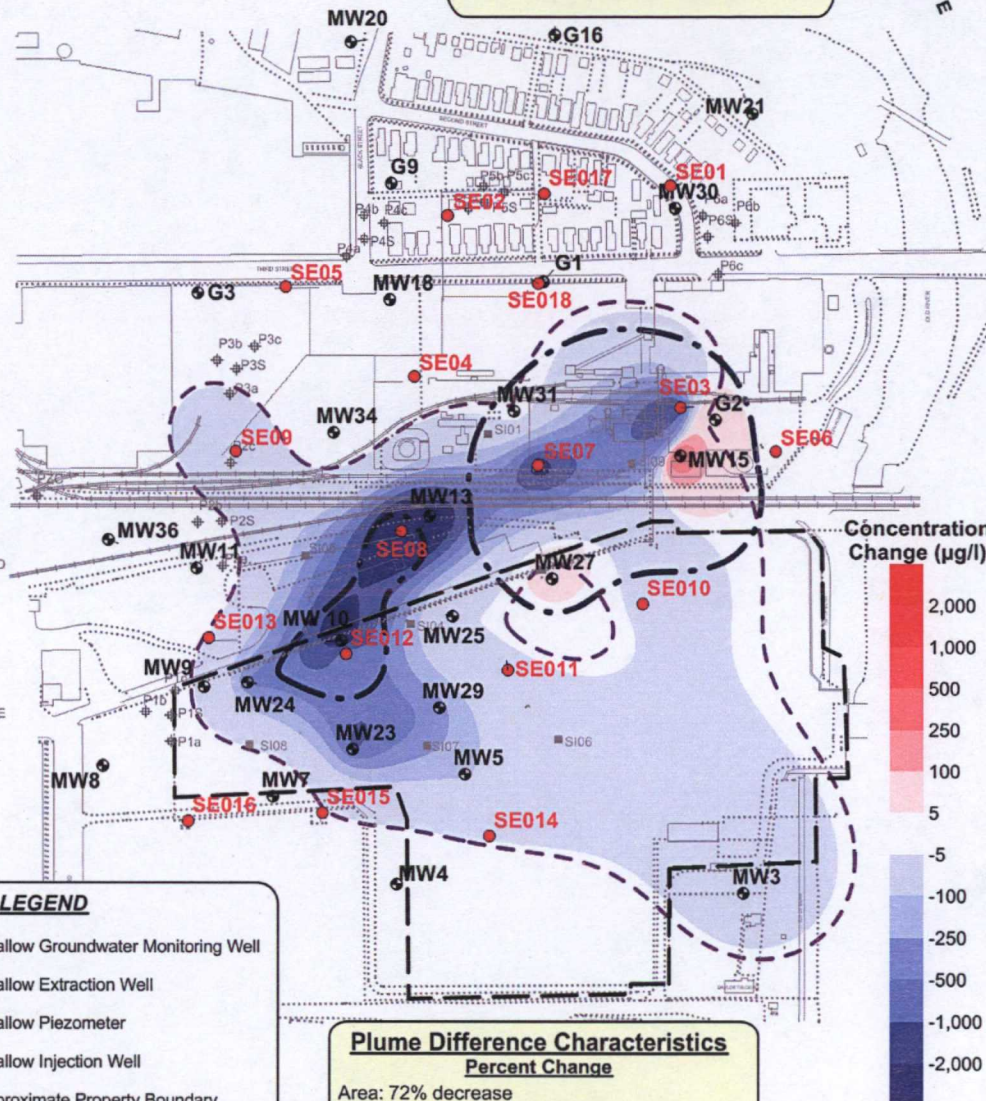
PZB

PZE

LEGEND

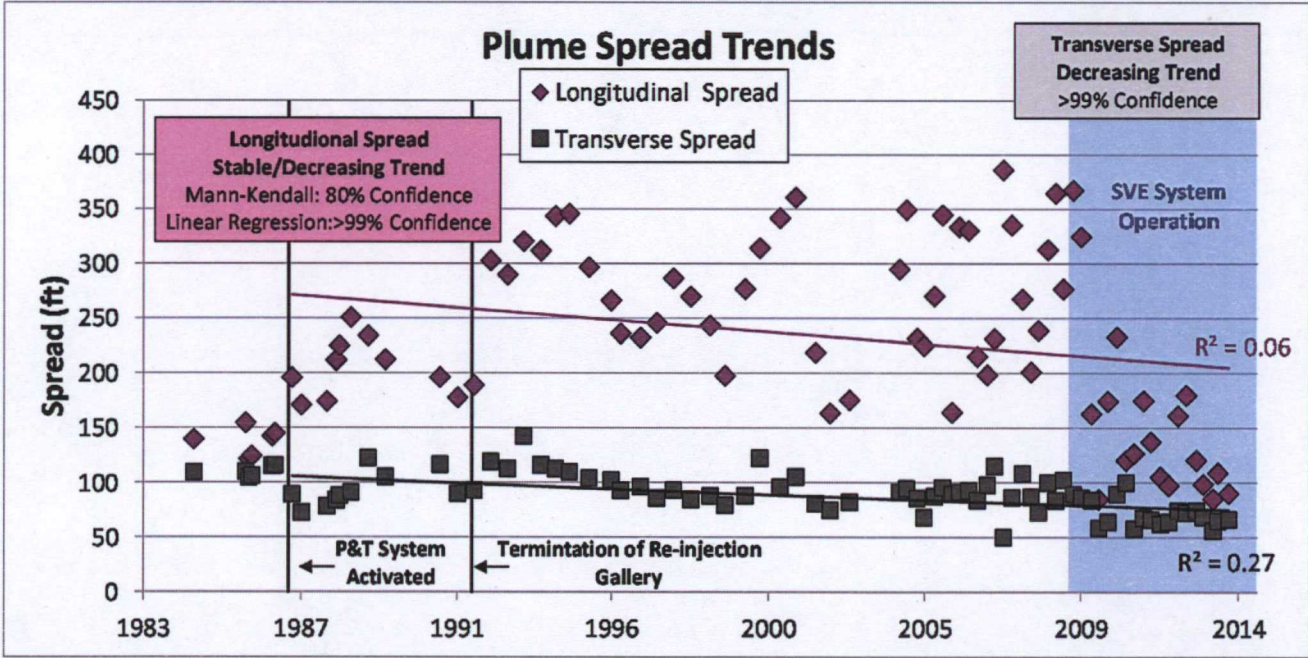
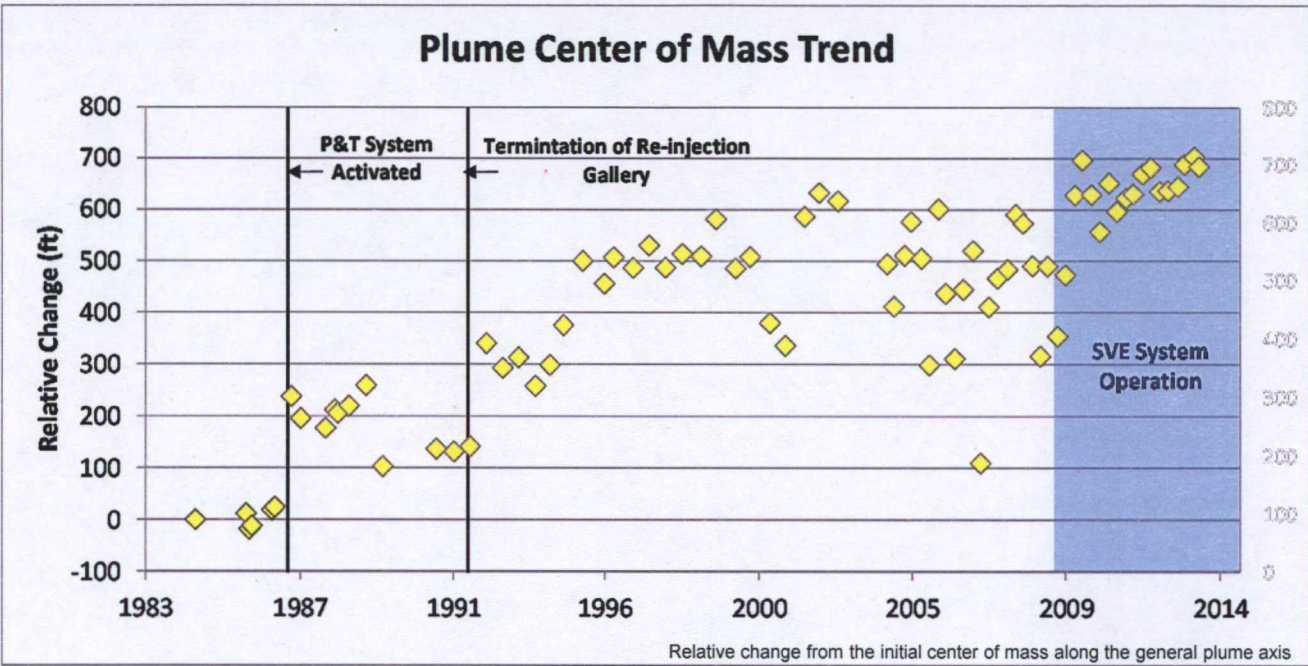
- MW31 ● Shallow Groundwater Monitoring Well
- SE10 ● Shallow Extraction Well
- P3S ● Shallow Piezometer
- SI06 ■ Shallow Injection Well
- Approximate Property Boundary
- - - Initial Plume Boundary (March 1987)
- - - Final Plume Boundary (March 2014)

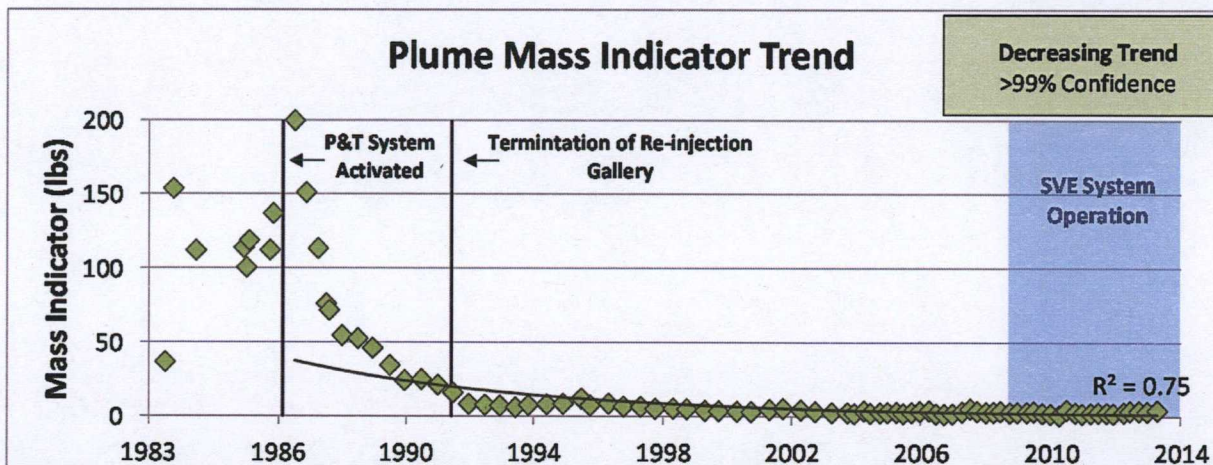
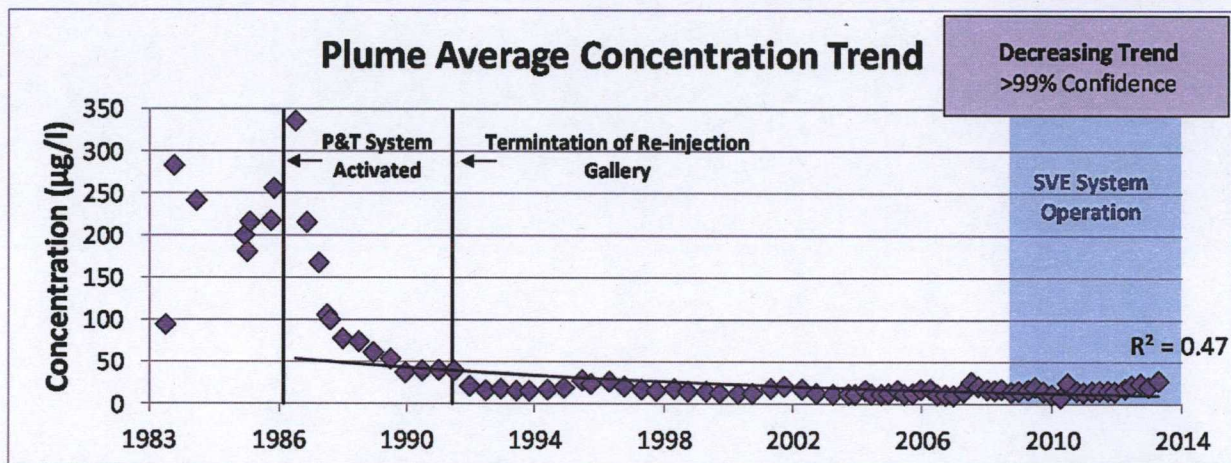
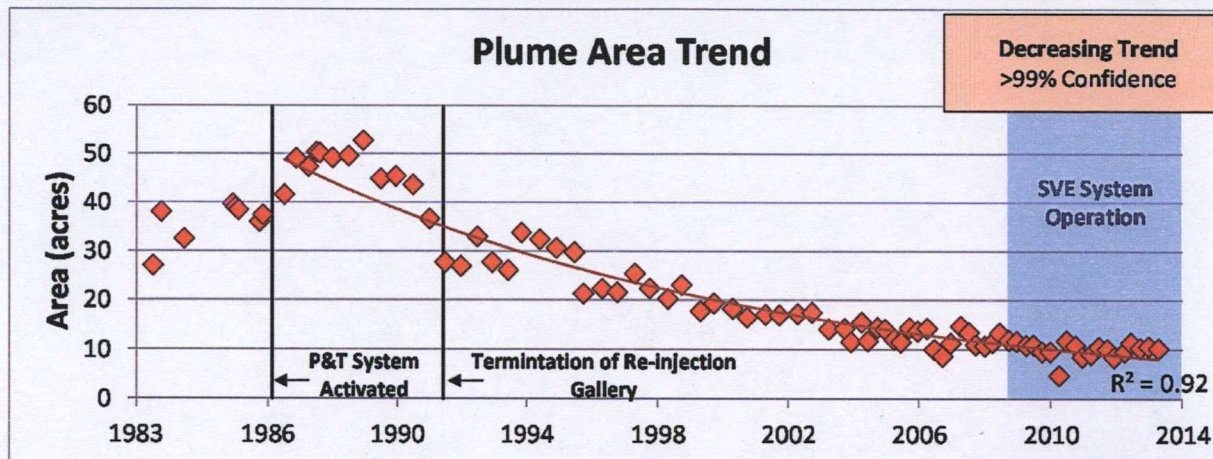
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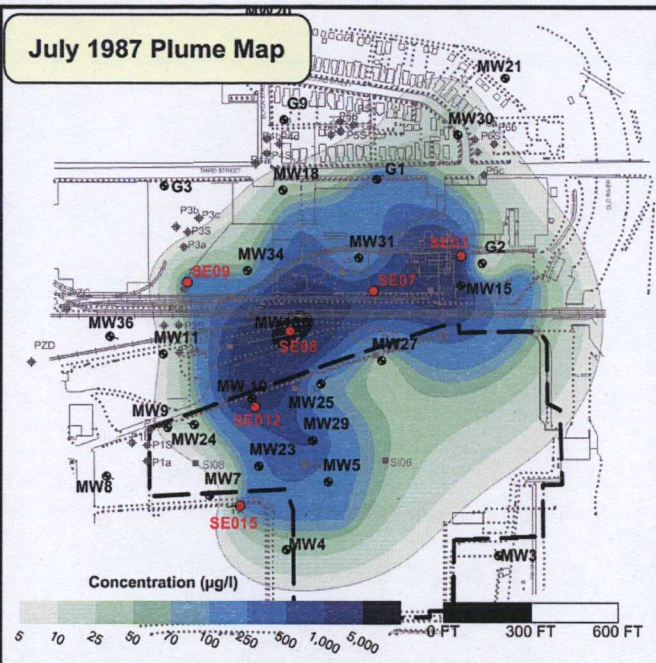
Plume Difference Characteristics Percent Change

Area: 72% decrease
Average Concentration: 82% decrease
Mass Indicator: 95% decrease

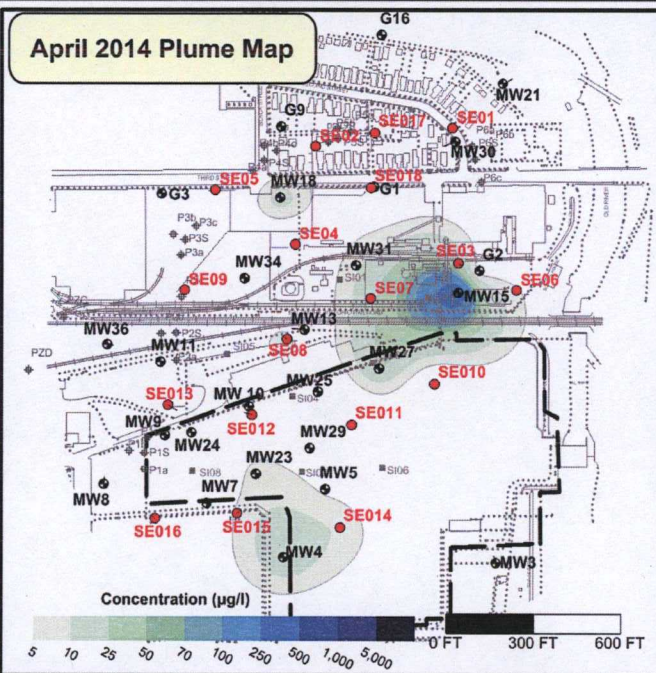




July 1987 Plume Map



April 2014 Plume Map



Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

Trichloroethene
Plume Difference Map
1987 vs. 2014

MW17

G21

PZA

MW16

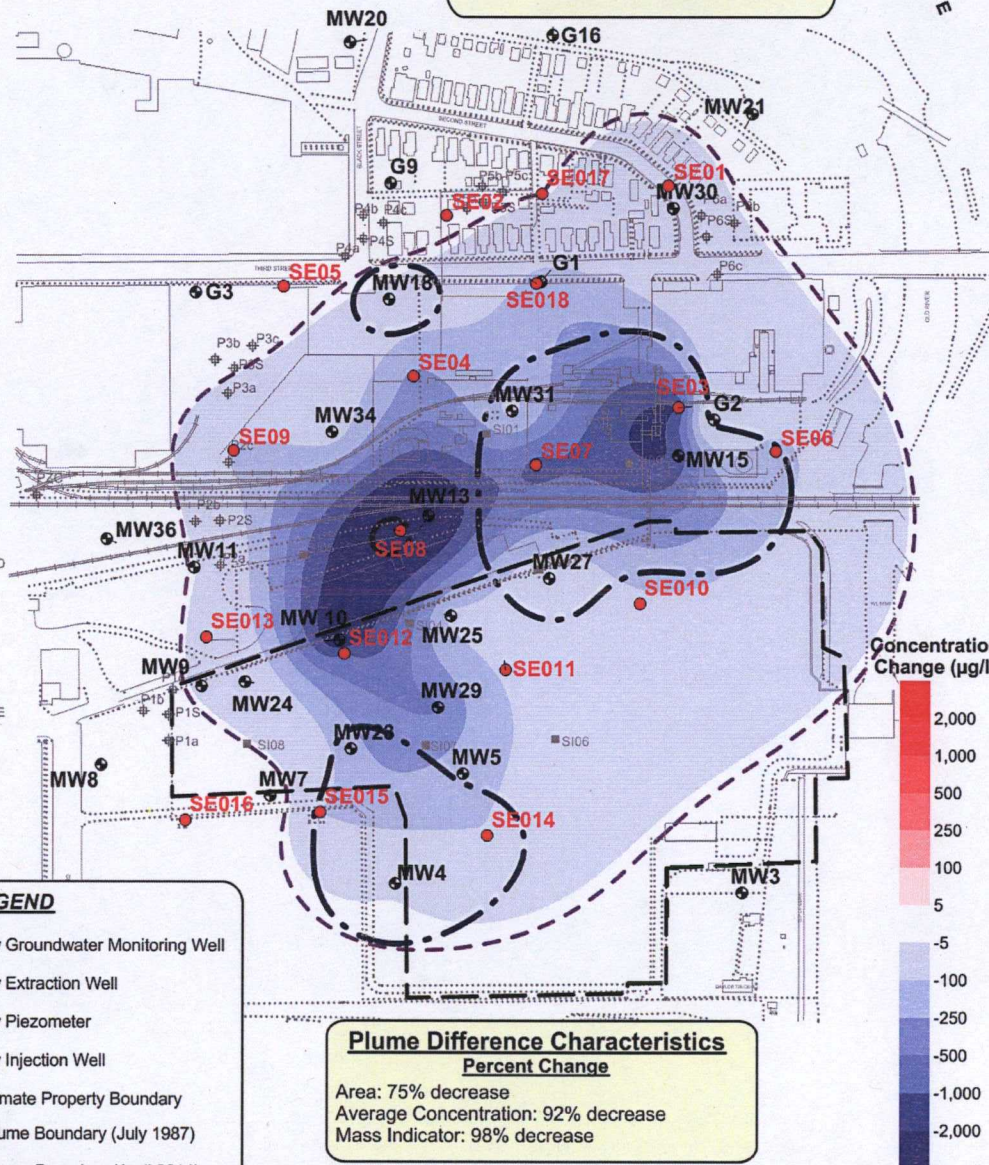
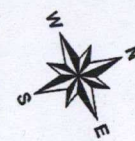
PZB

PZE

LEGEND

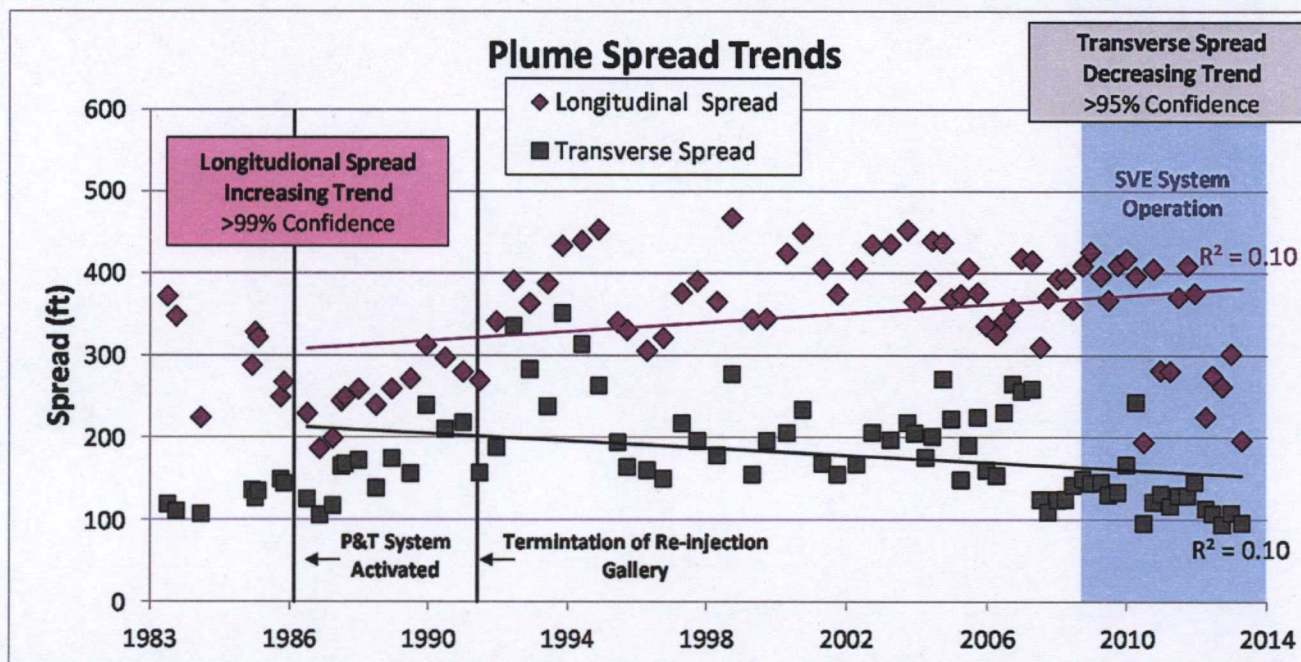
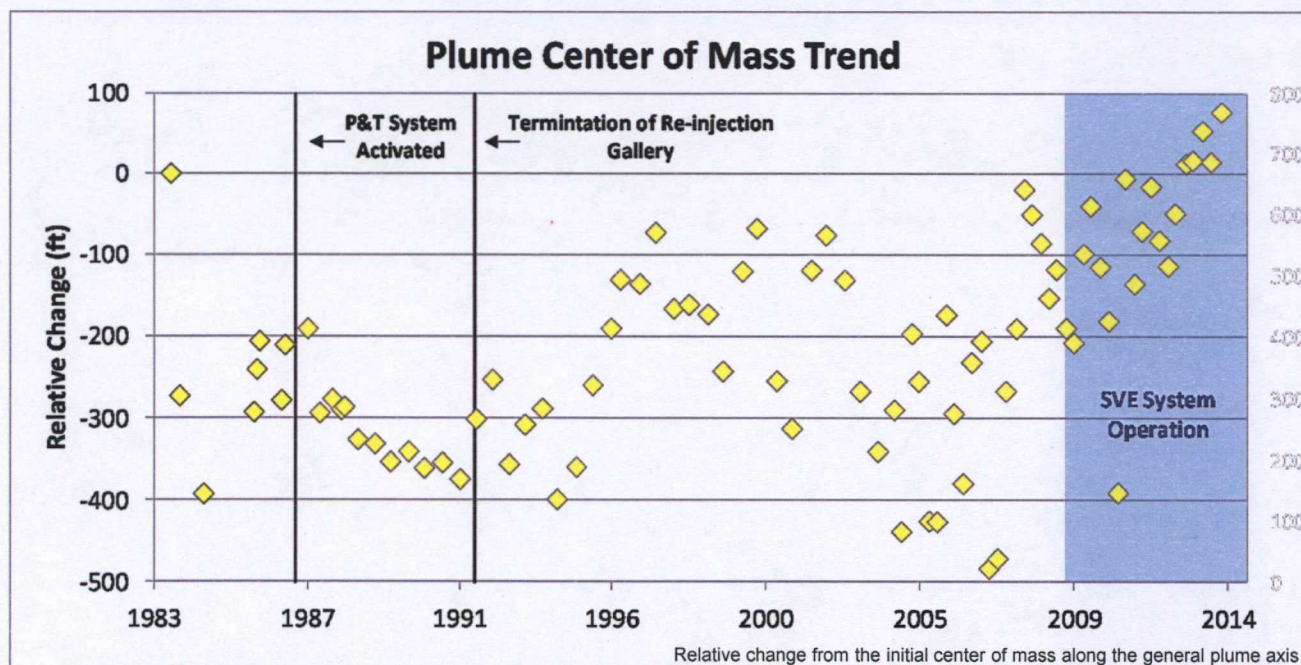
- MW31 ● Shallow Groundwater Monitoring Well
- SE10 ● Shallow Extraction Well
- P3S ● Shallow Piezometer
- SI06 ■ Shallow Injection Well
- Approximate Property Boundary
- - - Initial Plume Boundary (July 1987)
- - - Final Plume Boundary (April 2014)

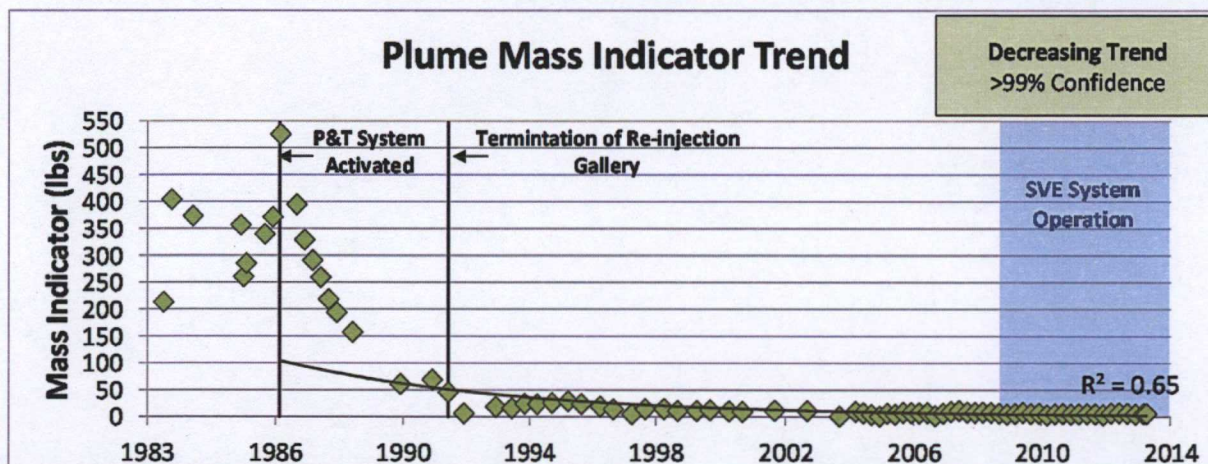
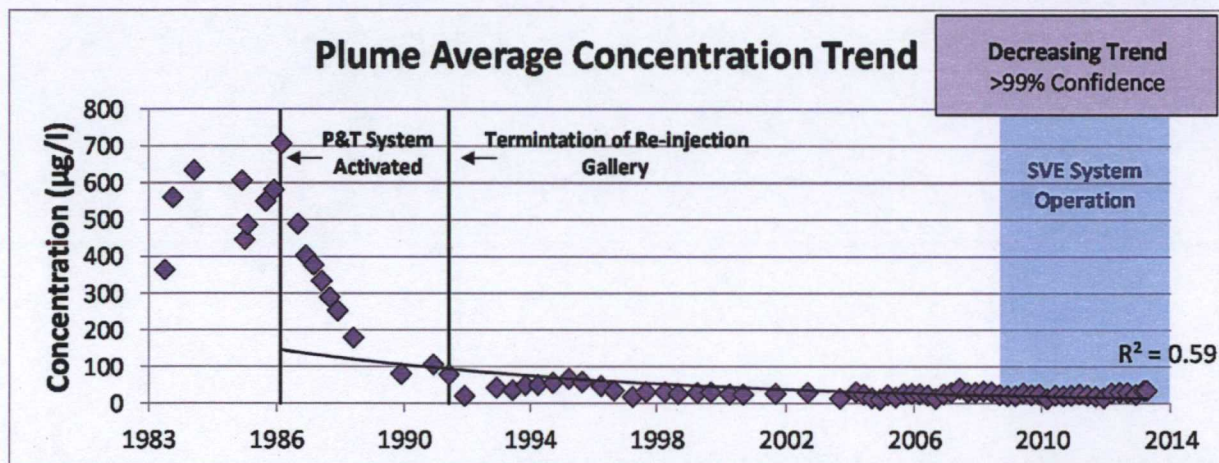
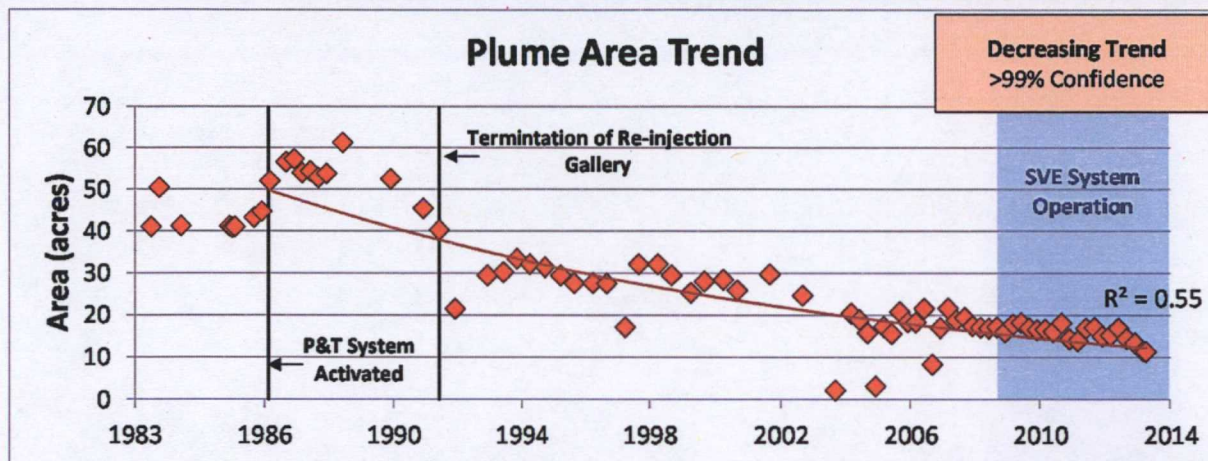
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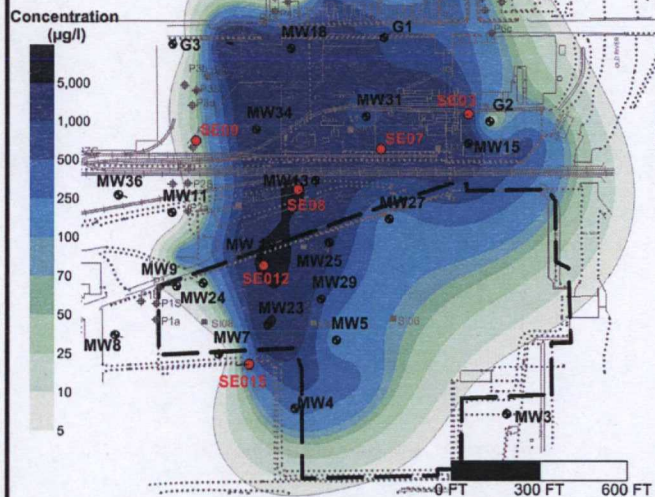
Plume Difference Characteristics Percent Change

Area: 75% decrease
Average Concentration: 92% decrease
Mass Indicator: 98% decrease

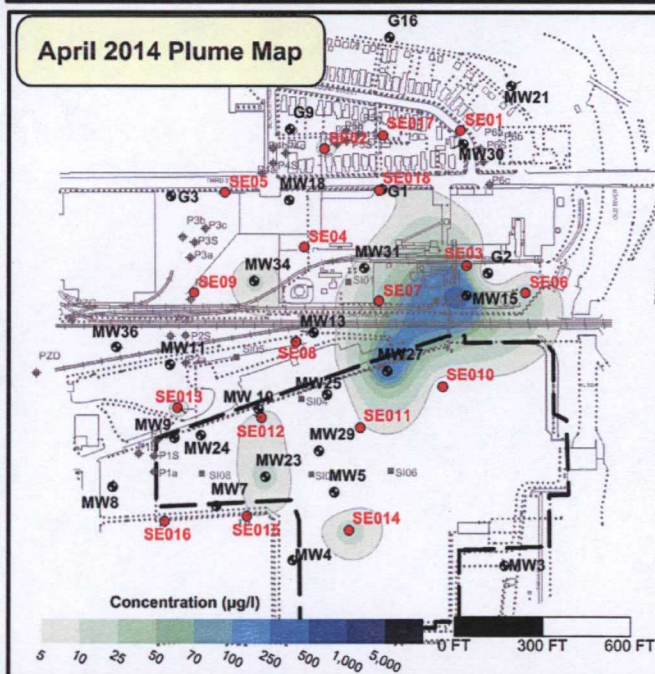




March 1987 Plume Map

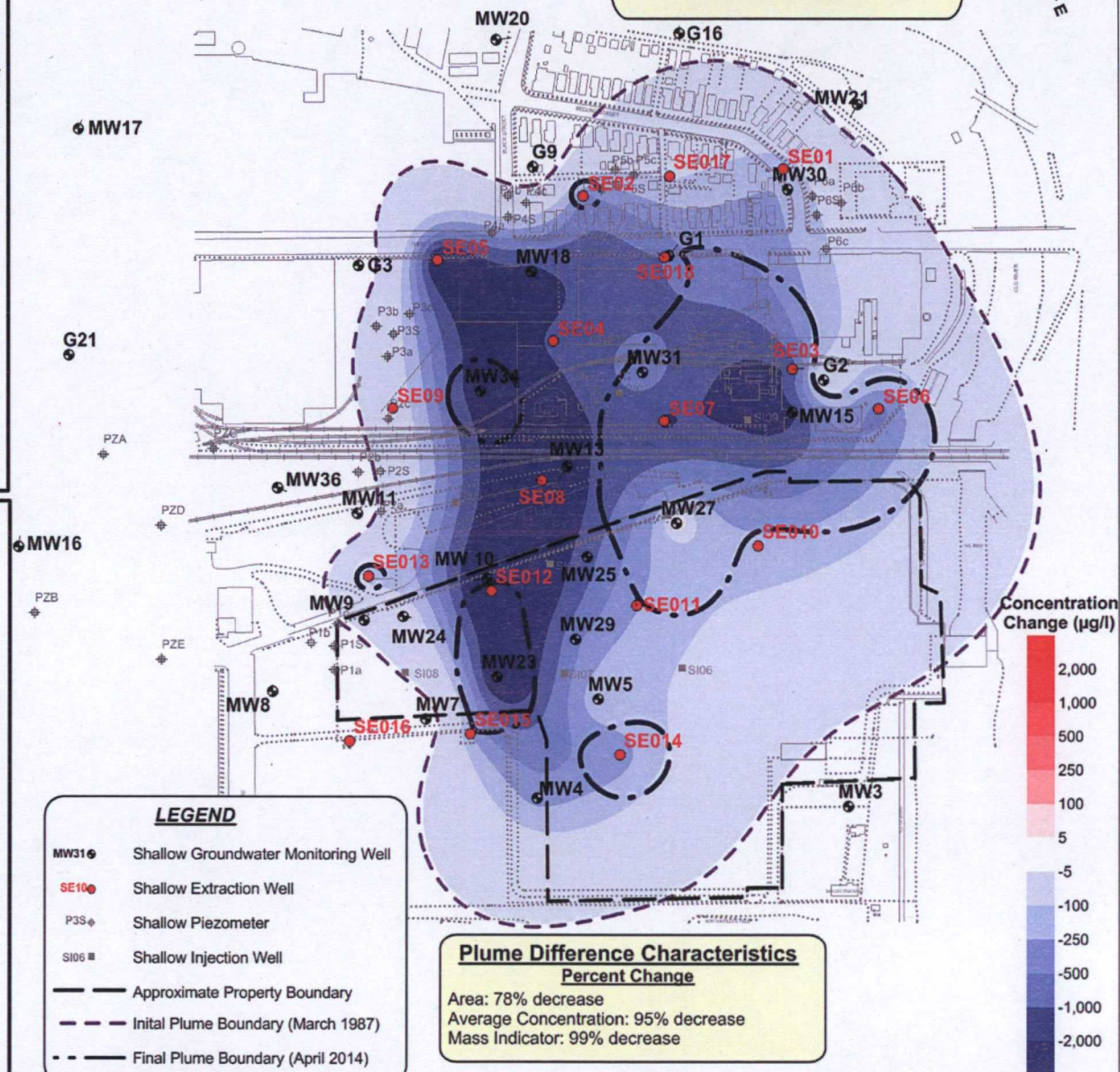
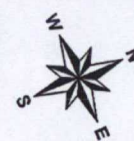


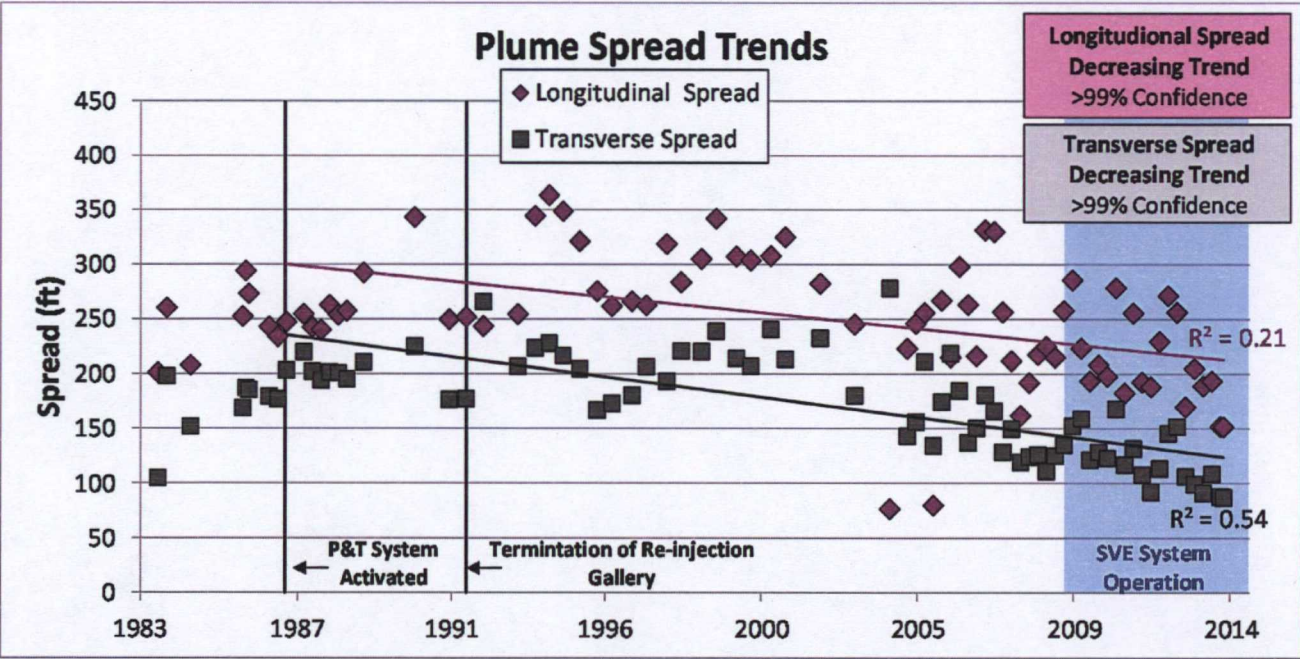
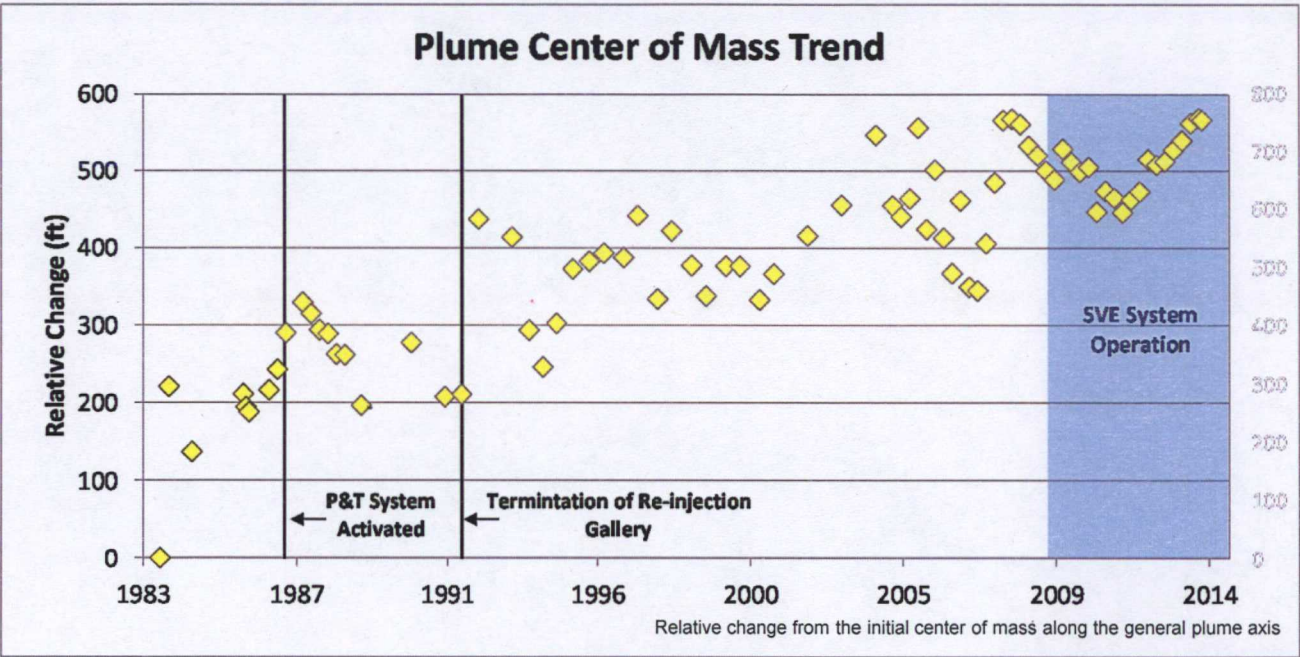
April 2014 Plume Map

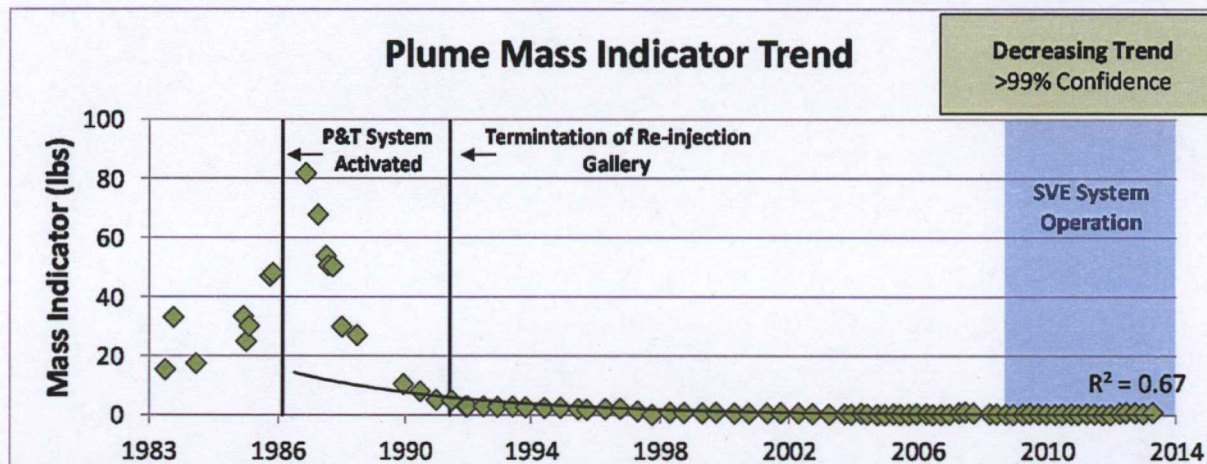
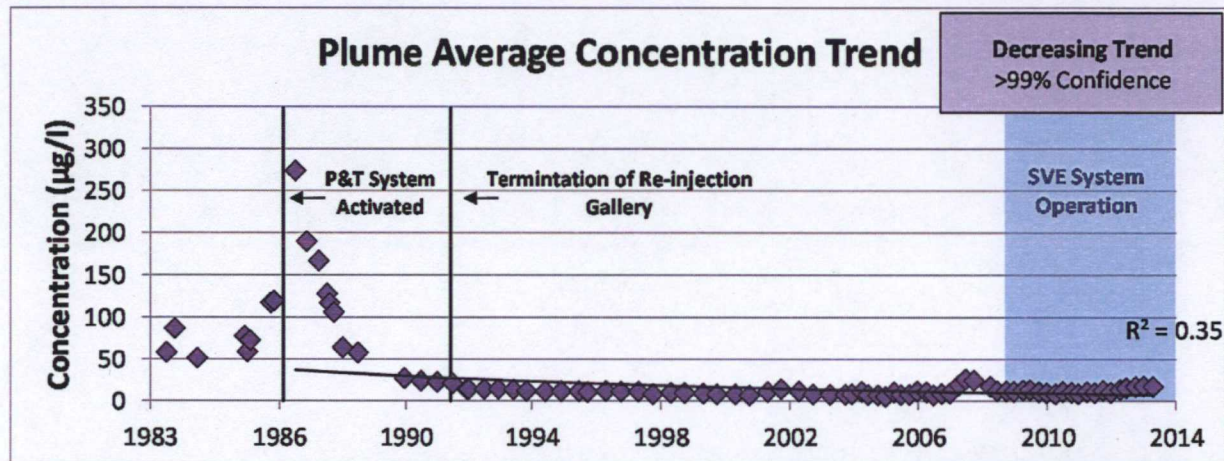
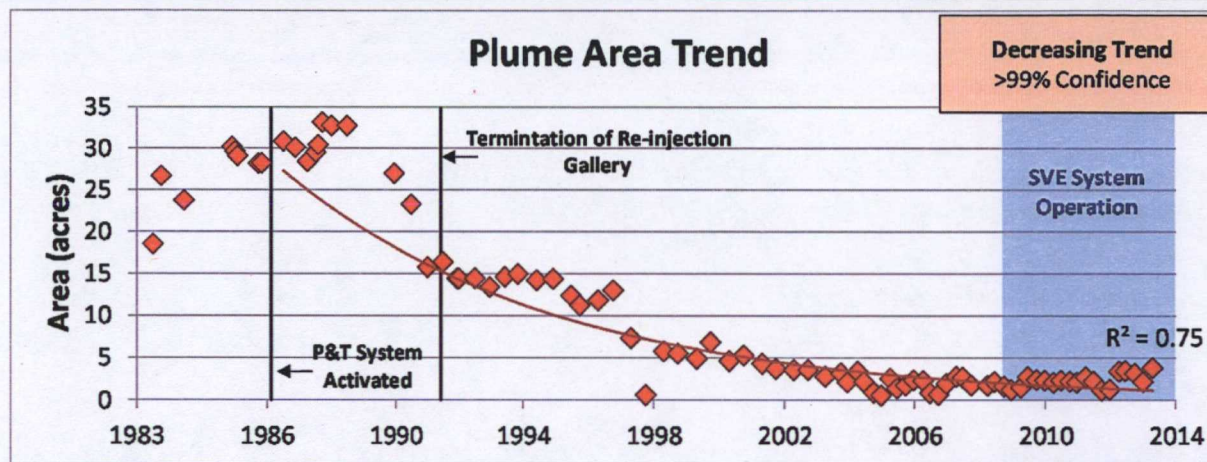


Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

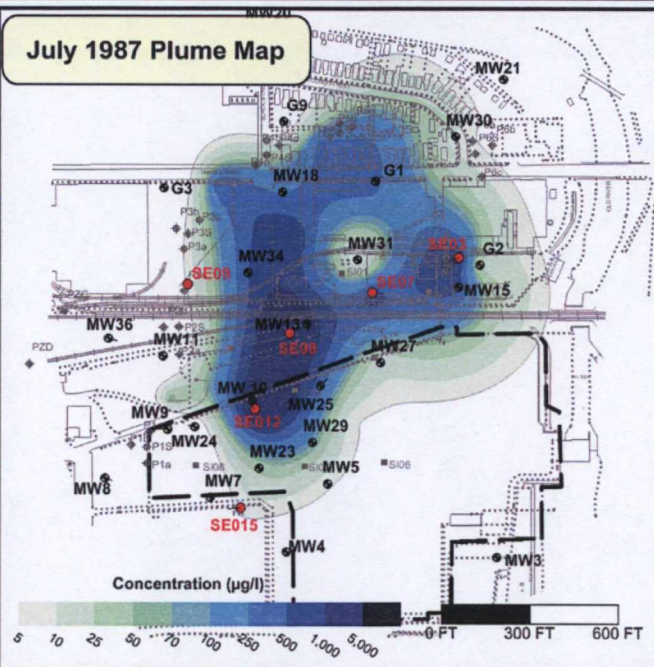
cis-1,2-Dichloroethene
Plume Difference Map
1987 vs. 2014



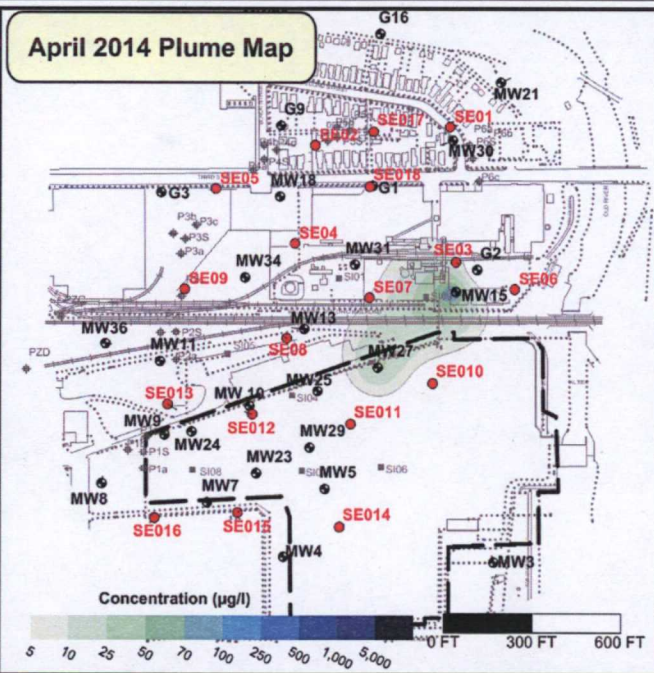




July 1987 Plume Map

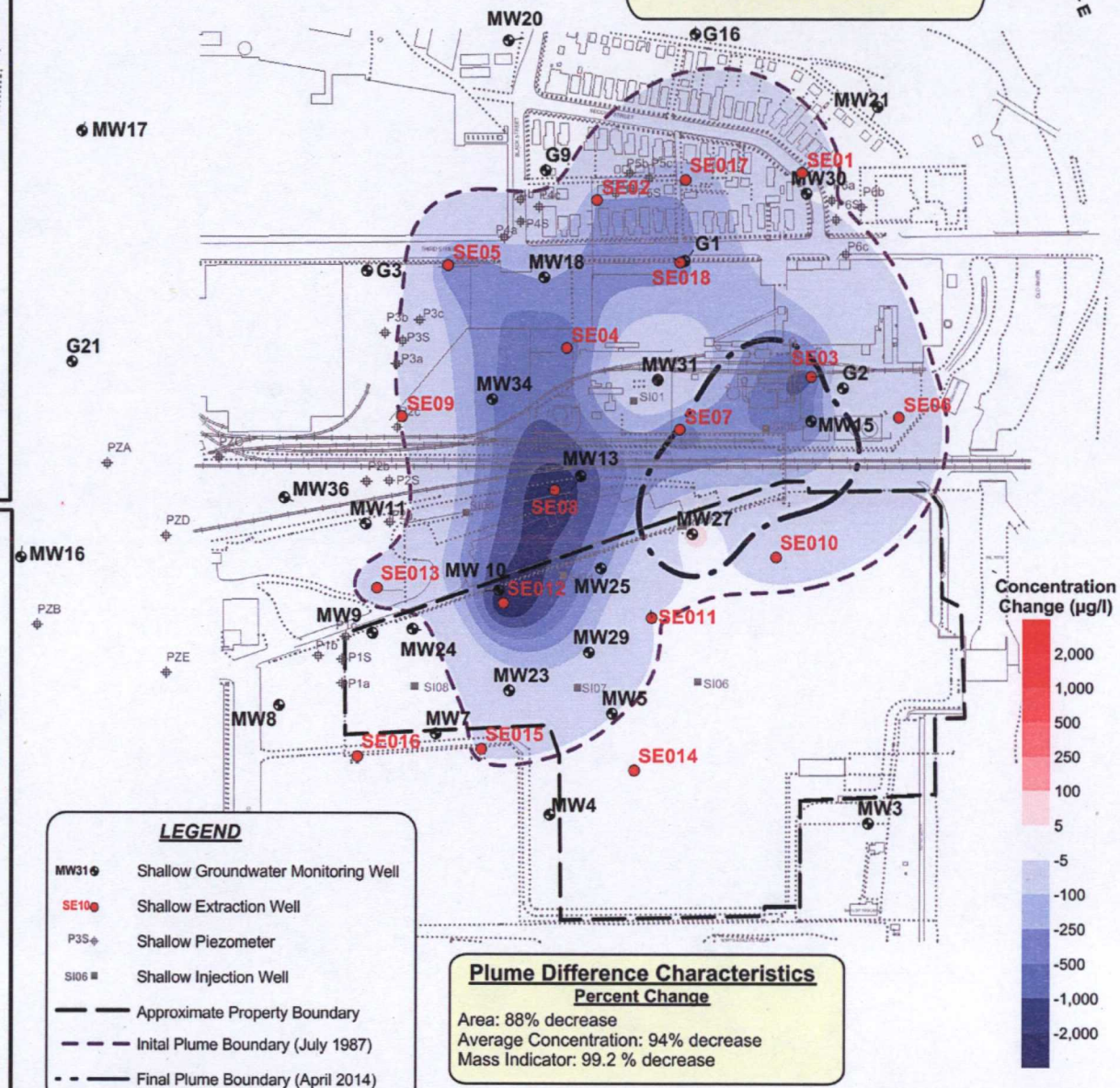


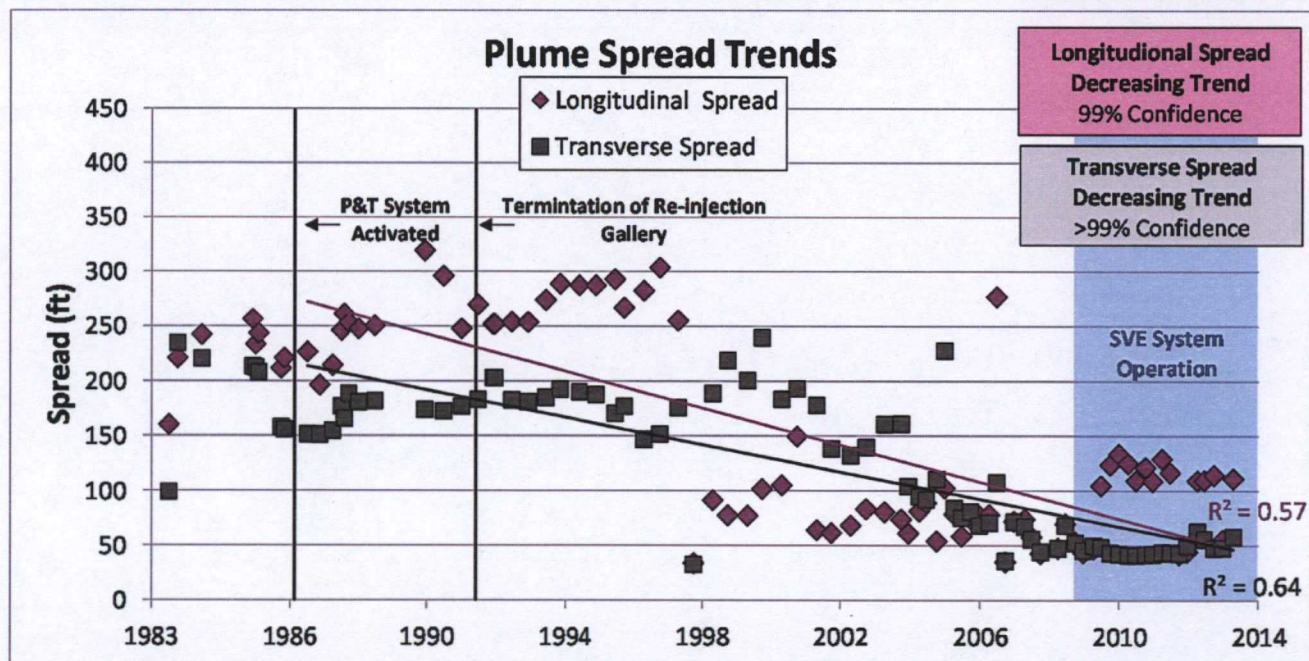
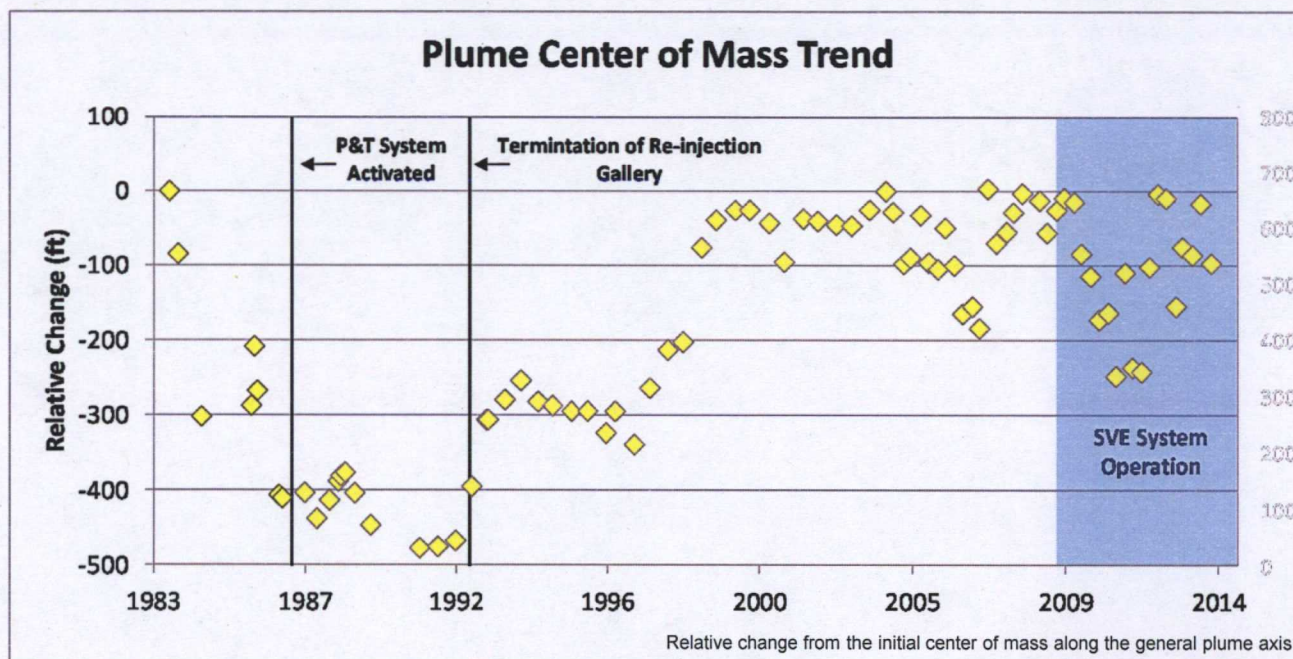
April 2014 Plume Map

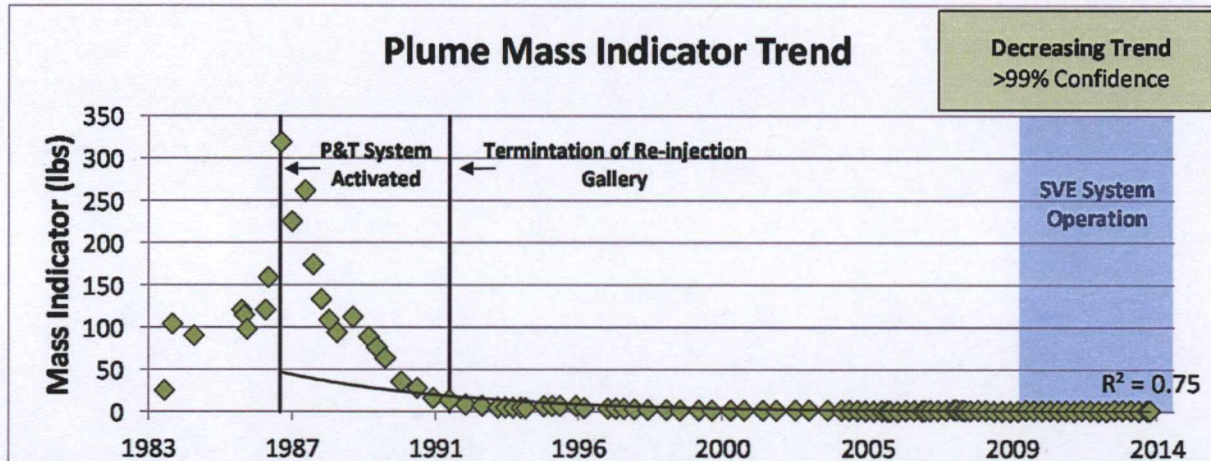
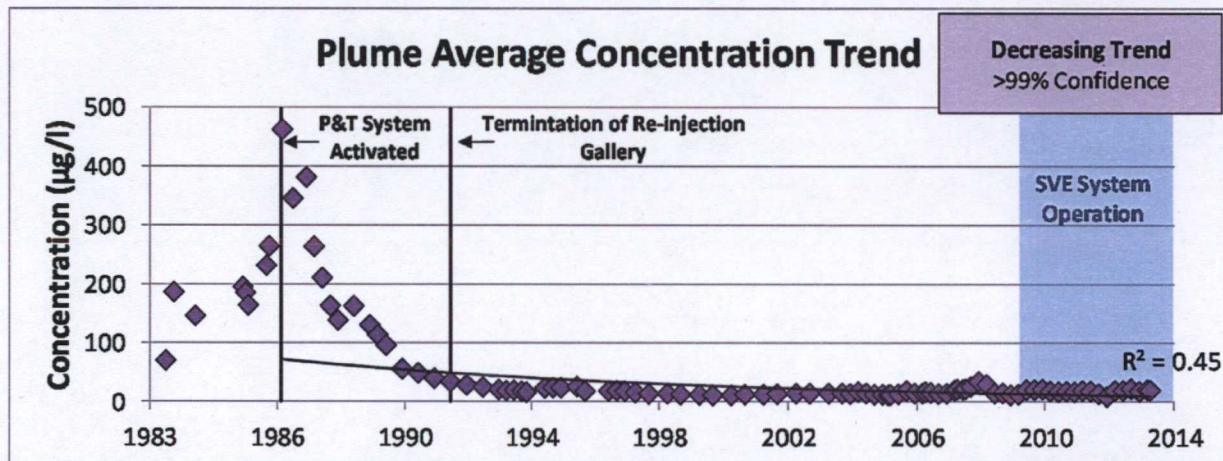
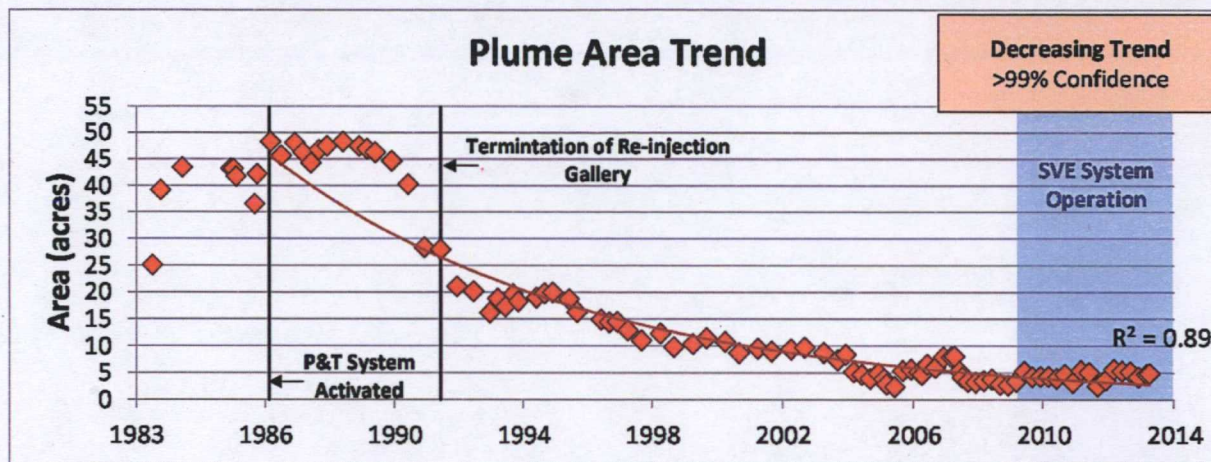


Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

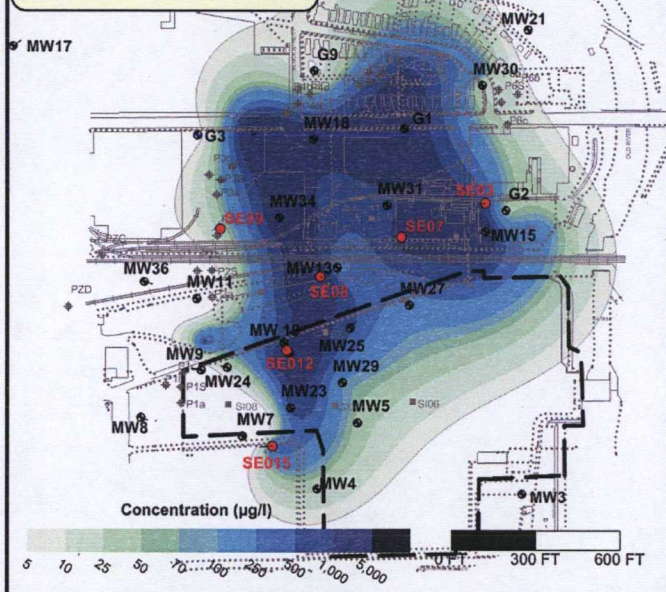
1,1-Dichloroethene
Plume Difference Map
1987 vs. 2014



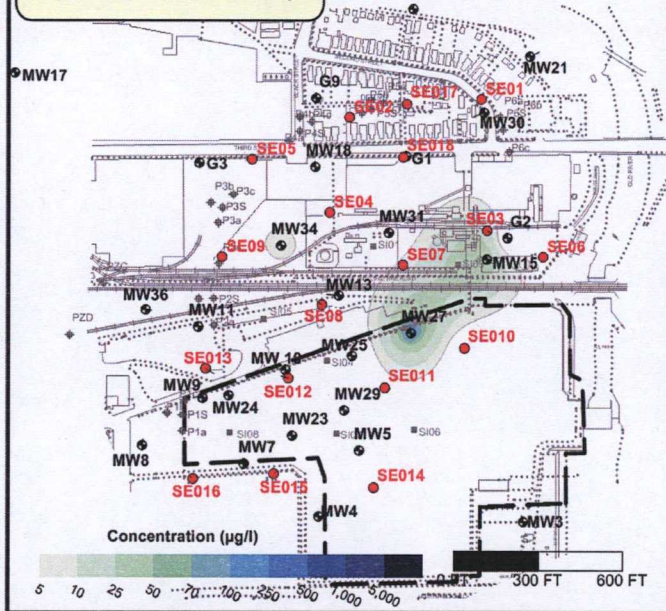




March 1987 Plume Map

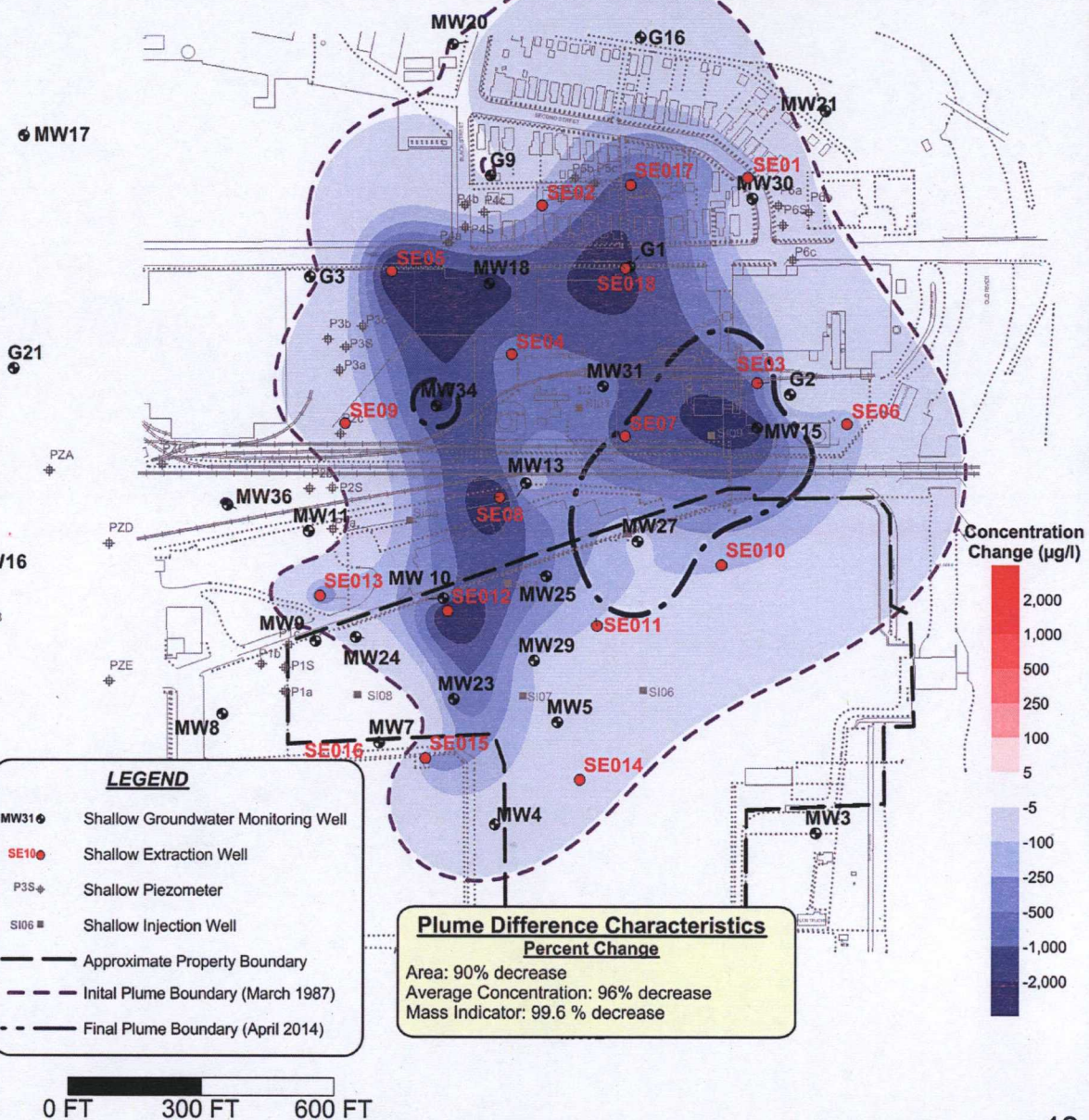
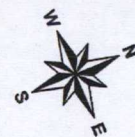


April 2014 Plume Map



Note:
This analysis requires fixed data points within a fixed area for the purposes of assessing relative changes of area, average concentration, and mass indicator over time. Therefore, any created isopleth maps are not intended to be a depiction or model of the actual plume but rather is meant to show conceptual behavior of the aforementioned metrics over time.

Vinyl Chloride
Plume Difference Map
1987 vs. 2014



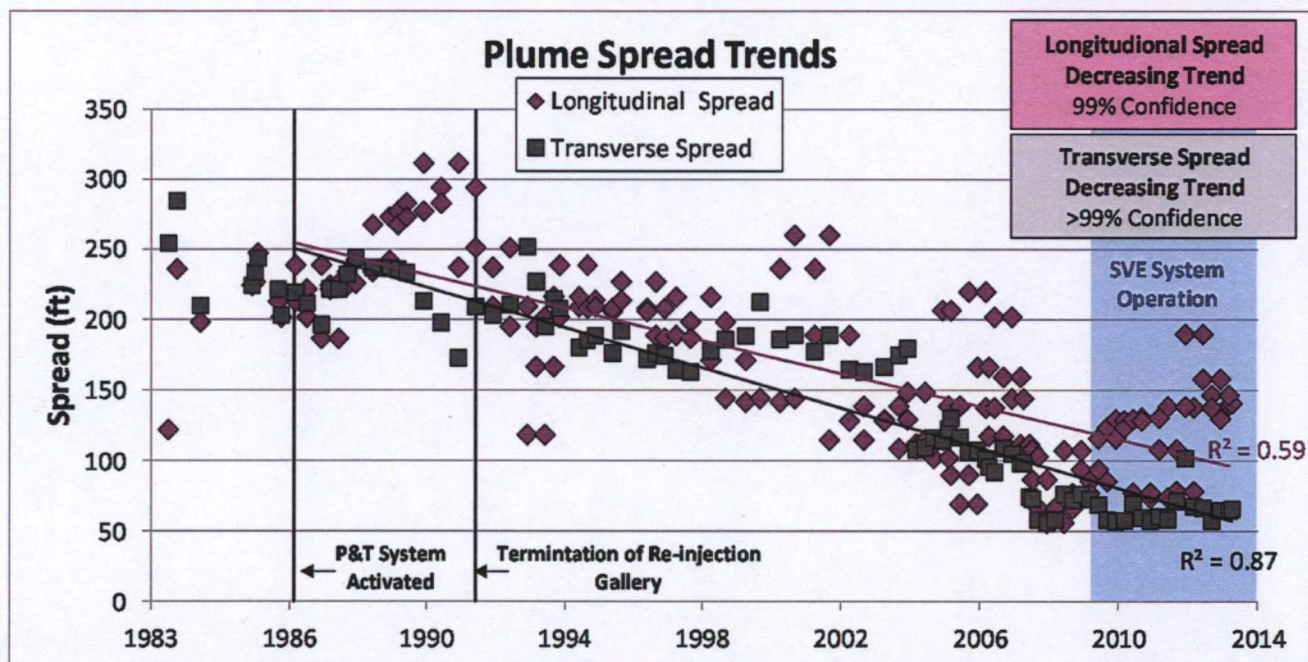
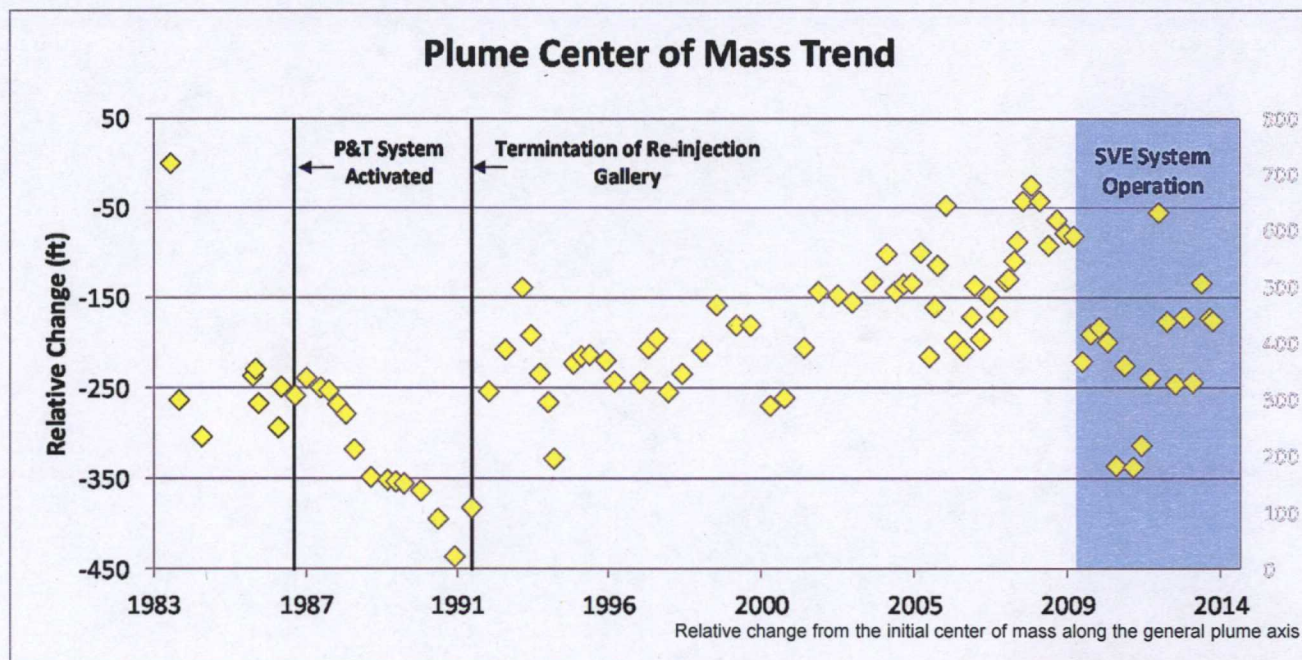
LEGEND

- MW31 ● Shallow Groundwater Monitoring Well
- SE10 ● Shallow Extraction Well
- P3S ● Shallow Piezometer
- SI06 ■ Shallow Injection Well

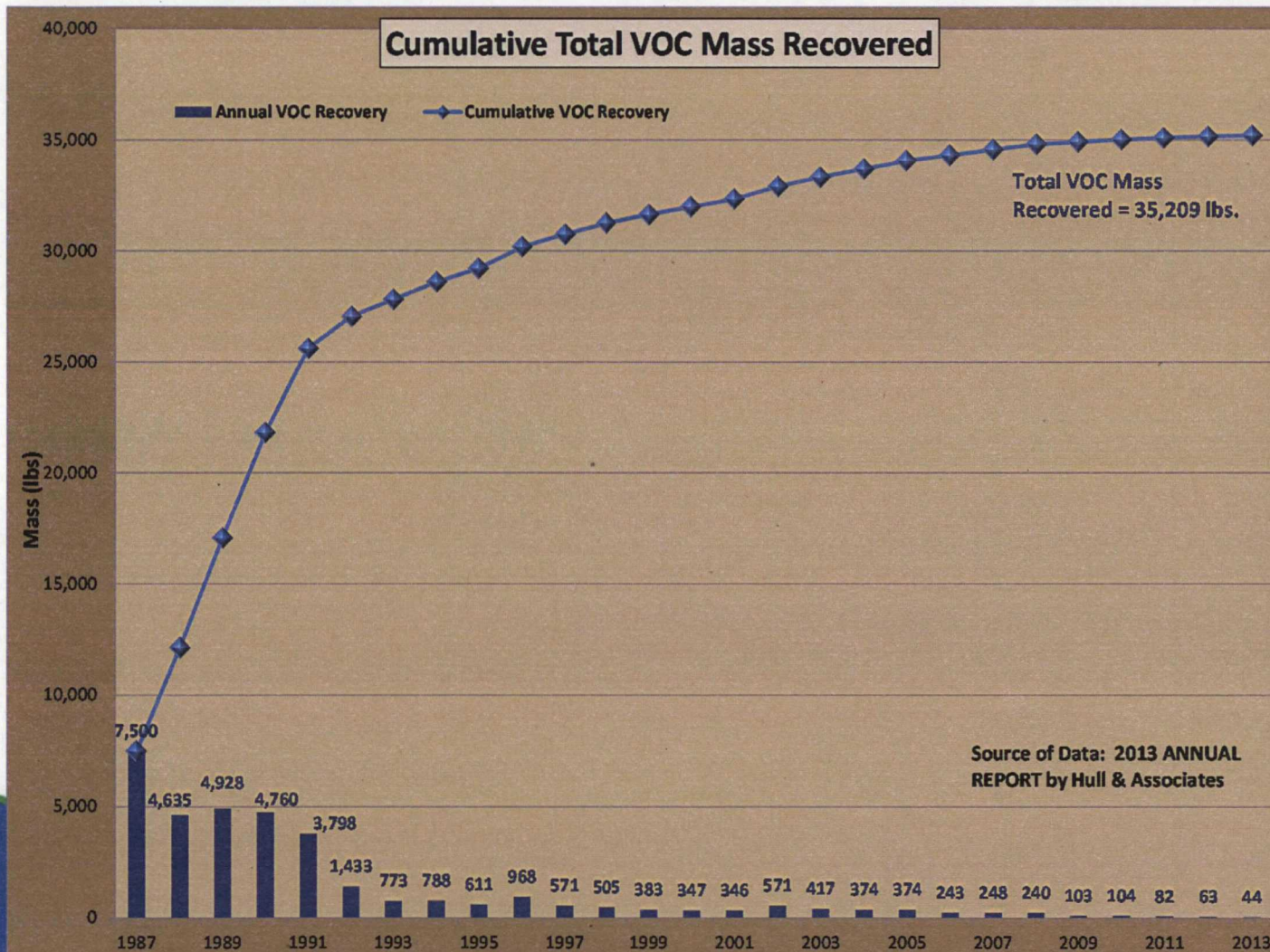
- Approximate Property Boundary
- - - Initial Plume Boundary (March 1987)
- Final Plume Boundary (April 2014)

Plume Difference Characteristics
Percent Change

Area: 90% decrease
Average Concentration: 96% decrease
Mass Indicator: 99.6 % decrease



- Total VOC Mass Recovery Trends Approaching Asymptotic



APPENDIX F

Site Inspection Checklist and Photos

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: <u>CHEM-DYNE</u>	Date of inspection: <u>MAY 21, 2015</u>
Location and Region: <u>OHIO, REGION 5</u>	EPA ID: <u>OHDO74727793</u>
Agency, office, or company leading the five-year review: <u>U.S. EPA</u>	Weather/temperature:
Remedy Includes: (Check all that apply) ☐ Landfill cover/containment ☐ Access controls ☐ Institutional controls ☒ Groundwater pump and treatment ☐ Surface water collection and treatment ☒ Other <u>SITE COVER/CAP</u> ☐ Monitored natural attenuation ☐ Groundwater containment ☐ Vertical barrier walls	
Attachments: Inspection team roster attached Site map attached	
II. INTERVIEWS (Check all that apply) — <u>CHARLES ("CHUCK") HANSEN</u>	
<u>and</u> 1. O&M site manager <u>RON HOLT PARTICIPATED IN SITE VISIT</u> Name Interviewed at site at office by phone Phone no. <u>ON BEHALF OF THE</u> <u>CHEM DYNE TRUST</u> Date Problems, suggestions; Report attached	
2. O&M staff Name Interviewed at site at office by phone Phone no. Title Problems, suggestions; Report attached Date	

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency OHIO EPA - PARTICIPATED IN SITE VISIT
 Contact CHUCK MELLON SITE PROJECT MANAGER
 Name Title Date Phone no.

Problems; suggestions; Report attached N/A

Agency _____
 Contact _____
 Name Title Date Phone no.
 Problems; suggestions; Report attached _____

Agency _____
 Contact _____
 Name Title Date Phone no.
 Problems; suggestions; Report attached _____

Agency _____
 Contact _____
 Name Title Date Phone no.
 Problems; suggestions; Report attached _____

4. **Other interviews (optional)** Report attached. N/A

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	O&M Documents O&M manual As-built drawings Maintenance logs Remarks _____	Readily available Readily available Readily available	Up to date Up to date Up to date	N/A N/A N/A
2.	Site-Specific Health and Safety Plan Contingency plan/emergency response plan Remarks _____	Readily available Readily available	Up to date Up to date	N/A N/A
3.	O&M and OSHA Training Records Remarks _____	Readily available	Up to date	N/A
4.	Permits and Service Agreements Air discharge permit Effluent discharge Waste disposal, POTW Other permits _____ Remarks _____	Readily available Readily available Readily available Readily available	Up to date Up to date Up to date Up to date	N/A N/A N/A N/A
5.	Gas Generation Records Remarks _____	Readily available	Up to date	N/A
6.	Settlement Monument Records Remarks _____	Readily available	Up to date	N/A
7.	Groundwater Monitoring Records Remarks _____	Readily available	Up to date	N/A
8.	Leachate Extraction Records Remarks _____	Readily available	Up to date	N/A
9.	Discharge Compliance Records Air Water (effluent) Remarks _____	Readily available Readily available	Up to date Up to date	N/A N/A
10.	Daily Access/Security Logs Remarks _____	Readily available	Up to date	N/A

IV. O&M COSTS

→ SEE NEXT PAGE

1. O&M Organization

State in-house

Contractor for State

✓ PRP in-house

Contractor for PRP

Federal Facility in-house

Contractor for Federal Facility

Other _____

2. O&M Cost Records

Readily available

Up to date

Funding mechanism/agreement in place

Original O&M cost estimate _____ Breakdown attached

Total annual cost by year for review period if available

From _____	To _____	_____	Breakdown attached
Date	Date	Total cost	
From _____	To _____	_____	Breakdown attached
Date	Date	Total cost	
From _____	To _____	_____	Breakdown attached
Date	Date	Total cost	
From _____	To _____	_____	Breakdown attached
Date	Date	Total cost	
From _____	To _____	_____	Breakdown attached
Date	Date	Total cost	

3. Unanticipated or Unusually High O&M Costs During Review Period:

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS

Applicable

N/A

NOT REQUIRED BY
DECISION

DOCUMENT

A. Fencing**1. Fencing damaged**

Remarks

OK

Location shown on site map

Gates secured

N/A

B. Other Access Restrictions**1. Signs and other security measures**

Remarks

OK

Location shown on site map

N/A

Chem-Dyne Site O&M Cost

Prepared by Chuck Hanson Secretary/Treasurer

<u>Account Name</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>
Direct Salaries and Related Costs	110,556	110,870	130,082	64,147	63,993	63,897	64,803
Plant Staff Support:	12,899	16,463	15,068	12,429	11,104	31,035	11,161
Utilities:	62,256	69,154	63,147	53,614	51,705	42,639	44,960
SVE Studies, Installation & Operation	-	287,441	28,871	85,391	21,576	23,844	23,656
Maintenance:	201,049	23,868	27,981	23,165	20,557	71,669	49,118
Decommissioning of Site Facilities	-	-	19,491	-	-	-	-
Sampling and Analytical	53,860	30,364	33,548	24,123	28,124	25,186	28,680
Waste Disposal	1,873	1,934	1,750	1,040	1,252	1,320	1,335
Financial, Accounting, Auditing etc.	33,917	49,089	58,494	48,759	51,519	48,766	45,111
Technical Support	109,256	61,696	75,693	53,412	72,331	75,356	141,058
Permit Fees	3,180	2,980	3,840	3,700	3,065	1,400	1,200
Total Operating & Maintenance	588,846	653,859	457,965	369,780	325,226	385,112	411,082

C. Institutional Controls (ICs)**1. Implementation and enforcement**

Site conditions imply ICs not properly implemented

Yes ☒ No ☒ N/A

Site conditions imply ICs not being fully enforced

Yes ☒ No ☒ N/A

Type of monitoring (e.g., self-reporting, drive by) _____

Frequency _____

Responsible party/agency _____

Contact _____

Name

Title

Date

Phone no.

Reporting is up-to-date

Yes No N/A

Reports are verified by the lead agency

Yes No N/A

Specific requirements in deed or decision documents have been met

Yes No ☒ N/A

Violations have been reported

Yes No ☒ N/A

Other problems or suggestions: Report attached

ICs ARE NOT REQUIRED BY THE DECISION DOCUMENT ALTHOUGH RESTRICTIONS MAY BE NEEDED. THE CONSENT DECREE DISMISSES ICs.

2. Adequacy

ICs are adequate

ICs are inadequate

N/A

Remarks *A FENCE SURROUNDS THE SITE. SOME WELLS ARE LOCATED OUTSIDE OF THE PROPERTY BOUNDARY*

D. General**1. Vandalism/trespassing**

Location shown on site map

☒ No vandalism evident

Remarks _____

2. Land use changes on site

N/A

Remarks *NONE,***3. Land use changes off site**

N/A

Remarks *NONE,***VI. GENERAL SITE CONDITIONS****A. Roads**

Applicable

N/A

1. Roads damaged

Location shown on site map

Roads adequate

N/A

Remarks *No.*

B. Other Site Conditions

Remarks _____

N/A

SITE COVER

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

THIS IS NOT A LANDFILL. THE REMEDY REQUIRES A CAP

1. **Settlement** (Low spots) *N/A* Location shown on site map Settlement not evident
 Areal extent _____ Depth _____
 Remarks _____

2. **Cracks** *N/A* Location shown on site map Cracking not evident
 Lengths _____ Widths _____ Depths _____
 Remarks _____

3. **Erosion** *N/A* Location shown on site map Erosion not evident
 Areal extent _____ Depth _____
 Remarks _____

4. **Holes** *N/A* Location shown on site map Holes not evident
 Areal extent _____ Depth _____
 Remarks _____

5. **Vegetative Cover** *Grass* *Cover properly established* No signs of stress
 Trees/Shrubs (indicate size and locations on a diagram)
 Remarks _____

6. **Alternative Cover** (armored rock, concrete, etc.) N/A
 Remarks _____

7. **Bulges** Location shown on site map *Bulges not evident*
 Areal extent _____ Height _____
 Remarks _____

8. Wet Areas/Water Damage <i>NOT Evident</i> Wet areas/water damage not evident Wet areas <i>NOT Evident</i> Location shown on site map Areal extent _____ Ponding Location shown on site map Areal extent _____ Seeps Location shown on site map Areal extent _____ Soft subgrade Location shown on site map Areal extent _____ Remarks _____			
9. Slope Instability Slides Location shown on site map <u>No evidence of slope instability</u> Areal extent _____ Remarks _____			
B. Benches Applicable <u>N/A</u> (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)			
1. Flows Bypass Bench Location shown on site map <u>N/A or okay</u> Remarks _____			
2. Bench Breached Location shown on site map <u>N/A or okay</u> Remarks _____			
3. Bench Overtopped Location shown on site map <u>N/A or okay</u> Remarks _____			
C. Letdown Channels Applicable <u>N/A</u> (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)			
1. Settlement Location shown on site map <u>No evidence of settlement</u> Areal extent _____ Depth _____ Remarks _____			
2. Material Degradation Location shown on site map <u>No evidence of degradation</u> Material type _____ Areal extent _____ Remarks _____			
3. Erosion Location shown on site map <u>No evidence of erosion</u> Areal extent _____ Depth _____ Remarks _____			

4.	Undercutting	Location shown on site map	No evidence of undercutting	
	Areal extent	Depth		
	Remarks			
5.	Obstructions	Type	No obstructions	
	Location shown on site map	Areal extent		
	Size			
	Remarks			
6.	Excessive Vegetative Growth	No Evidence of excessive growth		
	No evidence of excessive growth			
	Vegetation in channels does not obstruct flow			
	Location shown on site map	Areal extent		
	Remarks			
D. Cover Penetrations Applicable N/A				
1.	Gas Vents	Active	Passive	
	Properly secured/locked	Functioning	Routinely sampled	Good condition
	Evidence of leakage at penetration		Needs Maintenance	
	N/A			
	Remarks			
2.	Gas Monitoring Probes			
	Properly secured/locked	Functioning	Routinely sampled	Good condition
	Evidence of leakage at penetration		Needs Maintenance	N/A
	Remarks			
3.	Monitoring Wells (within surface area of landfill)			
	Properly secured/locked	Functioning	Routinely sampled	Good condition
	Evidence of leakage at penetration		Needs Maintenance	N/A
	Remarks			
4.	Leachate Extraction Wells	N/A		
	Properly secured/locked	Functioning	Routinely sampled	Good condition
	Evidence of leakage at penetration		Needs Maintenance	N/A
	Remarks			
5.	Settlement Monuments	Located	Routinely surveyed	N/A
	Remarks			

E. Gas Collection and Treatment		Applicable	N/A
1.	Gas Treatment Facilities Flaring Good condition Remarks _____	Thermal destruction Needs Maintenance	Collection for reuse
2.	Gas Collection Wells, Manifolds and Piping Good condition Remarks _____	Needs Maintenance	
3.	Gas Monitoring Facilities (e.g., gas monitoring of adjacent homes or buildings) Good condition Remarks _____	Needs Maintenance	N/A
F. Cover Drainage Layer		Applicable	N/A
1.	Outlet Pipes Inspected Remarks _____	Functioning	N/A
2.	Outlet Rock Inspected Remarks _____	Functioning	N/A
G. Detention/Sedimentation Ponds		Applicable	N/A
1.	Siltation Areal extent _____ Depth _____ Siltation not evident Remarks _____		N/A
2.	Erosion Areal extent _____ Depth _____ Erosion not evident Remarks _____		
3.	Outlet Works Remarks _____	Functioning	N/A
4.	Dam Remarks _____	Functioning	N/A

H. Retaining Walls		Applicable	<u>N/A</u>
1.	Deformations Horizontal displacement _____ Rotational displacement _____ Remarks _____	Location shown on site map _____	Deformation not evident Vertical displacement _____
2.	Degradation Remarks _____	Location shown on site map _____	<u>Degradation not evident</u>
I. Perimeter Ditches/Off-Site Discharge		Applicable	<u>N/A</u>
1.	Siltation Areal extent _____ Remarks _____	Location shown on site map _____	Siltation not evident Depth _____
2.	Vegetative Growth Vegetation does not impede flow Areal extent _____ Remarks _____	Location shown on site map _____	<u>N/A</u> Type _____
3.	Erosion Areal extent _____ Remarks _____	Location shown on site map _____	Erosion not evident Depth <u>N/A</u>
4.	Discharge Structure Remarks _____	Functioning	N/A
VIII. VERTICAL BARRIER WALLS		Applicable	<u>N/A</u>
1.	Settlement Areal extent _____ Remarks _____	Location shown on site map _____	Settlement not evident Depth _____
2.	Performance Monitoring Performance not monitored Frequency _____ Head differential _____ Remarks _____	Type of monitoring _____	<u>N/A</u> Evidence of breaching _____

IX. GROUNDWATER/SURFACE WATER REMEDIES		Applicable	N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines		Applicable	N/A
1.	Pumps, Wellhead Plumbing, and Electrical Good condition All required wells properly operating Needs Maintenance N/A Remarks _____		
2.	Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances Good condition Needs Maintenance Remarks _____		
3.	Spare Parts and Equipment Readily available Good condition Requires upgrade Needs to be provided Remarks _____		
B. Surface Water Collection Structures, Pumps, and Pipelines		Applicable	N/A
	Collection Structures, Pumps, and Electrical Good condition Needs Maintenance Remarks _____		
	Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances Good condition Needs Maintenance Remarks _____		
3.	Spare Parts and Equipment Readily available Good condition Requires upgrade Needs to be provided Remarks _____		

C. Treatment System		Applicable	N/A
1.	Treatment Train (Check components that apply) Metals removal _____ Oil/water separation _____ Bioremediation _____ Air stripping _____ Carbon adsorbers _____ Filters _____ Additive (e.g., chelation agent, flocculent) _____ Others _____ Good condition _____ Needs Maintenance _____ Sampling ports properly marked and functional _____ Sampling/maintenance log displayed and up to date _____ Equipment properly identified _____ Quantity of groundwater treated annually _____ Quantity of surface water treated annually _____ Remarks _____		
2.	Electrical Enclosures and Panels (properly rated and functional) N/A _____ Good condition _____ Needs Maintenance _____ Remarks _____		
3.	Tanks, Vaults, Storage Vessels N/A _____ Good condition _____ Proper secondary containment _____ Needs Maintenance _____ Remarks _____		
4.	Discharge Structure and Appurtenances N/A _____ Good condition _____ Needs Maintenance _____ Remarks _____		
5.	Treatment Building(s) N/A _____ Good condition (esp. roof and doorways) _____ Needs repair _____ Chemicals and equipment properly stored _____ Remarks _____		
6.	Monitoring Wells (pump and treatment remedy) Properly secured/locked _____ Functioning _____ Routinely sampled _____ Good condition _____ All required wells located _____ Needs Maintenance _____ N/A _____ Remarks _____		
D. Monitoring Data			
1.	Monitoring Data _____ Is routinely submitted on time _____ Is of acceptable quality _____		
2.	Monitoring data suggests: Groundwater plume is effectively contained _____ Contaminant concentrations are declining _____		

D. Monitored Natural Attenuation**1. Monitoring Wells (natural attenuation remedy)**Properly secured/locked ☒ FunctioningRoutinely sampled ☒Good condition ☒All required wells located ☒Needs Maintenance ☐N/A ☐

Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS**A. Implementation of the Remedy**

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

THE Remedy Requires the operation and maintenance of a groundwater pump & treat system. The remedy has been modified to include an SVE system (NORTH and SOUTH). The remedy has been effective in removing significant quantities of VOCs from the ground water and soil. The remedy is functioning as intended by the decision document.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The remedy is protective in the short-term due to the lack of ICS being fully implemented at the site.

The system has reached capacity.

The system is aged and pumps and repair costs may begin to escalate. Fouling of the system is a factor in the system performance.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

Overall, The System has been effective in plume containment. Perimeter monitoring well sampling results have been below the 100 TVOC cleanup level.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

The System has been optimized. Monitored Natural Attenuation has been recommended by the Trust. The Agencies are evaluating the Proposal. Additional investigations may be warranted in the area of MW-15 in the future.













