Final Five-Year Review Report

Riverfront Superfund Site
New Haven, Missouri

November 2014

Region 7
U.S. Environmental Protection Agency
Lenexa, Kansas

Approved by:

Robert Jackson
Superfund Division Director (Acting)
U.S. EPA, Region 7

11-17-14
Date:

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Attachments

List of Acronyms

ACL	Alternate Concentrations Limits
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirements
ARP	American Recreation Products, Inc.
ART	Advanced Remediation Technology
AS	Air Sparge
bgs	below ground surface
CalEPA	California Environmental Protection Agency
CALM	Cleanup Levels for Missouri
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-DCE	cis-1,2-Dichloroethene
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CSR	Code of (Missouri) State Regulations
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ESI	Expanded Site Investigation
FS	Feasibility Study
FYR	Five-Year Review
gpm	Gallons per minute
HHRA	Human Health Risk Assessment
IC	Institutional Controls
IDA	Industrial Development Authority of the City of New Haven
LTM	Long-Term Monitoring
LTRA	Long-Term Response Action
MCL	Maximum Contaminant Level
MDNR	Missouri Department of Natural Resources
MRBCA	Missouri Risk Based Corrective Action
MSL	Mean Seal Level

List of Acronyms (continued)

NCP	National Oil and Hazardous Substance Pollution and Contingency Plan
NHMC	New Haven Manufacturing Company
NPL	National Priority List
O&M	Operations and Maintenance
OU	Operable Unit
PCE	Tetrachloroethene
PPA	Prospective Purchaser Agreement
PRG	Preliminary Remediation Goal
PRP	Potentially Responsible Party
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objectives
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RWI	Residential Well Investigation
SAS	Source Area Soil
SVE	Soil Vapor Extraction
TBC	To-Be-Considered
TCE	Trichloroethene
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VC	Vinyl Chloride
VOC	Volatile Organic Compound

Executive Summary

A Five-Year Review (FYR) has been completed at the Riverfront Site in New Haven, Missouri. This is the second FYR at the site.

In 1986, the Missouri Department of Natural Resources (MDNR) began testing public-supply wells in the state for volatile organic compounds (VOCs) and detected the chlorinated solvent tetrachloroethene (PCE) in New Haven city wells W1 and W2. Based on results of numerous investigations, six Operable Units (OUs) were identified as sources of contamination at the Riverfront Site. The Riverfront Site was included on the National Priorities List (NPL) in December 2000. The six OUs are:

OU1: Front Street
OU2: Industrial Drive
OU3: Old City Dump
OU4: Maiden Lane Area
OU5: Old Hat Factory
OU6: Wildcat Creek Estates

Remedies have been selected and implemented for OU1, OU3, and OU5. The recently selected remedial actions for OU2 and OU6 are in the early phase of implementation. The injection of a chemical oxidant to enhance chemical oxidation of the chemicals of concern (COC) at OU4 started in 2012 and is planned to be completed by 2017. This review covers the period from November 20, 2009 through November 20, 2014.

OU1 (Front Street)

The OU1 2003 Record of Decision (ROD) called for a combination of institutional controls (ICs) to restrict exposure to the shallow aquifer and soil contamination, proprietary controls, an environmental covenant and easement, installation of an Advanced Remedial Technology (ART) well and associated equipment, and extension of the monitoring well network to monitor the plume. Institutional controls are in place. The OU1 remedy was declared to be operational and functional on November 2, 2005. All groundwater concentrations are below the Alternate Concentration Limits (ACLs) established from site monitoring results indicating that the system is meeting the performance goals (calculation of the ACLs is outlined in Section 4.1.1 of this Review). However, due to the system operational problems, it is recommended that the ART system be rehabilitated prior to the Missouri Department of Natural Resources (MDNR) assumption of O&M responsibility. If groundwater issues develop in the future, other remedial alternatives should be considered.

Subsequent to the vapor intrusion studies conducted in 2003, the adjusted toxicity of TCE was considered more toxic. Therefore, it is possible that vapor intrusion of volatile chemicals of concern (COCs) could impact the protectiveness of the remedy.

Institutional Controls (IC) identified in Section 4.1.3 are in place restricting well drilling and preventing unacceptable use of contaminated groundwater.

A protectiveness determination of the remedy at OU1 cannot be made at this time until further information is obtained regarding vapor intrusion of volatile COCs. Further information will be obtained by verifying that the previously recommended follow on vapor intrusion studies have been conducted and the adjusted toxicity values have been considered. It is expected that these actions will be completed by November 2015, at which time a protectiveness determination will be made.

OU2 (Industrial Drive) and OU6 (Wildcat Creek Estates)

OU2 (Industrial Drive) and OU6 (Wildcat Creek Estates) are located south of State Highway 100. OU2 is a contaminant source area located within the New Haven city limits and OU6 is the contaminant groundwater plume in the residential Wildcat Creek Estates area that emanates from OU2.

In 2011, the U.S. Environmental Protection Agency (EPA) issued the final ROD for OU2 and OU6. The selected remedy includes dense non-aqueous phase liquid (DNAPL) recovery, followed by in situ chemical oxidation, whole-house water treatment units, in situ groundwater treatment, ICs, and groundwater monitoring.

The Phase I Remedial Design and Remedial Action Work Plan for OU2/OU6 was completed in May 2013 and the remedy is in the early phases of implementation. Until remediation is complete, ICs identified in Section 4.2.3 adequately address groundwater exposure pathways that could result in unacceptable risk at OU2. Contaminated soil in the land-farm area, shown to be a risk for the hypothetical future residential scenario, would remain in place. However, current zoning in the land-farm area that does not allow residential use addresses the contaminated soil exposure pathway.

Current zoning that prevents residential use in the OU2 source area addresses the contaminated soil exposure pathway. The planned remediation of COCs in soils and groundwater at OU2 will address dermal, ingestion, and inhalation exposures. However, until the remediation activities are complete, indoor air concentrations of COCs due to the migration of vapors from contaminated soil or shallow groundwater are in excess of risk-based standards at OU2 for both the industrial and hypothetical residential scenario. Current zoning restricts residential use of the property. However, the vapor exposure risk to current industrial workers during the period of soil and groundwater treatment is not currently addressed by the remedy. The EPA reviewed the Sub-slab Vapor and Indoor Air Sampling Reports documenting sampling efforts completed in December 2010, January 2011, and June 2011. While EPA determined that the vapor intrusion pathway is complete at the Metalcraft Building at the former Kellwood Facility, the 2011 PCE indoor air sampling results did not indicate concentrations that exceeded the 1E-04 (1 in 10,000) to 1E-06 (1 in 1,000,000) residual risk range. Although current conditions do not indicate significant health risks, EPA noted that the sub-slab vapor concentrations of PCE and TCE exceeded sub-slab screening levels. The EPA concurred with the report recommendations to conduct further sampling and to consider modifications to the building HVAC system and other mitigation measures.

A protectiveness determination of the remedy at OU2 cannot be made at this time until further information is obtained. A protectiveness determination can be made pending the results of the vapor intrusion monitoring and evaluation efforts planned for 2015.

While the OU2 remedy is implemented, exposure pathways at the OU6 residential area that could result in unacceptable risk are being controlled. ICs identified in Section 4.2.3 restrict the installation of new wells. The four residences with private supply wells impacted by PCE contamination in excess of the maximum contaminant level[1] (MCL) continue to use whole-house filtration units. In the event that PCE is detected in other residential supply wells above the MCL, whole-house treatment systems will be installed in accordance with the Consent Order.

The remedy at OU6 is expected to be protective of human health and the environment upon completion of the remedial activities.

OU3 (Old City Dump)

The OU3 remedy is functioning as intended. Sampling of the landfill monitoring wells, surface seep and nearby domestic wells is occurring per the requirements of the 2003 ROD. ICs implemented at OU3 enhance the protectiveness of the remedy.

The 2003 ROD specified that if PCE concentrations in groundwater samples remained below the MCL of 5 µg /L after the conclusion of 1 year of quarterly sampling, sampling would be reduced to every 5 years. Based on the results from the 2003-2004 quarterly monitoring, sampling frequency decreased to once every 5 years. None of the May 2008 or September 2013 samples from monitoring wells, an onsite seep, or nearby domestic wells contained detectable quantities of PCE or other volatile contaminants of concern listed in the 2003 ROD.

Based on the 2008 and 2013 sampling, no substantial changes in water quality have been observed in monitoring wells, seep, or domestic well samples. Concentrations of constituents were within historical ranges and groundwater quality near OU3 appears stable and relatively unchanged.

[1] A primary maximum contaminant level (MCL) is the maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system. Primary MCLs are promulgated by EPA pursuant to the Safe Drinking Water Act, 42 U.S.C. §§300j-26 and are codified at 40 CFR Part 141.

ICs identified in Section 4.3.3 are in place. MDNR regulations prohibit placement of new wells within 300 feet of the landfill. Samples are collected from nearby monitoring wells and domestic wells every five years. The City of New Haven retains ownership of the dumpsite and the Environmental Covenant (2008) prohibits any use of the property that would be inconsistent with the environmental response in the ROD.

The remedy at OU3 is protective of human health and the environment.

OU4 (Maiden Lane Area)

The contamination source at OU4 is likely the result of a private citizen disposing of significant amounts of PCE into his home's grey water (sewer) line.

The ROD for OU4 (Maiden Lane Area) was issued in 2009 and the remedy to address soil contamination through in situ chemical oxidation is being implemented. The selected remedy includes a Technical Impracticability (TI) Waiver for groundwater in bedrock impacted from the OU4 soil source area. The TI Waiver is discussed in Section 4.4.1. ICs identified in Section 4.4.3 are in place restricting well drilling and preventing unacceptable use of contaminated groundwater. However, the vapor intrusion pathway warrants a more complete evaluation.

A protectiveness determination of the remedy at OU4 cannot be made at this time until further information is obtained. The vapor intrusion pathway risk may have been underestimated. It is expected that the re-evaluation of the vapor intrusion pathway, considering the more recently defined contamination boundaries and the updated inhalation toxicity values for Trichloroethene (TCE) and Tetrachloroethene (PCE), will be conducted by November 2015, at which time a protectiveness determination will be made.

OU5 (Old Hat Factory)

The OU5 2006 ROD documented that while the groundwater below OU5 was contaminated, the risk could be addressed with institutional controls and monitoring. The remedy was determined to be operational and functional in May 2009 and post-ROD groundwater monitoring is occurring. ICs identified in Section 4.5.3 are in place restricting well drilling and preventing unacceptable use of contaminated groundwater.

The remedy at OU5 is protective of human health and the environment.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Riverfront Superfund Site		
EPA ID: MOD981720246		
Region: 7	**State:** MO	**City/County:** New Haven/Franklin
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Matthew Jefferson		
Author affiliation: U.S. EPA Region 7		
Review period: November 20, 2013 – November 20, 2014		
Date of site inspection: 01/17/2014		
Type of review: Statutory		
Review number: 2		
Triggering action date: November 2009 (signature date of the last Review)		
Due date *(five years after triggering action date)*: November 2014		

Five-Year Review Summary Form (continued)

Issues/Recommendations
No issues were identified for OU3 (Old City Dump), OU5 (Old Hat Factory), or OU6 (Wildcat Creek Estates).

Issues and Recommendations Identified in the Five-Year Review: #1

OU1: Front Street	**Issue Category: Monitoring**			
	Issue: The equipment issues and groundwater fluctuations have made it difficult to determine the overall effectiveness of the system. The ART system has not operated since 2008.			
	Recommendation: The ART Well should be rehabilitated prior to MDNR's assumption of full O&M responsibility of OU 1.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	EPA	State	November 2015

Issues and Recommendations Identified in the Five-Year Review: #2

OU1: Front Street	**Issue Category: Monitoring**			
	Issue: Subsequent to previous vapor intrusion studies, the adjusted toxicity of TCE was considered more toxic. Therefore, it is possible that vapor intrusion of volatile COCs could impact the protectiveness of the remedy.			
	Recommendation: Verify that subsequent vapor intrusion studies have been conducted and the adjusted toxicity values have been considered.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	State	November 2015

OU2: Industrial Drive	**Issue Category:** Remedy Performance			
	Issue: EPA concurred with the recommendations in the Sub-slab Vapor and Indoor Air Sampling Reports (2011) that included recommendations to conduct further sampling and to consider modifications to the building HVAC system and other mitigation measures.			
	Recommendation: Evaluate the vapor exposure risk to determine if actions beyond the previously implemented operational changes are needed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	State	November 2015

Issues and Recommendations Identified in the Five-Year Review: #4

OU4: Maiden Lane Area	**Issue Category: Changed Site Conditions**			
	Issue: Residential receptors may be exposed to unacceptable risk due to vapor intrusion.			
	Recommendation: Re-evaluate the vapor intrusion pathway considering the more recently defined contamination boundaries and the updated inhalation toxicity values for TCE and PCE.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	State	November 2015

Protectiveness Statement OU1 Front Street
Protectiveness Determination: Protectiveness Deferred
Protectiveness Statement: A protectiveness determination of the remedy at OU1 cannot be made at this time until further information is obtained regarding vapor intrusion of volatile COCs. Further information will be obtained by verifying that the previously recommended follow on vapor intrusion studies have been conducted and the adjusted toxicity values have been considered. It is expected that these actions will be completed by November 2015, at which time a protectiveness determination will be made.

Protectiveness Statement OU2 Industrial Drive
Protectiveness Determination: Protectiveness Deferred
Protectiveness Statement: A protectiveness determination of the remedy at OU2 cannot be made at this time until further information is obtained. Prior to completion of the soil and groundwater treatment activities, further information will be obtained regarding the vapor exposure risk to current industrial workers. The recommendations in the Sub-slab Vapor and Indoor Air Sampling Reports (2011), that included further sampling and consideration of modifications to the building HVAC system and other mitigation measures, will be implemented. It is expected that these actions will be completed by November 2015, at which time a protectiveness determination will be made.

Protectiveness Statement OU3 Old City Dump
Protectiveness Determination: Protective
Protectiveness Statement: The remedy at OU3 is protective of human health and the environment.

Protectiveness Statement OU4 Maiden Lane
Protectiveness Determination: Protectiveness Deferred
Protectiveness Statement: A protectiveness determination of the remedy at OU4 cannot be made at this time until further information is obtained regarding vapor intrusion of volatile COCs. It is expected that the re-evaluation of the vapor intrusion pathway, considering the more recently defined contamination boundaries and the updated inhalation toxicity values for TCE and PCE, will be conducted by November 2015, at which time a protectiveness determination will be made.

Protectiveness Statement OU5 The Old Hat Factory
Protectiveness Determination: Protective
Protectiveness Statement: The remedy at OU5 is protective of human health and the environment.

Protectiveness Statement OU6 Wildcat Creek Estates
Protectiveness Determination: Will be Protective
Protectiveness Statement: The remedy at OU6 is expected to be protective of human health and the environment upon completion. In the interim, ICs restricting the installation of new wells, and the use of whole-house water treatment systems for impacted domestic wells, have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.

1.0 Introduction

The purpose of Five Year Reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c) and the National Oil and Hazardous Substance Pollution and Contingency Plan (NCP). CERCLA § 121(c) 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; 40 CFR § 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 Region 7 has conducted the second five-year review (FYR) of the remedial actions implemented at the Riverfront Superfund Site located in New Haven, Missouri as shown in Figure 1. The site is comprised of six OUs as shown in Figure 2.

The six operable units are:

OU1: Front Street
OU2: Industrial Drive
OU3: Old City Dump
OU4: Maiden Lane Area
OU5: Old Hat Factory
OU6: Wildcat Creek Estates

Remedies have been selected and implemented for OU1, OU3, and OU5. The in-situ remedy for OU4 soils started in 2013 and is planned to be completed by 2017. The recently selected remedial actions for OU2 and OU6 are in the early phase of implementation. This review covers the period from November 20, 2009 through November 20, 2014.

This is the second FYR for the Riverfront Superfund Site. The triggering action for this review is the 11/20/2009 signature date of the previous FYR. The FYR is required because hazardous substances, pollutants, or contaminants remain on the site above levels that allow for unlimited use and unrestricted exposure. This FYR is evaluating human health and environmental protectiveness of the remedies for all OUs. Because of the inclusion of ACLs in the OU1 ROD for groundwater remediation and the TI waiver for bedrock groundwater remediation in the OU4 ROD, FYRs will be required for the site in perpetuity.

2.0 Site Chronology

A chronology of significant site events and dates is provided in Tables 1 and 2.

Table 1: Chronology of Site Events

OU	EVENT	DATE
Site Wide	Contamination Discovered PWS-1 PWS-2	1986
Site Wide	Preliminary Assessment Completed	1988
Site Wide	Site Investigation Completed	1989
Site Wide	Expanded Site Inspection Completed	1994
02	PRP Removal Action Completed	1994
02	PRP Monitoring Agreement Established	1995
01	Information Repository Established	11/17/1999
Site Wide	Hazard Ranking System Package Completed	2000
01	Remedial Investigation/Feasibility Study Completed	6/2000
03	Remedial Investigation/Feasibility Study Completed	6/2000
Site Wide	Proposal to Place on National Priorities List Prepared	7/27/2000
01	Emergency Removal Action Completed	9/2000
Site wide	National Priorities Listing (NPL)	12/2000
Site Wide	Expanded Site Investigation/Remedial Investigation Completed	9/2001
06	PRP Emergency Removal Began	11/2001
05	Pre-Remedial Investigation Completed	2002
05	RI Initiated	2002
06	Administrative Order of Consent Finalized	5/2002
03	Focused Remedial Investigation Report Completed	1/2003
01	Focused Remedial Investigation Report Completed	1/2003
01	Feasibility Study Report Completed	9/2003
01	Public Meeting Held	7/29/2003
03	Feasibility Study Report Completed	9/2003
01	Record of Decision Signed	9/2003
03	Record of Decision Signed	9/2003
01	Consent Agreement Finalized	3/2004
06	PRP Remedial Investigation/Feasibility Study Began	3/16/2004
02	PRP Remedial Investigation/Feasibility Study Began	3/16/2004
Site Wide	Information Repository Established	7/2004
02	Residential Well Investigation Completed	7/2004
03	Remedial Design Completed	8/2004
01	Remedial Design Completed	9/2004
01	Construction Started (ART well)	11/2004
01	Construction Completed (ART well)	2/2005
01	ART Remedial System Startup	6/02/2005
01	System Operational and Functional (ART well)	11/2005
03	Information Repository Established	9/2006
05	Information Repository Established	11/2006
05	RI/FS Completed	12/2006

05	Record of Decision Finalized	12/2006
01	Final Long Term Remedial Action Field Sampling Plan Completed	3/2007
01	Interim Remedial Action Report Completed	6/2007
05	Remedial Action Completed	9/28/2007
04	Removal Action Completed	4/2008
04	RI/FS Completed	12/2008
04	Final Fractured Bedrock TI Evaluation Report	1/2009
04	Record of Decision Finalized (includes TI Waiver for groundwater in bedrock)	3/2009
05	System Operational and Functional	5/2009
03	PRP Remedial Action Competed	7/2009
Site Wide	First 5-Year Review	11/2009
02/06	Remedial Investigation Report Completed	6/2010
04	Remedial Design – Remedial Action Basis of Design Report Complete	12/2010
02/06	Record of Decision Signed	5/2011
02/06	Phase 1 Remedial Design/Remedail Action Work Plan Completed	5/2013
03	Operation and Maintenance	Ongoing
01	Long-Term Remedial Action (LTRA)	Ongoing

Table 2: Site Chronology for Individual OUs

OU	EVENT	DATE
Site Wide	Contamination Discovered PWS-1 PWS-2	1986
Site Wide	Preliminary Assessment Completed	1988
Site Wide	Site Investigation Completed	1989
Site Wide	Expanded Site Inspection Completed	1994
Site Wide	Hazard Ranking System Package Completed	1999-2000
Site Wide	Proposal to Place site on NPL prepared	7/27/2000
Site Wide	Site Placed on NPL	10/2000
Site Wide	Expanded Site Investigation/Remedial Investigation Completed	9/2001
Site Wide	Information Repository Established	7/2004
Site Wide	First 5-Year Review	11/2009
01	Information Repository Established	11/17/1999
01	Remedial Investigation/Feasibility Study Completed	6/2000
01	Emergency Removal Action Completed	9/2000
01	Focused Remedial Investigation Report Completed	1/2003
01	Feasibility Study Report Completed	9/2003
01	Public Meeting Held	7/29/2003
01	Record of Decision Signed	9/2003
01	Consent Agreement Finalized	3/2004
01	Remedial Design Complete	9/2004

01	Construction Started (ART well)	11/2004
01	Construction Completed (ART well)	2/2005
01	ART Remedial System Startup	6/02/2005
01	System Operational and Functional (ART well)	11/2005
01	Final Long Term Remedial Action Field Sampling Plan Completed	3/2007
01	Interim Remedial Action Report Completed	6/2007
01	Long-Term Remedial Action	Ongoing
02	PRP Removal Action Completed	1994
02	PRP Monitoring Agreement Established	1995
02	PRP Remedial Investigation/Feasibility Study Began	3/16/2004
02	Residential Well Investigation Completed	7/2004
02	Remedial Investigation Report Completed	6/2010
02	Record of Decision Signed	5/2011
02	Phase 1 Remedial Design/Remedail Action Work Plan Completed	5/2013
03	Remedial Investigation/Feasibility Study Completed	6/2000
03	Focused Remedial Investigation Report Completed	1/2003
03	Feasibility Study Report Completed	9/2003
03	Record of Decision Signed	9/2003
03	Remedial Design Completed	8/2004
03	Information Repository Established	9/2006
03	PRP Remedial Action Completed	7/2009
03	Operation and Maintenance	Ongoing
04	Removal Action Completed	4/2008
04	Remedial Investigation/Feasibility Study Completed	12/2008
04	Final Fractured Bedrock TI Evaluation Report	1/2009
04	Record of Decision Signed (includes TI Waiver for groundwater in bedrock)	3/2009
04	Remedial Design – Remedial Action Basis of Design Report Complete	12/2010
05	Pre-RI Investigation Completed	2002
05	RI Initiated	2002
05	Information Repository Established	11/2006
05	Remedial Investigation/Feasibility Study Completed	12/2006
05	Record of Decision Signed	12/2006
05	Remedial Design Completed	12/06/2007
05	Remedial Action Completed	01/30/2008
05	System Operational and Functional	5/2009
06	PRP Emergency Removal Completed	3/2002
06	Administrative Order of Consent Finalized	5/2002
06	PRP Remedial Investigation/Feasibility Study Began	3/16/2004
06	Remedial Investigation Report Completed	6/2010
06	Record of Decision Signed	5/2011
06	Phase 1 Remedial Design/Remedial Action Work Plan Completed	5/2013

3.0 Background

3.1 Site Name, Location, and Description

The Riverfront Site (CERCLIS # MO981720246) is located in New Haven, Missouri (population 1,867), along the southern bank of the Missouri River in Franklin County, about 50 miles west of St. Louis, Missouri (Figure 1). The principal road in the city is State Highway 100, which runs along part of an east-west trending ridge about 1 mile south of the Missouri River. The ridge forms a topographic divide between the Missouri River valley to the north and the Boeuf Creek valley to the south. The downtown business district is located within a narrow strip of floodplain and consists of several small shops and restaurants, a few homes, and several small, old manufacturing facilities. This area of New Haven is surrounded by a flood protection levee that is maintained by the United States Army Corps of Engineers (USACE). Land use north of the State Highway 100, including the downtown area, is mostly residential and light commercial, and land use outside the city is mostly pasture with some row crops. An industrial park, developed in the mid-1970s and containing several large manufacturing facilities, is located south of this ridge and State Highway 100.

There are two major aquifers in the New Haven area; the Ozark Aquifer and the Missouri River alluvial aquifer. Both are used extensively in Missouri; however, in the New Haven area, the Ozark Aquifer is the primary aquifer for domestic, industrial, and public water use. The Missouri River alluvial aquifer in the New Haven area contains high concentrations of iron and manganese and is not used for water supply. The Ozark Aquifer is a thick sequence of water-bearing dolostone, limestone, and sandstone formations ranging in age from Late Cambrian to Middle Devonian. Although these units collectively are a regional aquifer, the water-yielding capacity of the various individual units is variable. Yields of 200 to 1,000 gallons per minute (gpm) are not unusual for the lower zones in the area.

During 1986, the MDNR began testing public-supply wells in the state for volatile organic compounds (VOCs) and detected the chlorinated solvent tetrachloroethene (PCE) in New Haven city wells W1 and W2. Based on results of numerous investigations, six Operable Units (OUs) were identified as sources of contamination at the Riverfront Site. The Riverfront Site was included on the NPL in December 2000. The six OUs are:

OU1: Front Street
OU2: Industrial Drive
OU3: Old City Dump
OU4: Maiden Lane Area
OU5: Old Hat Factory
OU6: Wildcat Creek Estates

3.2 Physical Characteristics

3.2.1 Topography

New Haven is part of the Salem Plateau physiographic sub-province of the Ozark Plateau. The physiographic setting of New Haven is moderate to rugged terrain formed with steep valleys and thin soils, characteristic of the Ozark Plateau. In the upland areas, there are loess (wind-blown) deposits as thick as 15 feet overlying the typical Salem Plateau cherty, silty clay material. Topography in the New Haven area caused by the gradual uplift of the Ozark Dome, and erosion of uplifted rocks by precipitation, runoff, and stream flow, is accentuated because of its location along the Missouri River. The land surface elevation ranges from 470 feet above mean sea level (MSL) to 920 feet above MSL. An east-west trending ridge, along which State Highway 100 runs, lies about 1 mile to the south of the Missouri River, and divides the Missouri River valley to the north and the Boeuf Creek valley to the south. Elevations on this ridge reach up to 740 feet above MSL.

3.2.2 Hydrology

The major body of water in New Haven is the Missouri River, which borders the northern edge of the City. There are a number of small creeks and tributaries in the area, including Boeuf Creek, which lies to the south of OU2. A surface water divide between small tributaries that flow north to the Missouri River and tributaries that flow into Boeuf Creek lies along and north of Highway 100.

3.2.3 Geology

Bedrock Geology

New Haven is underlain by the geologic units of the Ozark Aquifer, a marine sedimentary, primarily carbonate, rock formation. The Ozark Aquifer is composed of eight lithological units, from top to bottom: the St. Peter Sandstone, Powell Dolomite, Cotter Dolomite, Jefferson City Dolomite, Roubidoux Formation, Gasconade Dolomite, Eminence Dolomite, and Potosi Dolomite. These formations are cherty dolostones and sandstones of Cambrian and Ordovician age.

Surficial Geology

New Haven, Missouri is covered by several unconsolidated surficial deposits including Quaternary-Age loess, residual deposits of the Buffalo Series, Quaternary-Age alluvium, and Quaternary-Age terrace deposits. The youngest of these is the loess, deposited in the Pleistocene epoch, consisting of uniform silt, tan to light brown, wind-blown particles, with locally small amounts of clay. The loess is located primarily at topographic highs in the area, and ranges from 0 feet to greater than 20 feet thick. The Quaternary-Age alluvium is found in the flood plains of the streams, and tends to consist of organic-rich deposits of silt and clay. The area around Boeuf Creek and its tributaries, including Wildcat Creek, contains large alluvial deposits with chert gravel. Quaternary-Age terrace deposits near Boeuf Creek are similar to the alluvial deposits found at a higher altitude, indicative of an earlier stream deposition event.

Structural Geology

New Haven is part of the Ozark Plateau, a broad structural and topographic dome characterized by karst (dissolved dolomite and limestone) topography. Regionally, the Ozark Plateau is characterized by dissolution-induced sinkholes, caves, fractures, and underground drainage. The Ozark Plateau is underlain by a broad asymmetrical anticlinal arch, whose gently-dipping limb faces south toward the Ouachita Mountains. Bedrock units in New Haven regionally dip to the northeast. The bedrock is fractured and jointed throughout, aligning southeast-northwest and southwest-northeast.

Soils

The predominant soils in the New Haven area are the Crider silt loam and the Hartville silt loam, with the Haymond silt loam present along creeks. The Crider silt loam is a deep, well drained soil that is mapped in a unit on 5 to 9 percent slopes and a unit on 9 to 14 percent slopes. Permeability of the Crider soil is moderate.

The Hartville silt loam is a very deep, poorly drained soil that is present on stream terraces and foot slopes. The surface layer is typically dark greyish brown. These soils have a permeability described as slow and the organic content is moderately low.

Haymond silt loam is the predominant soil in the flood plains of creeks in the OU2/6 area. The Haymond is a very deep, well drained soil that occurs in areas with little slope. Flooding for brief periods is common for this soil. The surface layer is dark greyish-brown. The soil has a moderate permeability and organic matter content.

3.2.4 Hydrogeology

The two major aquifers in the New Haven area are the Ozark Aquifer and the Missouri River Alluvial Aquifer. Both aquifers are used extensively in Missouri for domestic, industrial, and public water supply. The Ozark Aquifer provides all domestic, industrial, and public water used in the New Haven area. Currently the Missouri River alluvial aquifer is not used for water supply in the immediate vicinity of New Haven.

The Ozark Aquifer is a thick sequence of water-bearing dolostone, limestone, and sandstone formations ranging in age from Late Cambrian to Middle Devonian. Although these units collectively are a regional aquifer, the water-yielding capacity of the various individual units is variable. Geologic units of the Ozark aquifer present in the New Haven area are the St. Peter Sandstone, Powell Dolomite, Cotter Dolomite, Jefferson City Dolomite, Roubidoux Formation, Gasconade Dolomite, Gunter Sandstone Member of the Gasconade Dolomite, Eminence Dolomite, and Potosi Dolomite.

There are two distinct bedrock flow systems within the Ozark Aquifer, a shallow flow system and a deep flow system. The shallow bedrock flow system consists of the Cotter Dolomite and the Jefferson City Dolomite. Groundwater flow through the shallow flow system is divided in the New Haven area due to a surface water divide. The shallow aquifer under OU3, OU4, and OU5 flows to the northeast towards the Missouri River and at OU2 and OU6 flow is to the south, towards Boeuf Creek. The shallow flow system consists of two sandstone beds, the Upper Sandstone and the Swan Creek sandstone, which are members of the Cotter Dolomite. With the exception of the two sandstone units, the Cotter and Jefferson City Dolomites are poor water-producing formations and typically have low vertical and horizontal conductivity from a regional scale. The deep bedrock flow system consists of the Roubidoux Formation and older geological formations, including the Gasconade, Eminence, and Potosi Dolomite. Groundwater flow through the deep flow system is to the northeast, towards the Missouri River. Most domestic wells completed in the New Haven area are open to the Jefferson City Dolomite or the top of the underlying Roubidoux Formation. The lithology of the Roubidoux Formation is highly variable and includes sandstone, sandy dolomite, dolostone, mudstone, chert, and cherty dolostone. The Roubidoux Formation is located from approximately 350 to 450 ft bgs, or 120-220 ft above MSL and is probably is the most widely used formation in the New Haven area for domestic water supply.

3.3 Land and Resource Use

3.3.1 OU1 (Front Street)

Land Use

The OU is located in the eastern part of downtown New Haven. The OU was used for commercial industrial activities from the 1950s through the 1970s and the area is currently zoned commercial. The OU is surrounded by residential and commercial property, a parking lot, the levee and Missouri River to the north, a sanitary sewer lagoon to the east, and a vacant lot/commercial property to the west. The reasonably anticipated future land use is green space or a park and additional parking spaces.

Resource Use

Groundwater at OU1 is from the Missouri River alluvial aquifer. Depth to water ranges from 8 to 28 feet (ft). The groundwater flow is generally to the north, toward the Missouri River, at a velocity of between 35 and 60 feet per year; however, the flow is highly dependent on the Missouri River water stages; thus, during high river levels, groundwater flow can reverse directions and flow south. The water contains high concentrations of iron and manganese and is considered a non-drinking water aquifer in this area. There is no surface water at OU1.

The institutional controls implemented at the OU are discussed in Section 4.1.3. These include a deed restriction, a MDNR restriction on drilling new wells in the area, and a City of New Haven restriction which controls subsurface excavations, borings, or wells within 500 feet of the flood control levee. All of OU1 is within the Special Area 3 (Figure 3) as designated by the MDNR. Per the requirements of Special Area 3, the MDNR will provide written approval for all new wells prior to construction and provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis.

3.3.2 OU2 (Industrial Drive)

Land Use

OU2 is located in New Haven, Missouri. OU2 includes the historic operations on and in the Former Kellwood Facility, located at 202 Industrial Drive, New Haven, Missouri. The facility is currently owned and operated by Metalcraft Enterprises. Historical investigative activities within OU2 revealed that there are residual levels of PCE in the soil and elevated levels in the groundwater. OU2 is located within an industrial park, in a primarily rural area. Several residences are located nearby.

Resource Use

A well survey performed by the EPA and the United States Geological Survey (USGS) in the New Haven area found detectable levels of PCE in select residential wells south of OU2. The area where PCE has been detected in residential wells is identified as OU6. Since OU2 is within Special Area 3 (Figure 3) as described in Section 4.2.3, the MDNR will provide written approval for all new wells prior to construction and provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis.

3.3.3 OU3 (Old City Dump)

Land Use

The Old City Dump (OU3) is located in the southeastern part of New Haven along the north side of State Highway 100. The Old City Dump is currently used as a yard waste/gravel storage area and compost site. The City of New Haven Public Works Department maintains OU3. The surface of the dump is currently a mixture of gravel, dirt, and occasional pieces of weathered asphalt and concrete. The area immediately north and west of the Old City Dump is covered by dense woods of deciduous trees. The topography immediately north of the dump is rugged, consisting of a steep ravine where wastes were dumped until the entire upper end of the ravine was filled to its current level. On the east side of the dump there is a gravel parking lot. The city will remain the owner of OU3 and it intends to maintain the current type of use; thus it is reasonable to expect no development will occur in the foreseeable future. OU3 is surrounded by a mixture of commercial and residential property.

Resource Use

Currently there is no surface water or groundwater use at OU3. The contaminants detected in one monitoring well, BW-03, were found in "perched" water that is moving along bedding planes and fractures in the bedrock above the water table. This is a common occurrence in limestone aquifers as infiltrating water migrates down to the water table. Well BW-03 is less than 250 feet from the Old City Dump, and it is not unusual to find that contaminants have migrated this short distance in the unsaturated zone. The fact that seeps and the intermittent creeks in the steep ravines north and east of the dump have no contaminants suggests that extensive lateral movement of contaminants is not occurring.

Several residences, in close proximity to OU3, use domestic wells as their water supply. Most domestic wells in the area target the Roubidoux Formation because it is the first unit that yields appreciable quantities of water for domestic use. Groundwater age dating in the New Haven area indicates that most water in the Roubidoux Formation (a permeable sand-rich unit about 300-400 feet deep in the area) is less than 40 years old. Given the age of water and the large amount of water produced from the Roubidoux Formation compared to shallower units, it is likely that any impacts from the dump to nearby domestic wells would already have been observed. It is extremely unlikely that wells will be installed at the Old City Dump to supply water to residents or future workers because 10 CSR 23-3.010, included in Attachment 5, requires placement of all new wells at least 300 feet from a landfill.

During investigations, nested wells were installed and all domestic wells within one-half mile of OU3 were sampled. Data from the new nested well cluster confirms the suspected direction of groundwater flow. The high conductance of water produced from the wells indicates they are properly placed and intercepting typical landfill leachate. The absence of contaminants in the four nearby domestic wells indicates that widespread groundwater contamination from OU3 has not occurred and is unlikely in the future.

3.3.4 OU4 (Maiden Lane Area)

Land Use

OU4 is a 192-acre area in the north-central part of New Haven. The current OU4 area is generally bordered on the west by Maupin Avenue, on the south by Roberta Street, and extends east of Miller Street into undeveloped land within the city limits. OU4 straddles the topographic divide between the Missouri River to the north and Boeuf Creek to the south. Topography is asymmetric with steeper slopes to the north and east along the tributaries to the Missouri River and shallow slopes to the south. Elevations range from about 690 ft MSL at the former Kellwood Research facility to less than 500 ft MSL in downtown New Haven. The OU4 boundary encompasses a plume of PCE-contaminated groundwater that extends from a source area south of Maiden Lane north to the Missouri River. Because OU4 surrounds the groundwater plume in the bedrock aquifer, OU4 actually underlies OU5 (Old Hat Factory) and OU1 (Front Street). PCE contamination emanating from OU4 migrates through the bedrock aquifer beneath OU1 and OU5. The current and historical land use within OU4 is primarily residential. Non-residential land use in OU4 includes the Assumption Catholic Church, located on a 3.8-acre parcel on the northwest corner of the intersection of Miller Street and Maiden Lane. Future land use within OU4 is anticipated to be similar to its current use.

Resource Use

Currently, there is no use of groundwater within OU4. OU4 is within Special Area 3 as described in Section 4.4.3. The MDNR will provide written approval for all new wells prior to construction and provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis. Because of the proximity of OU4 to the Missouri River valley, which serves as a drain for regional and shallow groundwater flow, the PCE detected in the shallow bedrock at OU4 is not a threat to the public supply wells W3 and W4 located south of and upgradient from OU4, or to the domestic wells outside the city limits.

3.3.5 OU5 (The Old Hat Factory)

Land Use

The Old Hat Factory (OU5) is located on a 1.9-acre parcel in a mostly residential area at the southeast corner of the intersection of Maupin Avenue (west) and Wall Street (north) just south of downtown New Haven. At the time of the initial field investigation in 2002, OU5 consisted of a three-story 14,000- ft^2 (square foot) brick building at the northwest corner of the property with an attached 12,000- ft^2 one-story metal manufacturing building to the east, and an attached 4,200- ft^2 one-story office building to the south. The south half of the parcel consisted of an asphalt parking lot. Most of the building was demolished during 2003-04 and the OU was extensively re-graded and seeded in 2005. This portion of the parcel is currently a grassed vacant lot. Future use of the property is anticipated to remain commercial.

Resource Use

Currently, there is no groundwater or surface water use at OU5. OU5 is within Special Area 3 as described in Section 4.5.3. The MDNR will provide written approval for all new wells prior to construction and provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis. However, because of the steep terrain that makes well drilling difficult, combined with the availability of city water, it is unlikely that wells would be installed at OU5 to supply water to residents.

3.3.6 OU6 (Wildcat Creek Estates)

Land Use

In 1999, PCE was discovered in a residential well approximately 2000 ft downgradient of a landfarm area located at the OU2 Kellwood Industries Site. Three additional homes were later identified as having contaminated wells. The area with contaminated residential wells has been identified as OU6. Land use within OU6 is rural and rural residential and will remain so for the foreseeable future.

Resource Use

Eleven homes within the OU6 area use residential wells for domestic water. Homes whose wells have been contaminated with PCE have been equipped with whole house water treatment systems. The purpose of the treatment systems is to provide residents with acceptable drinking water while the remediation of the OU is completed. OU6 is within Special Area 3 as described in Section 4.6.3. The provisions of Special Area 3 requires that the MDNR be consulted before construction of a new well. The MDNR will provide written approval for all new wells prior to construction and provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis.

3.4 Site History and Initial Response Activities

The Riverfront Site is contaminated with industrial chemicals, primarily chlorinated volatile organics. In 1986, MDNR began testing public-supply wells in the state for VOCs and detected the chlorinated solvent PCE in New Haven city wells W1 and W2. These wells were more than 800 ft deep. Concentrations of PCE in water samples from city well W2 increased steadily with time from the initial detection of 28 micrograms per liter (µg/L) to a maximum of 140µg/L before the well was removed from service in 1993. The concentrations of PCE in water samples from city well W1 generally were less than the federal MCL of 5 µg/L. However, since well W1 was in the Missouri River floodplain and had a prior history of bacterial contamination attributed to a poor surface casing seal, it was removed from service in 1989. In 1988 and early 1994, two additional city wells (wells W3 and W4) were installed in the southern part of the city to compensate for the loss of city wells W1 and W2. Wells W3 and W4, while completed within the same aquifer, are cased several hundred feet deeper than wells W1 and W2. Various agencies have sampled city wells W3 and W4; no PCE or other VOCs have been detected in those samples.

Results from several previous investigations resulted in the initiation of an overall remedial investigation of the Riverfront Superfund site. During 1993-94, an Expanded Site Investigation (ESI) was conducted to collect sufficient data to score the site for possible placement on the NPL. Because several unresolved questions remained after the completion of the ESI, the EPA conducted an Expanded Site Investigation/Remedial Investigation (ESI/RI) in 2000 to collect information on groundwater flow and groundwater contamination in the vicinity of city well W2.

Results from the ESI/RI were used to scope the Remedial Investigation (RI) of the site which began in 2000 as an investigation into four potential contaminant source areas (operable units) that by 2003 had expanded into six operable units. The Site and its six OUs, as shown in Figure 2, became known as the Riverfront Site. In December 2000, the PCE contamination prompted the listing of the Riverfront Superfund Site on the NPL.

The six operable units are:

OU1: Front Street
OU2: Industrial Drive
OU3: Old City Dump
OU4: Maiden Lane Area
OU5: Old Hat Factory
OU6: Wildcat Creek Estates

At the start of the EPA RI, little was known about the source of PCE to city wells W1 and W2 or the potential for future contamination of city wells W3 and W4. By 2007, the EPA had completed investigations at three of the six operable units (OU1, OU3 and OU5), installed a long-term cleanup system for soil and shallow groundwater at OU1, identified and began cleanup of a major source of the PCE at OU4 that closed city wells W1 and W2, and identified a second major PCE source area in the south part of the city at OU2, that is being addressed by the Kellwood Company as a Potential Responsible Party (PRP).

3.4.1 OU1 (Front Street)

Various industries have operated at OU1 Front Street (Figure 4) since the 1950s. The New Haven Manufacturing Company (NHMC) began operating at OU1 in the 1950s and continued operations until 1972. The NHMC used PCE as a degreasing solvent in its manufacturing operations. The EPA has confirmed that waste PCE was washed out of the south doors of the building, where it pooled in low areas along the south side of Front Street. NHMC dissolved as a Missouri corporation in 1975. From 1983 to 1989, Riverfront Industries operated at OU1. Since 1989, OU1 has been occupied by Transportation Specialists, Inc. (1989 - 1993), who did not use PCE, and by Wiser Enterprises, Inc. (1997 – 2004).

The EPA began a RI in June 2000 and focused this effort at OU1 (Front Street), and OU3 (Old City Dump). A feasibility study (FS) for both areas began in the summer of 2002. During July 2000, the EPA conducted an emergency removal action at OU1 to replace a PCE contaminated water line that ran beneath Front Street. The polyethylene water line, which was permeable to PCE, allowed PCE contamination at OU1 to infiltrate the water supply line in this segment. The polyethylene water line was replaced with a steel line. During the removal action, the EPA removed near surface (less than 8 feet deep) PCE-contaminated soils along the water-line corridor and in adjacent soils. These soils were some of the most contaminated soils at the OU with PCE concentrations as high as 6,200,000 micrograms per kilograms (µg/kg). About 300 cubic yards of PCE-contaminated soil, containing an estimated PCE mass of about 70 kilograms (kg), were excavated during this removal action. In addition to mitigating the PCE contamination in the water line, the removal action provided a corridor of clean soil surrounding the water line beneath Front Street and adjacent areas.

The Record of Decision (ROD) to address soil and groundwater contaminated with PCE and other VOCs at OU1 was signed in September 2003.

3.4.2 OU2 (Industrial Drive)

Beginning in 1973, the Kellwood Company location at 202 Industrial Drive began operating a tube mill and metal fabrication operation, where small diameter aluminum tubing was made from aluminum coils and where aluminum was cut, swaged, bent, and hole-punched (Figure 5). Kellwood's operations on Industrial Drive were sold to American Recreation Products, Inc. (ARP), an independent company, on September 30, 1985. In November 1988, Kellwood bought ARP. In March 1989, ARP sold the facility to Metalcraft Enterprises.

In approximately 1990, the MDNR notified ARP and Kellwood Company that a former employee had stated that at some period during the operation of the tube mill, one or more employees of the tube mill disposed of cleaning solvent containing PCE or trichloroethene (TCE) on the City-owned property just to the north of 202 Industrial Drive. In April 1994, Kellwood and MDNR entered into an agreement to remediate the soils on the city-owned property north of the Former Kellwood facility and to monitor groundwater. In accordance with this plan, soils with concentrations of PCE exceeding 380,000 μg/kg were excavated and sent to an off-site incinerator. To meet the remedial objective of reducing levels of PCE and its degradation products in the soil to a concentration of 1,000 μg/kg or below, the remaining soil was land-farmed to maximize volatilization. This work was completed by Geotechnology under contract to Kellwood. In addition, Kellwood contracted Geotechnology to install a French drain system between the landfarm and the current Metalcraft facility and install three monitoring wells, MW-101, MW-102, and MW-103 north of the former Kellwood facility. As part of the 1995 agreement with MDNR, municipal well W3, the French drain system, and the three monitoring wells north of the Former Kellwood Facility (MW-101, MW-102, and MW-103) were sampled on a quarterly basis until March 2004. In June 2004, MDNR approved the written request from Kellwood to end the 1994 monitoring agreement, with the understanding that sampling of these wells would be continued as part of the RI.

In 1999, following the land-farming activities, a Phase I and Phase II environmental site assessment was performed by EMA on behalf of a prospective purchaser on properties near the landfarm area. PCE was detected in two downgradient monitoring wells, MW-2, MW-2A, and in MW-4, which is a well located approximately 600 feet southwest of the landfarm area. The EPA tasked the U.S. Geological Survey (USGS) for technical assistance in understanding the hydrogeology and PCE migration in the New Haven area. EPA subsequently asked USGS for further assistance in conducting a remedial investigation. Between 1999 and 2002, USGS installed groundwater monitoring wells, and collected soil, groundwater, residential well water, sediment, surface water, and tree core samples near the Former Kellwood facility. PCE was detected in each of these media.

The shallow groundwater in portions of OU2 contains PCE above the MCL of 5 μg/L. Based on current information, OU2 is not suspected to have been a source of contamination for city wells W1 and W2. City well W3 is located 1,000 feet north of the Former Kellwood Facility. Quarterly sampling performed from 1994 to date at W3 has not shown any contamination.

A Remedial Investigation (RI) of OU2 and OU6 was completed in June 2010 to fulfill the requirements of the Administrative Order on Consent, Docket No. CERCLA-07-2004-0078 (AOC) entered into by the EPA with Kellwood Company dated March 22, 2004. The RI included a number of field activities, followed by completion of a baseline human health risk assessment. The primary RI work tasks were a soil investigation, groundwater investigation, DNAPL investigation, sediment and surface water investigation, sanitary sewer investigation, and soil vapor sampling. The RI results for OU2 are provided below. The RI results specific to OU6 are discussed in Section 3.4.6.

Summary of the RI Results (OU2 specific results)

- Groundwater is the primary media of concern. The extent of impacts to the south of OU2 could not be determined using monitoring wells, due to lack of access; however, it appears that shallow groundwater discharges to Wildcat Creek.

• PCE was detected in wells north and northeast of OU2. It is possible that the PCE in these wells did not originate at OU2, as they are upgradient, up-dip, and up the slope of the top of bedrock.

• The results of the RI for OU2/6 indicate that PCE is present on the open lot north of the former Kellwood facility. The most highly impacted soils on the lot were removed for incineration in the early 1990s. However, soils containing PCE are present on the vacant lot, beneath Industrial Drive, and beneath the floor of the former Kellwood facility.

• PCE is present as a DNAPL in the shallow bedrock immediately north and northwest of the former Kellwood facility.

• Chemicals of Potential Concern (COPCs) detected in the OU2 soils and shallow groundwater were evaluated for the indoor air exposure pathway. Indoor air exposure concentrations were estimated from the soil and groundwater concentrations using EPA's (2004c) version of the Johnson Ettinger model. This model is a one-dimensional, analytical solution to passive diffusion and convective vapor-transport through the vadose zone and consists of the following two components: (1) diffusion through the unsaturated zone, and (2) convective and diffusive transport into a building. PCE was the only VOC identified as a COC in soils and groundwater for the indoor air exposure pathway.

• Five soil gas vapor samples were collected near neighboring New Haven High School. One VOC (PCE) was detected in one soil gas sample, but the concentration was below the EPA industrial air screening level and MDNR target levels for both residential and nonresidential use.

• A Human Health Risk Assessment (HHRA) was conducted for OU2 and OU6 as part of the Remedial Investigation. The risk assessment results are included in the 2010 RI Report and are summarized in Section 3.5.2 of this FYR.

Following the RI Report, a feasibility study was completed in August 2010, and in 2011, EPA issued the final ROD for OU2 and OU6. The remedial action selected for OU2 and OU6 addresses contaminated soil and DNAPL contamination in the fractured bedrock in the OU2 source area and the dissolved phase contamination in the groundwater within the unconsolidated deposits in OU6, downgradient of the source area. The site history and initial response activities for OU6 are discussed in Section 3.4.6. Additionally, the vapor intrusion pathway at the Metcraft building was further addressed in 2010 and 2011, and the results were reported in the 2011 reports by Parsons, a contractor to Kellwood.

3.4.3 OU3 (Old City Dump)

During the period of the mid-1950s through the early 1970s, the old city dump (Figure 6) operated under private ownership and was used as a community dump for domestic and industrial wastes. During its operation, hundreds of drums of industrial waste including industrial dyes and flammable solvents were reportedly placed in the dump. Reports also indicate that the liquid contents of the drums were burned in a pit onsite. The dump was closed in 1972 when the land was purchased by the City of New Haven. After its closure, the City of New Haven used the dump for disposal of demolition debris and yard waste.

During the RI at OU3, monitoring wells and a seep were sampled. Additional samples were collected from trees and seeps along the dump face and from streams and springs near the dump. Water samples were collected from a bedrock monitoring well (OU3-BW-03). Domestic wells near OU3 were also inventoried and sampled during the RI.

During the ESI and RI, a total of 22 trees and 4 seeps were sampled on and along the slopes of OU3. All four seeps were screened for the presence of PCE and other VOCs using the portable gas chromatograph.

There are no source materials or DNAPL in the groundwater constituting a principal threat at OU3. Only trace concentrations of PCE (0.23 to 1.10 µg/kg) were found in three tree-core samples. None of the samples from the domestic wells or springs contained detectable concentrations of PCE. Only trace amounts of PCE (below the MCL) were detected in a monitoring well, one stream sample, and one seep sample. The ROD to address PCE contamination at OU3 was signed in September 2003.

3.4.4 OU4 (Maiden Lane Area)

The OU4 subsite is shown in Figure 7. During the 1980s and 1990s, after two public supply wells for the City of New Haven were found to be contaminated with PCE, the MDNR and the EPA investigated to determine the source of the contamination. In 1998, the EPA requested that the USGS provide technical assistance in understanding the hydrogeology of New Haven. From 2000 to 2002, the USGS conducted an ESI and RI. The investigation included installation of bedrock monitoring wells upgradient of the two contaminated City wells. By 2005, the monitoring well investigation led to a focus on an area around Maiden Lane. At that time, EPA was concerned that PCE disposed of into the City sewer system at OU2 may have leaked from the sewer lines around Maiden Lane and created the PCE plume. However, based on sampling various media (soils, tree cores, indoor vapor from homes, sewer water, surface water, and groundwater) and from discussions with residents, the investigation found that the contamination source was likely the result of a private citizen disposing of significant amounts of PCE into his home's grey water (sewer) line. The sewer line discharged into a low area south of Maiden Lane, and from this point, the PCE migrated through the soils, into the bedrock, and then into the bedrock aquifer.

The PCE soil contamination is nearly all confined to this small, less than 0.2 acre area south of Maiden Lane. The groundwater plume extends from the shallow groundwater at the soil-rock interface below the source area soils, through the bedrock to the north, and possibly as far as the Missouri River. Groundwater contamination also extends slightly south of the soil source area, due to local topography. Overall, the PCE plume extends from the source area to city well W1, approximately 3,800 ft downgradient, to city well W2, approximately 3,000 ft downgradient, and likely to the Missouri River, approximately 4,000 ft downgradient.

The time critical removal action conducted by EPA at OU4 in 2007 consisted of the injection of sodium permanganate into the Maiden Lane contaminant source area. While this action resulted in the breakdown of some of the PCE into its nonhazardous constituents, the sampling data indicate that contaminants remain in the soils and that such contaminants continue to mobilize into the shallow aquifer and migrate. Because of the proximity of OU4 to the Missouri River valley, which serves as a drain for regional and shallow groundwater flow, the PCE detected in the shallow bedrock at OU4 is not a threat to the public supply wells W3 and W4 located south of and upgradient from OU4 or to the domestic wells outside of the city limits.

The ROD for OU4 to address soil and groundwater contaminated with PCE and other VOCs at OU4 was issued in March 2009.

3.4.5 OU5 (Old Hat Factory)

The OU5 subsite is shown in Figure 8. The initial pre-RI EPA investigation of the old hat factory was limited because interviews with former employees during previous MDNR and EPA investigations did not indicate use of PCE at the facility. The pre-RI investigation consisted of a site reconnaissance and the installation of a single monitoring well that was expected to “rule out” the old hat factory as a possible source of the PCE contamination. However, water samples collected in 2002 from the BW-09A borehole during drilling and from the completed well contained PCE concentrations ranging from 49 to 140 µg/L. Because the old hat factory was within 600 ft and upslope of both contaminated city wells (W1 and W2), the detection of PCE in samples from monitoring well BW-09A caused concern that the facility could be a potential source of the PCE contamination in the closed city wells. The old hat factory was designated OU5 of the Riverfront Superfund Site in mid-2002 and a RI was initiated. The primary contaminants at OU5 are PCE and its degradation products such as TCE, cis-1,2-dichloroethene (cis-DCE), and vinyl chloride (VC). A monitoring well network was established to confirm groundwater contamination and to determine if OU5 was the source of groundwater contamination for the impacted city wells W1 and W2. Although elevated concentrations of PCE were found in groundwater, and low levels of PCE were found in soils, it was determined that OU5 was not the source of contamination at the impacted city wells. An RI/FS was conducted and completed in June 2006.

The ROD addressing PCE contamination at OU5 was completed in December 2006.

3.4.6 OU6 (Wildcat Creek Estates)

Contamination from OU2 may have affected select private wells to the south in OU6 (Figure 5). PCE well above the MCL was discovered in residential wells approximately 2,000 feet down gradient from the land-farm area located at the OU2 Kellwood Site. A removal action conducted under an Administrative Order of Consent (AOC) dated March 26, 2002, provided whole-house filtration units for PCE-contaminated residential wells in OU6. Pursuant to the Order, the whole-house filtration units are sampled quarterly to ensure residents are not exposed to contaminated groundwater.

Kellwood began the investigation of OU2 and OU6 with the voluntary Residential Well Investigation (RWI). The RWI addressed residential wells south of OU2, which are collectively defined as OU6 of the Riverfront Superfund Site. The Interval Screening Phase of the RWI was completed between July and August 2004. In addition, two monitoring well clusters (MW1 and MW2) were installed south of OU2 between September and November 2004.

A Remedial Investigation (RI) of Operable Units OU2 and OU6 was completed in June 2010 to fulfill the requirements of the Administrative Order on Consent, Docket No. CERCLA-07-2004-0078 (AOC) entered into by the EPA with the Kellwood Company, dated March 22, 2004. The RI included a number of field activities, followed by completion of a baseline human health risk assessment. The primary RI work tasks were a soil investigation, groundwater investigation, DNAPL investigation, sediment and surface water investigation, sanitary sewer investigation, and soil vapor sampling.

<u>Summary of the RI Results (OU6 specific results)</u>

- Groundwater is the primary media of concern. The extent of impacts to the south of the subsite could not be determined using monitoring wells, due to lack of access; however, it appears that shallow groundwater discharges to Wildcat Creek.

• PCE is present in groundwater in the overburden near the bedrock interface and in the upper sandstone marker bed/uppermost bedrock south and west of the former Kellwood facility. This PCE appears to be migrating to the south and west. The potential exists for PCE to move downward to lower intervals through open boreholes; wells with poor seals or degraded casings; or through natural discontinuities in the rock .

• The primary risk for PCE to migrate to the lower Jefferson City/Roubidoux permeable zone is from wells with long open intervals. These wells may compromise the intervening strata, which would limit downward vertical migration of groundwater. Such risks have been addressed through the existing state well construction rules, and lining repairs of selected residential wells.

• Most of the groundwater flowing through the overburden and in the upper sandstone marker bed/uppermost bedrock interval is expected to discharge to the 500 and 600 tributaries, Wildcat Creek, and Boeuf Creek either as diffuse flow or in small springs. PCE in surface water is expected to volatilize to the atmosphere within a short distance downstream.

• Samples were collected from 31 residential wells located generally south of the former Kellwood facility in February through May 2008. PCE has been detected in several domestic wells south and southwest of the former Kellwood facility. The domestic wells that have been affected by PCE appear to be related to short-circuiting by an open well borehole. Domestic wells with VOCs above MCLs have whole-house water treatment units to remove VOCs from the water and achieve the MCLs.

• A Human Health Risk Assessment (HHRA) was conducted for OU2 and OU6 as part of the Remedial Investigation. The risk assessment results are included in the 2010 RI Report and are summarized in Section 3.5.6 of this FYR.

Following the RI Report, a feasibility study was completed in August 2010, and in 2011, EPA issued the final ROD for OU2 and OU6. The remedial action selected for OU2 and OU6 addresses contaminated soil and DNAPL contamination in the fractured bedrock in the OU2 source area and the dissolved phase contamination in the groundwater within the unconsolidated deposits in OU6 downgradient of the source area.

3.5 Basis for Taking Action

3.5.1 OU1 (Front Street)

The basis for action was to prevent human health risks from occurring due to future exposures to contamination found in groundwater and soil.

There were no current risks identified from groundwater at the time of the OU1 ROD since all residences and businesses were on city water. The potential future use of groundwater as a potable source resulted in significant risks. The primary COCs were TCE and PCE. VC and benzene also contributed to the estimated risks.

There were no current risks identified from contaminated surface soil at the time of the ROD. Significant risks were estimated for future exposure should the floor slab be removed without capping or covering the soil underneath. The primary COCs for future estimated risks were benzo(a)pyrene, arsenic, and PCE. Other COCs contributing to the overall estimated risk from the soil were benzo(b)fluoranthene, benzo(a)anthracene, indeno(1,2,3-cd)pyrene, TCE, and VC. There were no current exposures to subsurface soil COCs at OU1. In characterizing future excavation into contaminated soil, arsenic and PCE were found to be the primary COCs.

A screening-level Ecological Risk Assessment (ERA) was conducted to assess the potential for the existence of ecological receptors and pathways between those receptors and the COCs associated with the Riverfront Site as a whole. There was not a separate ERA done for OU1 specifically. The ERA for the Riverfront Site found that OU1 poses minimal risk to ecological receptors and determined that a follow-up Baseline ERA was not needed.

3.5.2 OU2 (Industrial Drive)

The basis for action was to prevent human health risks from occurring due to future exposures to contamination found in soils and groundwater.

A Baseline ERA was completed for the Riverfront Site as a whole in July 2002, which included areas within OU2 and OU6. PCE detections in surface water samples collected from Boeuf Creek and its tributaries were below the EPA Region 3 ecological screening benchmark. Since, no other site-related compounds were detected above their respective screening levels in the surface water samples collected from Beouf Creek or its tributaries, or in other media sampled at the site, no further ecological investigations or assessments were recommended.

A Human Health Risk Assessment (HHRA) was conducted for OU2 and OU6 to evaluate potential impacts to human health posed by chemical constituents in the soil, groundwater, surface water, and sediments. Based on the results of the risk assessment, remedial actions were required for OU2 and OU6. The risk assessment results for OU2 and OU6 are included in the 2010 RI Report. Following are the results associated with OU2:

- The total cancer risk and total hazard index values presented in Section 3.4.2 exceed the CERCLA risk range of E-04 (1 in 10,000) to E-06 (1 in 1,000,000) and the CERCLA protective level of 1 for potential future residents in OU2 where DNAPL is present and near the former Kellwood facility. Exposures include incidental ingestion, inhalation, dermal contact with contaminated soil, inhalation of indoor air (volatilizing from either soil or groundwater), and ingestion of groundwater from a future drinking water well. Locations where concentrations of PCE exceed target concentrations are underneath and immediately adjacent to (north and west of) the former Kellwood facility (soil) and south and southwest of the former Kellwood facility (groundwater). Current zoning of this area, and the reasonably anticipated future land use for this area, is commercial/industrial.

- The total cancer risk is within the target risk range for residents living near the former Kellwood facility (but away from the DNAPL contamination) via inhalation of indoor air (volatilizing from groundwater). The total hazard index is below target levels.

• For the industrial indoor worker, the risk is from PCE in soil and groundwater volatilizing to indoor air. The total cancer risk and total hazard index exceeds target ranges for industrial workers through inhalation of indoor air in the area where DNAPL is present underneath and north of the former Kellwood facility (soil), and south and southwest of the former Kellwood facility (groundwater).

• The results of the comparison of soil gas samples collected near the high school show that PCE, the only detected constituent (and only detected at location SVI-5), exceeds EPA's residential air screening level but is below EPA's industrial air screening level and all specified MDNR target levels for both residential and nonresidential use. Given that the exposure assumptions for a teacher/administrator/janitorial scenario would be similar to an industrial worker scenario, further evaluation of the teacher/administrator/janitorial receptor group is not warranted at this time. Further evaluation of a student scenario is also not warranted since a student's exposure would be even less than that of a teacher or a typical residential scenario.

3.5.3 OU3 (Old City Dump)

The basis for action at OU3 was to prevent future human health risks from occurring due to exposures to contamination found in groundwater and seeps. There were no current risks identified for OU3. Future potential risks were characterized assuming residential and commercial uses of contaminated groundwater, with seep water concentrations representing the exposure point concentrations for the COPCs - antimony, boron, manganese, nitrate, and PCE. The primary risk drivers were determined to be antimony, boron, and nitrate in the residential use scenario. For monitoring purposes, however, Applicable or Relevant and Appropriate Requirements (ARARs) and/or To-Be-Considered Guidelines (TBCs) were listed in the ROD for all COPCs evaluated. A screening-level ERA was conducted to assess the potential for the existence of ecological receptors and pathways between those receptors and the COCs associated with the Riverfront Site as a whole. There was not a separate ERA done for OU3 specifically. The ERA for the Riverfront Site found that OU3 poses minimal risk to ecological receptors and determined that a follow-up Baseline ERA was not needed.

3.5.4 OU4 (Maiden Lane Area)

A Human Health Risk Assessment was completed in 2008 to evaluate potential impacts to human health posed by chemical constituents in the soil, groundwater, surface water, sediments, sewer, outdoor air, and indoor air. Based on the results of the risk assessment, remedial actions were required for the soil and groundwater at OU4. The results are as follows:

- For total soil (surface and subsurface soil combined), PCE is at levels that present an unacceptable cancer risk and noncancer hazard to future residents at OU4. PCE is also at levels in OU4 soil that present a cancer risk to current/future industrial workers.

- In OU4 groundwater, PCE and TCE are at levels that present an unacceptable cancer risk to future residents. In addition, cis-I,2-dichloroethene, PCE and TCE are at levels in groundwater that present a noncancer hazard to future residents.

A screening-level ERA was conducted to assess the potential for the existence of ecological receptors and pathways between those receptors and the COCs associated with the Riverfront Site as a whole. There was not a separate ERA done for OU4 specifically. The ERA for the Riverfront Site found that OU4 poses minimal risk to ecological receptors. A May 2008 review of surface water sample results indicated that PCE concentrations in the OU4 tributaries did not exceed ecological screening values.

The ROD was signed in March, 2009. An interim remedial action consisting of injecting in- situ chemical oxidation (ISCO) into the soil was conducted in 2007. The remedial design is complete and implementation of the remedy is ongoing.

3.5.5 OU5 (Old Hat Factory)

The basis for remedial action at OU5 was to prevent future human health risks from occurring due to exposures to contamination found in groundwater.

There were no current risks identified from contaminated soil, vapors, or groundwater at OU5. Future potential risks were characterized and found to be significant, only if residential and commercial uses of groundwater occurred. The calculated risk estimates for the future resident exposure and future occupational worker, 1.3 E-03 and 1.6 E-04 respectively, exceed the CERCLA risk range of E-04 to E-06. PCE was the primary risk driver, and carbon tetrachloride and chloroform were identified as also contributing to significant risks. The cumulative noncancer HI was 2.1.

A screening-level ERA was conducted to assess the potential for the existence of ecological receptors and pathways between those receptors and the COCs associated with the Riverfront Site as a whole. There was not a separate ERA done for OU5 specifically. The ERA for the Riverfront Site found that OU5 poses minimal risk to ecological receptors and determined that a follow-up Baseline ERA was not needed.

3.5.6 OU6 (Wildcat Creek Estates)

The basis for action was to prevent human health risks from occurring due to future exposures to contamination found in groundwater.

A screening level ERA was completed for the Riverfront Site in July 2002. PCE detections in surface water samples collected from Boeuf Creek and its tributaries were below the EPA Region 3 ecological screening benchmark. Since, no other site-related compounds were detected above their respective screening levels in the surface water samples collected from Beouf Creek or its tributaries, or in other media sampled at the site, no further ecological investigations or assessments are recommended at this time.

A Human Health Risk Assessment (HHRA) was conducted for OU2 and OU6 to evaluate potential impacts to human health posed by chemical constituents in the soil, groundwater, surface water, and sediments. Based on the results of the risk assessment, remedial actions were required for OU2 and OU6. The risk assessment results for OU2 and OU6 are included in the 2010 RI Report and are summarized below:

• The total cancer risk and total hazard index exceed the target ranges for residents in OU6 using groundwater as drinking water prior to any treatment. The total cancer risk and total hazard index resulting from exposure to COCs in deep groundwater used as tap water prior to treatment for a current/future residential groundwater user living in OU6 were calculated to be 3.3 E-03 and 1.9. The risk is primarily driven from the ingestion of PCE in deep groundwater. With treatment at the affected homes, the human health risk assessment indicated that for ingestion of groundwater by hypothetical residents, the total cancer risk was within the acceptable risk range, and the hazard index was below target levels.

• The indoor pathway was evaluated for the shallow groundwater for the residents in OU6. Using the maximum detected groundwater concentration in the wells south of OU2 and within OU6, an indoor air concentration was calculated using the Johnson and Ettinger model, and one COPC (PCE) was identified for the groundwater to indoor air pathway for residents in OU6. The total cancer risk associated with inhalation of PCE was within the acceptable risk range and the hazard index was below target levels.

• The extent of impacts in groundwater has been adequately defined, and groundwater exposure risks have been addressed through the existing state well construction advisory, repairs to selected residential wells, and installation of whole house filtration systems.

• There are currently no ecological risk concerns related to surface water and sediment.

4.0 Remedial Actions

4.1 OU1 (Front Street)

4.1.1 Remedy Selection (OU1 Front Street)

The ROD for OU1 was signed on September 30, 2003. The remedial action for OU1 addresses both soil and groundwater contaminated with PCE and other VOCs. To remove the potential threat to human health, ICs were implemented to prevent exposure to the contaminated shallow aquifer and contaminated soil. Monitoring and limited treatment of the soil and groundwater contamination were also conducted. The key components of the OU1 remedy include:

- The implementation of ICs in layers enhance the protectiveness of the remedy. The primary form of IC is a proprietary control, specifically, a restrictive covenant and easement.

- One Advanced Remedial Technology (ART) well was installed. The ART well was designed to use in-situ physical treatment to remediate the soils in the location of the highest soil contamination, and to treat the leading edge of the groundwater plume.

- Groundwater monitoring will be conducted on a periodic basis. The monitoring will include sampling of monitoring wells and the ART well. The results from the first two years of sampling were used to establish ACLs (described below) for the groundwater COCs. Sampling parameters include VOCs and geotechnical parameters.

- Surface water and sediment samples were collected from the Missouri River in 2006, 2007, and 2009, prior to the first five-year review. Since the ACLs for VOCs were not exceeded during the sampling events, the Missouri River sampling was discontinued in 2009 after the first five-year review report.

RAOs provide a general description of what the response action is expected to accomplish. The Remedial Action Objectives (RAOs) for OU1 are to:

• prevent use of groundwater with contaminant levels exceeding MCLs as a drinking water source;

• prevent further degradation of the groundwater below the OU and in the plume; and

• prevent exposure to soil with contaminant concentrations which result in an excess cancer risk greater than 1E-06 or a non-cancer hazard index greater than 1.

The EPA generally seeks to return usable groundwater to beneficial use whenever practicable. When contaminated groundwater is currently or potentially used as a drinking water source, EPA typically selects a remedy that will restore the groundwater to achieve MCLs and non-zero Maximum Contaminant Level Goals (MCLGs) established under the Safe Drinking Water Act. Under limited circumstances specified in CERCLA, ACLs may be used instead of drinking water standards (typically, MCLs or MCLGs). The use of ACLs allows flexibility in establishing groundwater cleanup levels under limited circumstances.

After the completion of the FS, the EPA and MDNR continued to explore existing and innovative mechanisms for addressing contamination at OU1. One such mechanism, the use of ACLs, was incorporated into an additional alternative that became the preferred alternative for OU1.

The use of ACLs requires that three statutory criteria be met; these criteria are:

1) The contaminated groundwater has “known or projected points of entry to a surface water body”.
2) There must be no “statistically significant increases” of contaminants in the surface water body at those points of entry, or at points downstream.
3) It must be possible to reliably prevent human exposure to the contaminated groundwater through the use of ICs.

After two years of monitoring, the EPA determined that conditions at OU1 meet the criteria to support the use of ACLs. The following information documents this finding:

Criterion1: Extensive sampling performed during the RI and during subsequent field investigations has defined the contaminant plume boundary with a high degree of confidence. The contaminated groundwater plume originating at the Front Street OU (Figure 4) flows to the northeast approximately 600 feet where it enters the Missouri River. At the widest cross-section, just before entering the Missouri River, the plume attains a maximum width of about 300 feet. The “core” of this plume, which contains PCE concentrations above 500 µg/L, is bound by monitoring wells OU1-TW-C and OU1-TW-H. Substantial microbial degradation of PCE occurs within the plume, PCE concentrations decrease down the plume axis, and concentrations of degradation products such as cis-DCE, VC, and ethene increase. The RI determined that in the more than 30 years since the last known use of PCE at the facility, the contaminant plume has reached steady-state conditions, and concentrations within the plume will remain at their present levels or decrease as the result of degradation processes within the aquifer.

Criterion 2: During the RI, surface water and bed-sediment samples were collected upstream from the Missouri River, within the river, and downstream of the “known or projected” point of entry of the contaminant plume into the river. The water samples were collected from the bottom of the river during a low stage to maximize the potential for detecting the contaminant plume discharge. None of the water or bed-sediment samples contained detectable concentrations of PCE or its degradation products. A conservative analysis determined the maximum impact that the plume (the contaminated shallow aquifer) could have on the Missouri River water quality. The analysis conservatively assumed that the highest contaminant concentration detected in the core of the plume (11,000 µg/L PCE) discharges directly into the Missouri River. This concentration is several orders of magnitude larger than the maximum concentration detected within the groundwater plume in the discharge area along the Missouri River. The analysis further assumed that this plume discharges continuously for a distance of 400 feet along the Missouri River, and that the contaminated water entering the river does not mix with the overlying water. In fact, turbulent conditions at the base of the river would actually result in instantaneous mixing with thousands of cubic feet of surrounding river water, even during low flow conditions. Using these extremely conservative assumptions, the analysis concluded that the maximum PCE concentration that could occur at the downstream limit of the discharge zone in the Missouri River would be 1.2 µg/L, well below the drinking water MCL value and the Missouri Water Quality Standard for protection of aquatic life, which is 5 µg/L. The non-detections of PCE and its degradation products in the river samples collected during the RI confirm the conservative nature of the analysis and support the “no statistically significant increase” in contaminant concentrations criteria required for the use of ACLs.

Criterion 3: In-place measures preventing exposure, supplemented with additional institutional controls, prevent future exposure to contaminated groundwater associated with OU1. The flood protection levee surrounding downtown New Haven is owned by the City, but was constructed by the USACE using federal funds. The City is responsible for maintenance of the levee and ensuring that stringent guidelines for construction and other activities near the levee are followed. To maintain annual certification of the levee’s integrity from the USACE, the City must ensure compliance with guidelines that include controlling subsurface excavations, borings, and the installation of wells within 500 feet of the back of the levee. Before any such activities occur, the City and USACE must review a written plan of the activity. The USACE provides technical comments, and the City is responsible for approving or disapproving the plan and ensuring that the USACE guidelines are followed. The City public works department is responsible for oversight of subsurface activities near the levee. The Front Street OU is located in a highly visible area of downtown New Haven, near municipal offices and facilities; thus, any subsurface activities conducted at OU1 would presumably be readily observable and hence controllable. The City has a large financial interest in monitoring subsurface activities near the levee because if the USACE guidelines are not followed, the levee risks losing USACE certification, which would severely affect flood insurance rates in the area.

In accordance with the ROD, the first two years of sampling results from the downgradient wells completed in May 2007, along with the RI results, were used to determine the ACLs. The ACLs were set at one order of magnitude (times 10) above the highest concentration detected by the end of the second year of sampling.

ACLs for OU1 Downgradient Wells

Contaminant	Alternate Concentration Value (µg/L)
PCE	11,000
TCE	8,600
c-DCE	140,000
t-DCE	6,700
VC	9,000

4.1.2 Remedy Implementation (OU1 Front Street)

The active treatment portion of the remedial action was the installation of one Advanced Remedial Technology (ART) treatment well. The ART technology is a proprietary technology supplied by a single vendor. The ART well uses in-situ physical treatment (in-well aeration and pumping/air-stripping for groundwater, soil vapor extraction for soils) to remediate contaminated groundwater and soils. Based on the RI groundwater and soil sampling results, the ART well was installed at the source area of the groundwater plume. The leading edge of the plume is very near, but not directly below, the location of the highest soil contamination found in the RI. The ART well's location was a compromise to maximize the combined remediation of groundwater and soil. Installation of the ART well was completed in February 2005. The system became operational in May of 2005. Samples of the vapor from the ART system were collected on June 2, 2005 to determine if treatment of the vapor released from the ART system would be required to meet the MDNR emission standards. The results indicated that treatment of the vapor would not be required.

Three additional monitoring wells and two piezometers were installed to comply with the monitoring requirements in the ROD. One monitoring well was installed in the northeast (downgradient) portion of the OU1 source area to measure the effectiveness of the ART well's treatment. The two piezometers (one shallow and one deep) were installed within 5 feet of the ART well to measure the flow through the ART well. The other two monitoring wells were installed downgradient from the ART well to monitor the contaminant plume just before it enters the River to determine compliance with the ACLs. All wells had to comply with the guidelines established by the USACE for protection of the flood control levee. Installation of the monitoring wells was completed in March of 2005.

4.1.3 Institutional Controls (OU1 Front Street)

ICs were implemented at OU1 in layers to enhance the protectiveness of the remedy. The primary form of institutional proprietary control is an environmental covenant and easement. This form of proprietary control was selected as it is effective as an informational device and creates a readily enforceable legal property interest.

The EPA sought the imposition of an environmental covenant and easement on OU1 by the landowner. The MDNR was named the grantee of this environmental covenant and easement and has enforcement authority. The EPA was named as a third-party, or intended beneficiary, in this instrument so that EPA also has the ability to enforce the terms of the environmental covenant and easement.

The objectives of imposing an environmental covenant and easement on OU1 were to eliminate or minimize exposures to contamination remaining at OU1 and to limit the possibility of contamination migration. These objectives were achieved by use of the environmental covenant and easement as it: (1) provided notice; (2) limited use; and (3) provided federal and state access. Specifically, the environmental covenant and easement achieved this by:

- providing notice to prospective purchasers and occupants that there are contaminants in soils and the groundwater;

- ensuring that future owners are aware of any engineered controls put into place as part of this remedial action;

- prohibiting residential, commercial and industrial uses of land and groundwater, except those uses which would be consistent with the remedial action;

• limiting the disturbance of contaminated soils;

• prohibiting the placement of groundwater wells;

• prohibiting other ground penetrating activities which may result in the creation of a hydraulic conduit between water bearing zones;

• providing access to EPA and MDNR for verifying land use;

• prescribing actions that must be taken to install and/or maintain engineered controls (if applicable); and

• providing access to EPA and MDNR for sampling and the maintenance of engineered controls.

The primary form of IC implemented was a Protective Purchaser Agreement (PPA) between the United States, the State of Missouri, and the Industrial Development Authority of the City of New Haven (IDA). This PPA was filed in February 2004 with the EPA Region VII Hearing Clerk under Docket No. CERCLA-07-2004-0004 (Attachment 5). Pursuant to the PPA, the IDA agreed to, among other things:

• only use the site for surficial uses,

• not conduct any activities which would disturb contaminated soils at the site, and

• not place any groundwater wells at the site or otherwise penetrate the groundwater bearing unit(s) at the site.

Pursuant to the PPA, the IDA also granted to EPA and the MDNR access to OU1 for sampling, monitoring, or the implementation of response actions, and agreed to provide actual notice to any successors-in-interest or lessees of the site of any activity and use limitations on the site. A copy of the PPA was also recorded by the IDA with the Franklin County Recorder of Deeds.

Other implemented ICs include:

- OU1 was included in Special Area 3, as defined in 10 CSR 23-3.100(7), which requires consultation with the MDNR before construction of any new well in Special Area 3 (Figure 3 and Attachment 5). The MDNR will provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis. The MDNR will provide written approval for all new wells prior to construction. Special Area 3 was designated on April 30, 2006.

- The City provides oversight of the area around the flood protection levee. The flood protection levee surrounding downtown New Haven is owned by the City, but was constructed by the USACE using federal funds. The City is responsible for maintenance of the levee and ensuring that stringent guidelines for construction and other activities near the levee are followed. To maintain annual certification of the levee's integrity from the USACE the City must ensure that certain guidelines are followed; these include controlling subsurface excavations, borings, and the installation of wells within 500 feet of the back of the levee. This 500-foot area includes all of OU1.

4.1.4 System Operation/Operation and Maintenance (OU1 Front Street)

The ART well was only partially functional during the first FYR period and has not been fully operational since 2008. In October of 2008 the ART treatment well was shut down due to an oil leak in the compressor and the pump was not operating properly. Previously, iron-fouling and scale had resulted in decreased flow and was likely responsible for the pump issues. In the Fall of 2009, the pump was not operational and the air sparge (AS) compressor was still not functional due to the oil leak. When functional, the sparge well was receiving 10 standard cubic feet per minute (scfm) of 50 pounds per square inch (psi) air. This pressure is excessive for this application, as the necessary pressure to overcome hydraulic head is less than 5 psi. The reason for the compressor failure has not been diagnosed, however, pressure build-up due to screens clogged with precipitation and/or iron-fouling bacteria and scale could be responsible. By the Fall of 2010, the pump portion of the system was still not functional but both the compressor for the AS and the vacuum blower for the SVE were re-started. However, the AS compressor would not stay operational and shut down after a few hours of operation.

Operational data was not available for the SVE system, however the October 2010 air analytical data confirmed low concentrations of VOCs. The SVE portion of the system ran from September 2010 to February 2011. Estimated pounds of VOCs removed were 0.8 lbs. The ART system subcontractor attempted to make the final adjustments to the regulating valve for the ART system compressor on February 3, 2011, but found that the compressor's drive belt had failed. The new compressor drive belt was installed in April 2011, however, the pneumatic loading valve could not be adjusted resulting in the compressor starting and stopping approximately every four minutes by its internal pressure set points. In May 2011, the pneumatic loading valve was correctly adjusted, but the oil spray leak returned, and the compressor was turned back off for repairs. A new oil separator, oil filter, and pump interlock were installed in July 2012, however due to low water levels the compressor was turned off until groundwater elevation rose above 25 ft. bgs. A new pump head and motor were received but there was approximately 2 feet of sediment in the well so the new ART pump was scheduled for installation after the sediment was removed in early 2013. A shroud covering the pump was fabricated to limit the amount of sparge air captured by the pump. The SVE vacuum blower was started in October of 2012 but by May 2013, the blower overheated and would not restart. The pump installation was subsequently delayed until the Fall of 2014.

The current pending work scheduled for October 2014 includes: bailing/removal of sediment at the bottom of the ART well; acid treatment to clean the well casing; pumping the ART well to clear pack material of fines; installing a new ART pump with shroud; setting the compressed air discharge hose 2 feet above the pump intake; replacing the hose on well lid; and testing the groundwater sample port.

During the site inspection, conducted in January 2014 both the EPA and MDNR project managers indicated that they are aware of the operational issues associated with the ART treatment system. If future data or information warrants, MDNR or EPA may consider restarting operations or other corrective actions. However, if the MDNR wants the system to operate, EPA would pursue corrective actions.

4.1.5 Progress Since Last Review (OU1 Front Street)

The last FYR determined that the OU1 remedy was protective of human health and the environment. However, operational issues with the ART system were noted. Additionally, the previous FYR recommended documentation of the follow-up vapor intrusion studies conducted after the initial 2003 study.

The active treatment portion of the remedy, the ART well system, continued to experience operational problems during this five-year period due to equipment and water level issues. While the SVE portion of the system was operational for 5-6 months during this period, SVE does not directly address groundwater contamination. This current FYR recommends the evaluation and potential removal of the ART system from the remedial effort. If use of the ART system continues, the equipment should be rehabilitated prior to assumption of O&M responsibilities by MDNR.

Documentation of the post-2003 vapor intrusion studies has not been completed. Additionally, this current FYR recommends evaluation of the vapor intrusion risk at the site using the toxicity values that were adjusted subsequent to the initial 2003 studies.

Routine monitoring has continued throughout this period. The detected contaminant levels confirm that regardless of the problems associated with the ART well, all of the COCs within the downgradient portion of the plume, shown in Figure 4, remained well below the ACLs.

The ROD required annual sampling of the Missouri River for VOCs until the first FYR. Analytical results were below detection limits for all of the analytes. Since the ACLs were not exceeded during the first five-year period, the Missouri River sampling was discontinued. The IC portion of the remedy remains fully functional and there have not been any violations.

4.2 OU2 (Industrial Drive) and OU6 (Wildcat Creek Estates)

4.2.1 Remedy Selection OU2 (Industrial Drive) and OU6 (Wildcat Creek Estates)

OU 2 and OU 6 are located south of State Highway 100. OU2 is a contaminant source area located within the New Haven city limits and OU6 is the contaminant groundwater plume that emanates from OU2.

In 1989, investigations of VOCs were initiated in the area of the former Kellwood Facility and the open lot to the north, where disposal of spent PCE was reported.

In 1994, soil from the open lot exhibiting PCE concentrations exceeding 380,000 µg/kg was excavated for off-site incineration. In the 1990s, soil remaining in the open lot was tilled to maximize volatilization. DNAPL is still present in the area of the open lot.

A RI of OUs 2 and 6 was completed in June 2010. The RI addresses the extent of PCE and degradation products in; soil, groundwater, surface water, sediment, soil gas, and indoor air. A feasibility study was completed in August 2010.

The EPA reviewed the Sub-slab Vapor and Indoor Air Sampling Reports documenting sampling efforts at the Metalcraft Building completed in December 2010, January 2011, and June 2011. Seven sub-slab samples along with nine indoor air samples were taken during the 2011-2012 sampling events. Among the indoor air samples within the Metalcraft building, seven samples were taken in the manufacturing area of the plant floor and two were located in the office area. EPA determined that the vapor intrusion pathway is complete at the Metalcraft Building at the former Kellwood Facility. Although current conditions do not indicate significant health risks, EPA noted that the sub-slab vapor concentrations of PCE and TCE exceeded sub-slab screening levels. The EPA concurred with the report recommendations to conduct further sampling and to consider modifications to the building HVAC system and other mitigation measures by Kellwood.

In 2011, EPA issued the final ROD for the Industrial Drive area (OU2) and the Wildcat Creek Estates area (OU6). The remedial action selected for OU2 and OU6 addresses contaminated soil and DNAPL contamination in the fractured bedrock in the source area (OU2) and the dissolved phase contamination in the groundwater within the unconsolidated deposits downgradient of the source area (OU6).

The COCs are PCE, TCE, 1,2-DCE, and VC. Analytical results indicate that the extent of PCE; TCE; 1,2-DCE; and VC contamination in the OU2 soils is limited to a land-farm area north of the former Kellwood facility, beneath the former Kellwood facility, beneath Industrial Drive, and at the vacant lot northwest of the former Kellwood facility across Industrial Drive. Precipitation infiltrating soil and bedrock that may contain DNAPL, as well as groundwater migrating past areas with DNAPL, have released PCE, TCE and1,2-DCE to groundwater. PCE, TCE and 1,2-DCE, have been detected in the OU6 groundwater and surface water west and south of the former Kellwood facility.

The selected remedy in the 2011 ROD includes DNAPL recovery, followed by in situ chemical oxidation, whole-house treatment units, in situ groundwater treatment, ICs, and groundwater monitoring. The remedy includes the following components:

- The contaminated soil in the land-farm area will remain in place. Physical DNAPL recovery will be conducted in existing wells in the land-farm area with additional DNAPL recovery wells to be installed in the area north and west of the former Kellwood facility where DNAPL was detected during the RI. DNAPL recovery will be conducted in the source area to eliminate the continued migration of COCs into the groundwater. DNAPL recovery would continue until it becomes technically and physically impractical to continue. Enhanced recovery methods (e.g., applying a vacuum) may be utilized.

- Once physical DNAPL recovery efforts are complete, the recovery wells may be utilized for in situ chemical oxidation treatment of any residual contamination. Additional (smaller diameter) wells may be installed as part of the chemical oxidation treatment phase. DNAPL detected during the installation of these additional wells will be physically removed prior to the injection of oxidants. Prior to implementing the chemical oxidation phase of the work, a pilot test will be conducted in a limited portion of the area to evaluate the potential effectiveness. Results of the pilot test would then be used to plan future remedial activities.

• Existing wells BW-20 and L-12, and new monitoring wells that will be installed in the vicinity of the treatment area, will be used to evaluate the effectiveness of the treatment. Long-term groundwater monitoring will be conducted to track COC movement and attenuation. This monitoring will serve two functions; it will alert the potentially responsible party (PRP) to any changes in plume migration which may result in unacceptable exposures, enabling the PRP to take action to prevent such exposures; and it will generate data on the expected attenuation of COCs in the groundwater plume, thus providing information to EPA regarding the potential need for additional response actions.

• Chemical oxidation treatment will be repeated periodically as needed in the land-farm area until nearby and downgradient monitoring wells indicate groundwater concentrations of COCs are below MCLs or monitoring indicates that further treatment will not effectively reduce the concentrations of COCs.

• The state has promulgated well construction regulations (10 CSR 23-3.100, the Special Area 3 designation) for new wells constructed within OU2/OU6 to prevent the installation of new vertical conduits which could allow contamination from shallow aquifers to migrate to the deeper aquifers via improperly installed new water or heat pump wells. An environmental covenant or other appropriate proprietary control may also be imposed on the OU2 area to create activity and use limitations to help prevent exposures to hazardous substances.

• Community information on the contamination and the State Well Regulations would be provided through public meetings, public notices, five-year review process, and other appropriate opportunities.

• Any contaminated soil in the land-farm area would remain in place. ICs in the form of an environmental covenant, or other appropriate mechanism , would be implemented to prevent residential use of the property. Soil was not shown to be a risk except for a hypothetical future residential scenario which would require a change in the zoning for the land-farm area in order to be applicable. After remedial activities are completed in the land-farm area and recovery and treatment wells are properly abandoned, the area will be regraded and seeded.

• Groundwater monitoring will be conducted to monitor the changes in the contaminant concentrations over time within OU2 and OU6. This will include monitoring of residential wells.

• Residences with groundwater contaminated with COCs above MCLs (current or future residents) would have the option of receiving whole-house water treatment units. If a treatment unit is required at a new residence based on groundwater monitoring, the well would also be inspected to determine if repairs are required to stop migration of contaminated groundwater from the transmissive zone (upper sand) to the Lower Jefferson City/Roubidoux Formations. If such repairs are required, they would be implemented. Whole-house water treatment units will be maintained until the remedial action objectives are achieved.

• Treatability testing would be performed to determine the most effective in situ groundwater treatment technology for a line of treatment wells that would be installed downgradient of the land-farm at the southern end of Industrial Drive. Technologies that would be evaluated would potentially include bioremediation, chemical oxidation, and chemical reduction. In-situ treatment is expected to reduce concentrations of dissolved phase PCE in the nondrinking zone of the unconsolidated deposits.

• Following the selection of the most effective in situ groundwater treatment technology, Phase 2 of the alternative would be implemented. Phase 2 would include a pilot test for the recommended alternative followed by the design and implementation of the full-scale-treatment.

The final ROD for OU2 and OU6 selected the following RAOs:

• Protect human health by eliminating exposure (i.e., inhalation, incidental ingestion, dermal contact) to soil with concentrations of COCs in excess of risk-based standards (i.e., PCE at 550µg/kg). This RAO applies to the area around the land-farm area at OU2 for a hypothetical residential scenario.

• Protect human health by eliminating exposure (i.e., inhalation) to indoor air concentrations of COCs (as vapors) due to the migration of vapors from contaminated soil or shallow groundwater in excess of risk-based standards. The industrial use RAO for PCE in soils is 272 µg/kg, and in groundwater 423 µg/L; and the residential use RAO for PCE in soils is 36 µg/kg, and 44 µg/L for PCE in residential groundwater. This RAO applies to the area around the land-farm area for both the industrial and hypothetical residential scenario and at identified areas of impacted soil beneath the former Kellwood facility.

• Protect human health by preventing exposure (ingestion) to groundwater with chemical concentrations greater than their respective MCLs (i.e., PCE 5 µg/L; TCE 5 µg/l; cis-1-2,-DCE 70µg/L; and VC 2 µg/L).

• Protect the environment by minimizing further migration of groundwater containing COCs.

• Protect the environment by reducing the soil COC concentrations by eliminating or mitigating the soil-to-groundwater pathway.

• Protect the environment by minimizing the movement of DNAPL from fractured bedrock into groundwater.

• Protect the environment by eliminating exposure of wildlife to surface water, sediment, and surface soils with concentrations of COCs in excess of ecological risk-based standards and achieve compliance with ARARs for ecological protection such as the EPA Region 3 BTAG freshwater benchmarks.

4.2.2 Remedy Implementation (OU2 and OU6)

The OU2/OU6 ROD was finalized in May 2011. The Phase I Remedial Design and Remedial Action Work Plan for OU2/OU6 was completed in May 2013. The remedial action will be performed in stages. The remediation efforts in the initial phase (Phase1) focuses on DNAPL recovery and in situ chemical oxidation treatment in the source area. Phase 1 will also include treatability testing to determine the most effective technology for in situ groundwater treatment. Following selection of the in situ groundwater treatment technology, Phase 2 will include pilot testing, design, and implementation of the full-scale treatment.

The initial phase (Phase I) RA includes:

- **DNAPL Recovery Plan.** DNAPL recovery wells will be installed north and northwest of the former Kellwood Facility. DNAPL will be recovered through pumping or bailing. Based on the observed recovery of DNAPL, enhanced recovery through the application of a vacuum to one or more recovery wells may be implemented. DNAPL recovery will continue for a minimum of 6 months and will terminate when the recovery is no longer productive. Recovery will continue until concurrence to terminate is provided by EPA and MDNR.

- **In Situ chemical Oxidation Plan.** A bench-scale treatability study was recommended to test groundwater and subsurface materials in a laboratory setting to assess whether the COCs in groundwater can be adequately treated. Pilot testing of the chemical oxidant selected from the bench-scale testing will be performed to guide the full-scale application of the chemical oxidation. Detailed plans for full-scale chemical oxidation treatment will be developed following the pilot test.

- **Down-Gradient Groundwater Treatment Plan.** Laboratory treatability testing, followed by field pilot testing will be used to screen and evaluate several in-situ remedial technologies.

Detailed plans for the implementation of the selected down-gradient treatment technology will be developed following the pilot test.

- **Groundwater Monitoring Plan.** Site-wide groundwater sampling efforts conducted at the site since the 2008 Five Year Review (March/April 2009 and March/April 2010) were used in the development of the RI Report (2010), the ROD (2011), and the RD/RA Work Plan (2013). The initial site-wide monitoring well and site-wide residential well sampling event identified in the 2013 RD/RA Work Plan is planned following the installation of seven new treatment performance monitoring wells. The groundwater monitoring will be performed to evaluate the effectiveness of the groundwater treatments. Data from the initial sampling event was not available for incorporation into this review. The sampling frequency for wells included in the monitoring plan varies from annually to once every four years, depending on the well purpose. The monitoring frequency for each well type is detailed in Section 5.2 of the RD/RA Work Plan. Additionally, residential supply wells equipped with whole-house water treatment systems will be monitored. Systems will be sampled quarterly until analysis of multiple monitoring events indicate that the system is no longer needed.

- **Whole House Water Treatment Plan.** The OU6 removal action conducted by Kellwood connected one household to the public water supply . The residential supply private well at this residence (JS-37) was plugged and abandoned in 2013. Other residences outside of the city limits that demonstrate groundwater with COCs above the MCLs have the option of receiving whole-house water treatment units. The purpose of the treatment systems is to provide residents with acceptable drinking water while the remediation of OU2 and OU6 are completed. A response action conducted under an Administrative Order on Consent (AOC) dated March 26, 2002 provided whole-house treatment units at four residences with residential supply wells (wells JS-14, JS-36, JS-38, and JS-52).

The RD/RA AOC for OU2 requires Kellwood to conduct quarterly sampling of the residential whole-house treatment systems. If sampling results for PCE are below the MCL for at least 8 consecutive quarters, the systems are no longer required under the Consent Decree.

PCE concentrations have been below the MCL for the last 14 sampling events at JS-38 (since April 2009), and the last 12 sampling events at JS-52 (since June 2010). Influent concentration plots for these wells (JS-38 and JS-52) are included in Attachment 4. While the systems at JS-38 and JS-52 are no longer required under the Consent Order, the treatment systems are still in place and they are monitored voluntarily on an annual basis. However, their continued maintenance is not required under the current Consent Order.

The quarterly residential well sampling results support the continued use of the treatment systems for wells JS-14 and JS-36. Influent concentration plots for these wells (JS-14 and JS-36) are included in Attachment 4. Kellwood continues to conduct quarterly sampling and perform maintenance on these treatment systems in accordance with the Consent Order. Maintenance activities include an inspection at the time of each quarterly sampling event, replacement of the granular activated carbon media in the treatment systems due to either contaminant breakthrough or excessive pressure losses, and repair of system leaks.

The continued use of the whole-house filtration units at affected residences is evaluated during the sitewide five-year review process. In the event that PCE is detected above the MCL in a residential supply well, residences have the option to receive whole-house water treatment systems in accordance with the Consent Order. While not currently expected, additional treatment systems may be required in the future.

4.2.3 Institutional Controls (OU2 and OU6)

OU2 and OU6 are within an area designated as a "Sensitive Area" by the state (10 CSR § 23-3.100). Specifically, OU2 and OU6 are included in "Special Area 3" as set forth at 10 CSR § 23-3.100(7) which imposes requirements on well drilling in the area designed to prevent the installation of any well within or near the contamination that may result in an unacceptable human exposure. In addition to these restrictions, EPA, through the five year review process required by CERCLA § 121(c), will continue to review the remedy for protectiveness. As part of this process, EPA will inform and educate the owners of the properties where groundwater contamination is present of the potential health hazards posed by COCs and the need to comply with state well installation requirements.

4.2.4 System Operation/Operation and Maintenance (OU2 and OU6)

The Phase 1 Remedial Design and Remedial Action Work Plan for OU2 and OU6, dated May 17, 2013, was approved by the EPA. Since the remedy is in the early phase of implementation, only operation and performance data for the in place whole-house treatment systems is available. The four whole house water treatment systems discussed in Section 4.2.2 continue to operate. The two systems that are no longer required under the Consent Order (JS-38 and JS-52), are still in place and monitored voluntarily on an annual basis. However, their continued maintenance is not required under the current Consent Order. Per the 2013 RD, the two systems with PCE detections above the MCL (JS-14 and JS-36) will continue to be sampled quarterly until analysis of multiple monitoring events indicates that the system is no longer needed. Typical maintenance activities for these treatment systems include an inspection at the time of each quarterly sampling event, replacement of the granular activated carbon media in the treatment systems due to either contaminant breakthrough or excessive pressure losses, and repair of system leaks.

In addition to the private residences, New Haven’s City Well 3 is monitored on a quarterly basis.

4.2.5 Progress Since Last Review (OU2 and OU6)

The remedy is in the early phases of implementation.

4.3 OU3 (Old City Dump)

4.3.1 Remedy Selection (OU3 Old City Dump)

In 2003, EPA issued the final ROD for the Old City Dump (OU3) selecting institutional controls with groundwater monitoring. Currently, no exposure exists that represents an unacceptable risk to human health or the environment, hence there are no COCs. The COPCs for the Old City Dump Site include PCE, antimony, nitrate, boron, and manganese. Antimony and boron present a potential risk to a resident or occupational worker. However, based on the low levels detected, these chemicals do not require remediation, and consequently, there are no Preliminary Remediation Goals (PRGs). ICs will minimize contact with contaminated groundwater and surface water. Additionally, periodic monitoring of residential wells, one seep, and monitoring wells in the vicinity, will limit any potential future exposure to the COPCs. This response action will provide EPA and MDNR the means to evaluate this remedy, monitor any contaminant migration, and prevent any potential future risks from the Old City Dump Site (Figure 6).

The remedy includes the following components:

- Monitoring the groundwater through periodic sampling of four monitoring wells.

- Monitoring one surface seep (Seep M).

- Sampling parameters to include VOCs, inorganic compounds, and field geochemical parameters.

- Monitoring nearby domestic wells on a recurring basis, particularly immediately prior to the five-year review.

- ICs will involve a layering of proprietary and governmental controls on OU3 to prohibit or limit certain land uses, provide notice of contamination to future subsite owners and users, and educate the public on potential health hazards based on contaminants at the subsite.

The final ROD selected the following RAOs:

- Minimize contact with contaminated groundwater and surface water

- Monitor contaminant migration and prevent potential future risks from the Old City Dump

4.3.2 Remedy Implementation (OU3 Old City Dump)

The ROD for OU3 requires ICs and long-term monitoring (LTM) for the groundwater at the site. The City of New Haven is responsible for all LTM actions or designated entities as described in a Consent Decree between the United States and the City of New Haven, Missouri (EPA, 2007).

ICs were implemented at OU3 in layers to enhance the protectiveness of the remedy. The primary form of IC is a proprietary control, specifically an environmental covenant and easement. This form of proprietary control was selected as it is effective as an informational device and creates a readily enforceable legal property interest. The OU3 ICs are detailed in Section 4.3.3.

The selected remedy also uses monitoring to ensure that the contaminants do not migrate from OU3 and reach new receptors. As specified in the ROD, the selected remedy required; (1) a year of quarterly monitoring at the Old City Dump (four monitoring wells, Seep M, and four nearby domestic wells) to establish baseline conditions (conducted during 2003-2004), (2) verification that PCE is not present above the MCLs in groundwater at the dump site or at detectable concentrations in nearby domestic wells, and (3) annual inspections of the site conducted by the City.

Groundwater monitoring wells at OU3 are monitored to ensure that migration of contaminants above regulatory levels does not occur. All groundwater samples are analyzed for a comprehensive suite of inorganic constituents and VOCs as specified in the ROD, and in accordance with the collection procedures described in the OU3 Long Term Monitoring Quality Assurance Project Plan and Sampling and Analysis Plan. In the first year, the four existing monitoring wells at OU3 and the most contaminated seep were sampled quarterly and baseline water-quality samples were collected from four nearby domestic wells. The samples analytes included:

1) VOCs, to confirm that no PCE (or any other VOC) is migrating from OU3 at levels above its MCL.
2) Inorganics, to measure the levels of the other COPCs (antimony, boron, manganese, and nitrate).
3) Field parameters (dissolved oxygen, iron II, pH, oxidation-reduction potential, and temperature).

The ROD specified that if PCE concentrations in groundwater samples remained below the MCL of 5 μg/L after the conclusion of 1 year of quarterly sampling, sampling would be reduced to every 5 years. PCE was not detected above the MCL during the 2003-2004 quarterly monitoring, so sampling was decreased to once every 5 years starting in 2008.

On the five-year schedule, domestic well samples are analyzed for the same comprehensive suite of inorganic constituents and VOCs as the monitoring wells. Inorganic constituents in domestic well samples collected every 5 years are compared to the baseline concentrations of various constituents derived during the first year of quarterly RA monitoring. If concentrations of the suite of inorganic constituents (sodium, chloride, sulfate, nitrate, boron, iron, and strontium) commonly elevated in monitoring wells at the dump indicate substantial increasing trends, or if PCE is detected above laboratory reporting levels, the EPA could require annual monitoring of that particular domestic well or all domestic wells for VOCs or possibly other analytes specified in the ROD.

None of the May 2008 samples from monitoring wells, Seep M, or nearby domestic wells contained detectable quantities of PCE or other volatile contaminants of concern listed in the ROD.

The 2013 OU3 environmental monitoring effort was conducted by Barr Engineering Co. The monitoring effort, detailed below, included an inventory of the nearby domestic wells, an inspection of the facility, an inspection of monitoring wells and the seep, and groundwater monitoring. The monitoring results are documented in the 2013 Environmental Monitoring Report for Operable Unit 3, dated November 2013.

Domestic Well Inventory 2013

A database search of water-well installation records (referred to as “certified wells”) was requested through the MDNR Wellhead Protection Section in Rolla, Missouri during late summer 2013. A review of the records indicated that since the last sampling in 2008, only one additional domestic well record had been filed for a well installed within a one-mile radius of OU3. A site reconnaissance determined that the new well was outside the .5-mile radius from OU3, and a residential well that had previously been sampled (PB-17) had been removed.

Domestic wells JS-26, JS-28, JS-31, and Robller Well, shown in Figure 6, were sampled in September 2013.

Facility Inspection 2013

Barr Engineering's inspection of the condition of the monitoring wells, surface of the landfill, and security for the landfill did not reveal any major issues. During the September 16, 2013 inspection, Barr recommended the addition of "No Trespassing" signs along the southern boundary fence. A follow-up inspection conducted by the City of New Haven on November 20, 2013 confirmed that City employees had installed the signs along the fence. The 2008 location of Seep M did not have any seep flow at that exact location or in the general vicinity. Apparently, shallow groundwater under the landfill surface near the seep has found a different preferential pathway to surface at the base of the landfill. It should be noted that when sampling on a 5-year frequency, the seep location may change due to subsurface changes (i.e., settling, degradation of waste components) occurring between sampling events.

Groundwater Quality

Four monitoring wells (BW-03, BW-31, BW-31A, and BW-32) and four domestic wells (JS-26, JS-28, JS-31, and Robller Well) were sampled in September 2013. Flow was not observed at the location of Seep M. A seep sample was taken 20 feet southwest of the staked Seep M location where evidence of seep flow was observed between the dump piles. The groundwater monitoring results from the 2013 Environmental Monitoring Report are discussed in Section 5.4.3.

4.3.3 Institutional Controls (OU3 Old City Dump)

ICs have been implemented at OU3 in layers to enhance the protectiveness of the remedy. The primary form of IC is proprietary control, specifically an environmental covenant and easement. This form of proprietary control was selected as it is effective as an informational device and creates a readily enforceable legal property interest. The environmental covenant for the OU3 site was filed on April 14, 2008 (Attachment 5).

The City of New Haven currently owns OU3. The City of New Haven granted the environmental covenant and easement to the State of Missouri, and the EPA was named as a third-party beneficiary in this instrument so that EPA has the ability to enforce the terms of the environmental covenant and easement in addition to the State of Missouri. This environmental covenant and easement was patterned on the model environmental covenant and easement found in the Missouri Uniform Environmental Covenants Act, Mo. Rev. Stat §§260.1000-260.1039. The objectives of imposing an environmental covenant and easement on OU3 are to eliminate or minimize exposures to contamination remaining at OU3 and limit the possibility of the spread of contamination.

These objectives were achieved by use of the environmental covenant and easement as it will: (1) provide notice; (2) limit use; and (3) provide federal and state access.
Specifically, the environmental covenant and easement achieved this by:

- providing notice to prospective purchasers and occupants that there are contaminants in soils and the groundwater;

- ensuring that future owners are aware of any engineered controls put into place as part of this remedial action;

- prohibiting residential, commercial and industrial uses, except those uses which would be consistent with the remedial action;

- limiting the disturbance of contaminated soils;

- prohibiting the placement of groundwater wells;

- prohibiting other ground penetrating activities which may result in the creation of a hydraulic conduit between water bearing zones;

- providing access to EPA and the MDNR for verifying land use;

• prescribing actions that must be taken to install and/or maintain engineered controls (if applicable); and

• providing access to EPA and the MDNR for sampling and the maintenance of engineered controls.

In addition to the above proprietary control, governmental controls operate as effective ICs at OU3. The MDNR has promulgated regulations pertaining to the location and construction of wells. These regulations prohibit the placement of a well within 300 feet of a landfill. This prohibition, found at 10 C.S.R. 23-3.010, precludes the possibility that any well will be located in OU3 (copy included in Attachment 5).

The EPA also provides public education through the preparation and distribution of the Five-Year Review for the Site. The Five-Year Review informs citizens of the potential health hazards associated with exposure to contaminated groundwater and reminds city officials of the restrictions on OU3.

As described in the Final Operational and Monitoring Plan and Work Plan for Long-term Monitoring of Operable Unit 3, Riverfront Site, February 2008, site inspections are conducted annually by City personnel. Completion of the annual site inspection checklist provides verification and documentation that the ICs meet the stated goals in the ROD.

A review of ICs conducted by the EPA and detailed in the OU3 Environmental Monitoring Report (2013) noted:

• The ICs have been filed with the Franklin County Recorder of Deeds. The filed controls prohibit future development of the landfill site and provide notice of contamination to future landowners and users.

• The City of New Haven retains ownership of the dumpsite but has no specific city ordinance restricting land use or other activities at the facility.

- No written easements with adjacent property owners for access to monitoring wells are in place, and access continues to be through verbal agreement and a written request prior to sampling.

- Missouri Geological Survey (MGS) regulations that prevent the placement of potable water supply wells within 300 feet of a landfill continue to be in force (10 CSR 23-3.010).

4.3.4 System Operation/Operation and Maintenance (OU3 Old City Dump)

The City of New Haven completed the annual O&M inspection checklist for 2013. The inspection covered general site conditions, current land use, site access and fencing, condition of the monitoring wells and seep, and ICs. The City of New Haven continues to use the site as a compost area and bulk materials storage area, which is consistent with approved uses listed in the Consent Decree (EPA, 2007). Access to the landfill is restricted and fences were intact.

4.3.5 Progress Since Last Review (OU3 Old City Dump)

The last FYR determined that the OU3 remedy was protective of human health and the environment.

The implemented ICs remain in place. None of the groundwater or seep samples collected during 2013 contained detectable concentrations of PCE or chlorinated solvents. The OU3 remedy remains protective.

The 2008 FYR recommended obtaining access agreements or easements to facilitate future well sampling requirements. For the 2013 sampling event there were still no written easements with adjacent owners for access to monitoring wells. Access continues to be through verbal agreement and a written request prior to sampling.

4.4 OU4 (Maiden Lane Area)

4.4.1 Remedy Selection (OU4 Maiden Lane Area)

The remedial action selected in the March 26, 2009 ROD for OU4 addresses contaminated soil and groundwater in the fractured bedrock and is summarized below.

- Soils - The hazardous substances in the soils at OU4 are PCE, TCE, and vinyl chloride. The remedial action selected to address these COCs consists of the injection of a chemical oxidant to enhance chemical oxidation of the COCs, monitoring, and ICs. The contaminated soils at OU4 are considered "principal threat" wastes because the COCs are considered mobile source materials. Although contaminated groundwater also poses a risk, it is not considered a principal threat as defined by the EPA guidance. The most highly contaminated soils in the source area were treated during an EPA-lead removal action conducted in 2007. The residual contamination that remains following that removal action will be addressed as part of the selected remedy through in situ chemical oxidation. The injection of chemical oxidants will create an in situ reactive zone where the COCs will be destroyed. This will result in the remediation of the soil source area with the goal of reducing contamination levels in the soils to levels that will prevent continued migration of COCs to groundwater. EPA anticipates that ICs will be effective in reducing the potential for exposure to the contaminated soils during the remedial action and until the RAOs for the soils have been achieved. The primary IC for soils will be informational and educational. EPA, through the five-year review process, will continue to periodically inform and educate property owners of the potential health hazards posed by the COCs where soil contamination is present.

- Fractured Bedrock Groundwater - The hazardous substances in the fractured bedrock groundwater plume are PCE; TCE; cis-l,2-dichloroethene; and trans-1,2-dichloroethene. Remediation of the contaminated soil source area will eliminate the continued migration of contaminants into the groundwater. It is expected that the groundwater plume will discharge over time into the nearby Missouri River. Due to the large volume of water in the river and the relatively small quantity of COCs being discharged into the river from the plume, the plume contaminants are not detectable in the river and do not appear to pose a threat. With the remediation of the contaminant source area, the contaminant levels in the groundwater are expected to decrease over time to a level that is protective of human health. Active remediation of the groundwater is not included in the remedial action.

This selected remedial action provides for the overall protection of human health and the environment, a "threshold" criterion for remedy selection as set forth in the NCP; however, due to the highly fractured and variable bedrock conditions found at OU4, compliance with all ARARs through containment, collection, treatment, or other technologies is technically impracticable from the engineering perspective as well as disproportionately expensive for any potential benefit. As a result, a waiver based on technical impracticability (TI) was invoked in the ROD.

The rationale for invoking the TI waiver is detailed in the Fractured Bedrock Technical Impracticability Evaluation Report (2009). The TI zone is comprised of a block of fractured bedrock that is approximately 5,000 feet in length; 2,000 feet wide at the upgradient edge; 4,500 feet wide at the downgradient edge; and between 20 and 450 feet deep. EPA determined that active restoration of the contaminated groundwater in the OU4 bedrock was technically impracticable from an engineering perspective for the following reasons:

- The OU4 contaminated groundwater may extend to depths of more than 400 feet below ground surface.

- Fracture diameter, spacing, orientation, vertical extent, and connectivity within and between formations are unknown and cannot be accurately determined.

- Remediation of dissolved PCE contamination that has diffused into dead-end fractures, solution voids, and interstitial spaces would be a very slow process.

• The steep and developed terrain in the OU4 area would make installation of the numerous treatment or extraction wells necessary for active remediation very difficult. As a result, it may not be possible to treat the entire plume.

• For reasons discussed above, and considering the physical size of the plume and varying contaminant levels, installation of sufficient monitoring wells to assess the performance of any remediation activities accurately would be difficult.

• The potential presence of DNAPL below the source area is an additional complicating factor in actively remediating the plume.

ICs and long-term groundwater monitoring are also components of the selected remedy for the groundwater. Currently, there is no unacceptable groundwater or surface water exposures at OU4. All of the residences and businesses within OU4 are served by municipal water, and there are no known private wells providing potable water at OU4. OU4 is within an area designated "Special Area 3" in the MDNR, Missouri Geological Survey (MGS), Well Construction Code [10 C.S.R. 23-3.100(7)]. As a result of this designation, well drilling restrictions are in place that precludes the installation of any well within or near the plume that may result in an unacceptable exposure of humans to groundwater contamination. In addition to these restrictions, EPA, through the five-year review process, will continue to periodically inform and educate the owners of the properties where groundwater contamination is present of the potential health hazards posed by the COCs and the need to comply with state well installation requirements.

Long-term groundwater monitoring will be conducted by EPA to track COC movement and attenuation by physical processes. The monitoring will serve two functions: (1) it will alert EPA to any changes in plume migration that may result in unacceptable exposures, enabling EPA to take action to prevent such exposures; and (2) it will generate data on the expected physical attenuation of the COCs in the groundwater plume, thus providing information to EPA regarding the potential need for additional soil source area response actions and informing EPA and the state's consideration of the need for continuing ICs for OU4.

Groundwater monitoring will be accomplished by obtaining groundwater samples from existing bedrock monitoring wells and performing laboratory analysis on the samples for COCs. Provisions will be made for the abandonment of any monitoring wells, pursuant to MDNR requirements, when the RAOs are met or if EPA determines that monitoring is no longer necessary.

The RAOs developed for OU4 soils are:

- For protection of human health - prevent exposure to soils with contaminant concentrations which result in an excess cancer risk greater than 1 E-06 or an HQ greater than 1.0, whichever is less.

- For protection of the environment - reduce the soil contaminant levels and prevent/reduce migration of soil contaminants to the groundwater.

The RAOs developed for OU4 groundwater are:

- For protection of human health - prevent exposure to groundwater with contaminant levels greater than MCLs. For those contaminants without established MCLs, prevent exposure to groundwater with contaminant levels which result in an excess cancer risk greater than 1 E-06 or an HQ greater than 1.0, whichever is less.

- For protection of the environment - minimize further degradation of the local groundwater by the contaminants at OU4.

The ROD soil cleanup levels are designed to protect residents and utility workers from the contamination in the shallow soils (the soils from the surface to approximately 4 ft bgs). Below 4 ft bgs, the primary remediation need is to prevent the migration of PCE and other COCs in the soil to groundwater.

4.4.2 Remedy Implementation (OU4 Maiden Lane)

In 2007, the EPA conducted a Removal Action that treated the source area soil (SAS) with ISCO using sodium permanganate ($NaMnO_4$). Using direct push rigs, the $NaMnO_4$ solution was injected under pressure to remediate the soils contamination at specific depths. However, due to the nature of the soils in the source area, even fairly high injection pressures could not distribute the $NaMnO_4$ solution out more than a few inches into the surrounding soils. Therefore, in order to continue using similar direct push injections efforts to treat the soils, placement of injection points would need to be extremely close (the distance between points would need to be 1 foot or less).

The use of potassium permanganate ($KMnO_4$) solution was evaluated during the RD and is documented in the Remedial Action Basis for Design (2010). Because the contamination was deposited by slow infiltration over time, the SAS RD proposed the steady infiltration of $KMnO_4$ solution into the soils over time. The $KMnO_4$ solution will be pumped into infiltration fields that extend slightly beyond the edges of the contamination that is above the cleanup levels. The $KMnO_4$ solution will gradually infiltrate through the silt/clay soils and, as it moves downward through the soils and contacts the COCs, will oxidize the COCs to levels below the cleanup goals.

The November 2009 sampling results found that the central soils of the SAS, where drainage is concentrated, are often contaminated above the PCE and/or TCE cleanup levels from the surface to the residuum layer below (i.e., the entire soil column is contaminated). Earlier soil sampling efforts had generally not found contamination in the top four to six feet of the SAS. The 2010 sampling event identified contaminated soil at depth with clean overburden. With the discovery of the additional contaminated areas the remedy selection had to address a wider range of contamination levels and depths.

The treatment area will address the four combinations of soil contamination levels:

1) Very Heavily Contaminated Soils (PCE/TCE> 250,000 µg/kg): These will either be removed and disposed off site or treated in-situ.

2) Shallow Contaminated Soils < 6 ft bgs (PCE-550 µg/kg, TCE and VC -43 µg/kg): The contractor will excavate the soils to a depth of 6 ft bgs. The soils will be segregated until they can be analyzed. Soil batches above the clean-up level will be transported off-site for disposal. The excavated area will be utilized for ISCO infiltration basins.

3) Deep Contamination Soils (PCE-2,600 µg/kg, TCE-14,000 µg/kg, VC-1,700 µg/kg): These soils will be addressed by the ISCO ($KMnO_4$) infiltration fields created by the shallow excavations.

4) Very Deep Soils: These are areas where the contamination "pooled" on the bedrock surface and the upper residuum is not contaminated. This area will be addressed by treatment manholes drilled into the deeper soil contaminated areas, and screened at the base with sand and gravel. The manholes will be filled with ISCO solution for infiltration into the lower soil zones for treatment.

In summary, the remedial actions for OU4 consist primarily of implementing treatments of various soils:

- Removal/disposal or in-situ treatment of the very heavily contaminated soils;
- Excavation and testing of the shallow contaminated soil;
- Installation of the infiltration fields and manholes that will deliver the $KMnO_4$ solution that will treat the deep and very deep contaminated soils;

• Backfilling the excavations with shallow soil that is below the cleanup levels and any necessary makeup soil;

• Disposal of the contaminated shallow soil that is above the cleanup levels, and;

• Application of the $KMnO_4$ solution to the deep and very deep soils.

The resulting design includes three infiltration galleries: 1) 47 ft X 22 ft, 5.5 ft deep; 2) 43 ft X 40 ft, 5.5 ft deep; and 3) 46 ft X 22 ft, 5.5 ft deep; and 13 manholes 24" X 15 ft. (Figure 9)

Construction began in 2012. The three infiltrations beds (IB-1, IB-2, and IB-3) were excavated to a depth of 5.5 bgs, resulting in a total volume of 1,133 cu yds of soil. The soils were stockpiled and sampled to determine if any were "special waste" or if they could be reused at the site. A total of 24 samples were analyzed. After excavation, a gravel bed was placed at each of the excavation areas to a depth of 1.5 ft. above the bottom of the excavation. Infiltration piping was placed on top of the gravel layer and injection ports were extended to the new surface. Each was sized to hold one application of the ISCO solution for uniform infiltration into the soils below. The infiltration bed was backfilled by placing clean soil round the infiltration piping and then backfilling with soil to grade.

Thirteen 24 in. manholes were installed to address the deeper contamination zone. Depths ranged from 8 to 15 ft bgs. Within each manhole a 12 inch diameter casing and 2 inch drop-pipe was installed to allow the oxidant dose to be pumped into the bottom of the manhole. Between 3-5 ft of gravel was placed at the bottom and 1-3 ft of sand was placed on top of the gravel. The wells were completed with surface manhole covers. The location of the manholes can be seen in Figure 9.

Injections of $KMnO_4$ started in 2012 and are planned to be completed by 2017. Based on typical applications, a period of 3 months between applications is usual. However, the speed with which the oxidant is migrating through the soils will be monitored and the intervals between injections may be adjusted, as required.

The estimated volume of the oxidant solution is approximately 4,500 gallons per event. Based on the application schedule of quarterly applications for five years, the total oxidant dose would be 10,000 lbs and the total volume of solution would be approximately 95,000 gallons.

4.4.3 Institutional Controls (OU4 Maiden Lane)

The selected remedial alternative uses ICs to safeguard against exposures to the contaminated groundwater. OU4 is within the previously described Special Area 3 defined by the MDNR, Missouri Geological Survey (MGS), Well Construction Code [10 C.S.R. 23-3.100(7)]. As a result of this designation, well drilling restrictions are in place to prevent the installation of any well within an area of groundwater contamination which may create an unacceptable exposure to humans. It is unlikely that new wells would be installed near OU4 since municipal water is readily available in that area. The state regulations will ensure that if any new well construction or well deepening is planned, state officials will be informed and can prescribe methods for ensuring that no exposures to hazardous substances occur. These regulations should also be effective in preventing the construction of substandard wells which could spread contamination at or near OU4. The regulations are considered to be durable, as revocation would require the affirmative action of the state with notification to interested parties.

In addition to this restriction, EPA will continue to periodically inform and educate property owners of the potential health hazards posed by the COCs where groundwater contamination is present at OU4 and the need to comply with state well installation requirements. EPA will continue to provide public education through the preparation and distribution of fact sheets and/or a newsletter on the Site and by providing informational meetings which may be held every five years. The public education campaign is intended to inform citizens of the potential health hazards associated with exposure to contaminated groundwater and would remind the city officials and residents of the restrictions on OU4.

4.4.4 System Operation/Operation and Maintenance (OU4 Maiden Lane)

The first injections into the infiltration galleries were performed by Prudent Technologies, Inc. in the 1st quarter of 2012. A total of 3,500 gallons of potassium permanganate (1.18%) solution was injected into the infiltration beds using the three Fluid Injection Points. Approximately 40 gallons of a 2.34% solution of potassium permanganate solution was injected into each of the 13 manholes. Each of the injections was gravity fed and no flow rate was recorded, though the total volume injected was recorded. Prudent Technologies will conduct soil sampling during the soil treatment phase in Years 2, 4, 6, and 9 of operation. Based on the initial injections in the 1st quarter of 2012, Year 2 soil sampling should occur in 2014. The Year 2 soil sampling results were not available for this FYR.

In 2013, additional groundwater monitoring wells BW-17, and BW-18 were installed by the USGS to determine if there was DNAPL accumulating in fractured bedrock in the saturated zone. Preliminary analytical data of PCE > 190,000 µg/L in monitoring well BW-18 suggests that DNAPL is present at the source area. The USGS sampled several monitoring wells within the OU4 area in 2010, 2011, 2012, and 2013. While a sampling report for these events was not available for review, informal feedback received from the USGS suggested that post injection sampling results indicate movement of the potassium permanganate away from the infiltration galleries. Additional sampling in the vicinity of the infiltration beds is planned in 2014.

There is no available data for any additional system operation and maintenance or monitoring events for OU4.

4.4.5 Progress Since Last Review (OU4 Maiden Lane)

The ROD was signed just before the first FYR in 2009. This is the first full FYR for OU4.

4.5 OU5 (Old Hat Factory)

4.5.1 Remedy Selection (OU5 Old Hat Factory)

The ROD for OU5 is dated December 7, 2006. The selected remedy includes regular groundwater monitoring to track the location of the plume and the contaminant levels within the plume. The selected remedy also utilizes ICs which involve the use of existing State of Missouri well construction requirements and public education to prevent human use of the groundwater at OU5.

The RAOs developed for groundwater at OU5 were:

- minimize contact with the contaminated groundwater exceeding PRGs, and

- ensure that the contaminant levels in the groundwater and/or the volume of contaminated groundwater do not increase.

Increases in groundwater contaminant levels, migration of groundwater off-site, and/or identification of new sources of OU5 groundwater contamination may result in the implementation of additional remedial actions.

EPA will also provide public education through the preparation and distribution of fact sheets and/or a newsletter on OU5 and by providing informational meetings which may be held every five years. The public education campaign is intended to inform citizens of the potential health hazards associated with exposure to contaminated groundwater and would remind the city officials and residents of the restrictions on OU5.

4.5.2 Remedy Implementation (OU5 Old Hat Factory)

The selected remedy includes regular groundwater monitoring to track the location of the plume and the contaminant levels within the plume. The selected remedy also utilizes ICs which involve the use of existing MDNR well construction requirements and public education to prevent human use of the groundwater at OU5.

4.5.3 Institutional Controls (OU5 Old Hat Factory)

It is unlikely that new wells would be installed in the OU5 area since municipal water is available, and there are currently no known wells in use in the vicinity of OU5. While new wells at OU5 are not likely, MDNR has well construction restrictions referred to as Special Area 3, which includes the OU5 area (Attachment 5). These well construction restrictions are embodied in regulations found at10 Code of State Regulations (C.S.R.) 23-3.100(7). The regulations require notification to MDNR prior to construction of new wells or the deepening of any existing well within Special Area 3. The MDNR will provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis. The MDNR will provide written approval for all new wells prior to construction. The state regulations will ensure that if any new well construction or well deepening is planned, state officials will be informed and can prescribe methods for ensuring that no exposures to hazardous substances occur. These regulations should also be effective in preventing the construction of substandard wells which could spread contamination at or near OU 5. The regulations are considered to be durable as revocation would require the affirmative action of the state with notification to interested parties.

4.5.4 System Operation/Operation and Maintenance (OU5 Old Hat Factory)

In 2006, EPA signed a ROD for OU5 (EPA 2006). The ROD documented that while the groundwater below OU5 was contaminated, the risk could be addressed with ICs and monitoring. The ROD called for sampling twice per year for the first and second years and then annually for the next three years to provide data during the first FYR for OU5. After the first FYR, monitoring efforts would then be scaled back to one sampling round every five years to provide a current data set for the next FYR. The first FYR was completed in November 2009, and recommended that the current monitoring schedule be followed until the 2nd FYR, at which point the monitoring efforts could be scaled back to annually if the data indicates this is appropriate. Annual sampling at the OU5 site began in Fall 2010.

The Fall 2013 groundwater monitoring event involved collecting and analyzing groundwater samples from the OU5 monitoring wells: BW-09, BW-09A, BW-12A, BW-15, and BW-16. The data are used to monitor the contamination levels in the plume and determine if cleanup goals (MCLs) are being achieved for the site. The results from the 2013 sampling event are discussed in Section 5.4.5.

The selected remedy utilizes the ICs described in Section 4.5.3 to enhance the protectiveness of the remedy. It is expected that the EPA will also provide public education through the preparation and distribution of fact sheets and/or a newsletter for OU5 and by providing informational meetings which may be held every five years. The public education campaign would inform citizens of the potential health hazards associated with exposure to contaminated groundwater and remind the city officials and residents of the restrictions on OU5.

4.5.5 Progress Since Last Review (OU5 Old Hat Factory)

The last FYR determined that the OU5 remedy was protective of human health and the environment. No Issues or recommendations for OU5 were identified in the last FYR.

The bi-annual sampling events took place in 2009 and 2010. The annual events started in 2011 and have continued through the 2013 event. After the second FYR, the monitoring schedule and the level of effort necessary to conduct the LTRA activities will be reevaluated. In accordance with the ROD, increases in groundwater contaminant levels, migration of groundwater off-site, and/or identification of new sources of OU5 groundwater contamination could result in the implementation of additional remedial actions.

5.0 Five-Year Review Process

5.1 Administrative Components

The Riverfront Five Year Review included the following team members: Matthew Jefferson, EPA Region 7 Remedial Project Manager, Greg McCabe, Human Health Risk Assessor, Dan Nicoski, Hydrogeologist, Vanessa Madden, Ecological Risk Assessor, EPA Region 7; Evan Kifer, MDNR Project Manager; Michelle Hartman, Missouri Department of Health and Senior Services; and Greg Hattan, Geologist, Cathy Forgét, Risk Assessor, and Brian Roberts, Project Manager, U.S. Army Corps of Engineers, Kansas City District (CENWK).

5.2 Community Involvement

The notice announcing the commencement of the five-year review process was published in the local newspaper on November 1, 2013. At the end of the FYR, a newspaper notice will indicate the availability of the FYR report for viewing by the public. The completed FYR report will be available in the site information repository at the City Offices located at 101 Front Street, New Haven, MO 63068.

5.3 Document Review

This FYR included a review of relevant information contained in a variety of site-related documents. The information review primarily focused on documents produced after November 2009 (start of the second FYR time frame). A list of site-related documents, reviewed in total or in part during preparation of this FYR, is provided in Attachment 3.

5.4 Data Review

5.4.1 OU1 Front Street

The objective of site sampling activities is to provide data to support the remedial measures. To achieve this objective, a field sampling program was implemented to collect groundwater samples for laboratory analysis and the vapor system stream was analyzed to determine the effectiveness of the remedial system. According to the approved plan, groundwater monitoring was conducted quarterly for the first two years and semi-annually for six events thereafter. The sampling schedule was then due to be reevaluated. Due to maintenance issues with the ART treatment system, additional semi-annual sampling events were planned and conducted to provide additional data.

Groundwater: The current monitoring program consists of 10 monitoring wells, grouped into four units based on their proximity to the OU1 PCE source area and the OU1 plume. The OU1 plume consists of the chlorinated solvent PCE and its daughter products (TCE, c-DCE, t-DCE, 1,1-DCE, and VC), and extends from the PCE source area under Front Street to the Missouri River as shown in Figure 4. The first group consists of one well --Well OU1-TW-A -- which is upgradient of OU1. The second group consists of two wells -- Wells OU1- TW-B and OU1-TW-C -- which are located on the perimeter outside the PCE MCL contour of the plume, or between the MCL contour and the most contaminated portion of the plume (COCs greater than 500 µg/L). The third group consists of four wells -- Wells OU1-TW-J, ART-1, PZ-1, and PZ-2 --located in or near the source area of the contaminant plume. The last group consists of three wells -- Wells OU1-TW-G, OU1-TW-H, and OU1-TW-I -- located at the downgradient end of the contaminant plume. Sampling locations are shown on Figure 4, and the results of groundwater monitoring for all wells are summarized in Table 1-2 located in Attachment 4, OU1. Former Wells OU1-TW-D, OU1-TW-E and OU1-TW-F were eliminated from the sampling program and will not be discussed in this report. Wells OU1-TW-D and OU1-TW-E were on private property and were removed per the owner's request, and Well OU1-TW-F had a history of poor water recovery. While not discussed in this report, the sample results from Wells OU1-TW-D, OU1-TW-E, and OU1-TW-F are provided in Table 1-2 located in Attachment 4, and the wells are included on Figure 4. Contaminant trends for the monitoring wells and area water levels are in Figures 1-3 through 1-15 located in Attachment 4. Wells J, ART-1, PZ-1, and PZ-2 continue to show elevated levels of PCE and daughter products. The results in the recovery well, ART-1 show no trend. Other source area wells J, PZ-1, and PZ-2 show decreases in concentrations over the last two sampling events. Data concludes that additional source area contamination exists and the ART well should be either rehabilitated or additional remedial measures identified to reduce source area contamination and its impacts to groundwater. Downgradient wells G, H, and I show elevated levels of site COCs with no discernible trend; however, concentrations over the last five years remain below the ACLs. This, in conjunction with the surface water sampling results, show that contaminated groundwater from OU1 continues to discharge to the surface water but at levels that are protective of potential receptors.

Surface Water: The ROD required collection of samples from the Missouri River annually for the first 5 years of remediation. The FYR report (EPA 2009, page 24) states, "The non-detections of PCE and its degradation products in the river samples collected during the RI confirm the conservative nature of the analysis and support the "no statistically significant increase" in contaminant concentrations criteria required for the use of ACLs." Additionally, "Since groundwater ACLs were not exceeded during the first five years, the Missouri River sampling will be discontinued" (EPA 2009, page 27). Therefore, no Missouri River samples have been collected since the Fall 2009 sampling event and are therefore not included in this report.

5.4.2 OU2 Industrial Drive area and OU6 Wildcat Creek Estates

Since the last FYR a RI of OUs 2 and 6 was completed in June 2010 (Parsons, 2010). A FS was completed in August 2010 (Parsons, 2010) and a ROD was issued in May 2011 (EPA, 2011). Additionally, a Sub-slab Vapor and Indoor Air Sampling Investigation was conducted in 2010 and 2011 (Parsons 2011).

The investigations conducted since the last review indicate the presence of PCE in soil is limited to the open lot north of the former Kellwood facility, beneath the floor of the former Kellwood facility, and beneath and immediately west of Industrial Drive. DNAPL is present in bedrock fractures in a small area on the north and northwest sides of the former Kellwood facility.
PCE is present in groundwater south and west of the former Kellwood facility and appears to be migrating to the south and west. Most of the groundwater flowing through the overburden and in the upper sandstone marker bed/uppermost bedrock interval is expected to discharge to the 500 and 600 tributaries, Wildcat Creek, and Boeuf Creek. PCE was also detected in surface water in the 500 and 600 tributaries.

Two OU2/OU6 groundwater sampling events have been conducted since the last FYR, one in March-April 2009 with results and discussion included in the 2010 RI Report, and one in March-

April 2010. Table 2 from the Site-wide Groundwater Monitoring Data Report – March/April 2010 compares the 2009 and 2010 results (Table 2 is included in Attachment 4). The analytical data were compared to the screening criteria which was either the MDNR default target levels or EPA MCLs as applicable. Results for PCE, 1,2,-DCE, and TCE from the 2010 sampling event were generally lower than the 2009 detections but still well above the screening critieria.

Seven domestic/private supply wells within OU2/OU6 have had detections of PCE. One of these wells, JS-37, has been removed from service. Well JS-25 is not currently in use and Well JS-27 has consistently contained PCE at a concentration below the MCL. The remaining four wells, JS-14, JS-36, JS-38, and JS-52 have home treatment systems in place to remove VOCs to below MCLs for site COCs. These four wells are sampled quarterly and the time series plots for these residential wells showing influent concentrations of PCE for the sampling events through the second quarter of 2014 are provided in Attachment 4. As shown in the plots, the PCE concentrations at well JS-14 decreased sharply after the installation of a well liner in 2008 but concentrations show a slight increasing trend since 2010 and are above the MCL. PCE concentrations in wells JS-38 and JS-52 show a general decreasing trend since the installation of the well liners. Concentrations have now been below the MCL for the last 14 sampling events at JS-38 (since April 2009), and the last 12 sampling events at JS-52 (since June 2010). PCE concentrations fluctuated in JS-36 after the installation of the well liner in 2008 with concentrations ranging from approximately 160 ppb to 325 ppb. PCE detections from the more recent sampling events in JS-36 from 2012-2014 have ranged from 160 ppb to 200 ppb. Groundwater data collected from the residential wells shows that the plume continues to impact these wells. The treatment systems are effective in delivering potable water to these residences. Future remediation activities are expected to reduce plume contamination and groundwater monitoring results from these wells and other residential wells will be evaluated to ensure they are not impacted by the site contamination.

Sub-slab vapor sampling was performed at the Metalcraft Building in December 2010 and subsequent indoor air sampling was performed in January 2011. The primary objectives of the investigation were to (1) evaluate the potential presence of selected chemicals of concern in vapor under and within the Metalcraft building, and (2) evaluate, based on results, whether any additional actions are needed. On March 16, 2011, Parsons submitted to the EPA the "Sub-slab Vapor and Indoor Air Sampling Report, Riverfront Superfund Site, Operable Unit No. OU2/OU6, New Haven, Missouri". Specific to indoor air samples collected in the administrative section of the facility, the report concluded that for indoor air, PCE exceeded the EPA screening criterion based on a E-06 cancer risk in several samples. TCE slightly exceeded the E-06 screening criterion in one sample. Most of the samples were below the E-05 incremental cancer risk level of 20.8 $\mu g/m^3$, and the average of all samples (17.4 $\mu g/m^3$) was below this level. Sample results for locations ME06 and ME09 showed detections of PCE at 21 $\mu g/m^3$ and 24 $\mu g/m^3$ respectively, and TCE at 6.2 $\mu g/m^3$ and 2.6 $\mu g/m^3$ respectively. Tables 1 and 2, summarizing the sub-slab air and indoor air sample results from the March 2011 Report, are included in Attachment 4.

On August 18, 2011, Parsons submitted the "Indoor Air Evaluation Report, Riverfront Superfund Site, Operable Unit No. OU2/OU6, New Haven, Missouri". This report was submitted as a supplement to the March 16, 2011 report and provided the results of the second round of indoor air sampling conducted at the former Kellwood facility. The results of indoor air samples collected from the same locations in the administrative section of the facility (ME06 and ME09) showed that PCE was detected at 25 $\mu g/m^3$ and 7.6 $\mu g/m^3$ respectively, and TCE detected at 1.4 $\mu g/m^3$ and < 1.1 $\mu g/m^3$ respectively. The report noted that the sampling results for both the January and June 2011 sampling events were from conditions different than those that the plant workers would normally encounter since the samples were collected during non-operating hours when the doors were closed and the air supply and exhaust fans were not operating. The viability of installing a sub-slab depressurization system was also evaluated. The report concluded that the shallow depth to bedrock and limited thickness of gravel beneath the building slab would make implementation of a sub-slab depressurization system impractical and possibly ineffective. The August 2011 Report indicated that the data collected may be sufficient to support a no further action to address indoor air quality at the Metalcraft facility. However, the report also included a follow-on sampling approach if additional investigations are pursued to confirm this conclusion. Table 1 from the August 2011 Report, summarizing the indoor air sample results from the January and June 2011 sampling events, is included in Attachment 4.

The EPA reviewed the reports and determined that the vapor intrusion pathway is complete at the Metalcraft building. However, the 2011 PCE indoor air sampling results did not indicate concentrations that exceeded the 1E-04 to 1E-06 residual risk range. Depending on the sample location in the building, levels of PCE and TCE in the indoor air correspond to risk levels ranging from lE-06 to slightly greater than lE-05 with the highest risks in the office area. Although current conditions do not indicate significant health risks, the subslab vapor concentrations of PCE and TCE exceed subslab screening levels corresponding to a cancer risk of lE-04 and the HQ of 1. The EPA concurred with the report recommendations to consider modifications to the building HVAC system and to conduct further sampling during operational periods.

The remedial action detailed in the Phase 1 Remedial Design and Remedial Action Work Plan for OUs 2 and 6 (Parsons 2013) is in the early stages of implementation. A 2014 sampling event is tentatively planned for Spring 2014 following the installation of additional monitoring wells. Quarterly data from the residential wells with treatment systems are provided to EPA as Quarterly Residential Summary data tables.

5.4.3 OU3 Old City Dump

OU3 is on a 5-year sampling schedule based on previous sampling results. For OU3 groundwater data, the sampling beginning with the LTM (2003-2004) through the May 2008 event was described in the 2008 Environmental Monitoring Report For Operable Unit 3 (Old City Dump) (City of New Haven, October 21, 2008). The 2013 Environmental Monitoring Report for Operable Unit 3 (Old City Dump) (EPA, November 2013) outlines the results of the groundwater monitoring conducted at OU3 during September/October 2013.

The trend charts for select constituents, Table 3-1 showing selected constituents with a history of reported detections, and Table 3-2 comparing 2008 and 2013 sampling results are provided in Attachment 4.

The background values that had been used for comparison with the 2008 sampling data were used for OU3 during this reporting period. The indicator parameters for the effects of landfill leachate on groundwater remain consistent with the 2008 report: concentrations of dissolved chloride, alkalinity or bicarbonate, ammonia or nitrite plus nitrate, barium, boron, sodium, and strontium; and the presence of total VOCs

Four monitoring wells (BW-03, BW-31, BW-31A, and BW-32) and four domestic wells (JS-26, JS-28, JS-31, and Robller Well) were sampled in 2013. Since flow was not observed at the location of Seep M, a seep water sample was taken just southeast of the Seep M location.

For the monitoring points near the landfill, the trend charts reveal that the concentrations of the constituents generally have gone down in Seep M, BW-03, and BW-32. Concentrations in wells BW-31 and BW-31A have generally remained stable. In private well JS-26, zinc and copper concentrations have increased, but not to levels approaching EPA MCLs. Concentrations in private wells JS-28 and JS-31 have remained relatively stable. The Robller domestic well was sampled for the first time in 2013 (PCE not detected).

Results of the September 2013 sampling indicate no substantial increases in concentrations in the monitoring wells, domestic wells, or Seep M. Overall, concentrations of constituents in BW-03 were much lower than historical ranges. Concentrations of constituents in samples collected from monitoring wells BW-31, BW-31A, and BW-32 were within historical ranges, with the exception of specific conductance, which was lower than historical ranges for all wells. When comparing data collected during 2013 with reported historical concentrations, the following data trends were observed:

- None of the 2013 samples from the monitoring wells, Seep M, or nearby domestic wells contained detectable concentrations of PCE or other VOCs listed in the ROD (EPA, 2003b).

- Concentrations of most parameters that have historically been above background generally remained above background during the 2013 sampling. BW-03 had much lower concentrations of constituents compared with historical sampling results. There does not appear to be an increasing trend in concentrations for any of the monitoring wells or Seep M. One domestic well, JS-26, showed an apparent increase in concentration trends for zinc and copper, but not at concentrations approaching MCLs.

Historically, the following constituents have been reported periodically at concentrations above New Haven background in the landfill monitoring wells and seep: sodium, chloride, silica, sulfate, nitrates, antimony, arsenic, barium, boron, lithium, nickel, strontium, potassium, magnesium, calcium, and zinc. Of these constituents, only antimony and boron have been reported above the EPA primary MCL, and sulfate, iron, and manganese have been reported above the EPA secondary standard.

Historically, the following constituents have been reported at concentrations above New Haven background in the private water supply wells: sodium, chloride, sulfate, nitrate, barium, boron, copper, nickel, strontium, potassium, magnesium, calcium, and zinc. However, none of these constituents have been reported above the EPA primary MCL or EPA secondary standard.

In addition, trace concentrations of PCE, tri-methyl-benzene, and naphthalene were reported in landfill monitoring wells at levels near their corresponding reporting limits but not at levels near EPA MCLs. Seep M historically had trace concentrations of PCE and toluene at levels near their reporting limits. The last detections of any VOC from the groundwater at the landfill wells or the seep was during 2004.

5.4.4 OU4 Maiden Lane Area

OU4 sample data reviewed was from the tree cores (2000-2007), surface water and springs (2000-2005), well water (2000-2007), soil (2001-2005), sanitary sewer samples (2001-2004), and indoor air (2002-2004). All these data are in the Focused Remedial Investigation of Operable Unit 4 (USGS, September 2008). Soil borings were used to characterize the source area and for ISCO design. The results for soil borings from 2004, 2005, 2007, 2008, 2009, and 2010 are located in Table 4-1 in Attachment 4, and shown on Figure 9. These historical sampling results confirm the PCE source area and significant contamination in the bedrock interface.

The USGS sampled several monitoring wells within the OU4 area in 2010, 2011, 2012, and 2013. While a sampling report for these events was not available for review, informal feedback received from the USGS suggested that post injection sampling results indicate movement of the potassium permanganate away from the infiltration galleries. Additional sampling near the infiltration beds is planned in 2014.

5.4.5 OU5 Old Hat Factory

In 2006, EPA signed a ROD for OU5 (EPA 2006). The ROD documented that while the groundwater below OU5 was contaminated, the risk could be addressed with ICs and monitoring. The ROD called for sampling twice per year for the first and second years and then annually for the next three years to provide data during the first FYR for OU5. After the first FYR, monitoring efforts would then be scaled back to one sampling round every five years to provide a current data set for the next FYR. The first FYR was completed in November 2009, and recommended that the current monitoring schedule be followed until the 2nd FYR and then monitoring efforts can be scaled back to annually if the data indicates this is appropriate" Annual sampling at the OU5 site began in Fall 2010.

The Fall 2013 groundwater monitoring event involved collecting and analyzing groundwater samples from all the site monitoring wells: BW-09, BW-09A, BW-12A, BW-15, and BW-16. The data are used to monitor the contamination levels in the plume and determine if cleanup goals (MCLs) are being achieved for the site. Historical groundwater concentrations for the five monitoring well locations (shown in Figure 8) are included in Table 5-1 in Attachment 4, OU5.

The extent of contamination in groundwater at OU5 was evaluated from the site's monitoring well samples. The wells were sampled and analyzed for the presence of VOCs. The COCs at the site are PCE, CT, and chloroform. In the most recent sampling event, 2013, TCE was detected in two wells (BW-9A and BW-16). The laboratory analysis did not detect any other VOCs in the samples. The historical contaminant trend analysis shows a declining trend in both wells, as shown in Attachment 4, Figure 5-2. .

5.5 Site Inspection

A site inspection was held on January 16-17, 2014. All six OUs were visited. Participants in the site inspection included Matt Jefferson, EPA Region 7 RPM for the site, Evan Kifer, MDNR PM for the site, Rob Blake, and Laura McNeil employees of Black & Veatch, EPA's consultant for the site, John Schumacher an employee of the United States Geological Survey and Brian Roberts and Greg Hattan from USACE Kansas City District. City personnel, Peter O'Herin, New Haven Public Works Director, and Dave Blankenship, Assistant Public Work Director were available for a brief tour of OU3. A tour of OU2 and OU6 was provided by Lee Gorday, an employee of Parsons Environmental, the consultant for Kellwood. Site Inspection Checklists and Site Photographs can be found in Attachments 1 and 2. A summary of the inspection observations are listed below:

OU1

• The ART treatment system was not operational. The ongoing operational problems and possible future corrective actions were discussed.
• The monitoring well locations appeared to be in good condition.

OU2

• Viewed the area where the previous soil removal action/land-farming operation was conducted.
• Observed the marked locations for the DNAPL Recovery Wells. No remedy construction or operation activities were in progress at the time of the inspection.

OU3

• Observed the current use of the Old City Dump Site. Site continues to be used for yard waste and debris disposal.
• The gate to the site was open upon arrival. However, the City employees that met at the site indicated that the gate was typically closed and was temporarily open to facilitate the drop-off of Christmas Trees.

OU4

• Observed the infiltration bed area. There was some minor settling around the injection points.

• There was no active construction occurring during the site visit. Overall, the site appeared to be in good condition.

OU5

• No observed changes in land use.

• Monitoring wells appeared to be in good condition.

OU6

• Observed the Wildcat Creek Estates properties.

• There is no active remediation occurring at OU6 (whole-house treatment systems at 4 residences – these were not observed)

5.6 Interviews

Interviews were conducted during the site visit for OU1, OU3, OU4 and OU5 where remedies have been selected. The remedy for OU2 and OU6 is in the early phase of implementation. Those interviewed included Rob Blake (Black & Veatch), Evan Kifer (MDNR), Peter O'Herin and Dave Blankenship (City of New Haven). A brief summary of these interviews is provided below:

Individual Interviewed: Evan Kifer – PM for MDNR

Mr. Kifer was interviewed regarding OU1, OU3, OU4 and OU5. Mr. Kifer had no concerns regarding these OUs. He indicated that he has been kept well informed and information had been provided in a timely manner. During the inspection of OU1, Mr. Kifer acknowledged the problems associated with the ART well and indicated that when MDNR took over OU1, it was unlikely that they would continue operation of the system.

Individual Interviewed: Rob Blake – Black & Veatch Employee and EPA's Consultant for the Site.

Mr. Blake was interviewed concerning OU1, OU4, and OU5. Mr. Blake felt the remedy at OU1 was functioning adequately, although he did acknowledge the problems with the ART system. He indicated that they would make sure that the ART system was operational if MDNR decided to continue using the system after the transfer. At OU4, Mr. Blake indicated that he was unsure if the infiltration galleries would be successful since there was a perched water zone that they were initially unaware of that could interfere with the downward migration of the ISCO.

Individual Interviewed: Peter O'Herin and Dave Blankenship-City of New Haven.

Mr. O'Herin and Mr. Blankenship indicated that the site operation/monitoring for OU3 was status quo. Three domestic wells were recently sampled. The seep that was part of the sampling has dried up and was not sampled. There are no problems associated with this site.

6.0 Technical Assessment

6.1 Operable Unit 1 (Front Street)

6.1.1 OU1 Question A : Is the remedy functioning as intended by the decision documents?

Yes, the remedial action is functioning as intended.

6.1.1.1 Remedial Action Performance

The ROD called for a combination of ICs consisting of proprietary controls, an environmental covenant, and an easement to control exposure to the shallow aquifer and soil; installation of an ART well and associated equipment; and installation of additional monitoring wells and follow up sampling to monitor the plume. The OU1 remedy was declared Operational & Functional on November 2, 2005. The active component of the remedial system, the ART well, has not been fully functional for this five-year period. However, since all groundwater concentrations are below the ACLs, except those at the source area, the system is meeting the performance goals. Total air effluent concentrations are below regulatory levels under the Missouri Air Pollution Program.

On-going sampling is conducted as described in the Final Long-Term Remedial Action Field Sampling Plan for Riverfront Site, OU1 (March 2007). During the bi-annual sampling events, groundwater samples are collected using the procedures outlined in the LTRA Field Sampling Plan. The plume remains stable and the downgradient edge is well below the ACL's.

The land use controls remain in place and there have not been any land use related issues or violations.

6.1.1.2 System Operations and Maintenance

The ART well component of the remedy was not fully functional during this review period. There have been numerous equipment problems, multiple maintenance calls, and limited success in correcting the operational deficiencies. The pump and compressor shut down in 2008. In

2011 there were 8 attempts to restart the system, in 2012 there were 8 maintenance calls, there were 7 maintenance calls in 2013, and so far in 2014, there have been 2 maintenance visits. The pump, sparge compressor, and SVE vacuum blower have been repaired and replaced without lasting success. It is likely that groundwater geochemistry and bacterial issues play a role. Furthermore, water levels from the proximity to the Missouri River continue to present problems and have a detrimental effect on the equipment. When the water level is high it can occlude the SVE well screen. When the water table is low it can expose the lower screen which can result in burning up the pump.

6.1.1.3 Opportunities for Optimization

Over the past four years, there have been 28 maintenance calls for the ART well portion of the RA. Although all of the components have been replaced, the system is still not operational. The new pump recommended in the previous FYR was installed but it subsequently failed. There appear to be multiple issues that have a negative effect on the system components and it is unlikely that future equipment replacements or the addition of new equipment will resolve these issues. Even though the ART well has been nonfunctional, there has been no significant increase in the plume concentration during the review period. Since the plume appears stable and is unaffected by the ART system (whether operating or not), consideration should be given to eliminating the active ART system. Bi-annual monitoring should continue.

However, if there is a decision to restart the system, the ART well should not be used as a monitoring point to determine degradation rates or system success as the water in the remedial well is not representative of the surrounding plume.

6.1.1.4 Early indicators of Potential Issues

The monitoring program is in place to provide for early detection of plume movement. To date there are no indications of any potential plume issues.

6.1.1.5 Implementation of Institutional Controls and Other Measures

The ICs detailed in Section 4.1.3 are in place at the site. These restrictions will remain with the property to prevent future exposure to groundwater.

The selected remedy included quarterly groundwater monitoring for the first two years followed by semi-annual monitoring. Sampling results are compared to the ACLs established for the selected remedy. The current contamination levels are well below the established ACLs and, given the age of the source and lack of future contamination sources, should remain below the ACLs.

6.1.2 OU 1 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes.

6.1.2.1 Changes in Standards and TBCs

The EPA determined, and it was recorded in the ROD, that active restoration of the shallow aquifer was not practicable based on an evaluation of the balancing alternatives. It was further concluded that OU1 conditions met the criteria to allow ACLs to be established for groundwater chemicals of concern – PCE, TCE, VC, and benzene – after two years of monitoring data were collected.

ACLs for OU1 Downgradient Wells

Contaminant	Alternate Concentration Value (µg/L)
PCE	11,000
TCE	8,600
c-DCE	140,000
t-DCE	6,700
VC	9,000

Nothing has changed to affect the ACLs at OU1.

Cleanup levels for soil at OU1 were set at the state Cleanup Levels for Missouri, Table B1, Scenario A (residential) Soil Target Concentrations (STARC), September 1, 2001 for two chemicals of concern, Arsenic and Indeno(1,2,3-cd) pyrene. The ROD stated that since ACLs for groundwater were established, soil cleanup levels for other chemicals of concern that would typically be developed for the protection of groundwater were not necessary. CALM was not promulgated by the state, but was replaced by the Missouri Risk-Based Corrective Action (MRBCA) guidance. Those soil concentrations are compared to the current state standards in the table below.

Review of soil standards set as cleanup goals in the OU1 ROD				
Chemical of Concern	Soil Cleanup Level from ROD (mg/kg)	Basis for Cleanup Level	Current state standard*	Is current standard < standard listed in the ROD
Arsenic	11	Compliance with State ARAR **	4	Yes
Indeno (1,2,3-cd) pyrene	3	Compliance with State ARAR **	4	No
* MRBCA Table B-2 Tier 1 Risk-Based Target Levels Residential Land Use Soil Type 1 (Sandy) Current Edition, 2013				
** - Cleanup Levels for Missouri, Table B1, Soil and Groundwater Target Concentrations (STARC and GTARC)				

The maximum detected concentration of Indeno (1,2,3-cd) pyrene at OU1 is 9.5 mg/kg and Arsenic is 10.7 mg/kg. The state Tier 1 MRBCA concentration for Arsenic in soil has become more stringent; however, the 95% UCL concentration of 7.5 mg/kg used in the HHRA, and also the maximum concentration of 10.7 mg/kg are well within normal background concentration ranges for Arsenic.

6.1.2.2 Changes in Exposure Pathways

The human health baseline risk assessment (HHRA) evaluated receptors for potential exposures to contaminants in groundwater and soil. Potential exposure pathways to future residents included ingestion, dermal contact, and inhalation of COPCs in groundwater used as a potable/household water source. Potential exposure also included incidental ingestion, dermal contact, and inhalation of vapors and particulates from mixed soil. Additional receptors included industrial use, trespassers, and construction workers.

The HHRA used Region VII standard default values for exposure parameters (e.g., ingestion, inhalation rates, exposure frequency and duration, etc.) and accepted statistical and modeling methods to estimate exposure point concentrations (EPCs) that, when combined, resulted in conservative, reasonable maximum exposures (RMEs) for each exposure pathway. Some changes to these potential exposure pathways are discussed in Section 6.1.2.4 below, but none were identified that would result in greater exposure opportunities than those evaluated in the HHRA.

The surface soil risk driver COCs are benzo(a)pyrene, arsenic, and PCE. The surface soil exposures have excess cancer risks of 1.2E-04 for future residents and 2.85E-05 for future workers. The non-carcinogenic risks were less than 1 for both populations. However, for these future populations to be exposed to the contaminants would require that residences be built on the site and that the existing building floor slab be removed and not replaced with some type of capping material. Additionally, the implementation of ICs has substantially decreased the potential for unacceptable risk at OU1.

One pathway not evaluated in the HHRA was potential inhalation of vapors migrating from subsurface contamination and entering the breathing zone of a building. The HHRA (September 2003) identified two residences northeast of OU1 and stated that indoor air sampling studies for OU1 were inconclusive and ongoing. PCE was detected at 590 $\mu g/m^3$ in the basement air of one home, and was not detected in indoor air at the other. The ROD acknowledged ongoing studies for this pathway. Additional air sampling for PCE took place in July 2003 at the two residences.

Indoor air sampling results for one of the homes repeatedly showed no PCE contamination; PCE was again measured in the other. However, it was concluded that site related sources were not contributing to the concentration measured in the living room (i.e., 29 µg/m^3), since the two basement sample results were much lower, 3 L µg/m^3 (L meaning biased low) and 1.7 µg/m^3. Variations in the indoor air results were attributed to cleaning solutions, dry cleaning, or other household products. While it was determined that no emergency existed at the residence and remediation was not needed, additional sampling was recommended for a year to evaluate seasonal variations. The recommended studies were not available for review.

Additionally, no documentation was found as to whether or not the other volatile COCs at OU1 were evaluated as part of this vapor intrusion study. Subsequent to 2003, as further discussed below, the adjusted toxicity of TCE was considered more toxic, therefore, it is possible that vapor intrusion of volatile COCs could impact the protectiveness of the remedy.

As discussed in Section 4.1.3, ICs are currently preventing exposure to OU1 contaminated groundwater and surface soils. These controls should also prevent future exposure to the contaminants in both media, as well as protecting from vapor intrusion exposure for any future receptors.

6.1.2.3 Changes in Toxicity and Other Contaminant Characteristics

The OU1 HHRA was written just before the EPA's 2003 OSWER Toxicity Value Hierarchy that changed the recommended toxicity values.

All of the entities (EPA, ATSDR and Cal EPA) who derive toxicity values discussed in the 2003 hierarchy periodically retire, revise, and derive new toxicity values. For example, the "suite" of EPAs Integrated Risk Information System (IRIS) toxicity values available in 2003 differs from the IRIS toxicity values that exist today. Changes to the published toxicity values for several of the VOCs that were COPCs at OU1 are summarized in the table below. Only inhalation toxicity values are addressed since land use controls prevent the exposure to groundwater and soil at OU1, and the cleanup levels are based on the ACLs.

Chemical	Inhalation Toxicity Values					
	RfCi (mg/m3)			IUR (µg/m3)-1		
	BRA OU1	Current (b)	Change	BRA OU1	Current(b)	Change
PCE	10.6 (N)	0.004 (I, 2012)	More Toxic	3.1 E-06 (N)	2.6E-07	Less Carcinogenic
TCE*	0.04 (N)	0.002 (I, 2011)	More Toxic	1.7 E-6 (N)	4.1E-06	More Carcinogenic
cis-1,2-Dichloroethylene	NA	0.2	More Toxic			
1,1,1-Trichloroethane	2.2 (N)	5.0	Less toxic			
Benzene	0.006 (N)	0.03	Less toxic	7.8 E-06	7.8 E-06	No Change
Toluene	0.4	5	Less toxic			
Vinyl Chloride	0.1	0.1	No Change	4.4 E-06	4.4E-06	No Change
Xylenes (mixed)	None	0.1	More toxic			
Arsenic	NA	0.000015	More toxic	4.3 E-03	4.3E-03	No Change
Benzo(a)Pyrene				8.8 E-04	1.1E-03	More Carcinogenic
Indeno-(1,2,3-cd) pyrene				8.8 E-05	1.1E-04	More Carcinogenic
~Benz[a]anthracene				8.8 E-05	1.1E-04	More Carcinogenic
~Chrysene				8.8 E-07	1.1E-05	More Carcinogenic
~Benzo[b]fluoranthene				8.8 E-05	1.1E-04	More Carcinogenic
Chlordane		0.0007	More toxic	1 E-04	1 E-04	No Change

(b) EPA Regional Screening Levels, May 2014

(N) Source listed in HHRA (2003) as NCEA. National Center for Environmental Assessment Risk Assessment Issue Papers.

While some toxicity values now indicate greater health concerns, others indicate less. Non cancer and cancer inhalation toxicity factors and changes have been included for COCs that are evaluated in the ROD. The table provides a comparison of the previous vs. current toxicity factors that may be used if the decision is made to further evaluate the inhalation pathway.

6.1.2.4 Changes in Risk Assessment Methods (OU1)

Risk assessment methodologies have not changed in a way that could affect the protectiveness of the remedy. In July 2004, EPA finalized Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment. However, there were no significant changes in the interim guidance that affect the results of the OU1 HHRA.

The method of calculating cancer and non-cancer risks by the inhalation exposure route changed in Risk Assessment Guidance for Superfund (RAGS) Part F (EPA, 2009). Both the body weight and the inhalation rate were dropped from the inhalation risk equations and inhalation screening levels. The units in which air toxicity values for cancer are presented and used were changed from inhalation slope factors in $(mg/kg/day)^{-1}$ to inhalation unit risks in $(\mu g/m^3)^{-1}$. The units for non-cancer air toxicity values were changed from inhalation reference doses in mg/kg/day to inhalation reference concentrations in mg/m^3. Although this is a methodology change, it would not change the risk estimate sufficiently to affect the protectiveness of the remedy. Additionally, even though EPA completed the risk assessment slightly before this method change, the newer units were used in the OU1 risk assessment.

The standard default exposure factors (SDEFs) used to calculate average daily intakes of chemicals for human health risk assessments were updated by EPA in 2014, in the Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. SDEFs include factors estimating the dose taken in during a day or a single exposure event, the frequency and duration of exposures, the body weight of the receptor, the amount of skin exposed for exposure, and duration of shower or bathing exposure.

Changes in the SDEFs generally result in lowering of risk estimates, with some exceptions. Although this is a methodology change, it would not change the risk estimate sufficiently to affect the protectiveness of the remedy.

During the completion of a human health risk assessment, determinations are made as to whether individual chemicals or combinations of chemicals are protective of human health. However, groundwater cleanup goals for sites are most often set at ARAR values, or in the case of OU1, ACL values. Since the remediation goals for chemicals identified as COCs at OU1 were set at the ACL concentration instead of a risk based concentration, changes in risk assessment methodology do not affect the protectiveness of the remedy.

An ecological risk assessment was previously completed as part of the site wide-Riverfront ecological risk assessment using the EPA guidance, "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments" (EPA 1997). The ecological risk indicated that the potential for significant ecological impacts from OU1 are small. Although state and federal threatened and endangered species exist within Franklin County; none of these species are known to exist in the area or at OU1. The lack of suitable habitat in the vicinity of OU1 indicates that there is minimal potential for these species to be present. Surface water (Missouri River) analytical results did not detect contaminants, so the maximum possible concentrations were below the Ecological Screening Values. The Ecological Screening Values determine the ecological risks. Consequently, the potential for ecological receptors to be exposed to contaminants in the surface water is minimal, and there is no need for any additional Baseline ERA.

6.1.3 OU1 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. Refer to the OU1 protectiveness discussion in Section 9.0.

6.2 Operable Unit 2 (Industrial Avenue)

6.2.1 OU2 Question A: Is the remedy functioning as intended by the decision documents?

The Record of Decision for OU2 and OU6 selected the remedy for the OU2 contaminant source area, and OU6, the contaminant groundwater plume emanating from OU2. The OU2/OU6 remedy is in the early phase of implementation. Consequently, it is premature to conduct a technical assessment or protectiveness evaluation.

6.2.1.1 Remedial Action Performance

The OU2 remedy is in the early phase of implementation. Consequently, it is premature to conduct an assessment of the remedy performance.

6.2.1.2 System Operations and Maintenance

The OU2 remedy is in the early phase of implementation. Operation of the remedy has not started.

6.2.1.3 Opportunities for Optimization

The OU2 remedy is in the early phase of implementation. Consequently, it is premature to conduct a technical assessment or determine opportunities for optimization.

6.2.1.4 Early indicators of Potential Issues

The OU2 remedy is in the early phase of implementation. Consequently, it is premature to conduct a technical assessment or identify potential performance issues.

6.2.1.5 Implementation of Institutional Controls and Other Measures

OU2 is within an area designated as a "Sensitive Area" by the State (10 CSR § 23-3.100). Specifically, OU2 is included in "Special Area 3" as set forth at 10 CSR § 23-3.100(7) which imposes requirements on well drilling in the area designed to prevent the installation of any well within or near the contamination that may result in an unacceptable human exposure. In addition to these restrictions, EPA, through the five year review process required by CERCLA § 121(c), will continue to review the remedy for protectiveness. As part of this process, EPA will inform and educate the owners of the properties where groundwater contamination is present of the potential health hazards posed by COCs and the need to comply with state well installation requirements.

6.2.2 OU 2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes the assumptions are still valid.

6.2.2.1 Changes in Standards and TBC

The MCLs for all COCs are still the same as they were at the time of the ROD.

Contaminant	MCL in ROD	Current MCL	Change?
Tetrachloroethene	5 µg/L	5 µg/L	No
Trichloroethene	5 µg/L	5 µg/L	No
* Safe Drinking Water Act			

6.2.2.2 Changes in Exposure Pathways

The land use at OU2 has not changed. The total cancer risk and the total HI resulting from exposure to COCs in soil and groundwater at OU2/OU6 for a current/future industrial worker (indoor) are 1.9 E-03 and 0.1, respectively.

The ROD requires protection of human health by eliminating inhalation exposure to indoor air containing concentrations of COCs due to the migration of vapors from contaminated soil or shallow groundwater in excess of risk-based standards. The potential risk to receptors in indoor air was calculated using conservative models to estimate the groundwater and soil concentrations that would be representative of safe levels of PCE in indoor air. The risk-based standards for soil and groundwater based on vapor intrusion to indoor air were calculated based on the assumptions defined in the HHRA. The resulting industrial use RAO for PCE in soils is 272 µg/kg, and in groundwater 423 µg/L; and the residential use RAO for PCE in soils is 36 µg/kg, and 44 µg/L for PCE in residential groundwater. This ROD RAO applies to the area around the land-farm area for both the industrial and hypothetical residential scenario and at identified areas of impacted soil beneath the former Kellwood facility (Metalcraft building). The EPA reviewed the Sub-slab Vapor and Indoor Air Sampling Reports documenting sampling efforts at the Metalcraft Building completed in December 2010, January 2011, and June 2011. EPA determined that the vapor intrusion pathway is complete at the Metalcraft Building at the former Kellwood Facility. However, the 2011 PCE indoor air sampling results did not indicate concentrations that exceeded the 1E-04 to 1E-06 residual risk range. Although current conditions do not indicate significant health risks, EPA noted that the sub-slab vapor concentrations of PCE and TCE exceeded sub-slab screening levels.

Since this vapor intrusion pathway also has impacts from changing toxicity, it will be further discussed in the next section.

Groundwater ingestion has been eliminated for OU2 with the use of ICs as described in Section 4.2.3. The whole house treatment systems provided for the residences in OU6 eliminated potential inhalation of volatiles from groundwater as well as ingestion and dermal contact.

6.2.2.3 Changes in Toxicity and Other Contaminants

PCE and TCE have more recent toxicity values than those used in the 2010 risk assessment at OU2 and OU6. IRIS (EPA's Integrated Risk Information System) added new assessments for TCE in 2011 and PCE in 2012. The changes in toxicity are summarized below:

Chemical	Oral Toxicity Values					
	RfDo (mg/kg-day)			SFo (mg/kg-day)-1		
	Previous (b)	Current(b)	Change	Previous (d)	Current(b)	Change
PCE	0.01	6.00E-03	More Toxic	5.40E-01	2.10E-03	Less Carcinogenic
TCE	--	5.00E-04	More Toxic	1.30E-02	4.60E-02	More Carcinogenic

Chemical	Inhalation Toxicity Values					
	RfCi (mg/m3)			IUR (µg/m3)-1		
	Previous (d)	Current (b)	Change	Previous (d)	Current(b)	Change
PCE	2.70E-01	4.00E-02	More Toxic	5.90E-06	2.60E-07	Less Carcinogenic
TCE	1.00E-02	2.00E-03	More Toxic	2.00E-06	4.10E-06	More Carcinogenic

(b) IRIS
(d) Cal EPA

According to the 2010 RI, PCE was the only COC evaluated for the vapor intrusion pathway. In the case of the industrial indoor worker and the hypothetical resident at these locations, inhalation of PCE from soil and groundwater volatilizing to indoor air is a large contributor to the risk and hazard index. Locations where concentrations of PCE in soil exceed target concentrations for industrial indoor workers are underneath the building slab, and generally north and west of the former Kellwood facility (Metalcraft building). Subsequent to the RI, sub-slab vapor sampling and indoor air sampling was performed at the Metalcraft building in 2010 and 2011. The EPA reviewed the Sub-slab Vapor and Indoor Air Sampling Reports and concurred with the recommendations to conduct further sampling and risk evaluation, and to consider modifications to the building HVAC system and other mitigation measures.

Based upon the new IRIS assessments, PCE is now thought to be less carcinogenic than in the past. However, PCE is now viewed to be somewhat more toxic via oral and inhalation exposures with a lower oral RfD and lower inhalation RfC.

The assumed carcinogenic potency of TCE using the 2011 IRIS assessment is now greater. TCE is also now thought to have greater non-cancer toxicity. While TCE's toxicity values have changed, the MCL of 5 µg/l remains unchanged. Consequently, remedies and RAOs based upon MCLs are not affected. Since the institutional controls at OU2 and OU6 are still intact, and affected residents have been provided whole house treatment units, the changing toxicity of the contaminants will not impact the potential risk to residential receptors at the site. During the additional vapor intrusion evaluations for the industrial worker receptors at the Metalcraft building, use of the current toxicity values for PCE and TCE should be verified.

6.2.2.4 Changes in Risk Assessment Methods

Generally, the risk assessment methodology is the same now as it was in 2010.

Total incremental lifetime cancer risks for residential exposure scenarios were calculated by combining the estimated cancer risk for the adult and child. The standard default exposure factors (SDEFs) used to calculate average daily intakes of chemicals for human health risk assessments have been recently updated (USEPA, 2014b). SDEFs include such factors as estimating the dose taken in during a day or a single exposure event, the frequency and duration of exposures, and the body weight of the receptor. In evaluating the effects of these changes on the average daily intakes, some changes cause increases while others cause decreases. Additionally, as described above, the groundwater ingestion pathway has been eliminated for OU2 and OU6. Therefore, changes in SDEFs do not bring the protectiveness of the remedy into question.

The ecological risk assessment completed as part of the site wide-Riverfront ecological risk assessment was modified after the RI was prepared and additional soil, surface water, and sediment samples were collected in association with the investigation of OU2 and OU6. Thus, the conclusions of the baseline ecological risk assessment (BERA) were reassessed in light of this additional information. The ROD indicates that no site-related chemicals of potential ecological concern (COPECs) were detected at frequencies or concentrations likely to pose a risk to ecological receptors, and no further ecological investigations or assessments were recommended.

In the BERA, a PRG was established in surface water. This concentration was based on the EPA Region 5 EDQL. However, in 2003 EPA Region 5 updated the EDQLs to ESLs and a new level of 45 µg/L was established for PCE. EPA Region 3 updated its surface water screening benchmarks in 2006. Because of changes in the Region 3 BTAG (ecological) screening risk assessment benchmarks, the ROD changed the PRG for surface water to 111 µg/L for PCE. This methodology is still protective.

6.2.3 OU2 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. Refer to the OU2 protectiveness discussion in Section 9.0.

6.3 Operable Unit 3 (Old City Dump)

6.3.1 OU3 Question A: Is the remedy functioning as intended by the decision documents?

Yes, the remedy is functioning as intended.

6.3.1.1 Remedial Action Performance

The ROD for OU3 requires ICs and long-term monitoring (LTM) for the groundwater at the site (EPA, 2003b). The City of New Haven is responsible for all LTM actions or designated entities as described in a Consent Decree between the United States and the City of New Haven, Missouri (EPA, 2007).

ICs were implemented at OU3 in layers to enhance the protectiveness of the remedy. The primary form of IC is a proprietary control, specifically an environmental covenant and easement. This form of proprietary control was selected as it is effective as an informational device and creates a readily enforceable legal property interest. The OU3 ICs, detailed in Section 4.3.3, are in place.

The selected remedy also uses monitoring to ensure that the contaminants do not migrate from the Site and reach new receptors. The 2013 environmental monitoring effort for OU3 included an inventory of the nearby domestic wells, an inspection of the facility, an inspection of monitoring wells and the seep, and groundwater monitoring. The activities included in the 2013 monitoring effort are summarized in Section 4.3.2. The groundwater quality results from the 2013 sampling effort are discussed in Section 5.4.3.

6.3.1.2 System Operations and Maintenance

The City of New Haven completed the annual O&M inspection checklist for 2013. A copy of the completed checklist is included in Attachment 4 – OU3 Data. The inspection covered general site conditions, current land use, site access and fencing, condition of the monitoring wells and seep, and institutional controls. The City of New Haven continues to use the site as a compost area and bulk materials storage area, which is consistent with approved uses listed in the Consent Decree (EPA, 2007). Access to the landfill is restricted and fences were intact.

6.3.1.3 Opportunities for Optimization

As previously noted in the 2009 Review, there still are no written easements with adjacent owners for access to monitoring wells. Access continues to be through verbal agreement and a written request prior to sampling.

6.3.1.4 Early indicators of Potential Issues

As mentioned in Section 6.3.1.3 above, access to the private wells could be formalized with written easements with the adjacent property owners.

6.3.1.5 Implementation of Institutional Controls and Other Measures

The OU3 ICs mentioned in Section 6.3.1.1, and detailed in Section 4.3.3, are in place.

6.3.2 OU 3 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes, the assumptions are still valid. The RAOs for OU3 are described in Section 4.3.1.

6.3.2.1 Changes in Standards and TBCs

Federal MCLs were listed in the ROD as standards for antimony (6 µg/L), nitrate (10,000 µg/L), and PCE (5 µg/L). The standard listed for manganese (50 µg/L) was taken from Missouri 10 CSR 20.7.031, Water Quality Criteria for Designated Uses. In addition to the state regulation, EPA has established a standard of 50 µg/L for manganese under the National Secondary Drinking Water Regulations (NSDWRs) which are not enforceable standards. Because no federal or state standard for boron could be located and because it is a risk driver at the site, the lifetime Health Advisory level of 600 µg/L was selected as the cleanup standard. The Federal MCL for Antimony and Nitrate have not changed. The Boron Federal Lifetime health advisory level has increased to 6000 µg/l in the 2012 Edition of the Drinking Water Standards (EPA Office of Water, 2012).

Additionally, the state has added Boron to the current water quality regulation 10 CSR 20-7.031 Water Quality Standards 1-29-2014. This replaced the previous state standard referenced in the ROD.

Chemical of Potential Concern	Cleanup Level (µg/L)	Basis for Cleanup Level	Current Standard	Source	Change?
Antimony	6	MCL	6	MCL	No
Boron	600	LHAL**	6000	LHAL**	Yes
			2000	State Standard	Yes
Manganese	50	State Standard	50	State Standard	No
Nitrate	10000	MCL	10000	MCL	No
PCE	5	MCL	5	MCL	No

Notes

µg/L - micrograms per liter

MCL - EPA Maximum Contaminant Level

LHAL - Lifetime Health Advisory Level

State Standard in ROD Criteria for Designated Uses, Chapter 7 - Water Quality, 10 CSR 20.7

Current state standard **10 CSR 20-7.031** Water Quality Standards 1-29-2014.

** No MCL or other ARAR established for boron. The TBC value (the LHAL) was used

As shown in the table, the current ARARs or TBCs are the same or higher than the cleanup levels defined in the ROD.

6.3.2.2 Changes in Exposure Pathways

The HHRA for OU3 was completed in 2002 and assessed hypothetical exposure pathways assuming potable/domestic use of groundwater. Current residential exposures were assessed for ingestion of inorganics detected in a domestic well located just west of OU3. There was no unacceptable risk or hazard for this receptor.

A future residential scenario assessed ingestion of COPCs in groundwater, and dermal contact and vapor inhalation while showering. A future worker scenario included ingestion of contaminants in groundwater. The Total Hazard Index for the future residential and worker groundwater scenario exceeded 1.0. However, ingestion of groundwater was essentially the only contributor to the potential hazards, and the main contaminants that contributed to the toxicity were antimony and boron resulting in a total pathway HI greater than 1.0.

It is a highly conservative assumption that residents and workers could be exposed to contaminated groundwater from OU3. The contamination has not affected drinking water in the area around OU3. The aquifer at OU3 consists of multiple formations. Most domestic wells do not use the Cotter Dolomite surface formation as the target formation for their water supply. However, there are no aquitards between the Cotter Dolomite and deeper formations of the Ozark Aquifer, thus, if contamination were present, it would have the potential to affect wells drilled near OU3. The environmental covenant eliminated these exposure pathways to groundwater by prohibiting placement of groundwater wells on the property, and minimized exposure opportunities to soil by limiting disturbance.

However, to be extremely conservative, the OU3 risk assessment assumed that the future resident and the future onsite worker would use seep water for 100% of their water ingestion and used the maximum detected concentration of Antimony and Boron in the risk assessment calculations. In reality, these seeps are very difficult to access (at the bottom of a steep slope), have very low flows, and are ephemeral.

There were no exposure pathways evaluated for soil; based on the tree coring data, it was concluded in the RI that soil was not the source of PCE groundwater contamination for the Riverfront Site.

There have been no changes in land use that would impact the protectiveness of the remedy. Currently, the Old City Dump is used for surface disposal of trees and yard waste. This land use is consistent with the environmental covenant filed at the Franklin County Recorder of Deeds office on April 14, 2008, limiting disturbance of contaminated soils and prohibiting placement of groundwater wells on the property. MDNR regulations restrict placement of wells within 300 feet of a landfill, which assures that groundwater use immediately downgradient of OU3 will not change. There are no controls beyond 300 ft that would prevent future changes in land or water use.

The ROD similarly states that the current and reasonably anticipated future land use will continue to be a yard waste/gravel storage area and compost site.

6.3.2.3 Changes in Toxicity and Other Contaminants

The January 2003 OU3 risk assessment and the selection of toxicity values predated EPA's 2003 OSWER Toxicity Value Hierarchy. This directive recommended a change in the hierarchy of sources used for risk assessment. Among other changes, the HEAST (EPA's Health Effects Assessment Summary Tables) were dropped from a tier 2 to tier 3 source. The ROD describes the toxicity value sources in the following order:

1) The EPA's IRIS database for toxicity value (i.e., carcinogenic slope factors and noncarcinogenic reference doses (EPA, September 2002).

2) National Center for Environmental Assessment (NCEA) - Superfund Technical Support Center

3) Risk Assessment Issue Papers for Tetrachloroethene (June 1997 and December 2001).

All of the entities (EPA, ATSDR and Cal EPA) who derive toxicity values discussed in the 2003 Hierarchy periodically retire, revise, and derive new toxicity values. As a result, and as an example, the "suite" of IRIS (EPA Integrated Risk Information System) toxicity values available at the time of the ROD differs from the IRIS toxicity values that exist today.

Toxicity values for antimony and boron are summarized below.

Chemical	Oral Toxicity Values				
	RfDo (mg/kg-day)				
	Previous (b)	Current (c)	Change	Date Revised	Date Retrieved
Antimony	.0004	.0004	None		Retrieved 4-2014
Boron	.09	0.2	Less toxic	Updated 08/05/2004	Retrieved 4-2014

(b) Value from 2003 Risk Assessment, Value from IRIS 2002.
(c) IRIS, 2014
Therefore, toxicity values used in the ROD are protective.

6.3.2.4 Changes in Risk Assessment Methods

EPA's 2009 Supplemental Inhalation Risk Assessment Guidance for Superfund (RAGS Part F) changed the type and unit of the inhalation toxicity values presented and used by EPA. This change in inhalation methodology would not have an impact on the decisions at the site since the COPCs at the site are not volatile.

The standard default exposure factors (SDEFs) used to calculate average daily intakes of chemicals for human health risk assessments have been recently updated (USEPA, 2014b). SDEFs include such factors as estimating the dose taken in during a day or a single exposure event, the frequency and duration of exposures, and the body weight of the receptor. In evaluating the effects of these changes on the average daily intakes, some changes cause increases while others cause decreases.

However, the minor modification to the exposure factors at OU3 would not have a significant impact since, as described above, exposure via the groundwater ingestion pathway is highly unlikely. Also, the concentrations used in the risk assessment were the maximum detected

Antimony and Boron at locations where there are not currect receptors. Therefore, changes in SDEFs do not bring the protectiveness of the remedy into question.

An ecological risk assessment was previously completed as part of the site wide-Riverfront ecological risk assessment using the EPA guidance, "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments" (EPA 1997). The ecological risk indicated that the potential for significant ecological impacts from OU3 are small. Although state and federal threatened and endangered species exist within Franklin County; none of these species are known to exist in the area or at OU3. The presence of suitable habitat in the vicinity of OU3 indicates that there is potential for these species to be present. Surface water (Missouri River) analytical results did not detect contaminants, so the maximum possible concentrations were below the Ecological Screening Values, which determine the ecological risks. Consequently, the potential for ecological receptors to be exposed to contaminants in the surface water is minimal, and there is no need for any additional Baseline ERA.

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

No other information has come to light, including newly-identified ecological risks or natural disasters, that could affect the protectiveness of the OU3 remedy.

6.4 Operable Unit 4 (Maiden Lane)

6.4.1 OU4 Question A: Is the remedy functioning as intended by the decision documents

The OU4 remedy is in the early phase of implementation. Consequently, it is premature to conduct a technical assessment evaluation.

The remedial action selected in the March 26, 2009 ROD for OU4 addresses PCE, TCE, and vinyl chloride contamination in soil and groundwater in the fractured bedrock. The remedial action selected to address these COCs consists of the injection of a chemical oxidant to enhance chemical oxidation of the COCs, monitoring, and institutional controls (ICs). Due to fractured bedrock, the groundwater contamination was addressed with a TI waiver. Groundwater monitoring will track contaminant levels and migration. The current status of remedy implementation is detailed in Section 4.4.2.

Prudent Technologies, Inc. performed the first injections into the infiltration galleries in the 1st quarter of 2012. Prudent Technologies will conduct soil sampling during the soil treatment phase in Years 2, 4, 6, and 9 of operation. Based on the initial injections in the 1st quarter of 2012, Year 2 soil sampling should occur in 2014. The Year 2 soil sampling results were not available for this FYR.

In 2013, additional groundwater monitoring wells BW-17, and BW-18 were installed by the USGS to determine if there was DNAPL accumulating in fractured bedrock in the saturated zone. Preliminary analytical data of PCE > 190,000 µg/l in monitoring well BW-18 suggests that DNAPL is present at the source area. The USGS sampled several monitoring wells within the OU4 area in 2010, 2011, 2012, and 2013. While a sampling report for these events was not available for review, informal feedback received from the USGS suggested that post injection sampling results indicate movement of the potassium permanganate away from the infiltration galleries. Additional sampling near the infiltration beds is planned in 2014.

6.4.1.1 Remedial Action Performance

The OU4 remedy is in the early phase of implementation. Consequently, it is premature to conduct an assessment of the RA performance.

6.4.1.2 System Operations and Maintenance

The first injections into the infiltration galleries were performed in the 1st quarter of 2012. A total of 3,500 gallons of potassium permanganate (1.18%) solution was injected into the infiltration beds using the three Fluid Injection Points. Approximately 40 gallons of a 2.34% solution of potassium permanganate solution was injected into each of the 13 manholes. The first round of soil sampling is scheduled in 2014.

6.4.1.3 Opportunities for Optimization

There is not sufficient performance data to evaluate the performance of the remedy and identify opportunities for optimization.

6.4.1.4 Early indicators of Potential Issue

There is not sufficient performance data to evaluate the performance of the remedy and identify potential issues.

6.4.1.5 Implementation of Institutional Controls and Other Measures

The selected remedial alternative uses ICs as stated in 4.4.3 to safeguard against exposures to the contaminated groundwater. The ICs are in place and functioning as intended.

In addition to this restriction, EPA intends to continue to periodically inform and educate property owners of the potential health hazards posed by the COCs where groundwater contamination is present at OU4 and the need to comply with state well installation requirements. It is expected that EPA will continue to provide public education through the preparation and distribution of fact sheets and/or a newsletter on the Site and by providing informational meetings which may be held every five years. The public education campaign is intended to inform citizens of the potential health hazards associated with exposure to contaminated groundwater and remind the city officials and residents of the restrictions on OU4.

6.4.2 OU 4 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes, the assumptions are still valid with some modifications described below. The RAOs for OU4 are described in section 4.4.1. MCLs and screening levels for OU4 are summarized in a table in Section 6.4.2.1.

6.4.2.1 Changes in Standards and TBCs

The groundwater ARARs listed in the ROD are MCLs. The MCLS for the groundwater COC's at OU4 (PCE, TCE, and cis-1,2-dichloroethene) have not changed since the ROD in 2009. The remedy selected at OU4 was unable to meet ARARs and therefore a waiver based on technical impracticability was invoked. Due to the highly complex and variable bedrock conditions found at the Site, compliance with all ARARs through containment, collection, treatment, or other technologies would be extremely uncertain and costly. A TI waiver for certain chemical-specific ARARs was written prior to the ROD indicating that compliance with groundwater MCLs at OU4 is technically impracticable from an engineering perspective. As a result, the ROD documented a waiver for certain chemical-specific ARARs since compliance with such requirements is technically impracticable from an engineering perspective.

The soil cleanup levels are listed in the same "ARAR" table as groundwater ARARs. These are site specific cleanup levels based on protection of human health with the assumption listed in the Region VI human health screening levels of 2008 (ROD, 2009). These cleanup levels are summarized in the table below. Sampling events in 2009 and 2010 have found soil contamination at levels exceeding what had been detected previously, but the contamination is currently being addressed in the remedial action at the OU.

OU4 Chemical Specific ARARs from ROD, 2009

Groundwater

Contaminant	ARAR Value / Reference		Maximum Detection	Current MCL
Volatile Organic Compounds				
cis-1,2-Dichloroethcnc	70 µg/L	1	210 µg/L	70 µg/L
trans-1,2-Dichlorocthene	100 µg/L	1	30 µg/L	100 µg/L
Tetrachloroethene	5µg/L	1	9.100 µg/L	5µg/L
Trichloroethene	5 µg/L	1	100 µg/L	5 µg/L

1) Safe Drinking Water Act

Soils

Contaminant	Soil Cleanup Goal Value / Reference		Maximum Detection	Current screening Levels (3)
Volatile Organic Compounds				
Tetrachloroethene	550 µg/kg	2	8,000,000 µg/kg	22,000 µg/kg
Trichloroethene	43 µg/kg	2	42,800 µg/kg	910 µg/kg
Vinyl Chloride	43 µg/kg	2	NAF	60 µg/kg

Contaminant of Concern (COC)

(2) EPA Region 6 Human Health Medium-Specific Screening Levels, 2008.

(3) EPA Regional Screening Levels, May 2014
NAF – Not Analyzed For

The ICs at OU4 do not specifically address digging, so the possibility of direct contact with contaminated soil and groundwater would remain. Since the soil RGs are human health based, but have slightly different changes in methodology, they are slightly different than those in the ROD, but show that the soil RGs in the ROD are protective. As an additional note, the title of the ARAR table in the ROD is a bit misleading, because the groundwater MCL would be ARARs, but the soil levels provided are health based screening levels instead of promulgated regulations. These chemical specific soil values have been included as remedial goals also for OU4, but are better referred to as To Be Considered (TBC) values instead of ARARs.

6.4.2.2 Changes in Exposure Pathways

The 2008 HHRA evaluated exposure routes for each receptor at the Riverfront OU4 Site as provided below.

• Residents - Ingestion and dermal contact with groundwater, surface water, sediment and soil. Inhalation of indoor and outdoor air.

• Industrial Workers - Ingestion and dermal contact with surface water, sediment and soil. Inhalation of indoor and outdoor air.

• Construction Workers - Ingestion and dermal contact with surface water, sediment soil and sanitary sewer water. Inhalation of outdoor air.

Based on the completed exposure pathways and calculations made in the HHRA, OU4 presents an unacceptable cancer risk and non-cancer HQ to current and future residents and workers.

For current residents, the estimated total cancer risk was 9.1E-05 to 2.5E-03 and the non-cancer HQ range from 0.1 to 3.0 (RI). The estimated cancer risk to future residents of 5.4E-01 and non-cancer HQ of 900 is based on a baseline condition which does not include the institutional controls implemented at the site that eliminated household use of groundwater. This risk is therefore controlled or managed by the ICs.

Future residential exposures to PCE in soil also result in unacceptable cancer risk and non-cancer hazard. The total estimated cancer risk to current and future workers ranges from 5.1E-05 to 1.7E-03, which at the upper end exceeds the CERCLA cancer risk range of E-04 to E-06. The non-cancer HQ values range from 0.3 to 10 using the exposure point concentrations calculated as the 95% upper confidence limit of the mean for the reasonable maximum exposure, again exceeding the CERLCA HI threshold of 1 at the upper end.

The cancer risks and non-cancer hazards to workers primarily are due to PCE in soil and outdoor air. Most of the estimated cancer risk and non-cancer hazard to current residents and current and future workers is from estimated outdoor air concentrations of PCE which were calculated using a conservative air model, and are likely overestimated.

Outdoor air concentrations (resulting from volatilization of groundwater and soil) were estimated using modeling methods in which the volatilization factor (VF) for a chemical is related to chemical specific diffusion coefficients in water and soil as wells as site-specific physical and meteorological conditions. VFs for residents, industrial workers, and construction workers were developed using a combination of site-specific and default assumptions in accordance with EPA's *Supplemental Guidance/or Developing Soil Screening Levels for Superfund Sites* (EPA, 2002b). The EPCs for outdoor vapors were based on the EPCs for measured soil and groundwater data and the calculated chemical specific VFs. These levels likely overestimated the actual concentration of volatiles in outdoor air. Additionally, the maximum concentration predicted was used as the exposure point concentration in the risk assessment. The soil remediation goals listed above are still protective because they do account for inhalation of vapors from soil as well as direct contact exposures.

For the evaluation of inhalation of indoor air, a total of 22 indoor air samples were collected from 5 residential homes and an elementary school. The RME EPCs for each individual home/residential property was the maximum detected concentration from the exposure unit. The assessment of this pathway is further discussed below.

6.4.2.3 Changes in Toxicity and Other Contaminants

PCE and TCE have newer or more recent toxicity values than were used in the 2008 risk assessment at OU4. IRIS (EPA’s Integrated Risk Information System) added new assessments for TCE in 2011 and PCE in 2012. A comparison of the toxicity values used in the BRA and the current changes in toxicity have been summarized as a part of this five year review.

In the HHRA, cancer risks associated with exposure to TCE were evaluated using oral and inhalation slope factors derived by both the National Center for Environmental Assessment (NCEA) and CalEPA. Since the inhalation of indoor and outdoor vapors were both estimated for continuous daily exposures (24 hours), the total cancer risk and noncancer hazards were calculated separately for exposures to indoor and outdoor vapors.

In the case of the industrial indoor worker and the future resident at these locations, inhalation of PCE and TCE from soil and groundwater volatilizing to indoor air is a large contributor to an unacceptable risk and hazard index. However, there are no RAOs for the vapor intrusion pathway at the site. The TI waiver (2009) for OU4 concluded that the "Vapor intrusion pathway is likely not a concern" because of the results of indoor air sampling in 2002-2003. However, as discussed below, this may need to be reassessed.

Based upon the new IRIS assessments, PCE is now thought to be somewhat more toxic than in the past via oral and inhalation exposures with a lower oral RfD and lower inhalation RfC. PCE is now thought to be less carcinogenic than in the past.

The assumed carcinogenic potency of TCE using the 2011 IRIS assessment is now greater than previously calculated with the Cal EPA Toxicity assessment, but less than previously thought using the NCEA toxicity data. Therefore, the TCE calculated risks if done today would be between the two estimates for each receptor provided in HHRA. TCE is also now thought to have greater non-cancer toxicity than before. Therefore remedies having an RAO of reducing cancer risk from oral or inhalation exposures to not exceed a cancer risk of 1E-06 and an HI of 1, would be affected by the new IRIS assessment for TCE.

Chemical	Oral Toxicity Values					
	RfDo			SFo		
	(mg/kg-day)			(mg/kg-day)-1		
	BRA OU4	Current (b)	Change	BRA OU4	Current(b)	Change
PCE	1 E-02 (IRIS, 1/2008)	6.0E-03	More Toxic	5.4E-01	2.1E-03	Less Carcinogenic
TCE*	3 E-04 (NCEA 1/2008)	5.0E-04	More Toxic	4 E-01 (NCEA 1/2008)	4.6E-02	Less Carcinogenic
TCE*		5.0E-04	More Toxic	1.3 E-02 (Cal EPA 5/2008)	4.6E-02	More Carcinogenic
cis-1,2-Dlchloroethylene	1 E-02 (PPRTV 5/2008)	2 E-03	More Toxic		NA	

Chemical	Inhalation Toxicity Values					
	RfCi			IUR		
	(mg/m3)			(µg/m3)-1		
	BRA OU4	Current (b)	Change	BRA OU4	Current(b)	Change
PCE	6 E-01 (NCEA, 2008)	4.0E-02	More Toxic	5.9 E -6 (Cal EPA 5/2008)	2.6E-07	Less Carcinogenic
TCE*	4 E-02 (NCEA, 2008)	2.0E-03	More Toxic	1.1 E- 4 (NCEA 1/2008)	4.1E-06	Less Carcinogenic
TCE*				2.0 E-6 (Cal EPA 5/2008)	4.1E-06	More Carcinogenic
cis-1,2-Dichloroethylene	NA	2.0E-01	More Toxic	NA	NA	

(b) IRIS, 2014
* TCE was assessed under both the Cal EPA toxicity assessment and the NCEA toxicity assessment in the OU4 BRA.
NCEA . National Center for Environmental Assessment
Dates are dates retrieved.

Remedies and RAOs based upon MCLs are not affected. While TCE's toxicity values have changed, the MCL of 5 µg/l remains unchanged. Since the ICs at OU4 are still intact and residents have been provided an alternative water supply, the changing toxicity of the contaminants will probably not impact the potential risk to receptors at the site,

6.4.2.4 Changes in Risk Assessment Methods

Since the ROD in 2009, the following additional risk assessment guidance has been issued or changed:

- RAGS Part F, Supplemental Inhalation Risk Assessment Guidance. EPA, 2009.
- Vapor Intrusion Frequently Asked Questions (FAQs), with new attenuation and migration factors EPA, 2012.
- Recommended Default Exposure Factors. EPA, 2014.

The standard default exposure factors (SDEFs) used to calculate average daily intakes of chemicals for human health risk assessments have been recently updated (USEPA, 2014b). SDEFs include factors estimating the dose taken in during a day or a single exposure event, the frequency and duration of exposures, the body weight of the receptor, amount of skin exposed for exposure, and duration of shower or bathing exposure, In evaluating the effects of these changes on the average daily intakes, some changes cause increases while others cause decreases, but changes in the SDEFs generally result in lowering of risk estimates. Therefore, changes in SDEFs do not bring the protectiveness of the remedy into question.

The risk assessment methodology of the vapor intrusion pathway has been revised since the 2008 risk assessment. This pathway may or may not pose an unacceptable risk or hazard using current methodology. This pathway for current residents was considered in the HHRA by using previous indoor air samples taken and analyzed in 2002 to 2004. It summarized that there were 21 indoor air samples taken and analyzed for VOCs at four residences and the New Haven Elementary School at OU4. Most of the samples for PCE and degradation products were low. The detected PCE concentrations ranged from 0.08 to 6.2 $\mu g/m^3$. For the Site, a screening level of 3.0 $\mu g/m^3$ was established as an indoor air level of concern in the HHRA. Only one sample contained PCE higher (6.2 µg/m^3) than the level of concern. The two remaining samples from that same residence contained PCE at levels less than 1.0 µg/m^3.

However, as a part of this five year review, it was noted that the location of the vapor intrusion samples were on the edge of what we now know as the extent of contamination as better defined in the November 2009 sampling report. This report summarized that soils sampling results often were detected at levels above the PCE and/or TCE cleanup levels from the surface to the bottom of the soil column in locations around the OU4 source area where drainage is concentrated. Also the residential properties around the area of the OU4 site have increased in number between the earlier maps from the RI at the site and the more recent in the 2009 and 2010 sampling reports.

Considering the change in methodology for VI pathway and the toxicity revisions, there is a potential to have underestimated the potential risk and hazards. The RI reported that 24 hour time integrated indoor air samples were taken at two or three locations per residence and the elementary school. They were analyzed by EPA Region VII for PCE and degradation products (TCE, cis-1,2-dichloroethene, and vinyl chloride). PCE is reported quantitatively in the TI waiver report, and then a separate value is reported for the sum of the three daughter products. Given the site conditions, it is possible that TCE is present at concentrations comparable to those reported for PCE. The acceptable screening level concentrations for TCE are now lower than PCE due to the changed toxicity.

Additionally, there are no remedial action objectives for OU4 that address the vapor intrusion pathway (EPA, 2009). The HHRA indicates unacceptable risks or hazard indexes for several pathways at OU4. Although many of the exposures have been eliminated by the institutional controls at the site, the vapor intrusion pathways with the modified toxicity of TCE and PCE have not been sufficiently evaluated.

An ecological risk assessment was previously completed as part of the site wide-Riverfront ecological risk assessment using the EPA guidance, “Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments” (EPA 1997). The ecological risk concluded that OU4 poses minimal risk to ecological receptors. A May 2008 review of analytical results for surface water samples indicated that the PCE concentrations in the OU4 tributaries did not exceed the ecological screening values. The Ecological Screening Values determine the ecological risks. Consequently, the potential for ecological receptors to be exposed to contaminants in the surface water is minimal, and there is no need for any additional Baseline ERA.

6.4.3 OU4 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Yes. Refer to the OU4 protectiveness discussion in Section 9.0.

6.5 Operable Unit 5 (Old Hat Factory)

There have been no changes in land use that would impact the protectiveness of the remedy.

6.5.1 OU5 Question A : Is the remedy functioning as intended by the decision documents?

Yes, the remedy is functioning as intended.

6.5.1.1 Remedial Action Performance

The remedy is functioning as intended. The December 2006 ROD documented that while the groundwater below OU5 was contaminated, the risk could be addressed with ICs and monitoring. ICs have been implemented at OU5 and monitoring is ongoing. The selected remedy utilizes public education and the ICs outlined in Section 4.5.3. The ROD called for two years of bi-annual sampling followed by three years of annual sampling. At this time, a decision would be made whether or not sampling could be reduced to once every five years to coincide with the Five Year Review. The third and final, annual sampling report was submitted in 2013 in time for inclusion in this FYR. Groundwater analytical results and trend analysis are discussed in Section 5.4.5 and included in Table 5-1 and Figure 5-2 in Attachment 4, OU5. There have been no changes in land use that would impact the protectiveness of the remedy.

6.5.1.2 System Operations and Maintenance

LTRA monitoring activities have continued on schedule without incident. Since Operation consists of sampling from passive diffusion bags (PDBs), there is no equipment to maintain. During the site inspection all of the wells appeared to be in good repair and no issues were noted.

6.5.1.3 Opportunities for Optimization

Given the low groundwater contamination levels, and as recommended in the ROD, consideration should be given to reducing groundwater analytical to biennial sampling. This would allow for two sampling events prior to the next FYR.

6.5.1.4 Early indicators of Potential Issues

There are no issues noted in this FYR.

6.5.1.5 Implementation of Institutional Controls and Other Measures

The ICs put in place minimize future contact with the contaminated groundwater exceeding PRGs. OU5 is located within the footprint of OU4 and within MDNR Special Area 3. The MDNR will provide written approval for all new wells prior to construction.

6.5.2 OU 5 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes, the assumptions are still valid. The 2006 HHRA assessed potentially completed exposure pathways to COPCs in soil and groundwater. Current workers and future residents, workers, and construction workers were assumed exposed through ingestion, dermal contact, and vapor inhalation pathways. Vapors that may intrude into buildings were modeled from groundwater, and vapors that could migrate into the breathing zone of outdoor workers were modeled from soil. Since public water is currently available, only future residents and workers were assumed to use groundwater as a potable or domestic source.

There have been no known changes in exposure pathways since the time of the OU5 HHRA.

6.5.2.1 Changes in Standards and TBCs

PCE was the risk driver. Its MCL is 5 µg/L. The only other contaminants in groundwater that contributed to excess cancer risk above one-in-a-million (1×10^{-6}) were carbon tetrachloride and chloroform. The MCL for carbon tetrachloride is 5 µg/L. The MCL and MCL goal were both listed for chloroform, 80 µg/L and 70 µg/L. The former applies to total trichloromethanes that may be detected in water. These standards have not changed and there are no newly promulgated standards.

Since there were no significant risks from exposures to soil in the human health risk assessment, there were no changes to be evaluated.

6.5.2.2 Changes in Exposure Pathways

There have been no changes in land use since completion of the HHRA. Most of the old hat factory buildings have been torn down with the exception of the historic opera house section. This building is currently undergoing renovation and is expected to be utilized in the future.

OU5 is within an area designated by MDNR as Special Area 3 under the Well Construction Code [10 CSR 23-3.100(7)]. This designation restricts well drilling and is designed to preclude the installation of wells within an area of groundwater contamination. In addition to this restriction on groundwater use, institutional controls in the ROD include continued efforts by EPA to inform and educate property owners where groundwater contamination is located and the associated potential health risks from exposure.

6.5.2.3 Changes in Toxicity and Other Contaminants

An oral slope factor from CalEPA is now available for assessing ingestion/dermal exposures to chloroform which is generally used by EPA on Superfund sites. Considering the MCL (80µg/L) for chloroform is identified in the ROD, this change in available toxicity information has no impact on the protectiveness of remedy.

Chemical	Oral Toxicity Values							
	RfDo				SFo			
	(mg/kg-day)				(mg/kg-day)-1			
	BRA OU5	Current	Source	Change	BRA OU5	Current	Source	Change
PCE	1 E-02 (IRIS, 2005)	6.0E-03	(IRIS, 2014)	More Toxic	0.54 (Cal EPA, 2005)	2.1E-03	(IRIS, 2014)	Less Carcinogenic
Carbon Tetrachloride	7.0 E-4 (IRIS, 2005)	4.0E-03	(IRIS, 2014)	Less Toxic	0.13 (IRIS, 2005)	7.0E-02	(IRIS, 2014)	Less Carcinogenic
Chloroform	1 E-02 (IRIS, 2005)	1.0E-02	(IRIS, 2014)	No change	NA	3.10E-02	(Cal EPA)	More Carcinogenic

Chemical	Inhalation Toxicity Values							
	RfCi				IUR			
	(mg/m3)				(µg/m3)-1			
	BRA OU5	Current	Source	Change	BRA OU5	Current	Source	Change
PCE	0.035 (Cal EPA, 2005)	4.0E-02	(IRIS, 2014)	About the same	5.9 E -6 (Cal EPA, 2005)	2.6E-07	(IRIS, 2014)	Less Carcinogenic
Carbon Tetrachloride	0.04 (Cal EPA, 2005)	1.0E-01	(IRIS, 2014)	Less Toxic	1.5 E-05(IRIS, 2005)	6.0E-06	(IRIS, 2014)	Less Carcinogenic
Chloroform	0.3 (Cal EPA, 2005)	9.8E-02	ATSDR	More Toxic	2.3 E-5 (IRIS, 2005)	2.3E-05	(IRIS, 2014)	No change

Dates are dates retrieved.

6.5.2.4 Changes in Risk Assessment Methods

There were no significant changes in risk assessment methodologies that would affect the protectiveness of the remedy. While EPA finalized Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment in July 2004, there were no significant changes from the interim guidance, which was followed in the OU3 HHRA (EPA 2003).

The OU5 risk assessment evaluated the vapor intrusion pathway by using a groundwater screen of Johnson and Ettinger's Model for Subsurface Vapor Intrusion into Buildings to quantify intake and associated risks and hazards (J&E 2004). Using this model, the total lifetime excess cancer risks posed to indoor receptors for exposure to volatiles that may potentially intrude into indoor spaces from groundwater exceed the point of departure but fall within the target risk range. The total cancer risk calculated to future residents based on vapor intrusion from groundwater was 2 E-06 and was nearly exclusively driven by PCE. As demonstrated in the Table, the current calculated excess inhalation risk from PCE would be slightly less due to the change in the IUR.

EPA’s 2009 Supplemental Inhalation Risk Assessment Guidance for Superfund (RAGS Part F) changed the type and unit of the inhalation toxicity values presented and used by EPA. Inhalation reference doses for non-cancer toxicity had been presented as inhalation reference doses in mg/kg-day and were replaced with inhalation reference concentrations (RfC) in mg/m^3. Inhalation slope factors presented in (mg/kg-day)-1 were replaced with inhalation unit risks in ($\mu g/m^3$)-1. Although the risk assessment was slightly before this modification by EPA the newer units were used in the 2006 risk assessment. Sources of toxicity values, as well as the actual toxicity values, are provided in the table above. As noted in the tables, some of the toxicity values have changed slightly.

The standard default exposure factors (SDEFs) used to calculate upper bound daily intakes of chemicals for human health risk assessments have been recently updated (USEPA, 2014b). SDEFs include factors estimating the dose taken in during a day or a single exposure event, the frequency and duration of exposures, the body weight of the receptor, amount of skin exposed for exposure, and duration of shower or bathing exposure, In evaluating the effects of these changes on the average daily intakes, some changes cause increases while others cause decreases, but changes in the SDEFs generally result in lowering of risk estimates. Therefore, changes in SDEFs do not bring the protectiveness of the remedy into question.

An ecological risk assessment was previously completed as part of the site wide-Riverfront ecological risk assessment using the EPA guidance, “Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments” (EPA 1997). The ecological risk assessment concluded that OU5 poses minimal risk to ecological receptors. Since the potential for ecological receptors to be exposed to contaminants in the surface water is minimal, there is no need for any additional Baseline ERA.

6.5.3 OU5 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light, including newly-identified ecological risks or natural disasters, that could affect the protectiveness of the OU5 remedy.

6.6 Operable Unit 6 (Wildcat Creek Estates)

6.6.1 OU6 Question A : Is the remedy functioning as intended by the decision documents?

The Record of Decision for OU2 and OU6 selected the remedy for the OU2 contaminant source area, and OU6, the contaminant groundwater plume emanating from OU2. The OU2/OU6 remedy is in the early phase of implementation. Consequently, it is premature to conduct a technical assessment or protectiveness evaluation. However, the remedy, when fully implemented, is expected to function as intended by the ROD.

6.6.1.1 Remedial Action Performance

The overall OU2/OU6 remedy is in the early phase of implementation. However, the Whole House Treatment Plan portion of the remedy, implemented prior to the ROD, continues. Currently, four residences are equipped with whole-house treatment systems. The residential wells are sampled quarterly. Based on the quarterly sampling results, the treatment systems at two of the four residences are no longer required under the Consent Order. While these two systems are still in place and voluntarily monitored, continued maintenance is not required under the Consent Order. The quarterly residential well sampling supports the continued use and maintenance of the other two treatment systems.

6.6.1.2 System Operations and Maintenance

The Phase 1 Remedial Design and Remedial Action Work Plan for OU2 and OU6, dated May 17, 2013, was approved by EPA. Since the remedy is in the early phase of implementation, only operation and performance data for the in place whole-house treatment systems is available.

The four whole house water treatment systems discussed in Section 6.6.1.1 continue to operate. The two systems that are no longer required under the Consent Order (JS-38 and JS-52), are still in place and monitored voluntarily on an annual basis. However, their continued maintenance is not required under the current Consent Order. Per the 2013 RD, the two systems with PCE detections above the MCL (JS-14 and JS-36) will continue to be sampled quarterly until analysis of multiple monitoring events indicates that the system is no longer needed. Typical maintenance activities for these treatment systems include an inspection at the time of each quarterly sampling event, replacement of the granular activated carbon media in the treatment systems due to either contaminant breakthrough or excessive pressure losses, and repair of system leaks.

6.6.1.3 Opportunities for Optimization

The OU2/OU6 remedy is in the early phase of implementation. Consequently, it is premature to conduct a technical assessment or determine opportunities for optimization.

6.6.1.4 Early indicators of Potential Issues

The OU2/OU6 remedy is in the early phase of implementation. While it is premature to conduct a technical assessment, there are no current early indicators of potential performance issues.

6.6.1.5 Implementation of Institutional Controls and Other Measures

The required ICs, detailed in Section 4.2.3, are in place and functioning as intended.

6.6.2 OU 6 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes, as identified in the subsections within Section 6.2.2 for OU2, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the OU2/OU6 remedy are still valid.

6.6.3 OU6 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light, including newly-identified ecological risks or natural disasters, that could affect the protectiveness of the OU6 remedy.

7.0 Issues

Table 3 presents the issues or deficiencies identified during this FYR period that would prevent the remedy from being protective.

Table 3: Issues

Issue #	Issue	Affects Protectiveness (Y/N)	
		Current	Future
	OU1 ISSUE		
1	The equipment issues and groundwater fluctuations have made it difficult to determine the overall effectiveness of the system. The ART system has not operated since 2008.	No	No
2	The 2003 vapor intrusion studies at the existing residential properties recommended monitoring, however no documentation of the monitoring has been located. Additionally, PCE was analyzed and reported quantitatively, but the other volatile COCs were not. Subsequent to the 2003 studies, the adjusted toxicity of TCE was considered more toxic than PCE. Therefore, it is possible that vapor intrusion of volatile COCs could impact the protectiveness of the remedy.	No	Yes
	OU2 ISSUE		
3	EPA concurred with the recommendations in the Sub-slab Vapor and Indoor Air Sampling Reports (2011) that included recommendations to conduct further sampling and to consider modifications to the building HVAC system and other mitigation measures.	No	Yes
	OU4 ISSUE		
4	Residential receptors may be exposed to unacceptable risk due to vapor intrusion.	No	Yes

Additional concerns, not rising to the level of a ‘protectiveness’ issue are the following:

- OU3: No written easements with adjacent property owners for access to monitoring wells and sampled private wells are in place and access continues to be through verbal agreement.

- OU6: Indoor air concentrations were calculated using the Johnson Ettinger model. To assess the potential for vapor intrusion in the residences with whole-house filtration systems in OU6, it may be prudent to sample for subslab soil gas and indoor air while checking the performance of the whole-house filtration systems. While modeling was used in the past, actual indoor air data would better allow for characterization of potential health risks.

8.0 Recommendations and Follow-Up Actions

Table 4 provides a list of recommended actions to address the issues identified in Section 7.0.

Table 4: Recommendations and Follow-Up Actions

Issue #	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
	OU1 RECOMMENDATIONS			
1	The ART Well should be rehabilitated prior to MDNR's assumption of full O&M responsibility of OU 1.	EPA	MDNR	Nov 2015
2	Vapor intrusion should be evaluated at this site using current methodology. Specifically include the two residences on-site, and any other building with basements that are occupied or have a reasonable potential to become occupied. Include site specific volatile COCs such as PCE, TCE, DCE, and benzene. Implement response measures if necessary to reduce risk concluded from this pathway. Include the results of all vapor intrusion evaluation in the Public Record.	EPA	MDNR	Nov 2015
	OU2 RECOMMENDATIONS			
3	Evaluate the vapor exposure risk to determine if actions beyond the previously implemented operational changes are needed.	EPA	MDNR	Nov 2015
	OU4 RECOMMENDATIONS			
4	Re-evaluate the vapor intrusion pathway considering the more recently defined contaminated boundaries and the updated inhalation toxicity values for TCE and PCE	EPA	MDNR	Nov 2015

Additional recommendations that are not related to 'protectiveness' issues:

- OU1: It appears that the issues associated with the ART remedial system are significant and will not be resolved by adding or replacing equipment. It is recommended that the ART system be removed from this remedial effort.
- OU3: Obtain access agreements or easements for future well sampling required by the ROD.
- OU6: Re-evaluate the vapor intrusion pathway using current assessment methods.

9.0 Protectiveness Statements

OU1 (Front Street)

A protectiveness determination of the remedy at OU1 cannot be made at this time until further information is obtained.

Documentation of the vapor intrusion studies at the existing residential properties is incomplete. A protectiveness determination of the remedy at OU1 cannot be made at this time until further information is obtained regarding vapor intrusion of volatile COCs. Further information will be obtained by verifying that the previously recommended follow on vapor intrusion studies have been conducted and the adjusted toxicity values have been considered. It is expected that these actions will be completed by November 2015, at which time a protectiveness determination will be made.

ICs identified in Section 4.1.3 are in place restricting well drilling and preventing exposure to contaminated groundwater.

OU2 (Industrial Avenue)

A protectiveness determination of the remedy at OU2 cannot be made at this time until further information is obtained. Prior to completion of the soil and groundwater treatment activities, further information will be obtained regarding the vapor exposure risk to current industrial workers. The recommendations in the Sub-slab Vapor and Indoor Air Sampling Reports (2011), that included further sampling and consideration of modifications to the building HVAC system and other mitigation measures, will be implemented. It is expected that these actions will be completed by November 2015, at which time a protectiveness determination will be made.

OU3 (Old City Dump)

The remedy at OU3 is protective of human health and the environment.

OU4 (Maiden Lane Area)

A protectiveness determination of the remedy at OU4 cannot be made at this time until further information is obtained regarding vapor intrusion of volatile COCs. It is expected that the re-evaluation of the vapor intrusion pathway, considering the more recently defined contamination boundaries and the updated inhalation toxicity values for TCE and PCE, will be conducted by November 2015, at which time a protectiveness determination will be made.

OU5 (Old Hat Factory)

The remedy at OU5 is protective of human health and the environment.

OU6 (Wildcat Creek Estates)

The remedy at OU6 is expected to be protective of human health and the environment upon completion of the remedial activities.

In the interim, exposure pathways that could result in unacceptable risk are being controlled. ICs identified in Section 4.2.3 restrict the installation of new wells. The use of whole-house treatment systems for impacted domestic wells prevent exposure. In the event that PCE is detected in a residential supply well above the MCL, whole-house treatment systems will be installed in accordance with the Consent Order.

10. Next Review

The next five-year review for the Riverfront Site in New Haven, Missouri is required by November 20, 2019, five years from the date of this review.

FIGURES

Figure 1 – Site Location

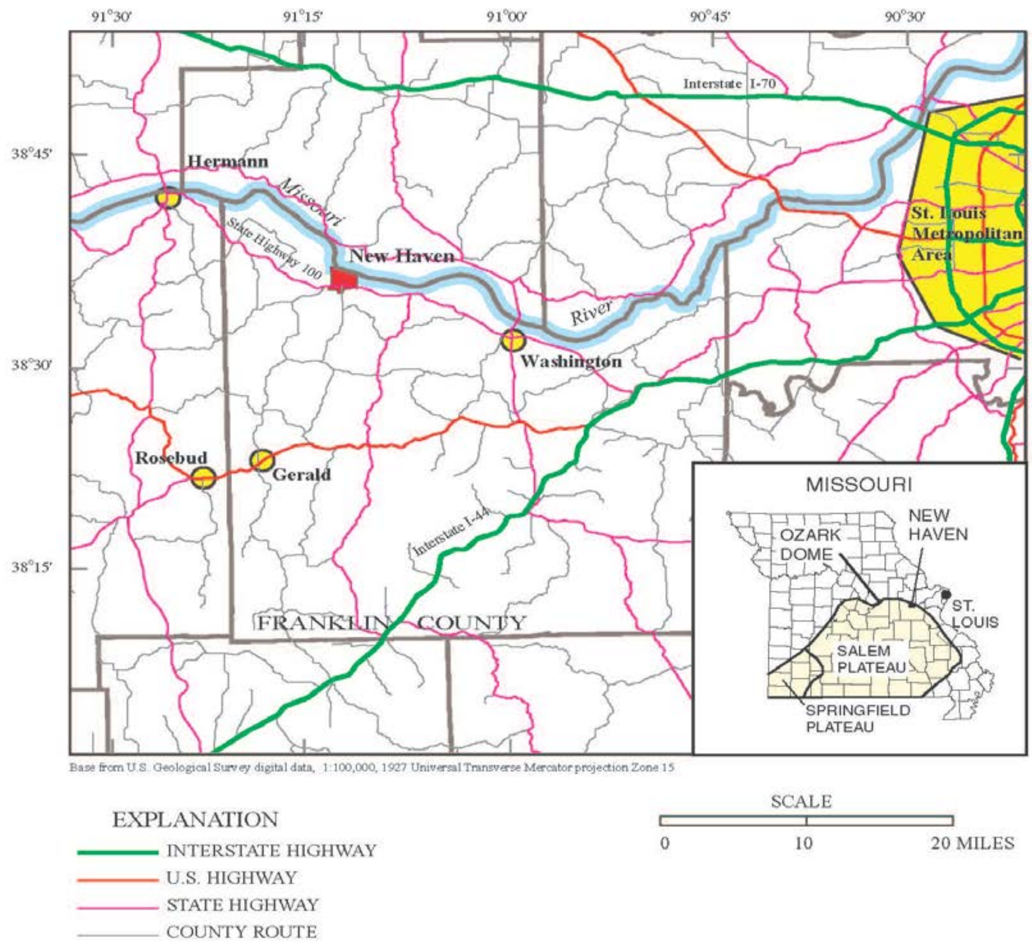


Figure 1-01. Location of the city of New Haven and Franklin County, Missouri.

Figure 2 – Riverfront Operable Units

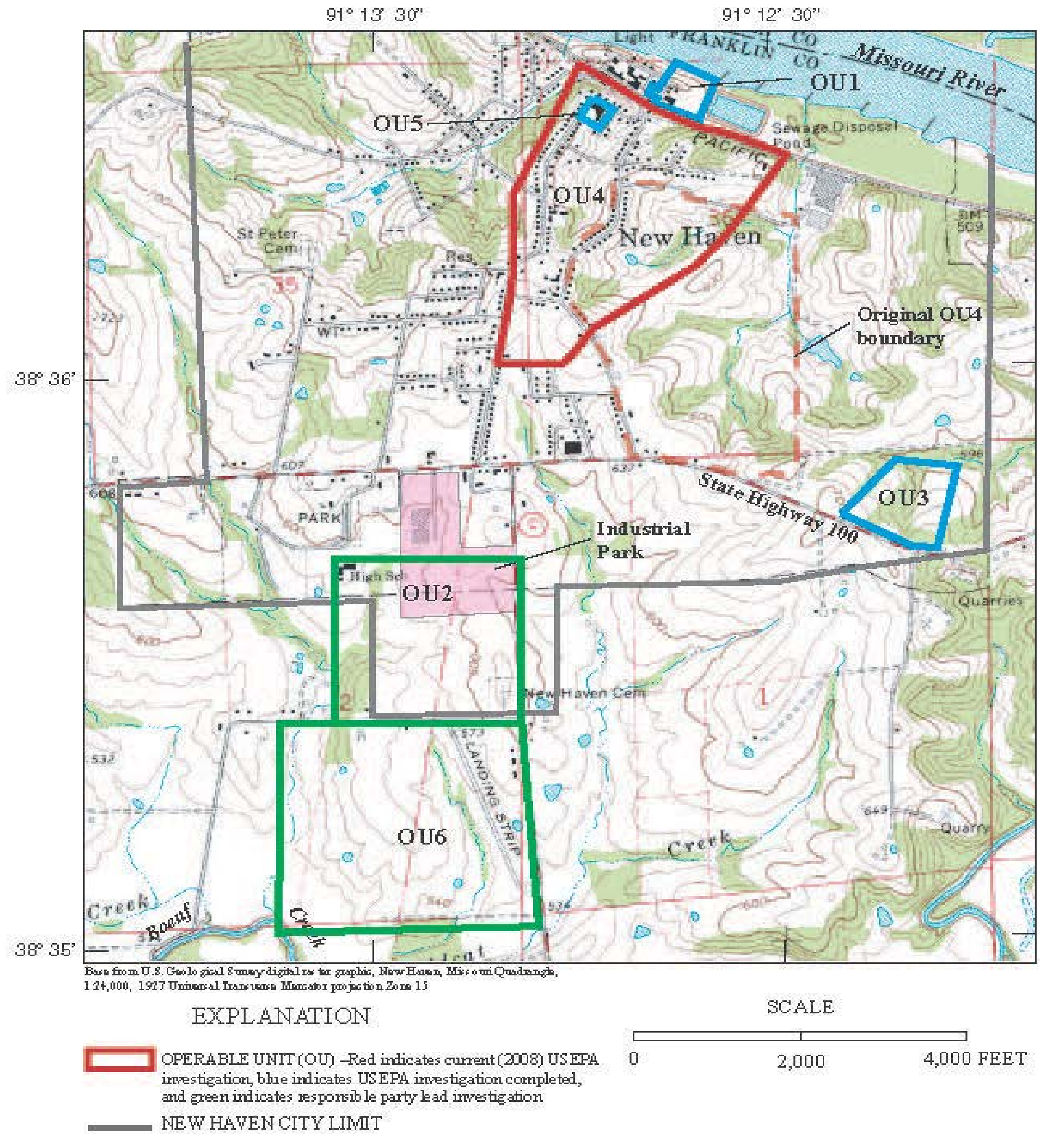


Figure 1-02. Topography in the New Haven Remedial Investigation (RI) study area and location of Operable Units (OUs).

Figure 3 - Special Area 3 Land Use Control

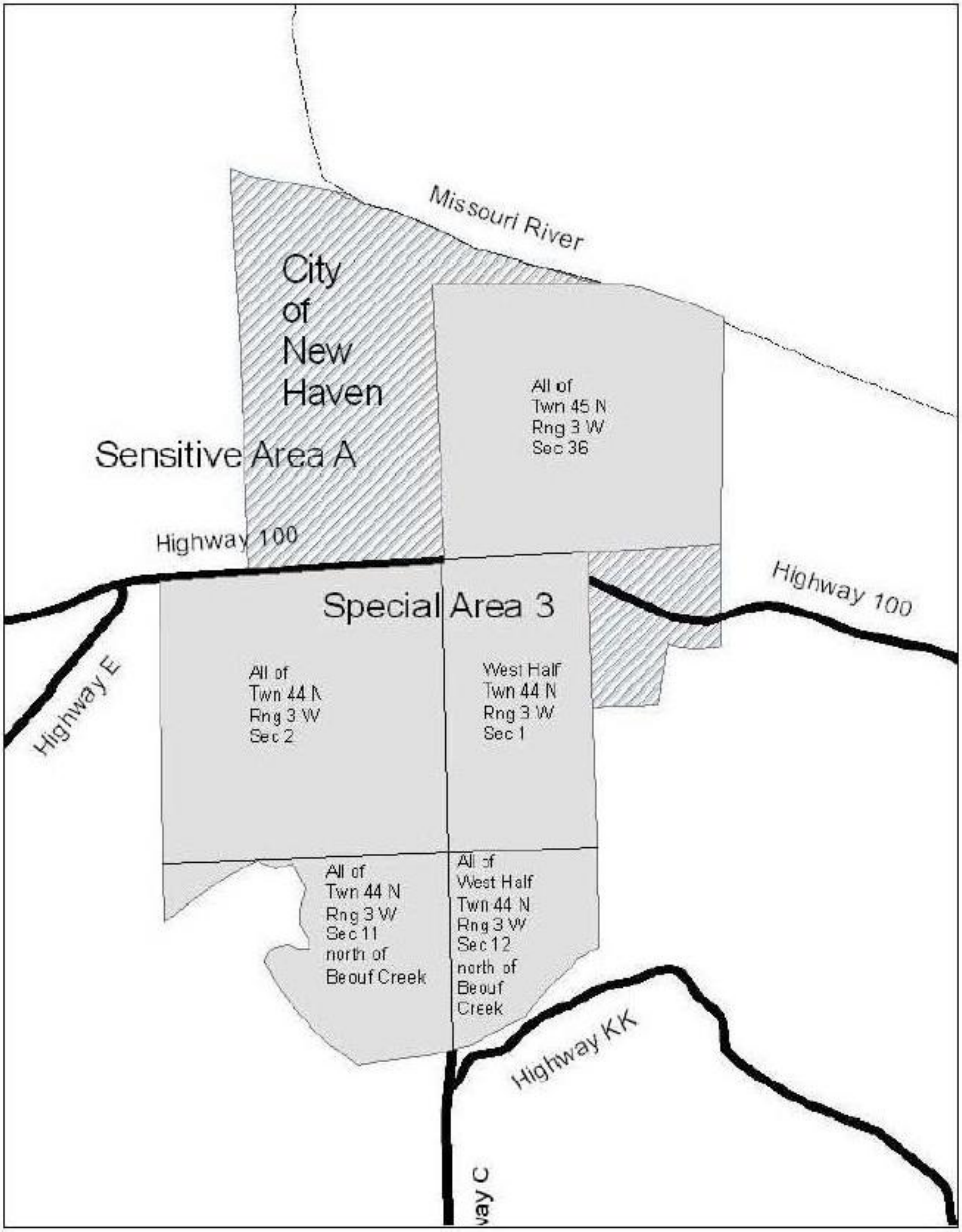
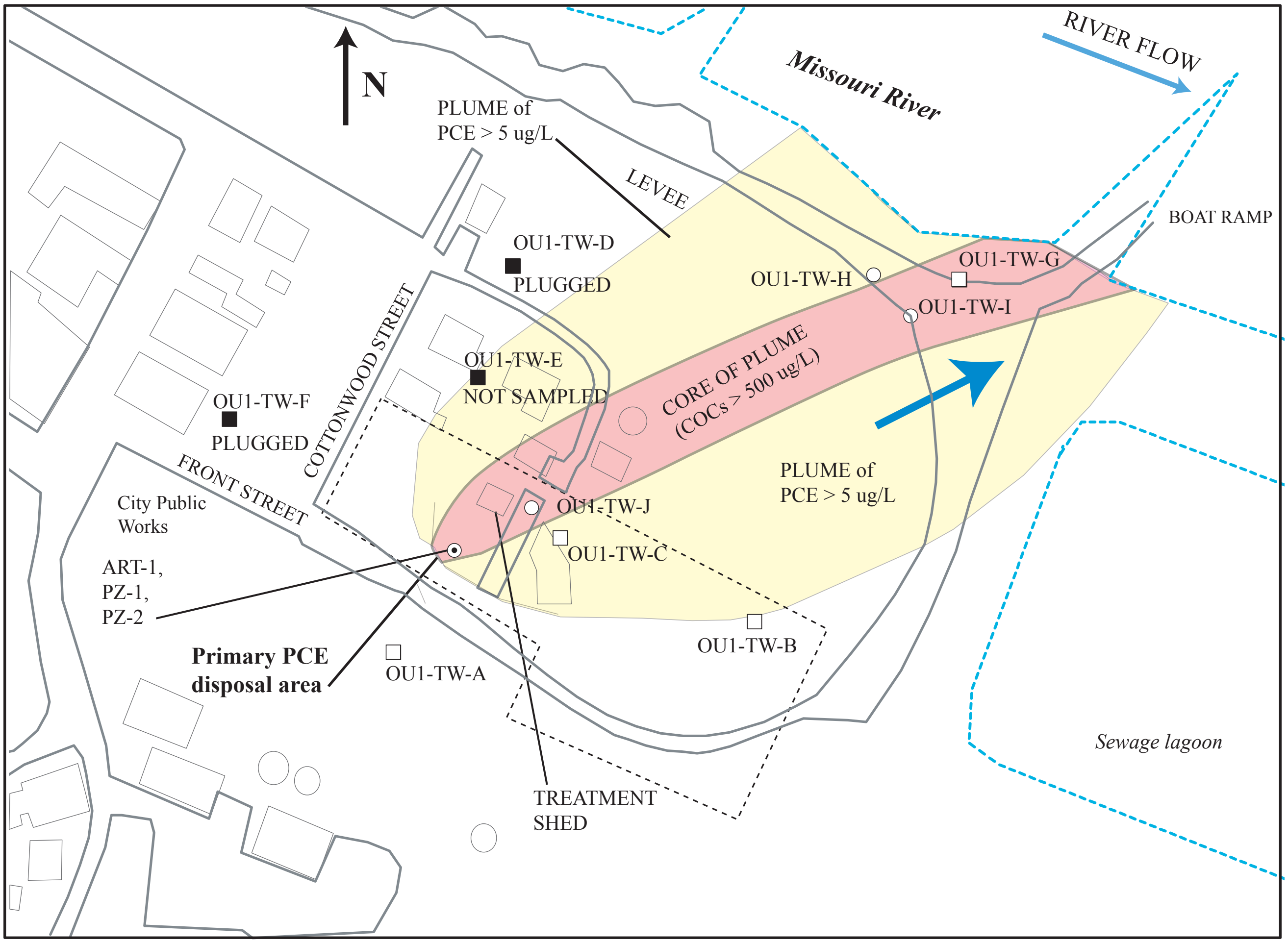


Figure 4 - Operable Unit 1



SOURCE: USGS OU1 RI

SCALE

0 100 200 FEET

EXPLANATION

STREAM

BUILDING

FRONT STREET SITE PROPERTY LINE

APPROXIMATE AREA CONTAINING PCE ABOVE THE MCL OF 5.0 MICROGRAMS PER LITER

APPROXIMATE AREA CONTAINING COCs ABOVE 500 MICROGRAMS PER LITER

LTRA MONITORING WELLS (TW-H, -I AND -J)

OU1-TW-A RI MONITORING WELL AND NUMBER

ART WELL ART-1 AND PIEZOMETERS PZ-1 AND PZ-2

NOTE:

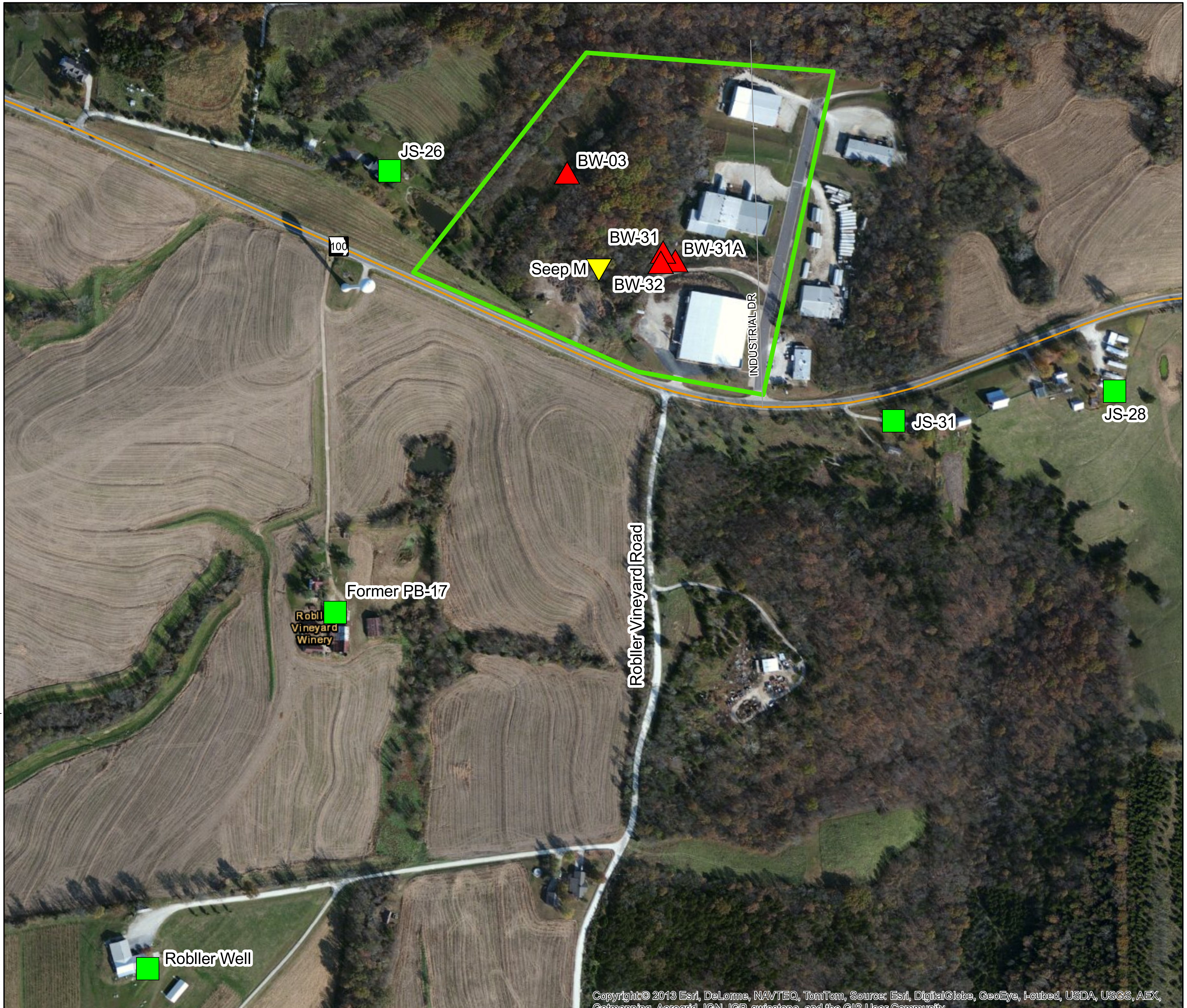
1. COCs ARE PCE, TCE, C-DCE AND VC.
2. WELL G SHOWN IN CORE OF PLUME ALTHOUGH COCs ONLY TOTAL 120ug/L.

FIGURE **4**
APPROXIMATE EXTENT OF PCE
GROUNDWATER PLUME,
MAY 2013
OPERABLE UNIT 1
RIVERFRONT SUPERFUND SITE
OU1 LTRA

Z:\044722\NEW HAVENOU1\USGS\C0008448 06/28/2013

Figure 5 - Operable Units 2 and 6

J:\1442 PARCOMM\442806_Kellwood\GIS\Kellwood\MXDs\RI_FS_Revision_May2010\Fig3-8a_Task2c_res_wells_PCE.mxd - 5/23/2010 @ 7:31:38 PM



Legend

- OU3 Boundary
- Private Water Well
- Monitoring Well
- Seep Previously Sampled

Figure 6 - Operable Unit 3

Meters
50 0 50 100 150

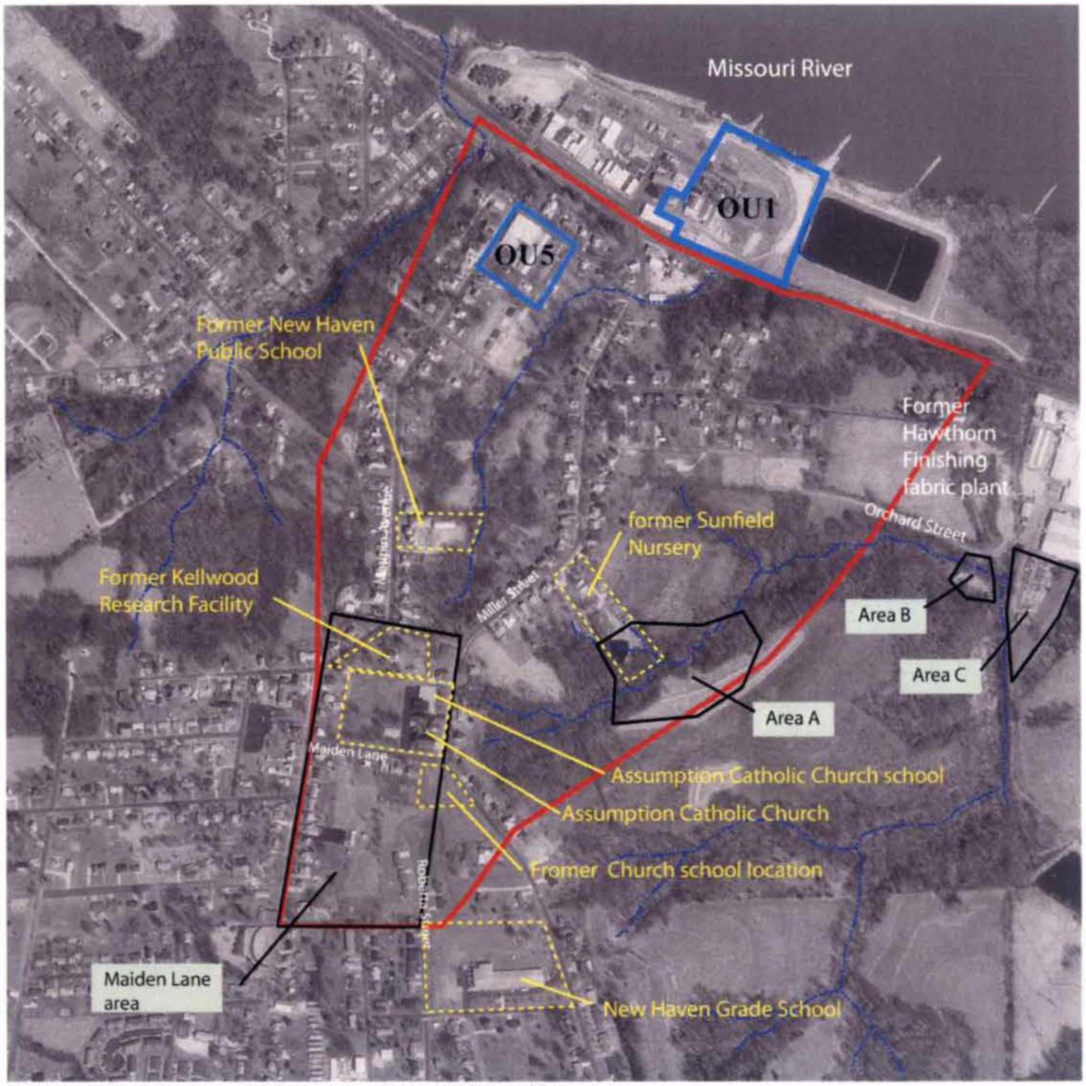
Feet
100 0 100 200 300 400 500 600 700

BARR

Figure 6

LOCATION OF DOMESTIC WELLS, MONITORING WELLS, AND SEEPS AT OU3
New Haven, MO
Franklin County

Figure 7 - Operable Unit 4



Base from U.S. Geological Survey digital orthophoto, 1:24,000, 1927 Universal Transverse Mercator projection Zone 15

OPERABLE UNIT BOUNDARY

FOCUS AREA OF OU4 INVESTIGATION

NON-RESIDENTIAL LAND-USE PARCEL IN OU4

SCALE

0 750 1,500 FEET

FIGURE 1-3
OPERABLE UNIT 4 SUBSITE DETAIL
RIVERFRONT SUPERFUND SITE
OPERABLE UNIT 4 FS

SOURCE: USGS OU4 RI, 2008
Z:\044706\C0008322.ai 7/18/2008

Figure 8 - Operable Unit 5

EXPLANATION

ASPHALT

EXISTING MONITORING WELL

SANITARY SEWER MANHOLE

SITE BOUNDARY

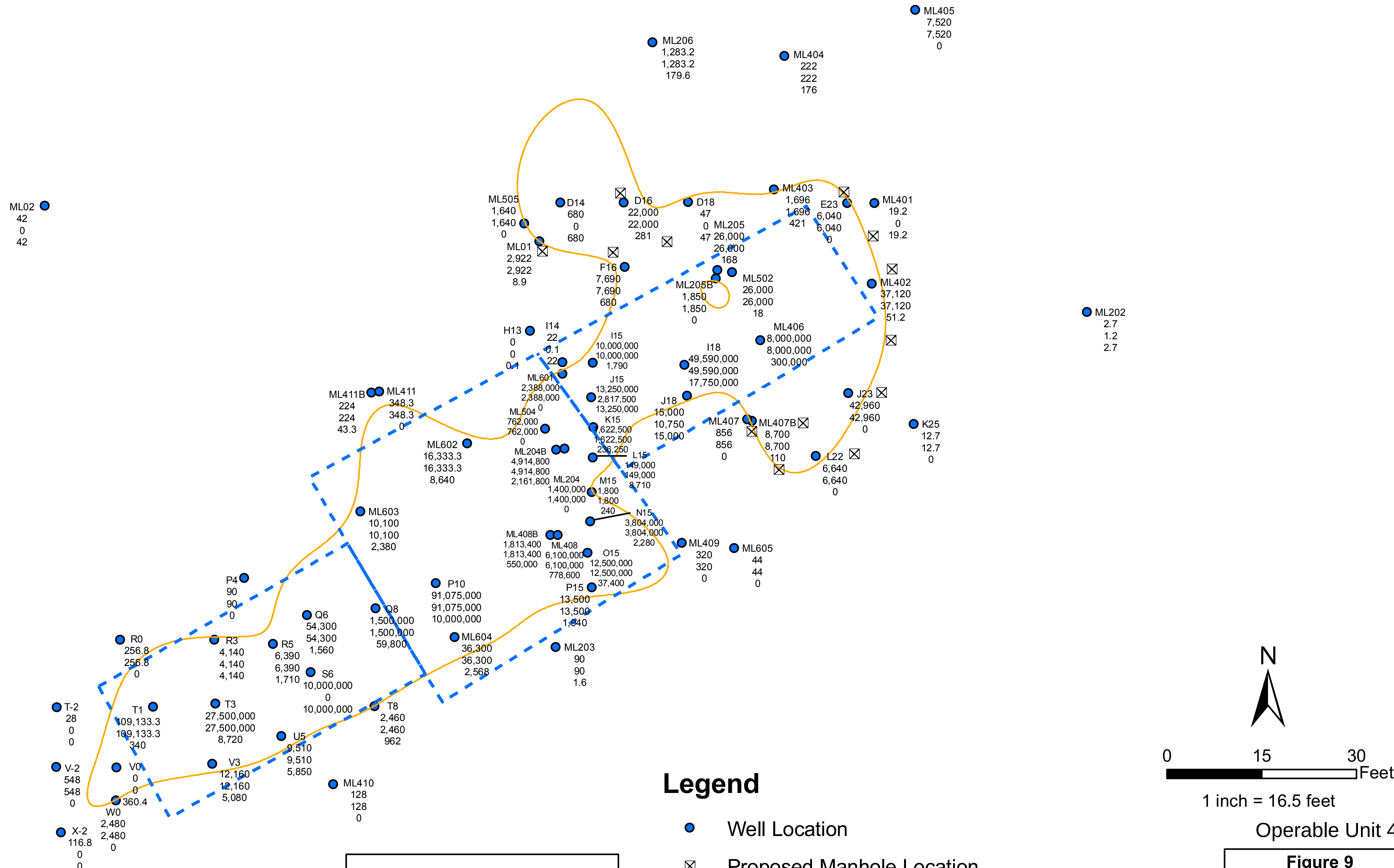
NOTE:

1. BUILDING HAS BEEN EXTENSIVELY DEMOLISHED AND REMAINDER RESTORED. OUTLINE SHOWN FOR CONVENIENCE.

2. SITE WAS EXTENSIVELY REGRADED IN 2005. WELLS BW-9 AND 9A HAD TO BE CUT DOWN TO BE FLUSH MOUNTS AGAIN.

FIGURE 8
OU5 LOCATION MAP
RIVERFRONT SUPERFUND SITE
OPERABLE UNIT 5 LTRA

SOURCE: USGS
Z:\PROJECTS\044722 - NEW HAVEN OU1\USGS DRAWINGS\C0008367 03/09/2009



ML603	Soil Sampling Location
10,100	Max PCE at All Depths
10,100	Max PCE below 6 ft.
2,380	Max PCE 0-6 ft.

Legend

- Well Location
- Proposed Manhole Location
- PCE 2,600 ug/kg Contour
- Proposed Infiltration Field

Operable Unit 4

Figure 9
Proposed Infiltration Fields and Manhole Locations, Very Heavily Contaminated Soils Treated In-Situ

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ATTACHMENTS

ATTACHMENT 1

Site Inspection Checklists

Site Inspection Checklist (OU1)

I. SITE INFORMATION	
Site name: Riverfront OU1 Front Street Site	**Date of inspection:** January 17, 2014
Location and Region: New Haven, County, Missouri	**EPA ID:** MOD981720246
Agency, office, or company leading the five-year review: USACE-NWK	**Weather/temperature:** Cloudy cold, light snow, 20s

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: Remedy includes Advanced Remedial Technology (ART) Treatment System
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _Rob Blake_______ __Black and Veatch Corp__ __1/17/2014
Name Title Date
Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _913-458-6681_____________
Problems, suggestions; ☐ Report attached ____

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 __US EPA___________________
Contact ___Matt Jefferson_________ Remedial Project Mgr_ January 17, 2014 (913) 551-7520
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __None

4. **Other interviews** (optional) ☐ Report attached. Evan Kifer MDNR

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☒ O&M manual — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ As-built drawings — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ Maintenance logs — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks__Inspection/maintenance logs dating back to system startup. Instruction for inspection and maintenance procedures provided on logs. BSCO electric O&M____________________

2. **Site-Specific Health and Safety Plan** — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☒ Contingency plan/emergency response plan — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks__Inspection checklist identifies contact numbers in case of problems.

3. **O&M and OSHA Training Records** — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks____O &M Records____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☐ Other permits______________________ — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks_with City____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks____

7. **Groundwater Monitoring Records** — ☒ Readily available — ☒ Up to date — ☐ N/A

   Remarks____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks____

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks____

10. **Daily Access/Security Logs** — ☒ Readily available — ☒ Up to date — ☐ N/A

    Remarks____.

IV. O&M COSTS
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__EPA lead :Contractor Black and Veatch
2. **O&M Cost Records** ☒ Readily available ☒ Up to date ☐ Funding mechanism/agreement in place Original O&M cost estimate____________________ ☐ Breakdown attached
3. **Unanticipated or Unusually High O&M Costs During Review Period** Describe costs and reasons: __Pump replacement, compressor replacement, blower replacement

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A
A. Fencing
1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A Remarks__
B. Other Access Restrictions
1. **Signs and other security measures** ☒ Location shown on site map ☐ N/A Remarks_Lock on remedial building. Part of Special Area 3, public notification well restictions, drilling restrictions

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) _Scheduled Bi-annual monitoring, O&M of system as needed.
Frequency _Weekly OMM checks
Responsible party/agency _EPA Region 7
Contact Matt Jefferson | Remedial Project Manager | June 17, 2014 | (913) 551-7520
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

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_Within Special Area 3

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks

2. **Land use changes on site** ☐ N/A
Remarks_There had been no change in land use on site.

3. **Land use changes off site** ☐ N/A
Remarks__No apparent change in land use in vicinity of site.

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions

Remarks ___None

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 ____NA____________
☐ Quantity of surface water treated annually____________
Remarks:_ART Well___(Not operational at the time of inspection)____________

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 ___SVE Effluent____________

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
E. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely 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.). _Designed to remove mass at the head of the plume. System is not operational due to equipment issues.
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. ____Semi-annual groundwater analytical is being conducted and is sufficient to track groundwater contamination. ACLs are in place for potential discharge into the Missouri River.

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. __The were 28 maintenance calls due to issues with various components of the ART system since 2011. All of the major components have been replaced. There appears to be continual issues with both water levels from fluctuations of the neighboring Missouri River and problems associated with the water geochemistry. Bacterial growth, precipitation, and scaling have resulted in clogged screen issues. It is unlikely these issues will be resolved. However, the plume appears to be stable and contaminant concentrations are well below the ACL's at the receptor. There does not appear to be a protectiveness issue.____
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. _It is recommended that consideration be given to eliminating the ART system. Should contamination levels exceed the ACLs in the downgradient portion of the plume a more aggressive remedial approach such as source area excavation be considered.

Site Inspection Checklist (OU2/OU6)

I. SITE INFORMATION	
Site name: Riverfront OU2	**Date of inspection:** January 17, 2014
Location and Region: New Haven, County, Missouri	**EPA ID:** MOD981720246
Agency, office, or company leading the five-year review: USACE-NWK	**Weather/temperature:** Cloudy cold, light snow, 20s

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Other: Remedy is not yet in place. OU2 Phased approach with construction startup in late January. OU6 has in-house carbon treatment systems that are sampled quarterly.

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _Lee Gorday_______ __Parsons __ __1/17/2014
   Name Title Date
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _(314) 819-5024_____________
   Problems, suggestions; ☐ Report attached ____
   ____

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 __US EPA___________________
   Contact ___Matt Jefferson_________ Remedial Project Mgr_ January 17, 2014 (913) 551-7520
   Name Title Date Phone no.
   Problems; suggestions; ☐ Report attached __None
   ____
   ____

4. **Other interviews** (optional) ☐ Report attached. Evan Kifer MDNR

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents**			
	☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
	☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
	☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A
	Remarks__In early construction phase. ____________________			
2.	**Site-Specific Health and Safety Plan**	☒ Readily available	☒ Up to date	☐ N/A
	☒ Contingency plan/emergency response plan	☒ Readily available	☒ Up to date	☐ N/A
	Remarks__Inspection checklist identifies contact numbers in case of problems.			
3.	**O&M and OSHA Training Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks___			
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
	☐ Other permits______________________	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_with City_			
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
7.	**Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A
	Remarks			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_.			

IV. O&M COSTS	
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_Parsons is the Contractor for the PRP (Kellwood)________________________________
2.	**O&M Cost Records** ☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place Original O&M cost estimate_____________________ ☐ Breakdown attached
3.	**Unanticipated or Unusually High O&M Costs During Review Period** Describe costs and reasons: ___________________________________
V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A	
A. Fencing	
1.	**Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A Remarks____.
B. Other Access Restrictions	
1.	**Signs and other security measures** ☒ Location shown on site map ☐ N/A Remarks_Part of Special Area 3, public notification well restictions, drilling restrictions______________________

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) _Scheduled Bi-annual monitoring, O&M of system a
Frequency _Daily: Construction on-going
Responsible party/agency _EPA Region 7

Contact	Matt Jefferson	Remedial Project Manager	June 17, 2014	(913) 551-7520
	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

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks _Within Special Area 3

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks

2. **Land use changes on site** ☐ N/A
Remarks _There had been no change in land use on site.

3. **Land use changes off site** ☐ N/A
Remarks __No apparent change in land use in vicinity of site.

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions

Remarks ___None

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 ____NA
☐ 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
E. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy) ☐ Properly secured/locked ☐ Functioning ☐ Routinely 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.). This site is in the very early stages of construction of a phased remedial approach at OU2. In house treatment for houses in the Wildcat Creek Estates OU6. In-house treatment systems were not inspected.
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.

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. ____ ____ ____ ____ ____ ____
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. ____ ____ ____ ____ ____ ____ ____ ____ ____

Site Inspection Checklist (OU3)

I. SITE INFORMATION	
Site name: Riverfront OU3 Front Street Site	**Date of inspection:** January17, 2014
Location and Region: New Haven, County, Missouri	**EPA ID:** MOD981720246
Agency, office, or company leading the five-year review: USACE-NWK	**Weather/temperature:** Cloudy cold, 20's
Remedy Includes: (Check all that apply) ☐ Landfill cover/containment ☒ Access controls ☒ Institutional controls ☐ Groundwater pump and treatment ☐ Surface water collection and treatment ☒ Other: Monitoring	☐ Monitored natural attenuation ☐ Groundwater containment ☐ Vertical barrier walls
Attachments: ☒ Inspection team roster attached	☐ Site map attached

II. INTERVIEWS (Check all that apply)
1. **O&M site manager** _City of New Haven/Barr Engineering__ __ (Name) __ (Title) January 17, 2014 (Date) Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ___573-638-5000___________ Problems, suggestions; ☐ Report attached ___Not Interviewed_____
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 __US EPA___________________ Contact ___Matt Jefferson____________ (Name) Remedial Project Mgr_ (Title) June 17, 2014 (Date) (913) 551-7520 (Phone no.) Problems; suggestions; ☐ Report attached ___None____
4. **Other interviews** (optional) ☐ Report attached.
Evan Kifer – MDNR RPM – No problems noted

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents**			
	☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
	☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
	☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A
	Remarks__Info not present at inspection but forwarded shortly after inspection			
2.	**Site-Specific Health and Safety Plan**	☐ Readily available	☐ Up to date	☐ N/A
	☐ Contingency plan/emergency response plan	☐ Readily available	☒ Up to date	☐ N/A
	Remarks__Well sampling and walk through inspections			
3.	**O&M and OSHA Training Records**	☒ Readily available	☐ Up to date	☐ N/A
	Remarks____Inpsection reports available			
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
	☐ Other permits____________________	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_with City_			
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
7.	**Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A
	Remarks			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_.			

IV. O&M COSTS

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__Inspections with Ciy of New Haven______________

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate_____________________ ☐ Breakdown attached

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

Describe costs and reasons: __None

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks___Fencing intact
.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks_Gated and usually locked, no trespassing and site description signs in place. Gates were open for Christmas tree disposal .

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) _inspection annually and groundwater monitoring every 5 Responsible party/agency _City of New Haven/EPA Contact _Matt Jefferson (Name) Remedial Project Manager (Title) January 17, 2014 (Date) (913) (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
2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A Remarks: Restrictive covenant filed by city in place. Site on the Missouri Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites. Any substantial change in property use must be approved by MDNR.
D. General
1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident Remarks
2. **Land use changes on site** ☐ N/A Remarks_There had been no change in land use on site.
3. **Land use changes off site** ☐ N/A Remarks__No apparent change in land use in vicinity of site.
VI. GENERAL SITE CONDITIONS
A. Roads ☒ Applicable ☐ N/A
1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks

B. Other Site Conditions
Remarks ___None

VII. LANDFILL COVERS ☐ Applicable ☒ N/A			
A. Landfill Surface: Inspected but landfill cover requirement not spelled out in ROD			
1.	**Settlement** (Low spots) Areal extent______________ Remarks______________	☐ Location shown on site map Depth____________	☒ Settlement not evident
2.	**Cracks** Lengths____________ Widths___________ Depths__________ Remarks______________	☐ Location shown on site map	☒ Cracking not evident
3.	**Erosion** Areal extent______________ Remarks______________	☐ Location shown on site map Depth____________	☒ Erosion not evident
4.	**Holes** Areal extent______________ Remarks______________	☐ Location shown on site map Depth____________	☒ Holes not evident
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** Areal extent______________ Remarks______________	☐ Location shown on site map Height____________	☒ Bulges not evident

8.	**Wet Areas/Water Damage** ☒ Wet areas/water damage not evident ☐ Wet areas ☐ 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__Seeps previously identified in ROD and sampling required.________________________ ____	
9.	**Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability Areal extent______________ Remarks____ ____	
B. Benches	☐ Applicable ☒ N/A (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.)	
C. Letdown Channels	☐ Applicable ☒ N/A (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.)	

D. Cover Penetrations	☐ Applicable	☒ N/A

E. Gas Collection and Treatment	☐ Applicable	☒ N/A
F. Cover Drainage Layer	☐ Applicable	☒ N/A Existing Drainage Adequate
G. Detention/Sedimentation Ponds	☐ Applicable	☒ N/A

H. Retaining Walls ☐ Applicable ☒ N/A

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident
   Areal extent______________ Depth____________
   Remarks____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☒ Vegetation does not impede flow
   Areal extent______________ Type____________
   Remarks____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent______________ Depth____________
   Remarks____

4. **Discharge Structure** ☒ Functioning ☐ N/A
   Remarks_Adequate surface drainage_____________________________________

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

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.). Restrictive Covenant in place. No contamination in adjacent wells
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. None

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. None
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Site Currently used as tree and brush site and compost facility.

Site Inspection Checklist (OU4)

I. SITE INFORMATION	
Site name: Riverfront Site – OU4	**Date of inspection:** January 17, 2014
Location and Region: New Haven, Franklin County, Missouri	**EPA ID:** MOD981720246
Agency, office, or company leading the five-year review: U.S. EPA Region 7	**Weather/temperature:** cold cloudy lt snow…20's

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☐ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: Soil source area treatment with in situ chemical oxidation
- ☒ Other: Groundwater long-term monitoring
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** __NA________________ ____________________ ____________
Name Title Date
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ______________
Problems, suggestions; ☐ Report attached _____
____
____

2. **O&M staff** ______________________________ ____________________ ____________
Name Title Date
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ______________
Problems, suggestions; ☐ Report attached ____
____

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 __USEPA Region 7__________________________
Contact __Matt Jefferson, Remedial Project Manager__ __January 17, 2014_____ __913-551-7520
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached __Project is in early stages of the remedial effort. Infiltration galleries have been installed and charged with ISCO.
____

4. **Other interviews** (optional) ☐ Report attached. Evan Kifer

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)
OU4 is in early stage of the remedial effort. Injection wells and infiltration galleries have been installed and inoculated however no sampling has been completed. No On-site documents are available to review yet.

IV. O&M COSTS
No On-site documents are available to review yet.
V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A
A. Fencing
1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A .
B. Other Access Restrictions
1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A

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) _Visual inspection of OU4 area. Frequency _Inspections as part of the Five year review process. Responsible party/agency _EPA/State of Missouri Contact _ __Matt Jefferson, Remedial Project Manager____ __January 17, 2014____ 913- 551-7520 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 ____OU4 is contained with Special Area 3. Area 3, as defined in 10 CSR 23-3.100(7), which requires that the MDNR be consulted before construction a new well in Special Area 3. The MDNR will provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis. The MDNR will provide written approval for all new wells prior to construction. Special Area 3 became effective on April 30, 2006.
2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A Remarks_Reviewed text of 10 CSR 23-3.100(7).

D. General	
1.	**Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident Remarks
2.	**Land use changes on site** ☒ N/A Remarks There had been no change in land use on site.
3.	**Land use changes off site** ☒ N/A Remarks No apparent change in land use in vicinity of site.

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A	
1.	**Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks Roads used to access OU4 area during inspection were adequate.

B. Other Site Conditions

Remarks All areas inspected were in very good condition and appeared to be well maintained.

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A

C. Treatment System ☐ Applicable ☒ N/A

D. Monitoring Data - There is no data available at this time. Monitoring wells were observed and are in good condition.

E. Monitored Natural Attenuation or LTM ☒ Applicable ☐ N/A

1. **Monitoring Wells** (natural attenuation remedy or LTM Plan)
☒ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks: No analytical data has been collected.

X. OTHER REMEDIES ☐ **Applicable** ☒ **N/A**

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.).

_NA____

____

____

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.

_NA____

____

____

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.

_NA____

____

____

____

____

D. Opportunities for Optimization

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

____

____

____

Site Inspection Checklist (OU5)

I. SITE INFORMATION	
Site name: Riverfront Site – OU5	**Date of inspection:** January 17, 2014
Location and Region: New Haven, Franklin County, Missouri	**EPA ID:** MOD981720246
Agency, office, or company leading the five-year review: U.S. EPA Region 7	**Weather/temperature:** Cloudy cold 20's snow
Remedy Includes: (Check all that apply) ☐ Landfill cover/containment ☐ Access controls ☒ Institutional controls ☐ Groundwater pump and treatment ☐ Surface water collection and treatment ☒ Other: Long term monitoring	☐ Monitored natural attenuation ☐ Groundwater containment ☐ Vertical barrier walls
Attachments: ☒ Inspection team roster attached	☐ Site map attached

II. INTERVIEWS (Check all that apply)
1. **O&M site manager** _Robert Blake__ (Name) __Black and Veatch__ (Title) __1/17/2014 (Date) Interviewed ☒ at site ☐ at office ☐ by phone Phone no. __816 458-6681____________ Problems, suggestions; ☐ Report attached ____
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 __USEPA Region 7___________________________ Contact __Matt Jefferson (Name), Remedial Project Manager (Title)_________ _January17, 2014 (Date) 913-551-7520 (Phone no.) Problems; suggestions; ☐ Report attached __ Sampling is ongoing under the Long Term Remedial Action Sampling Plan. _______________________________________
4. **Other interviews** (optional) ☐ Report attached. Evan Kifer

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents**			
2.	**Site-Specific Health and Safety Plan**	☒ Readily available	☐ Up to date	☐ N/A
	☐ Contingency plan/emergency response plan	☐ Readily available	☐ Up to date	☐ N/A
	Remarks__A site-specific health and safety plan for LTRA was prepared by Black and Veatch in 2007 and is available for review and use.			
3.	**OSHA Training Records**	☒ Readily available	☐ Up to date	☐ N/A
	Remarks___			
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
	☐ Other permits___	☐ Readily available	☐ Up to date	☒ N/A
	Remarks___			
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks___			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks___			
7.	**Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A
	Remarks___			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks___			
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A
	Remarks___			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks___			

IV. O&M COSTS

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: Contractor to EPA______________________________

2. **O&M Cost Records**

☒ Readily available ☒ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate____________________ ☐ Breakdown attached

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

Describe costs and reasons: __None __Sampling only_____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks______________________________

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☒ N/A
Remarks__ ____________________

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) _Visual Inspection of OU5 area. Frequency _Inspections as part regular sampling events and the Five year review process. Responsible party/agency _EPA/State of Missouri Contact _ Matt Jefferson, Remedial Project Manager __June 17, 2014____ 913- 551-7520 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 ____OU5 is contained with Special Area 3. Area 3, as defined in 10 CSR 23-3.100(7), which requires that the MDNR be consulted before construction a new well in Special Area 3. The MDNR will provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis. The MDNR will provide written approval for all new wells prior to construction. Special Area 3 became effective on April 30, 2006.	
2.	**Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A Remarks _Reviewed text of 10 CSR 23-3.100(7).	
D. General		
1.	**Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident Remarks	
2.	**Land use changes on site** ☐ N/A Remarks_Land use was previously commercial. Construction is on-going on site for site redevelopment.	
3.	**Land use changes off site** ☐ N/A Remarks__No apparent change in land use in vicinity of site.	
VI. GENERAL SITE CONDITIONS		
A. Roads ☒ Applicable ☐ N/A		
1.	**Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A Remarks_Roads used to access OU5 during inspection were adequate.	
B. Other Site Conditions		
	Remarks _All areas inspected were in very good condition and appeared to be well maintained.	
VII. LANDFILL COVERS ☐ Applicable ☒ N/A		

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A
IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
C. Treatment System ☐ Applicable ☒ N/A
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
E. Monitored Natural Attenuation or LTM ☒ Applicable ☐ N/A
1. **Monitoring Wells** (natural attenuation remedy or LTM Plan) ☒ Properly secured/locked ☒ Functioning ☒ Routinely 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.). _Monitoring is conducted per ROD & IC's in place
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. _Contamination in farthest down gradient well but no room for additional wells down gradient due to topography. Contamination in down gradient would be detected in upgradient well of OU1
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. _None noted
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. _None Noted

Site Inspection Team Roster		
Personnel	**Representing**	**Phone Number**
Matt Jefferson	EPA	913- 551-7520
Robert Blake	Black and Veatch	816-458-6681
Laura McNeil	Black and Veatch	913 458-4512
Evan Kifer	MDNR	573-751-1990
Lee Gorday (OU2 & OU6 only)	Parsons	314-576-7330
John Schumacher	USGS	573-308-3678
Brian Roberts	USACE	816-389-3892
Greg Hattan	USACE	816-389-3579

Attachment 2

Site Inspection Photographs

OU1 Front Street Site – Bird's eye view with north at top.

OU1 Front Street Site (January 17, 2014) - ART Treatment System Shed. ART Well and PZs in foreground. This is the primary PCE disposal area. (Facing NE from concrete area).

OU1 Front Street Site (January 17, 2014) – ART Treatment shed and one of two residences located north of site.

OU1 Front Street Site (January 17, 2014) – Interior ART Treatment System Shed.

OU1 Front Street Site (January 17, 2014) – Interior ART Treatment System Shed.

Existing MW-OU1-TW-C (one of six existing wells). Three additional MWs were installed as part of the remedial action. (SE of treatment shed)

OU2 Industrial Avenue (Kellwood Site) – Bird's eye view with north at top.

OU2 - Future DNAPL Recovery Well Area. Recovery wells to be installed on the north side of the building (area shown in this photo) and around the corner on the west side of the building.

OU2 Former Kellwood Building. MW-102 (one of the wells in the site-wide monitoring well network) shown in the foreground. This is the general area of the soil removal action/land-farming conducted between 1994 and 1998.

OU3 Old City Dump Site – Bird's eye view with north at top.

Old City Dump Site (January 17, 2014) – facing north.

Old City Dump Site (January 17, 2014) – facing north. Site used as a yard waste/gravel storage area and compost site.

OU4 Maiden Lane Site – Bird's eye view with north at top.

OU4 Maiden Lane (Looking northeast). PCE contamination in the shallow groundwater runs from northeast to southwest following the drainage pattern of the local topography. Deeper groundwater flows toward the Missouri River to the north.

OU4 Maiden Lane. Northeast Infiltration Bed for In-situ treatment of PCE contaminated soils.

OU4 Maiden Lane. Northeast Infiltration Bed (facing southwest).

OU5 Old Hat Factory Site – Bird's eye view with north at top.

OU5 facing northwest. MWs BW-9 and BW-9A in foreground. MW BW-16 is approximately 100 feet northeast of these wells. Background MW BW-15 is located SW of the building and MW BW-12A is sidegradient of OU5 .

OU5 - MWs BW-9 and BW-9A.

OU6 Wildcat Creek Estates Area – Bird's eye view of residences near intersection of Highway C and Wildcat Creek Lane. Wells on property bound eastern extent of the groundwater plume associated with OU2 Industrial Avenue Site (north at top).

OU6 - Facing north, OU2 in background. Two monitoring wells that are part of the groundwater monitoring well network can be seen in the foreground. Residences in the Wildcat Creek Estates (OU6) are to the south.

OU6 - Facing south toward the Wildcat Creek Estates Area.

OU6 - Wildcat Creek Estates Area facing northwest.

Attachment 3
List of Documents

OU1: Front Street:

Baseline Risk Assessment, Operable Unit 1 (Missouri Department of Health (MDOH), Jan 2003)

Actual ACL Calculations, OU1 (EPA, July 16, 2003)

ROD (EPA, September 30, 2003)

Sampling Data Evaluation Report, Spring 2007 (Black & Veatch., January 11, 2008)

Final Data Evaluation Report, Operable Unit 1(Black & Veatch, November 7, 2006)

Interim Remedial Action Report, Operable Unit 1 (Black & Veatch, June 29, 2007))

Final Long-Term Remedial Action Field Sampling Plan (Black & Veatch, March 2007)

Final Winter 2007 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, June 14, 2007)

Final Summer 2007 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, January 18, 2008)

Final Spring 2009 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, September 8, 2009)

Final Fall 2009 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, January 21, 2010)

Trip Report, Spring 2010 Groundwater Sampling Operable Unit 1 (Black & Veatch, April 27, 2010)

Final Spring 2010 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, August 23, 2010)

Final Fall 2010 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, February 23, 2011)

Draft Spring 2011 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, July 11, 2011)

Final Fall 2011 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, March 9, 2012)

Trip Report, Monitoring Well D Plugging/Abandonment Site Visit on 7-25-2012 Operable Unit 1 (Black & Veatch, September 6, 2012)

Trip Report, ART Maintenance Site Visit on 7-26-2012 (Black & Veatch, September 6, 2012)

Final Spring 2012 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, October 2, 2012)

Draft Fall 2012 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, February 19, 2013)

USEPA Letter, Ref 2012 Sampling Data Evaluation Report, ART well system status (USEPA, March 8, 2013)

Final Spring 2013 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, September 3, 2013)

ART Treatment System History and Maintenance Unit 1 (Black & Veatch, February 12, 2014)

Draft Fall 2013 Sampling Data Evaluation Report Operable Unit 1 (Black & Veatch, March 6, 2014)

OU1 and OU3:

Focused Remedial Investigation of Operable Units OU1 and OU3 (USGS and Black & Veatch, January 2003)

Feasibility Study Report (Black & Veatch, February 28, 2003)

OU2 Industrial Drive Area and OU6 Wildcat Creek Estates Area

Statement Of Work, Remedial Investigation/Feasibility Study, Riverfront Superfund Site, Operable Unit No. 2 (EPA Region 7)

Revised Final Remedial Investigation/Feasibility Study Work Plan, Operable Unit No. 2 (Parsons, February 2, 2006)

Final Administrative Order on Consent (AOC) For Whole-House Filtration For Residences In The South New Haven Area (EPA, March 25, 2002)

Figure 1, Monitoring and Domestic Well Locations, OU2/OU6 (Parsons, provided by EPA on July 20, 2009)

Tables 1 through 4, Summary of Data From Quarterly Sampling (last sampled February 2009), OU2/OU6, (Parsons and provided by EPA on July 20, 2009)

Remedial Investigation Report, Operable Unit No. 2/6 (Parsons, June 1, 2010)

Site-wide Groundwater Monitoring Data Report- March/April 2010 Sampling Event, Operable Unit No. 2/6 (Parsons, July 6, 2010)

Sub-slab and Indoor Air Sampling Report, Operable Unit No. 2 and Operable Unit No. 6 (Parsons, March 2011)

Record of Decision, Operable Unit No. 2 and Operable Unit No. 6 (USEPA, May 2011)

Indoor Air Evaluation Report, Operable Unit No. 2 and Operable Unit No. 6 (Parsons, August 2011)

Phase 1 Remedial Design and Remedial Action Work Plan, Operable Unit No. 2/6 (Parsons, May 17, 2013)

OU3: Old City Dump

Baseline Risk Assessment, Operable Unit 3 (MDOH, January 2003)

ROD (EPA, September 30, 2003)

Consent Decree, OU3 (US District Court, Sept 6, 2007)

Operational and Monitoring Plan for Operable Unit 3 (Old City Dump) (The City Of New Haven, January 16, 2007)

2008 Environmental Monitoring Report For Operable Unit 3 (Old City Dump) (City of New Haven, October 21, 2008)

2013 Environmental Monitoring Report For Operable Unit 3 (Old City Dump) (USEPA, November 2013)

OU4: Maiden Lane Area

Final Human Health Risk Assessment Report, OU4 (Black & Veatch, July 2008)

Final Feasibility Study Operable Unit 4 (Black & Veatch, November 12, 2008)

Focused Remedial Investigation Of Operable Unit 4 (USGS, September, 2008)

Final Fractured Bedrock Technical Impracticability Evaluation Report Operable Unit 4, (Black & Veatch, January 29, 2009)

ROD, OU4 (EPA Region 7, March 26, 2009)

Final Remedial Action Basis of Design, Maiden Lane Subsite OU4, (Black & Veatch, December 2010)

Final Operation and Maintenance Plan, Maiden Lane Subsite OU4, (Black & Veatch, December 20, 2010)

Final Remedial Action Cost Estimate, Maiden Lane Subsite OU4, (Black & Veatch, August 16, 2011)

Final Remedial Action Specifications, Maiden Lane Subsite OU4, (Black & Veatch, January 27, 2011)

OU5: Old Hat Factory

ROD OU5, (EPA Region 7, December 7, 2006)

Final Long-Term Remedial Action Field Sampling Plan OU5 (Black & Veatch, September 26, 2007)

Baseline Human Health Risk Assessment For OU5 (Missouri Department Of Health, January 2006)

Final Fall 2008 Sampling Data Evaluation Report OU5 (Black & Veatch, April 13, 2009)

Focused Remedial Investigation of OU5 (USGS, June 2006)

Feasibility Study OU5 (Black & Veatch, June 27, 2006)

Final Spring 2009 Sampling Data Evaluation Report OU5 (Black & Veatch, July 29, 2009)

Final Fall 2009 Sampling Data Evaluation Report OU5 (Black & Veatch, December 16, 2009)

Final Spring 2010 Sampling Data Evaluation Report OU5 (Black & Veatch, July 1, 2010)

Final Fall 2010 Sampling Data Evaluation Report OU5 (Black & Veatch, February 23, 2011)

Final Fall 2011 Sampling Data Evaluation Report OU5 (Black & Veatch, January 12, 2012)

Final Fall 2012 Sampling Data Evaluation Report OU5 (Black & Veatch, February 27, 2013)

Trip Report, Fall 2013 Sampling Trip OU5 (Black & Veatch, November 18, 2013)

Draft Fall 2013 Sampling Data Evaluation Report OU5 (Black & Veatch, January 23, 2014)

ATTACHMENT 4

Data

ATTACHMENT 4
OU1
Data Tables, Trend Analysis
Front Street Site, Riverfront Superfund Site

Table 1-2
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2013 Sampling (05/07/2013)

Well A

Parameter	Date / Units	7/23/2002 Pump		7/24/2003 Pump		4/21/2005 Pump		5/31/2005	9/20/2005 PDB		12/13/2005 PDB	
cis-1,2-Dichloroethene	ug/L	1	U	1	U	10	U	NS	5	U	1	UJ
Tetrachloroethene	ug/L	1	U	1	U	10	U	NS	5	U	1	U
Trichloroethene	ug/L	1	U	1	U	10	U	NS	5	U	1	UJ
Vinyl Chloride	ug/L	2	U	2	U	10	U	NS	5	U	1	U

Parameter	Date / Units	2/15/2006 PDB		5/23/2006 PDB		8/15/2006 PDB		11/14/2006 PDB		3/8/2007 PDB		5/22/2007 PDB	
cis-1,2-Dichloroethene	ug/L	0.5	U	1	U	1	U	0.5	U	0.5	U	1	U
Tetrachloroethene	ug/L	1.3		1	U	1	U	0.5	U	0.5	U	1	U
Trichloroethene	ug/L	0.5	U	1	U	1	U	0.5	U	0.5	U	1	U
Vinyl Chloride	ug/L	0.5	U	1	UJ	1	U	0.5	U	0.5	U	1	U

Parameter	Date / Units	8/14/2007 PDB		3/11/2008 PDB		10/27/2008 PDB		10/27/2008 Upper Pump		10/27/2008 Lower Pump		5/26/2009 PDB	
cis-1,2-Dichloroethene	ug/L	1	U	1	U	1	U	1	U	1	U	0.5	U
Tetrachloroethene	ug/L	10	U	1	U	1	U	1	U	1	U	0.5	U
Trichloroethene	ug/L	1	U	1	U	1	U	1	U	1	U	0.5	U
Vinyl Chloride	ug/L	1	U	1	U	1	U	1	U	1	U	0.5	U

See notes on next page.

Table 1-2
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2013 Sampling (05/07/2013)

Well A

Parameter	Date Units	10/12/2009 PDB	4/19/2010 PDB	10/26/2010 PDB	4/28/2011 PDB	10/18/2011 PDB
cis-1,2-Dichloroethene	ug/L	1 U	0.5 U	0.5 U	1 U	1 U
Tetrachloroethene	ug/L	1 U	0.5 U	0.5 U	1 U	1 U
Trichloroethene	ug/L	1 U	0.5 U	0.5 U	1 U	1 U
Vinyl Chloride	ug/L	1 U	0.5 U	0.5 U	1 U	1 U

Parameter	Date Units	4/23/2012 PDB	10/16/2012 PDB	5/7/2013 PDB
cis-1,2-Dichloroethene	ug/L	0.5 U	1 U	0.5 U
Tetrachloroethene	ug/L	0.5 U	1 U	0.5 U
Trichloroethene	ug/L	0.5 U	1 U	0.5 U
Vinyl Chloride	ug/L	0.5 U	1 U	0.5 U

In February 2006, Acetone was detected at 7.9 ug/L and Cyclohexane was detected at 0.56 ug/L.
In November 2006, Cyclohexane was detected at 1.7 ug/L.
In March 2007, Cyclohexane was detected at 2.1 ug/L.
In May 2009, Acetone was detected at 12 ug/L.
In October 2009, Acetone was detected at 5.6 J ug/L.
In April 2011, Acetone was detected at 5.8 J ug/L.
In April 2012, 2-Hexanone was detected at 5.5 ug/L.

U - Not detected. Number is the detection limit.
UJ - Not detected. Number is an estimated detection limit.
PDB - Passive Diffusion Bag
Pump - Peristaltic Pump
NS - Not Sampled
For all PDB samples, Well A was sampled at 31 ft.

Table1- 2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2013 Sampling (05/07/2013)

Well B

Parameter	Date / Units	7/23/2002 Pump	7/24/2003 Pump	4/21/2005 Pump	5/31/2005	9/20/2005 PDB	12/13/2005 PDB
cis-1,2-Dichloroethene	ug/L	1 U	1 U	10 U	NS	5 U	1.5
Tetrachloroethene	ug/L	0.32 J	1 U	10 U	NS	5 U	4.7
Trichloroethene	ug/L	1 U	1 U	10 U	NS	5 U	1.5 J
Vinyl Chloride	ug/L	2 U	2 U	10 U	NS	5 U	1 U
Methyl Tert-Butyl Ether	ug/L	2 U	2 U	10 U	NS	5 U	1.8 J

Parameter	Date / Units	2/15/2006	5/23/2006 PDB	8/15/2006 PDB	11/14/2006 PDB	3/8/2007 PDB	5/22/2007 PDB
cis-1,2-Dichloroethene	ug/L	3.6	1 U	1.2	1.1	0.67	1 U
Tetrachloroethene	ug/L	11	7.3	3.3	4.9	7	1 U
Trichloroethene	ug/L	3	1 U	1.2	1	0.68	1 U
Vinyl Chloride	ug/L	0.5 U	1 UJ	1 U	0.5 U	0.5 U	1 U
Methyl Tert-Butyl Ether	ug/L	0.5 U	1 UJ	1 U	0.77	0.89	1.5

Parameter	Date / Units	8/14/2007 PDB	3/11/2008 PDB	10/28/2008 PDB	10/28/2008 Upper Pump	10/28/2008 Upper Pump (DUP)	10/28/2008 Lower Pump
cis-1,2-Dichloroethene	ug/L	1 U	1.1	1 U	1 U	1 U	1 U
Tetrachloroethene	ug/L	1.3	2.1	1 U	3.0	2.9	2.7
Trichloroethene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	ug/L	1 U	1 U	1 U	1 U	1 U	1 U
Methyl Tert-Butyl Ether	ug/L	1.6	3.6	2.3	1.8	1.8	1.8

See notes on next page.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2013 Sampling (05/07/2013)

Well B

Parameter	Date / Units	5/26/2009 PDB	5/26/2009 PDB DUP	10/12/2009 PDB	4/19/2010 PDB	10/26/2010 PDB	4/28/2011 PDB
cis-1,2-Dichloroethene	ug/L	0.5 U	0.5 U	1 U	0.5 U	0.5 U	1 U
Tetrachloroethene	ug/L	0.5 U	0.5 U	1 U	0.5 U	0.5 U	1 U
Trichloroethene	ug/L	0.5 U	0.5 U	1 U	0.5 U	0.5 U	1 U
Vinyl Chloride	ug/L	0.5 U	0.5 U	1 U	0.5 U	0.5 U	1 U
Methyl Tert-Butyl Ether	ug/L	2	2	1.4	1	0.99	1.4

Parameter	Date / Units	10/18/2011 PBD	4/23/2012 PBD	10/16/2012 PBD	10/16/2012 PBD DUP	5/7/2013 PBD	5/7/2013 PBD DUP
cis-1,2-Dichloroethene	ug/L	1 U	0.5 U	1 U	1 U	0.5 U	0.5 U
Tetrachloroethene	ug/L	1 U	0.88	1 U	1 U	1.8	2.0
Trichloroethene	ug/L	1 U	0.5 U	1 U	1 U	0.5 U	0.5 U
Vinyl Chloride	ug/L	1 U	0.5 U	1 U	1 U	0.5 U	0.5 U
Methyl Tert-Butyl Ether	ug/L	1 U	0.53 J	1 U	1 U	0.54	0.52

In February 2006, Acetone was detected at 5.3 ug/L and Cyclohexane at 0.93 ug/L.
In November 2006, Cyclohexane was detected at 2.8 ug/L.
In May 2007, Bromoform was detected in the sample and LDL trip blank at 1.2 ug/L.
In May 2009, Cyclohexane was detected in the primary sample at 1.1 ug/L and in the duplicate sample at 0.6 ug/L.
In October 2009, Cyclohexane was detected at 1.4 ug/L.
In April 2011, Acetone was detected at 5.7 J ug/L.

NS - Not Sampled
U - Not detected. Number is the detection limit.
J - Result is an estimate.
PDB - Passive Diffusion Bag
Pump - Peristaltic Pump
For all recent PDB samples,
Well B was sampled at 32.5 ft.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2013 Sampling (05/07/2013)

Well C

Parameter	Date / Units	7/23/2002 Pump	4/9/2003 Pump	7/24/2003 Pump	4/21/2005 Pump	5/31/2005 PDB ^	5/31/2005 Pump	9/20/2005 PDB	12/13/2005 PDB ^^
cis-1,2-Dichloroethene	ug/L	23	21	6.5	3,700	250	180	470	310
Tetrachloroethene	ug/L	23	14	10	5,000	140	410	320	260
Trichloroethene	ug/L	9.5	4.8	3.6	2,300	140	150	210	220
Vinyl Chloride	ug/L	0.69 J	1 J	2 U	1,000 U	2.5 U	7.6 U	5 U	5 U

Parameter	Date / Units	2/15/2006 Bailer	5/23/2006 PDB	8/15/2006 PDB	11/14/2006 PDB	3/8/2007 PDB	5/22/2007 PDB	5/22/2007 PDB DUP	8/14/2007 PDB
cis-1,2-Dichloroethene	ug/L	610	130	110	94	170	79	77	7.9
Tetrachloroethene	ug/L	1,100	150	210	180	500	330	320	48
Trichloroethene	ug/L	170	110	60	20	150	79	80	8
Vinyl Chloride	ug/L	10 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U

Parameter	Date / Units	3/11/2008 PDB	3/11/2008 PDB DUP	10/29/2008 PDB	10/29/2008 Pump	10/29/2008 Pump DUP	5/26/2009 PDB	5/26/2009 PDB DUP
cis-1,2-Dichloroethene	ug/L	39	35	340	1,000	1,100	25	22
Tetrachloroethene	ug/L	190	210	160	450	450	200	200
Trichloroethene	ug/L	40	35	110	300	300	25	25
Vinyl Chloride	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Parameter	Date / Units	10/12/2009 PDB	10/12/2009 PDB DUP	4/20/2010 PDB	4/20/2010 PDB DUP	10/26/2010 PDB
cis-1,2-Dichloroethene	ug/L	260	260	11	11	19 J *
Tetrachloroethene	ug/L	200	210	93	93	22
Trichloroethene	ug/L	88	88	9.3	9.2	9.2 J
Vinyl Chloride	ug/L	5 U	5 U	5 U	5 U	5 U

See notes on next page.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2013 Sampling (05/07/2013)

Well C

Parameter	Date / Units	4/28/2011 PDB	10/18/2011 PDB	4/24/2012 PDB	10/16/2012 PDB	5/7/2013 PDB
cis-1,2-Dichloroethene	ug/L	11	20	25	78	5 U
Tetrachloroethene	ug/L	79	27	110	140	77 J*
Trichloroethene	ug/L	6.9	9.3	11	34	5 U
Vinyl Chloride	ug/L	5 U	5 U	5 U	5 U	5 U

In December 2005, Acetone was detected at 7.6 ug/L.
In May 2006, Acetone was detected at 480 J ug/L.
For the PDB samples through May 2006, Well C was sampled at 30 ft.
In October 2008, t-DCE was detected in the Primary sample at 6.2 ug/L and in the duplicate sample at 6.0 ug/L.
In May 2009, methylene chloride was detected in the duplicate sample at 5.4 ug/L.
In October 2009, Acetone was detected in the Primary sample at 6.6 ug/L and in the duplicate sample at 6.1 ug/L.
In October 2011, Acetone was detected at 10 ug/L.
In October 2012, Naphthalene was detected at 19 ug/L.

PDB - Passive Diffusion Bag
Pump - Peristaltic Pump
U - Not detected. Number is the detection limit.
J - Result is an estimate.
^ - Result may be biased low. Vial cap was not tight.
^^ - Result may be inaccurate or biased low, since PDB was not completely submerged.
* - Result is an estimate due to a discrepancy in the duplicate results.

Table1- 2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2012 Sampling (4/23/2012)

Well D

Parameter	Date / Units	7/23/2002 Pump	4/9/2003 Pump	7/24/2003 Pump	4/21/2005 Pump	5/31/2005	9/20/2005 PDB	12/13/2005 PDB
cis-1,2-Dichloroethene	ug/L	1.1	1.6	0.98 J	10 U	NS	5 U	1 U
Tetrachloroethene	ug/L	1.5	1 U	0.27 J	10 U	NS	5 U	1 U
Trichloroethene	ug/L	0.44 J	0.87 J	0.38 J	10 U	NS	5 U	1 UJ
Vinyl Chloride	ug/L	1 U	2 U	2 U	10 U	NS	5 U	1 U

Parameter	Date / Units	2/15/2006 PDB	5/23/2006 PDB	8/15/2006 PDB	11/14/2006 PDB	3/8/2007 PDB	5/22/2007 PDB	8/14/2007 PDB
cis-1,2-Dichloroethene	ug/L	0.8	1.3	1 U	0.77	2.2	1 U	1.7
Tetrachloroethene	ug/L	0.5 U	1 U	1 U	0.5 U	0.5 U	1 U	1 U
Trichloroethene	ug/L	0.5 U	1 U	1 U	0.5 U	0.5 U	1 U	1 U
Vinyl Chloride	ug/L	0.5 U	1 UJ	1 U	0.5 U	0.5 U	1 U	1 U

Parameter	Date / Units	3/11/2008 PDB	10/28/2008 PDB	10/28/2008 Upper Pump	10/28/2008 Lower Pump	5/26/2009 PDB	10/12/2009 PDB
cis-1,2-Dichloroethene	ug/L	1 U	1	1.3	1.1	0.63	1 U
Tetrachloroethene	ug/L	1 U	1 U	1 U	1 U	0.5 U	1 U
Trichloroethene	ug/L	1 U	1 U	1 U	1 U	0.5 U	1 U
Vinyl Chloride	ug/L	1 U	1 U	1 U	1 U	0.5 U	1 U

See notes on next page.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2012 Sampling (4/23/2012)

Well D

	Date	4/19/2010		10/26/2010		4/28/2011	
Parameter	Units	PDB	PDB DUP	PDB	PDB DUP	PDB	PDB DUP
cis-1,2-Dichloroethene	ug/L	0.5 U	0.5 U	0.83	0.5 U	1 U	1 U
Tetrachloroethene	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U
Trichloroethene	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U
Vinyl Chloride	ug/L	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U

	Date	10/18/2011		4/23/2012		
Parameter	Units	PDB	PDB DUP	PDB	PDB DUP	Per Owner request in April 2012, Well D was plugged July 25, 2012 and cannot be sampled.
cis-1,2-Dichloroethene	ug/L	1 U	1 U	0.5 U	0.5 U	
Tetrachloroethene	ug/L	1 U	1 U	0.5 U	0.5 U	
Trichloroethene	ug/L	1 U	1 U	0.5 U	0.5 U	
Vinyl Chloride	ug/L	1 U	1 U	0.5 U	0.5 U	

In February 2006, Acetone was detected at 6.6 ug/L and Cyclohexane at 0.93 ug/L.
In November 2006, Cyclohexane was detected at 4.2 ug/L.
In March 2008, Cyclohexane was detected at 1.4 ug/L.
In May 2009, Cyclohexane was detected at 1.1 ug/L.
In October 2009, Acetone was detected at 5.6 ug/L.
In April 2011, Acetone was detected at 7.6 J ug/L and at 8.4 J ug/L in the duplicate sample.

PDB - Passive Diffusion Bag
Pump - Peristaltic Pump
U - Not detected. Number is the detection limit.
J - Result is an estimate.
NS - Not Sampled
For the PDB samples, Well D was sampled at 28 ft.

Table1- 2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2010 Sampling (4/20/2010)

Well E

Parameter	Date / Units	7/23/2002 Pump	7/24/2003 Pump	4/21/2005 Pump	5/31/2005 Bailer	9/20/2005 Dry	12/13/2005 Dry
cis-1,2-Dichloroethene	ug/L	52	91	45	75	NS	NS
Tetrachloroethene	ug/L	210	260	70	220	NS	NS
Trichloroethene	ug/L	36	72	45	59	NS	NS
Vinyl Chloride	ug/L	10 U	13 U	10 U	3.8 U	NS	NS

Parameter	Date / Units	2/15/2006 Dry	5/23/2006 Bailer	8/15/2006 Dry	11/14/2006 Dry	3/8/2007 Dry	5/22/2007 Bailer
cis-1,2-Dichloroethene	ug/L	NS	5.8	NS	NS	NS	13
Tetrachloroethene	ug/L	NS	130	NS	NS	NS	130
Trichloroethene	ug/L	NS	15	NS	NS	NS	16
Vinyl Chloride	ug/L	NS	1 UJ	NS	NS	NS	1 U

Parameter	Date / Units	8/14/2007 Bailer	3/11/2008 Bailer	10/29/2008 Bailer	5/26/2009 Bailer	10/12/2009 Bailer	4/20/2010 Bailer
cis-1,2-Dichloroethene	ug/L	5 U	15	49	23	60	46
Tetrachloroethene	ug/L	95	86	110	62	41	100
Trichloroethene	ug/L	10	9	15	11	22	19
Vinyl Chloride	ug/L	5 U	5 U	5 U	5 U	7.4	0.5 U

Parameter	Date / Units	Well E
cis-1,2-Dichloroethene	ug/L	No Longer Sampled Per Owner Request April 2010
Tetrachloroethene	ug/L	
Trichloroethene	ug/L	
Vinyl Chloride	ug/L	

Pump - Peristaltic Pump
Dry - Well dry, unable to sample.
NS - Not Sampled/ Dry Well
U - Not detected. Number is the detection limit.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Summer 2006 Sampling (8/15/2006)

Well F

Parameter	Date / Units	7/23/2002 Pump		7/24/2003 Pump		4/21/2005 Pump		5/31/2005	9/20/2005 PDB		12/13/2005
cis-1,2-Dichloroethene	ug/L	1	U	0.21	J	10	U	NS	5	U	NS
Tetrachloroethene	ug/L	1	U	1	U	10	U	NS	5	U	NS
Trichloroethene	ug/L	1	U	1	U	10	U	NS	5	U	NS
Vinyl Chloride	ug/L	2	U	2	U	10	U	NS	5	U	NS

Parameter	Date / Units	2/15/2006	5/23/2006	8/15/2006	Well Permanently Closed, October 2006
cis-1,2-Dichloroethene	ug/L	NS	NS	NS	
Tetrachloroethene	ug/L	NS	NS	NS	
Trichloroethene	ug/L	NS	NS	NS	
Vinyl Chloride	ug/L	NS	NS	NS	

PDB - Passive Diffusion Bag
Pump - Peristaltic Pump
For the PDB samples, Well F was sampled at 33 ft.

NA - Not Analyzed
NS - Not Sampled
U - Not detected. Number is the detection limit.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2013 Sampling (05/08/2013)

Well G

	Date	5/9/2002	5/17/2002	7/23/2002		4/9/2003		7/24/2003
Parameter	Units	Pump	Pump	Pump	Pump	Pump	Pump	Pump
cis-1,2-Dichloroethene	ug/L	370	170	370	380	190	190	250
trans-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	41	40	130	150	2.1 J	1.8 J	65
Trichloroethene	ug/L	17	18	45	48	1.2 J	1.3 J	27
Vinyl Chloride	ug/L	71	13	25 J	25 J	60	61	37

	Date	4/21/2005	12/13/2005	2/15/2006	5/23/2006	8/15/2006	11/14/2006	3/8/2007
Parameter	Units	Pump	PDB	PDB	PDB	PDB	PDB	PDB
cis-1,2-Dichloroethene	ug/L	160	420	260	120	260	330	140
trans-1,2-Dichloroethene	ug/L	20 U	5 U	25 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	20 U	100	25 U	5 U	37	8.5	5 U
Trichloroethene	ug/L	20 U	53	25 U	5.6	18	5 U	5 U
Vinyl Chloride	ug/L	25	28	52	35	55	110	21 J

	Date	5/22/2007	ACLs	8/14/2007	3/11/2008	10/29/2008		5/26/2009
Parameter	Units	PDB		PDB	PDB	PDB	Pump	PDB
cis-1,2-Dichloroethene	ug/L	28	140,000	120	62	150	210	37
trans-1,2-Dichloroethene	ug/L	5 U	550	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	5 U	11,000	16	5 U	5 U	23	5 U
Trichloroethene	ug/L	5.9	8,600	9.7	5 U	5 U	13	5 U
Vinyl Chloride	ug/L	5 U	9,000	5 U	9.9	49	22	53

See notes on next page.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From the End of RI Sampling (7/23/2002) to Spring 2013 Sampling (05/08/2013)

Well G

Parameter	Date / Units	ACLs	10/12/2009 PDB	4/20/2010 PDB	10/26/2010 PDB	10/26/2010 PDB DUP	4/28/2011 PDB	4/28/2011 PDB DUP
cis-1,2-Dichloroethene	ug/L	140,000	62 J	160	1,400 J *	2,600 J *	1,600	1,600
trans-1,2-Dichloroethene	ug/L	550	5 U	5 U	6.7	9.2	5 U	5 U
Tetrachloroethene	ug/L	11,000	5 U	5 U	5 U	6.6	9.9	5 U
Trichloroethene	ug/L	8,600	5 U	5 U	5.5 J	8.4 J	5 U	5 U
Vinyl Chloride	ug/L	9,000	42 J	35	98	92	390	380

Parameter	Date / Units	ACLs	10/18/2011 PDB	10/18/2011 PDB DUP	4/24/2012 PDB	10/16/2012 PDB	10/16/2012 PDB DUP	5/8/2013 PDB	5/8/2013 PDB DUP
cis-1,2-Dichloroethene	ug/L	140,000	1,500	1,500	1,000	610	620	73	63
trans-1,2-Dichloroethene	ug/L	550	5 U	5.0	5 U	5.2	5.3	5 U	5 U
Tetrachloroethene	ug/L	11,000	200	170	59	570	610	41 J*	25 J*
Trichloroethene	ug/L	8,600	97	88	37	160	160	6.5	5 U
Vinyl Chloride	ug/L	9,000	120	130	43	6.6	7.7	5 U	5 U

* - Result is an estimate due to a discrepancy in duplicate results.
Well G not sampled on May 31, 2005 or September 20, 2005.
In May 2009, Methylene Chloride was detected at 15 ug/L.
In October 2009, Methylene Chloride was detected at 5.2 ug/L.
In April 2011, 1,1-DCE was detected at 8.1 ug/L in the primary sample and at 7.3 ug/L in the duplicate sample.
In October 2011, 1,1- DCE was detected at 12 ug/L in the primary sample and at 11 ug/L in the duplicate sample.
In October 2012, Naphthalene was detected at 14 ug/L in the duplicate sample.

Pump - Peristaltic Pump
U - Not detected. Number is the detection limit.
J - Result is an estimate.
PDB - Passive Diffusion Bag

For the PDB samples, Well G was sampled at 38 ft.
ACLs - Alternate Concentration Limits (in ug/L) were established in August 2007, and revised January 2013.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/08/2013)

Well H

	Date	4/21/2005	9/20/2005					12/13/2005	
	Sample Method	Pump	PDB	PDB	PBD	PBD	PBD	PBD ^	PBD
Parameter	Units	38' btoc	19' btoc	24' btoc	28' btoc	34' btoc	39' btoc	28' btoc	39' btoc
cis-1,2-Dichloroethene	ug/L	81	8.7	62	81	140	140	43	230
trans-1,2-Dichloroethene	ug/L	10 U	5 U	5 U	5 U	7.2	7.6	5 U	13
Tetrachloroethene	ug/L	85	140	200	240	430	400	350	540
Trichloroethene	ug/L	20	18	38	52	85	92	65	130
Vinyl Chloride	ug/L	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

	Date	2/15/2006	5/23/2006	8/15/2006	11/14/2006	3/8/2007	5/22/2007		8/14/2007
	Sample Method	PDB	PDB	PDB	PDB	PDB	PDB		PDB
Parameter	Units	39' btoc	39' btoc	39' btoc	39' btoc	39' btoc	39' btoc	ACLs	34' btoc
cis-1,2-Dichloroethene	ug/L	280	83	210	260	29	15	140,000	51
trans-1,2-Dichloroethene	ug/L	19	5 U	9.6	14	5 U	5 U	550	5 U
Tetrachloroethene	ug/L	250	180	440	310	65	68	11,000	160
Trichloroethene	ug/L	71	44	61	91	12	14	8,600	34
Vinyl Chloride	ug/L	10 U	5 U	12	5 U	5 UJ	5 U	9,000	5 U

	Date		3/11/2008	10/29/2008				5/26/2009	
	Sample Method		PDB		Lower PDB	Upper Pump	Lower Pump	Upper PDB	Lower PDB
Parameter	Units	ACLs	34' btoc	34' btoc	39' btoc	22' btoc	32' btoc	34' btoc	39' btoc
cis-1,2-Dichloroethene	ug/L	140,000	53	83	82	100	110	35	34
trans-1,2-Dichloroethene	ug/L	550	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	11,000	120	190 J	150	150	190	110	76
Trichloroethene	ug/L	8,600	31	28	20	30	34	20	15
Vinyl Chloride	ug/L	9,000	5 U	5 U	5 U	5 U	5 U	5 U	5 U

See notes on next page.

Table1- 2 (Continued)
OU1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/08/2013)

Well H

	Date		10/12/2009	4/20/2010		10/26/2010		4/28/2011	
	Sample Method		PDB	Upper PDB	Lower PDB	Upper PDB	Lower PDB	Upper PDB	Lower PDB
Parameter	Units	ACLs	39' btoc	34' btoc	39' btoc	34' btoc	39' btoc	34' btoc	39' btoc
cis-1,2-Dichloroethene	ug/L	140,000	29	50	50	73 J *	32 J *	170	180
trans-1,2-Dichloroethene	ug/L	550	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	11,000	71	110	110	110	160	180	150
Trichloroethene	ug/L	8,600	9.5	18	19	39 J	21 J	45	36
Vinyl Chloride	ug/L	9,000	5.1	5 U	5 U	5 U	5 U	5 U	5 U

	Date		10/18/2011		4/24/2012		10/16/2012	5/8/2013	
	Method		Upper PDB	Lower PDB	Upper PDB	Lower PDB	Lower PDB	Upper PDB	Lower PDB
Parameter	Units	ACLs	34' btoc	39' btoc	34' btoc	39' btoc	39' btoc	34' btoc	39' btoc
cis-1,2-Dichloroethene	ug/L	140,000	30	110	150	130	230	55	100
trans-1,2-Dichloroethene	ug/L	550	5 U	5 U	5 U	5 U	7.6	5 U	5 U
Tetrachloroethene	ug/L	11,000	270	270	90	120	260	88 J*	160 J*
Trichloroethene	ug/L	8,600	29	55	52	37	100	15	25
Vinyl Chloride	ug/L	9,000	5 U	5 U	24	28	5 U	5 U	5.7

In December 2005, Acetone was detected in the 28' sample at 7.7 ug/L
and in the 39' sample at 7.0 ug/L.
In November 2006, Cyclohexane was detected at 6.7 ug/L.
In May 2009, Methylene Chloride was detected at 8.4 ug/L.
In October 2009, Acetone was detected at 7.4 ug/L.

ACLs - Alternate Concentration Limits were established in August 2007,
and revised in January 2013.

Pump - Peristaltic Pump
btoc - below top of casing
U - Not detected. Number is the detection limit.
PDB - Passive Diffusion Bag
J - Result is an estimate.
^ - Results may be inaccurate or biased low, since PDB was
not completely submerged.
* - Result is an estimate due to a discrepancy in the duplicate results.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/08/2013)

Well I

	Date	4/21/2005		9/20/2005				
	Sample Method	Pump	Pump	PDB	PDB	PDB	PDB	PBD
Parameter	Units	38' btoc	38' btoc DUP	19' btoc	24' btoc	28' btoc	34' btoc	39' btoc
1,1-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	3,600	3,800	150	2,800	4,100	6,100	6,400
trans-1,2-Dichloroethene	ug/L	48	39	5 U	13	19	26	22
Tetrachloroethene	ug/L	720	720	210	610	950	1,100	900
Trichloroethene	ug/L	450	460	44	420	700	860	690
Vinyl Chloride	ug/L	75	76	5 U	17	36	62	110

	Date	12/13/2005			2/15/2006		5/23/2006	8/15/2006	11/14/2006
	Sample Method	PDB ^	PDB	PDB	PDB	PDB	PDB	PDB	PDB
Parameter	Units	28' btoc	39' btoc	39' btoc DUP	39' btoc	39' btoc DUP	39' btoc	39' btoc	39' btoc
1,1-Dichloroethene	ug/L	11	11	10	670 U	28	5 U	68	30
cis-1,2-Dichloroethene	ug/L	4,800	8,300	8,300	12,000	12,000	1,600	14,000	14,000
trans-1,2-Dichloroethene	ug/L	14	11	10	670 U	55	15	21	35
Tetrachloroethene	ug/L	790	100	120	670 U	11	950	200	650 J
Trichloroethene	ug/L	420	14	18	670 U	35	660	190	460 J
Vinyl Chloride	ug/L	120	340	350	670 U	340 J	8.1	900 J	430 J

	Date	3/8/2007	5/22/2007	ACLs	8/14/2007	3/11/2008	10/29/2008	
	Sample Method	PDB	PDB		PDB	PDB	Upper PDB	Lower PDB
Parameter	Units	39' btoc	39' btoc		34' btoc	34' btoc	34' btoc	39' btoc
1,1-Dichloroethene	ug/L	5 U	5 U	887	5 U	5 U	6.4	7.9
cis-1,2-Dichloroethene	ug/L	1,100	990	140,000	2,200	770	2,500	2,900
trans-1,2-Dichloroethene	ug/L	15	9.9	550	6.1	8	5 U	7.1
Tetrachloroethene	ug/L	540	620	11,000	650	680	390	430 J
Trichloroethene	ug/L	360	300	8,600	200	260	23	110
Vinyl Chloride	ug/L	5 UJ	26	9,000	180	8	1,100	680

See notes on next page.

Table1- 2 (Continued)
OU1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/08/2013)

Well I

	Date		10/29/2008		5/26/2009		10/12/2009	4/20/2010	
	Sample Method		Upper Pump	Lower Pump	Upper PDB	Lower PDB	Lower PDB	Upper PDB	Lower PDB
Parameter	Units	ACLs	22.9' btoc	32.9' btoc	34' btoc	39' btoc	39' btoc	34' btoc	39' btoc
1,1-Dichloroethene	ug/L	887	5 U	5.8	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	ug/L	140,000	1,800	2,500	550	540	560	290	540
trans-1,2-Dichloroethene	ug/L	550	16	17	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	11,000	620 J	620 J	350	180	150	300	190
Trichloroethene	ug/L	8,600	210	230	110	89	14	63	67
Vinyl Chloride	ug/L	9,000	330	360	26	62	190	5 U	14

	Date		10/26/2010		4/28/2011		10/18/2011	
	Sample Method		Upper PDB	Lower PDB	Upper PDB	Lower PDB	Upper PDB	Lower PDB
Parameter	Units	ACLs	34' btoc	39' btoc	34' btoc	39' btoc	34' btoc	39' btoc
1,1-Dichloroethene	ug/L	887	5 U	5 U	7	11	5 U	5 U
cis-1,2-Dichloroethene	ug/L	140,000	160 J *	210 J *	1,300	1,700	29	55
trans-1,2-Dichloroethene	ug/L	550	5 U	5 U	5.7	5 U	5 U	5 U
Tetrachloroethene	ug/L	11,000	160	130	200	150	190	170
Trichloroethene	ug/L	8,600	40 J	37 J	44	19	21	21
Vinyl Chloride	ug/L	9,000	5.8	28 J	140	300	5 U	5 U

	Date		4/24/2012		10/16/2012	5/8/2013	
	Sample Method		Upper PDB	Lower PDB	Lower PDB	Upper PDB	Lower PDB
Parameter	Units	ACLs	34' btoc	39' btoc	39' btoc	34' btoc	39' btoc
1,1-Dichloroethene	ug/L	887	5 U	5 U	12	5 U	5 U
cis-1,2-Dichloroethene	ug/L	140,000	720	1,200	1,700	440	520
trans-1,2-Dichloroethene	ug/L	550	10	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	11,000	150	22	86	120 J*	71 J*
Trichloroethene	ug/L	8,600	41	8.2	20	38	37
Vinyl Chloride	ug/L	9,000	100	65	24	22	50

Pump - Peristaltic Pump
btoc - below top of casing
Well I was not sampled in May 2005.
U - Not detected. Number is the detection limit.
PDB - Passive Diffusion Bag
J - Result is an estimate.
^ - Results may be inaccurate or biased low, PDB not completely submerged.
* - Result is an estimate due to a discrepancy in the duplicate results.
In December 2005, Acetone was detected in the 28' sample at 6.7 ug/L, and in the 39' sample at 7.4 ug/L (7.2 ug/L in the Duplicate).
In November 2006, Cyclohexane was detected at 13 ug/L.
In October 2009, Acetone was detected at 7.4 J ug/L.
ACLs - Alternate Concentration Limits were established in August 2007, and revised in January 2013.
In May 2013, Chloroform was detected in the 39' sample at 6.2 J ug/L.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/08/2013)

Well J

	Date	4/21/2005	5/31/2005		9/20/2005			
	Sample Method	Pump	PDB	Pump	PDB	PDB	PDB	PDB
Parameter	Units	30' btoc	30' btoc	30' btoc	20' btoc	25' btoc	25' btoc Dup	30' btoc
cis-1,2-Dichloroethene	ug/L	1,700	870	2,000	140	1,200	1,300	1,100
trans-1,2-Dichloroethene	ug/L	15	NA	NA	5 U	10	10	8
Tetrachloroethene	ug/L	6,200	3,300	4,800	880	3,200	3,200	6,200
Trichloroethene	ug/L	3,000	920	2,700	110	520	540	770
Vinyl Chloride	ug/L	30	NA	NA	5 U	5 U	5 U	10

	Date	12/13/2005		2/15/2006	5/23/2006		8/15/2006	11/14/2006	
	Sample Method	PDB ^	PDB	PDB	PDB	PDB Dup	PDB	PDB	PDB Dup
Parameter	Units	25' btoc	30' btoc	30' btoc	30' btoc	30' btoc	30' btoc	30' btoc	30' btoc
cis-1,2-Dichloroethene	ug/L	370	660	680	300	300	1,000	1,300	1,100
trans-1,2-Dichloroethene	ug/L	5 U	5 U	67 U	5 U	5 U	10	14	13
Tetrachloroethene	ug/L	1,000	300	170	1,300	1,400	1,100	1,500	1,200
Trichloroethene	ug/L	150	110	140	290	290	360	310	270
Vinyl Chloride	ug/L	5 U	70	67 U	5 U	5 U	46	15	15

	Date	3/8/2007		5/22/2007	8/14/2007	3/11/2008	10/29/2008			
	Sample Method	PDB	PDB (DUP)	PDB	PDB	PDB	Upper PDB	Lower PDB	Upper Pump	Lower Pump
Parameter	Units	30' btoc	30' btoc	30' btoc	25' btoc	25' btoc	25' btoc	30' btoc	23.5' btoc	29.5' btoc
cis-1,2-Dichloroethene	ug/L	320	290	110	95	1,300	120	450	1,200	2,500
trans-1,2-Dichloroethene	ug/L	50 U	50 U	5 U	5 U	11	5 U	6.8	39	42
Tetrachloroethene	ug/L	2,300	2,300	920	870	2,600	1,200 J	1,300 J	3,000	6,800
Trichloroethene	ug/L	320	310	130	100	1,200	170	250	710	1,400
Vinyl Chloride	ug/L	50 UJ	50 UJ	5 U	5 U	20	5 U	5 U	11	12

See notes on next page.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/08/2013)

Well J

	Date	5/26/2009		10/12/2009	4/20/2010		10/26/2010	
	Sample Method	Upper PDB	Lower PDB	PDB	Upper PDB	Lower PDB	Upper PDB	Lower PDB
Parameter	Units	25' btoc	29.5' btoc	30' btoc	25' btoc	29.5' btoc	25' btoc	29.5' btoc
cis-1,2-Dichloroethene	ug/L	340	720	1,400	160	180	29 J*	160 J*
trans-1,2-Dichloroethene	ug/L	5 U	5 U	39	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	590	2,200	1,200	460 J	960 J	350	2,000
Trichloroethene	ug/L	180	580	770	95	120	48 J	89 J
Vinyl Chloride	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U

	Date	4/28/2011		10/18/2011		4/24/2012		10/16/2012
	Sample Method	Upper PDB	Lower PDB	Upper PDB	Lower PDB	Upper PDB	Lower PDB	Lower PDB
Parameter	Units	25' btoc	29.5' btoc	25' btoc	29.5' btoc	25' btoc	30' btoc	30' btoc
cis-1,2-Dichloroethene	ug/L	15	16	8.2	51	460	1,000	470
trans-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	410	660	300	380	710	1,200	1,300
Trichloroethene	ug/L	31	41	10	30	290	850	230
Vinyl Chloride	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U

	Date	5/8/2013	
	Sample Method	Upper PDB	Lower PDB
Parameter	Units	25' btoc	30' btoc
cis-1,2-Dichloroethene	ug/L	120	140
trans-1,2-Dichloroethene	ug/L	5 U	10 U
Tetrachloroethene	ug/L	360 J*	590 J*
Trichloroethene	ug/L	50	66
Vinyl Chloride	ug/L	5 U	10 U

* - Result is an estimate due to a discrepancy in the duplicate results.
^ - Results may be inaccurate or biased low, PDB was not submerged.
In December 2005, Acetone was detected in the 30' sample at 7.4 ug/L and in the 25' sample at 6.0 ug/L.
In November 2006, 1,1,2-TCA was detected at 12 ug/L in the primary sample and 11 ug/L in duplicate sampl
In October 2009, Acetone was detected at 5.5 J ug/L and Bromodichloromethane at 8.3 ug/L.
In October 2010, Methylene Chloride was detected in the 25' sample at 5.8 ug/L.
In October 2011, Acetone was detected at 25 J ug/L in the 25' sample and at 23 J ug/L in the 29.5' sample.

PDB - Passive Diffusion Bag
Pump - Peristaltic Pump
btoc - below top of casing
U - Not detected. Number is the detection limit.
J - Result is an estimate.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/07/2013)

PZ - 1

Parameter	Date / Units	4/21/2005	5/31/2005	9/20/2005	12/13/2005	2/15/2006	5/23/2006	8/15/2006	11/14/2006
			Pump			Bailer	PDB	PDB	PDB
cis-1,2-Dichloroethene	ug/L	NS	2,750	NS	NS	90	630	550	400
trans-1,2-Dichloroethene	ug/L	NS	NA	NS	NS	25 U	6.4	5 U	6.7
Tetrachloroethene	ug/L	NS	23,500	NS	NS	220	1,100	2,300	1,400
Trichloroethene	ug/L	NS	2,480	NS	NS	28	320	310	160
Vinyl Chloride	ug/L	NS	NA	NS	NS	25 U	5 U	5 U	5 U
Bromodichloromethane	ug/L	NS	NA	NS	NS	25 U	5 U	5 U	5 U

Parameter	Date / Units	3/8/2007	5/22/2007	8/14/2007	3/11/2008	6/17/2008		10/29/2008	
		PDB	PDB	PDB	PDB	PDB	PDB (DUP)	PDB	Pump
cis-1,2-Dichloroethene	ug/L	110	68	30	99	1,100	1,100	3,900	1,600
trans-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	11	17	29	13
Tetrachloroethene	ug/L	430	470	42	2,100	4,700 J	4,300 J	9,300 J	4,000 J
Trichloroethene	ug/L	42	42	18	121	1,300 J	1,200 J	3,100	1,300
Vinyl Chloride	ug/L	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	ug/L	5 U	5 U	5 U	5 U	12	11	5 U	5 U

Parameter	Date / Units	5/26/2009	10/12/2009	4/20/2010	10/26/2010	4/28/2011	10/18/2011	4/24/2012	10/16/2012	5/7/2013
		PDB	PDB	PDB	PDB	PDB	PDB	PDB	PDB	PDB
cis-1,2-Dichloroethene	ug/L	850	2,400	1,800	1,200 J *	460	190	1,200	1,000	27
trans-1,2-Dichloroethene	ug/L	5 U	18	9	5.2	10	5 U	5 U	6.6	5 U
Tetrachloroethene	ug/L	2,900	4,500	5,700	3,200	2,000	1,400	2,300	1,200	94 J*
Trichloroethene	ug/L	600	1,400	800	490 J	420	110	180	290	8.1
Vinyl Chloride	ug/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	ug/L	5 U	14	5 U	5 U	5.9	5 U	5 U	5 U	5 U

In November 2006, 1,1,2-TCA was detected at 12 ug/L.
In October 2009, Acetone was detected at 27 ug/L.
In October 2011, Acetone was detected at 8.3 J ug/L.
In October 2012, Acetone was detected at 20 ug/L
and Naphthalene was detected at 24 J ug/L.

Pump - Peristaltic Pump PDB - Passive Diffusion Bag
For the PDB samples, Well PZ-1 was sampled at 28 ft.
NS - Not sampled. NA - Not Available.
U - Not detected. Number is the detection limit.
J - Result is an estimate.
* - Result is an estimate due to a discrepancy in the duplicate results.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/07/2013)

ART - 1

	Date	4/21/2005	5/31/2005	9/20/2005	12/13/2005	2/15/2006	5/23/2006
Parameter	Units		Pump	Pump			Pump
cis-1,2-Dichloroethene	ug/L	NS	10,475	2,100	NS	NS	140
trans-1,2-Dichloroethene	ug/L	NS	5 U	5 U	NS	NS	5 U
Tetrachloroethene	ug/L	NS	6,000	1,900	NS	NS	160
Trichloroethene	ug/L	NS	898	330	NS	NS	43
Vinyl Chloride	ug/L	NS	NA	13	NS	NS	5 U

	Date	8/15/2006		11/14/2006	3/8/2007	5/22/2007	8/14/2007
Parameter	Units	Pump	Pump Dup	Pump	Pump	Pump	PDB
cis-1,2-Dichloroethene	ug/L	420	410	54	200	11	5 U
trans-1,2-Dichloroethene	ug/L	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	ug/L	400	400	230 J	210	62 J	5 U
Trichloroethene	ug/L	150	150	25 J	72	8.6	5 U
Vinyl Chloride	ug/L	5 U	5 U	5 U	5 UJ	5 U	5 U

	Date	3/11/2008	6/17/2008	10/29/2008	5/26/2009	10/12/2009	4/20/2010
Parameter	Units		Pump	Pump *	Bailer	NS	Bailer
cis-1,2-Dichloroethene	ug/L	NS	190	290	260	Bailer Lost	2,500
trans-1,2-Dichloroethene	ug/L	NS	5 U	5 U	5 U		12
Tetrachloroethene	ug/L	NS	260 J	290 J	820		4,600
Trichloroethene	ug/L	NS	110 J	62	270		510
Vinyl Chloride	ug/L	NS	5 U	5 U	5 U		9

	Date	10/26/2010	4/28/2011	10/18/2011	4/24/2012	10/17/2012	5/7/2013
Parameter	Units	NS	NS	Bailer	Peristaltic Pump	Bailer	NS
cis-1,2-Dichloroethene	ug/L	Pump not installed, and bailer would not fit in wellhead.	Pump not installed, and bailer would not fit in wellhead.	2,100	1,300	2,000	Pump not installed, and bailer lost down well.
trans-1,2-Dichloroethene	ug/L			15	5 U	20	
Tetrachloroethene	ug/L			4,200	1,900	2,700	
Trichloroethene	ug/L			590	440	480	
Vinyl Chloride	ug/L			34	6.9	5 U	

Pump - System's Well Pump
The ART system's pump intake is approximately 29 feet bgs.
NS - Not Sampled
U - Not detected. Number is the detection limit.
* - Since 10/29/2008, ART system components have been turned off due to several maintenance issues.
In October 2012, Naphthalene was detected at 12 ug/L.

Table 1-2 (Continued)
OU1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/07/2013)

PZ - 2

Parameter	Date / Units	5/22/2007 Bailer	8/14/2007 Bailer	3/11/2008 Bailer	6/17/2008 Bailer	10/29/2008 Pump
1,1-Dichloroethene	ug/L	5 U	8	10	5 U	20
cis-1,2-Dichloroethene	ug/L	3,300	11,000	25,000	2,100	13,000
trans-1,2-Dichloroethene	ug/L	23	50	320	13	81
Tetrachloroethene	ug/L	2,600	7,600	11,000	3,900 J	17,000 J
Trichloroethene	ug/L	950	3,600	8,700	640 J	13,000
Vinyl Chloride	ug/L	5 UJ	5 U	7.7	5 U	9.5

Parameter	Date / Units	5/26/2009 Bailer	10/12/2009 Not Sampled	4/20/2010 Bailer	10/26/2010 Bailer	4/28/2011 Bailer
1,1-Dichloroethene	ug/L	5 U	Well was Dry	10	5.3 J	5 U
cis-1,2-Dichloroethene	ug/L	9,500		6,600	4,100 J *	1,900
trans-1,2-Dichloroethene	ug/L	56		44	31	13
Tetrachloroethene	ug/L	7,800		15,000	15,000	12,000
Trichloroethene	ug/L	5,100		3,900	4,900 J	3,500
Vinyl Chloride	ug/L	5 U		5 U	5 U	5 U

Parameter	Date / Units	10/18/2011 Bailer	4/24/2012 Pump	4/24/2012 Pump Dup	10/16/2012 Not Sampled	5/7/2013 Bailer
1,1-Dichloroethene	ug/L	12	50 U	50 U	Well was Dry	25 U
cis-1,2-Dichloroethene	ug/L	5,800	5,200 E	6,000 E		7,100
trans-1,2-Dichloroethene	ug/L	70 J	50 U	50 U		56
Tetrachloroethene	ug/L	26,000	24,000 E	25,000 E		15,000 J*
Trichloroethene	ug/L	9,600	9,800 E	11,000 E		3,800
Vinyl Chloride	ug/L	11	50 U	50 U		25 U

U - Not detected. Number is the detection limit.
J - Result is an estimate.
E - Result estimated, outside lab calibration range (high); see message at end of Appendix A, Spring 2012 (BVSPC 2012e).
Well PZ-2 not sampled in 2005, 2006, or March 2007 because it was dry.
* - Result is an estimate due to a discrepancy in the duplicate results.

Table 1-2 (Continued)
OU 1 Remedial Action Groundwater Results
From Baseline Sampling (4/21/2005) to Spring 2013 Sampling (05/07/2013)

Quality Control - Trip Blanks

Parameter	Date / Units	4/21/2005	5/31/2005	9/20/2005	12/13/2005	2/15/2006		5/23/2006		8/15/2006	
						Routine	LDL	Routine	LDL	Routine	LDL
cis-1,2-Dichloroethene	ug/L	10 U	10 U	5 U	5 U	10 U	0.5 U	5 U	1 U	5 U	1 U
trans-1,2-Dichloroethene	ug/L	10 U	10 U	5 U	5 U	10 U	0.5 U	5 U	1 U	5 U	1 U
Tetrachloroethene	ug/L	10 U	10 U	5 U	5 U	10 U	0.5 U	5 U	1 U	5 U	1 U
Trichloroethene	ug/L	10 U	10 U	5 U	5 U	10 U	0.5 U	5 U	1 U	5 U	1 U
Vinyl Chloride	ug/L	10 U	10 U	5 U	5 U	10 U	0.5 U	5 U	1 UJ	5 U	1 UJ

Parameter	Date / Units	11/14/2006		3/8/2007		5/22/2007		8/14/2007		3/11/2008	
		Routine	LDL	Routine	LDL	Routine	LDL	Routine	LDL	Routine	LDL
cis-1,2-Dichloroethene	ug/L	5 U	0.5 U	5 U	0.5 U	5 U	1 U	5 U	1 U	5 U	1 U
trans-1,2-Dichloroethene	ug/L	5 U	0.5 U	5 U	0.5 U	5 U	1 U	5 U	1 U	5 U	1 U
Tetrachloroethene	ug/L	5 U	0.5 U	5 U	0.5 U	5 U	1 U	5 U	1 U	5 U	1 U
Trichloroethene	ug/L	5 U	0.5 U	5 U	0.5 U	5 U	1 U	5 U	1 U	5 U	1 U
Vinyl Chloride	ug/L	5 U	0.5 UJ	5 UJ	0.5 U	5 U	1 U	5 U	1 U	5 U	1 U

Parameter	Date / Units	6/17/2008	10/29/2008	10/27/2008	5/26/2009		10/12/2009		4/20/2010		10/26/2010	
		Routine	Routine	LDL	Routine	LDL	Routine	LDL	Routine	LDL	Routine	LDL
cis-1,2-Dichloroethene	ug/L	5 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U	5 U	0.5 U
trans-1,2-Dichloroethene	ug/L	5 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U	5 U	0.5 U
Tetrachloroethene	ug/L	5 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U	5 U	0.5 U
Trichloroethene	ug/L	5 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U	5 U	0.5 U
Vinyl Chloride	ug/L	5 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U	5 U	0.5 U

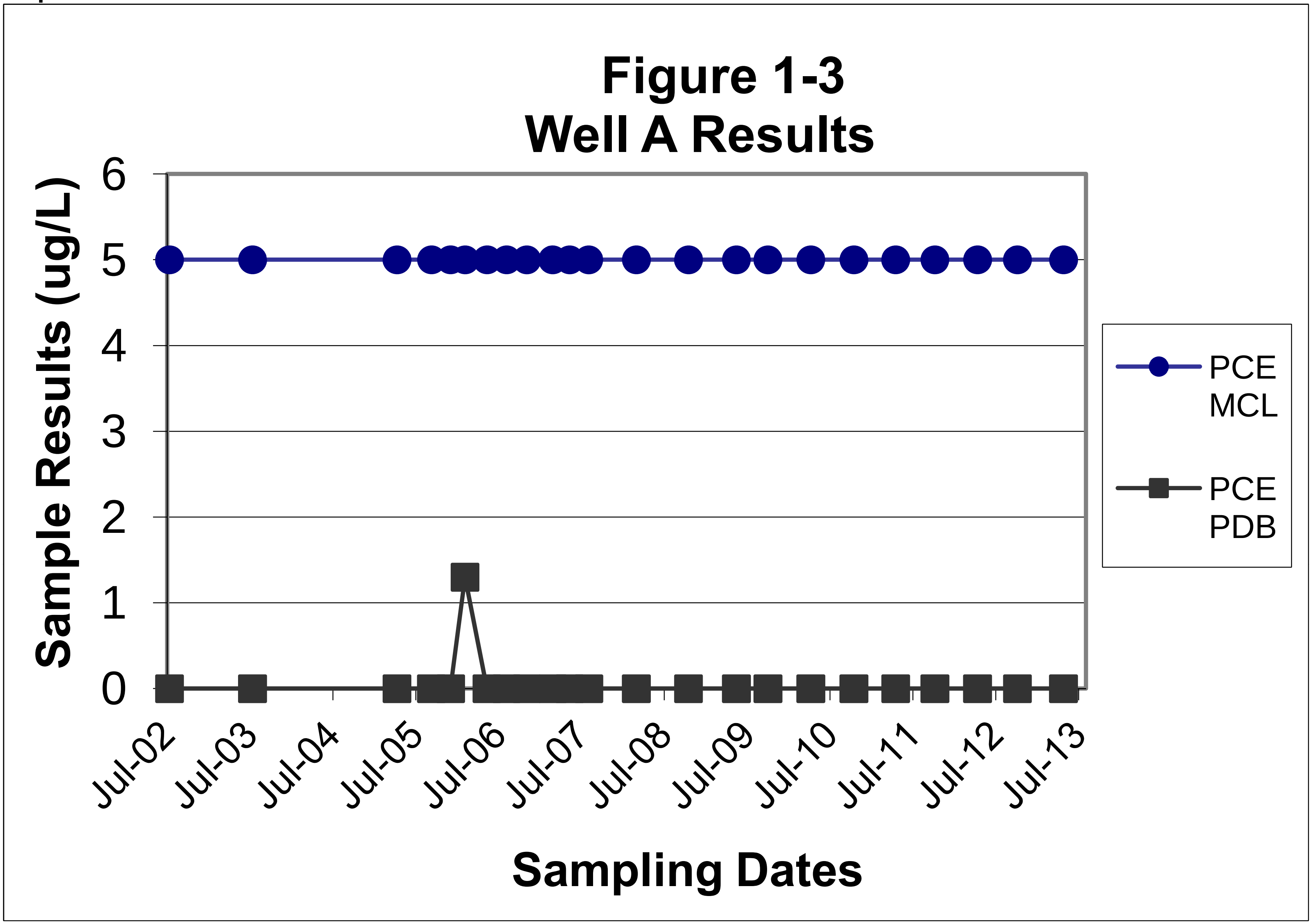
Parameter	Date / Units	4/28/2011		10/18/2011		4/24/2012		10/16/2012		5/7/2013	
		Routine	LDL	Routine	LDL	Routine	LDL	Routine	LDL	Routine	LDL
cis-1,2-Dichloroethene	ug/L	5 U	1 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U
trans-1,2-Dichloroethene	ug/L	5 U	1 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U
Tetrachloroethene	ug/L	5 U	1 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U
Trichloroethene	ug/L	5 U	1 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U
Vinyl Chloride	ug/L	5 U	1 U	5 U	1 U	5 U	0.5 U	5 U	1 U	5 U	0.5 U

In December 2005, Acetone was detected at 5.1 ug/L.
In May 2007, Bromoform was detected in the LDL trip blank at 1.2 ug/L.
In October 2010, slight Methylene Chloride contamination was found in both the routine (below CRQL levels) and LDL (0.8 ug/L) trip blanks.
In October 2012, Naphthalene was detected at 35 J ug/L in the routine sample.

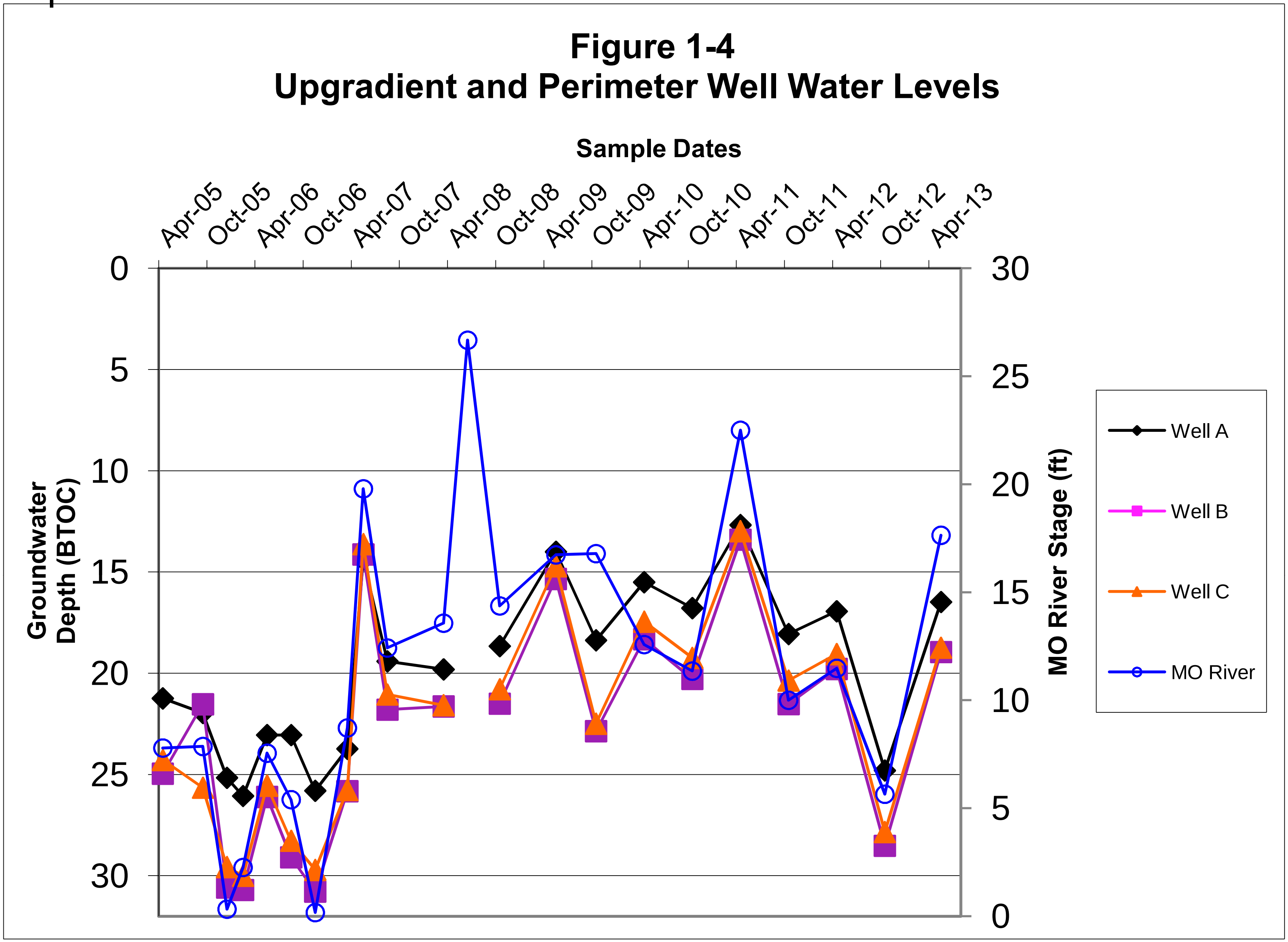
LDL - Low Detection Limits
U - Not detected. Number is the detection limit.

Riverfront Site

Operable Unit No. 1



Riverfront Site
Operable Unit No. 1



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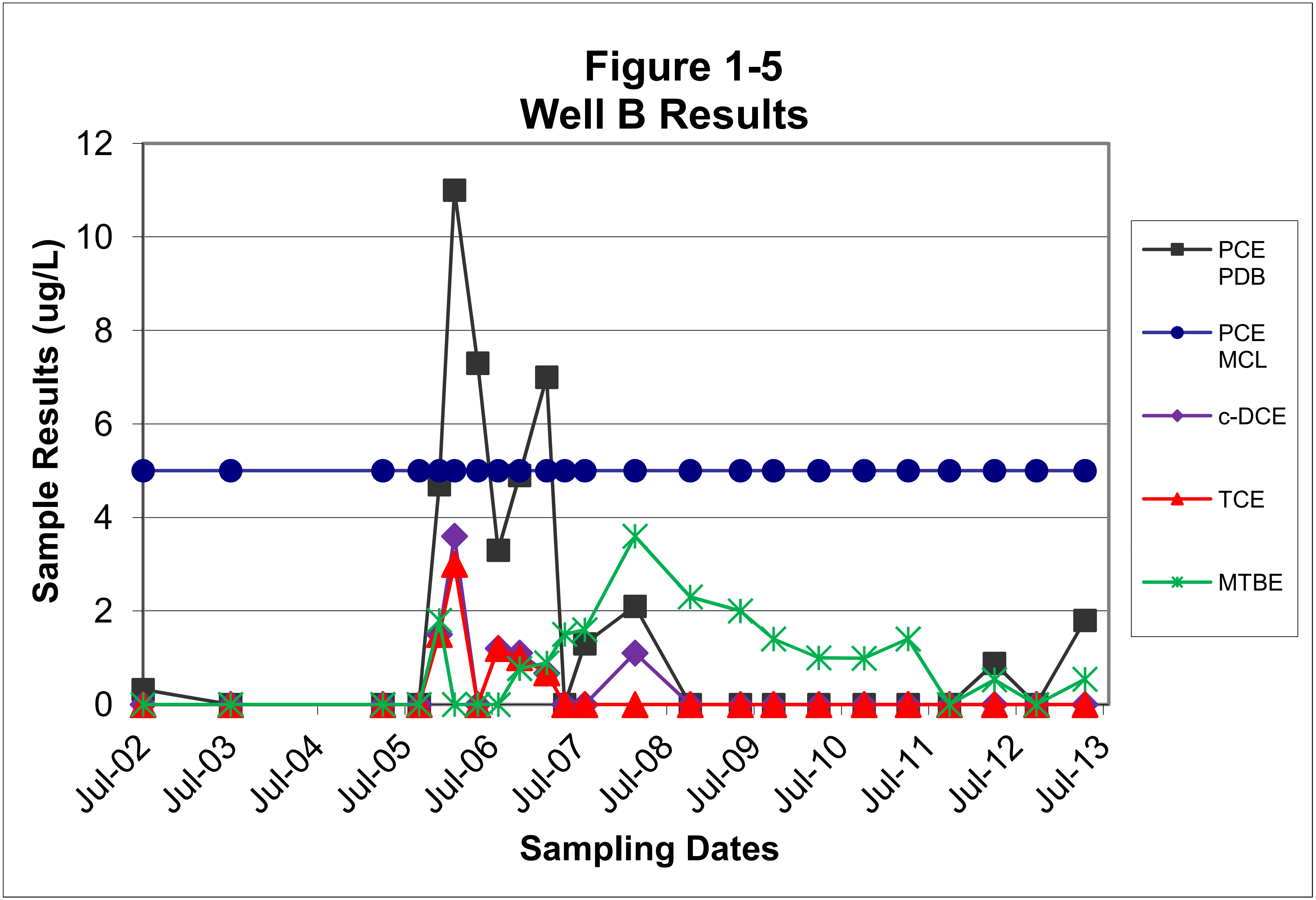

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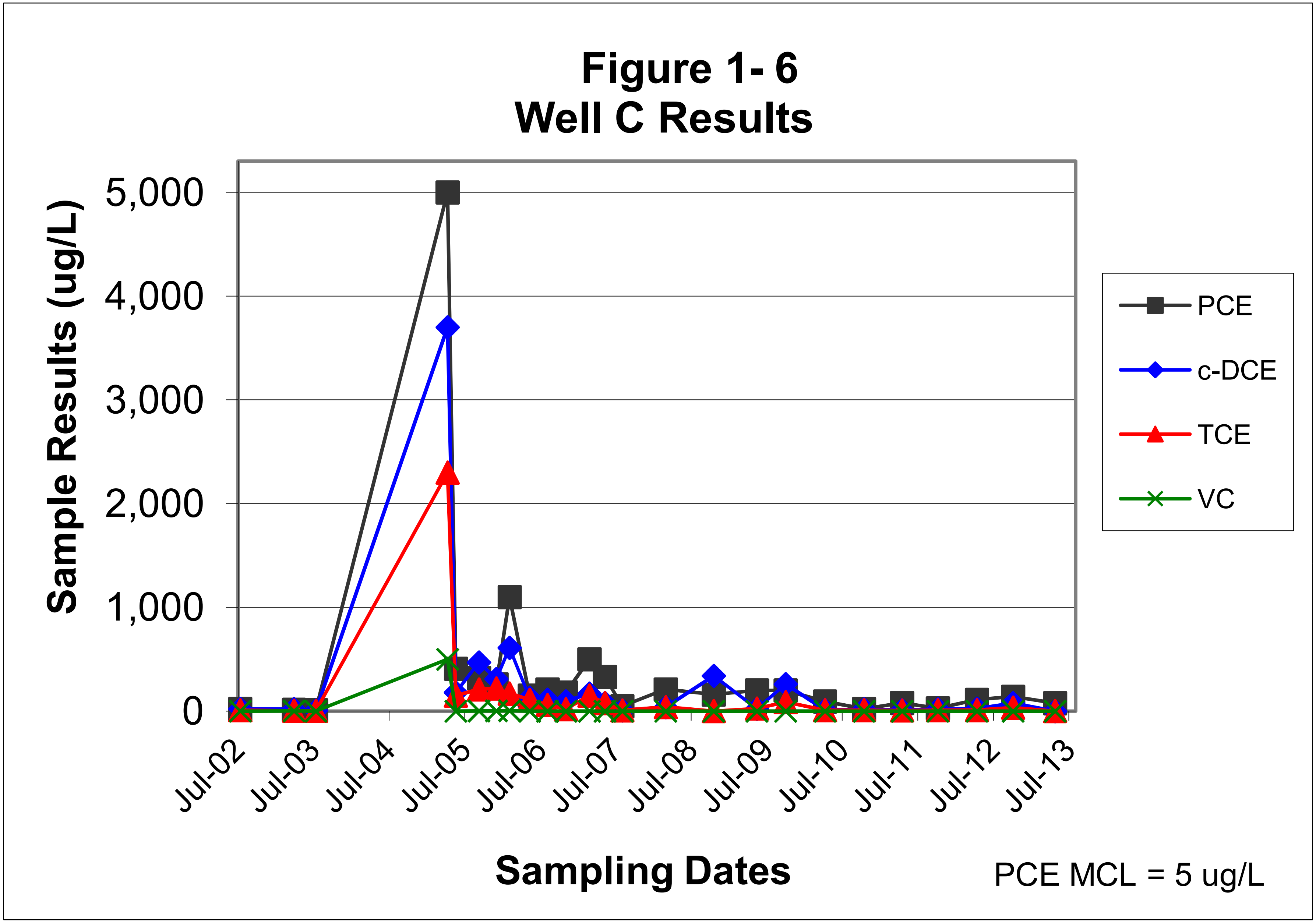

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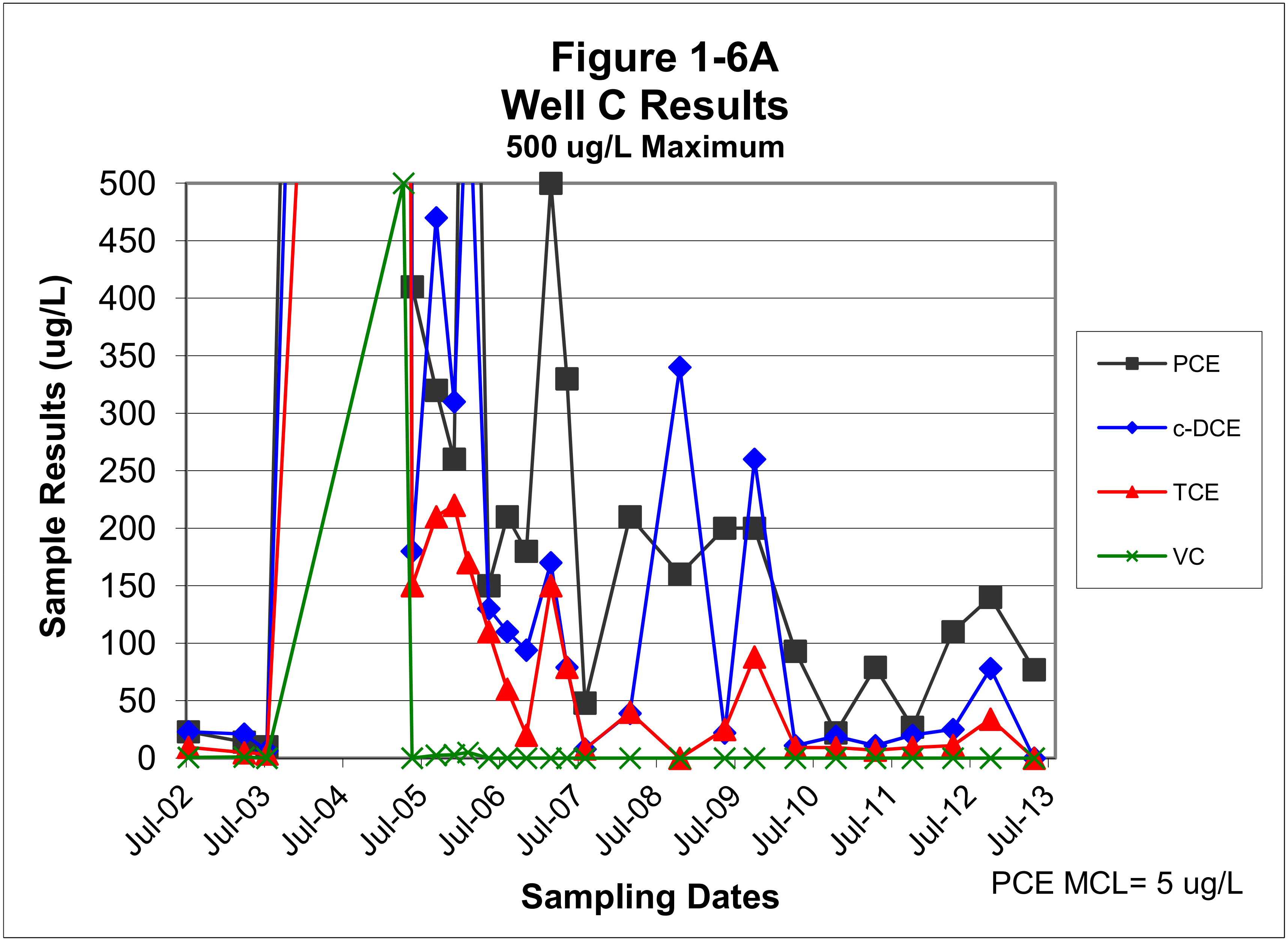

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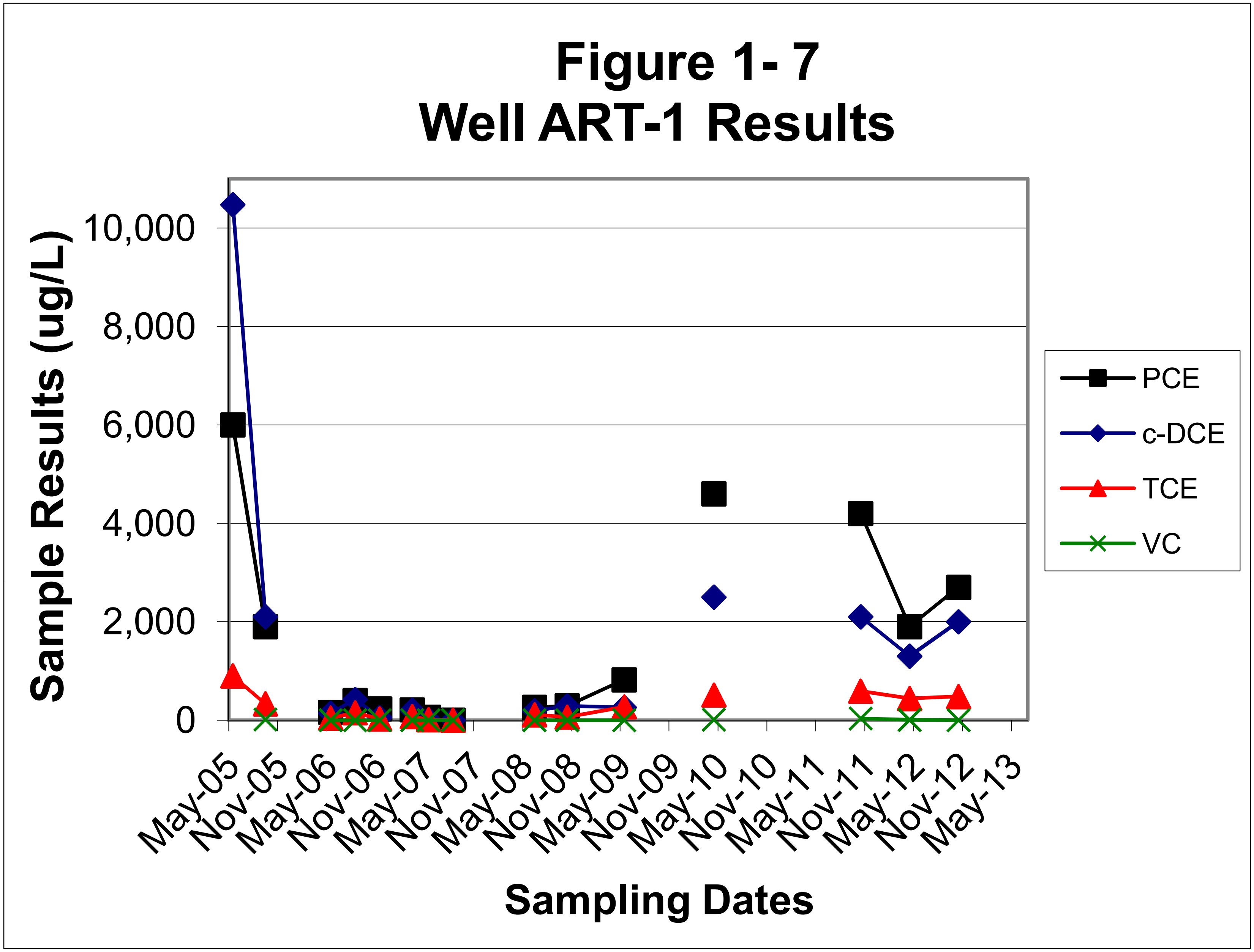

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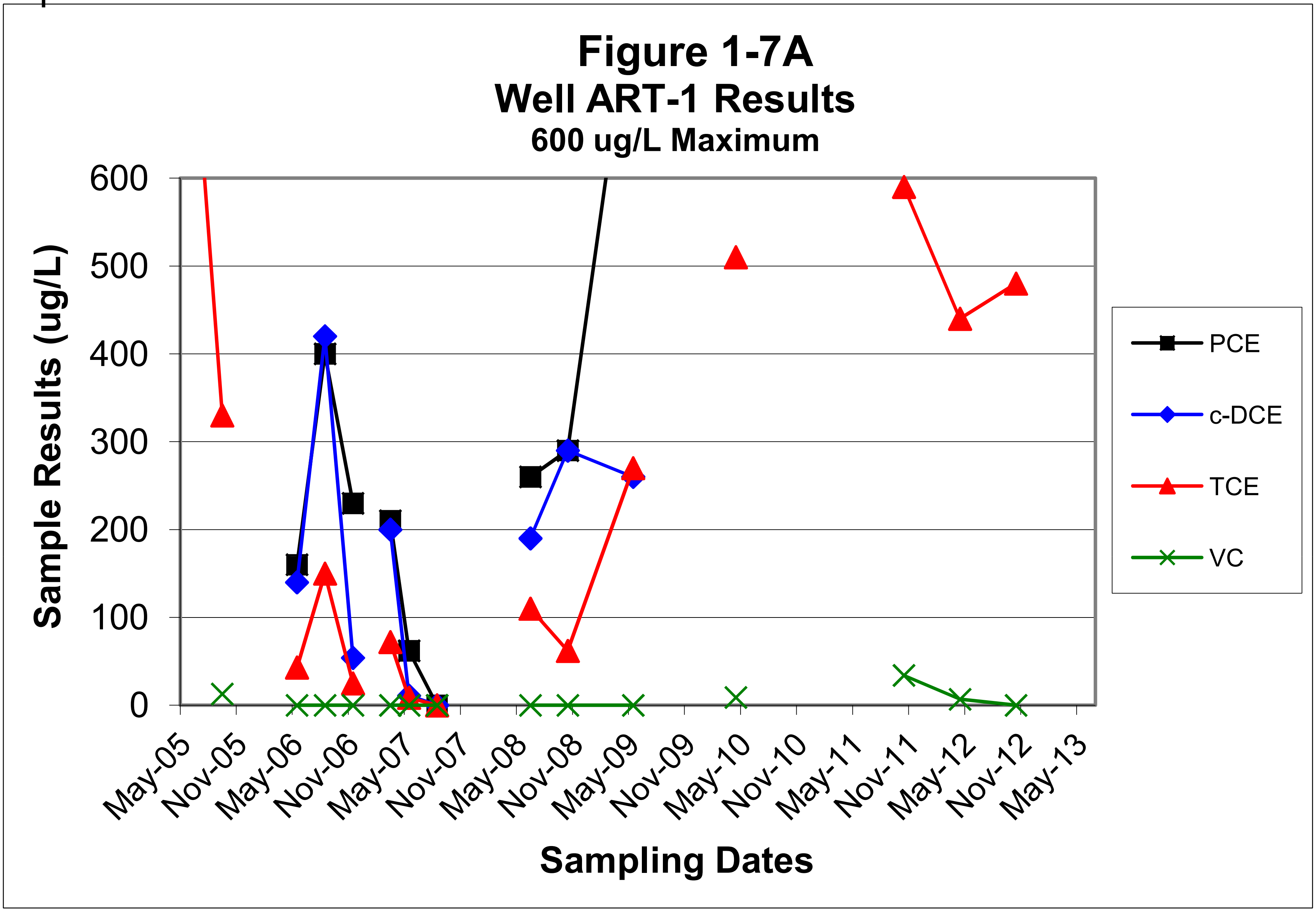

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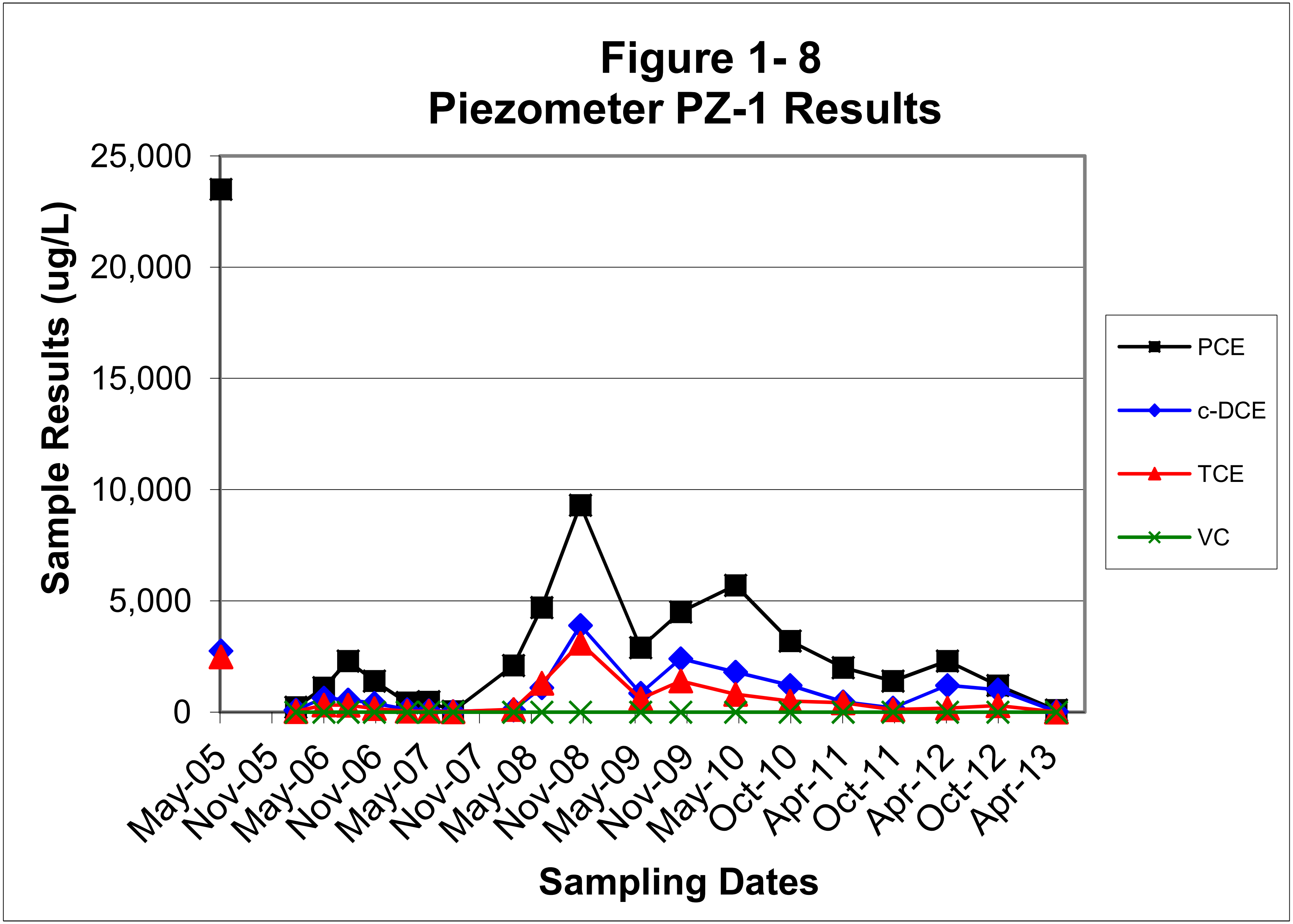

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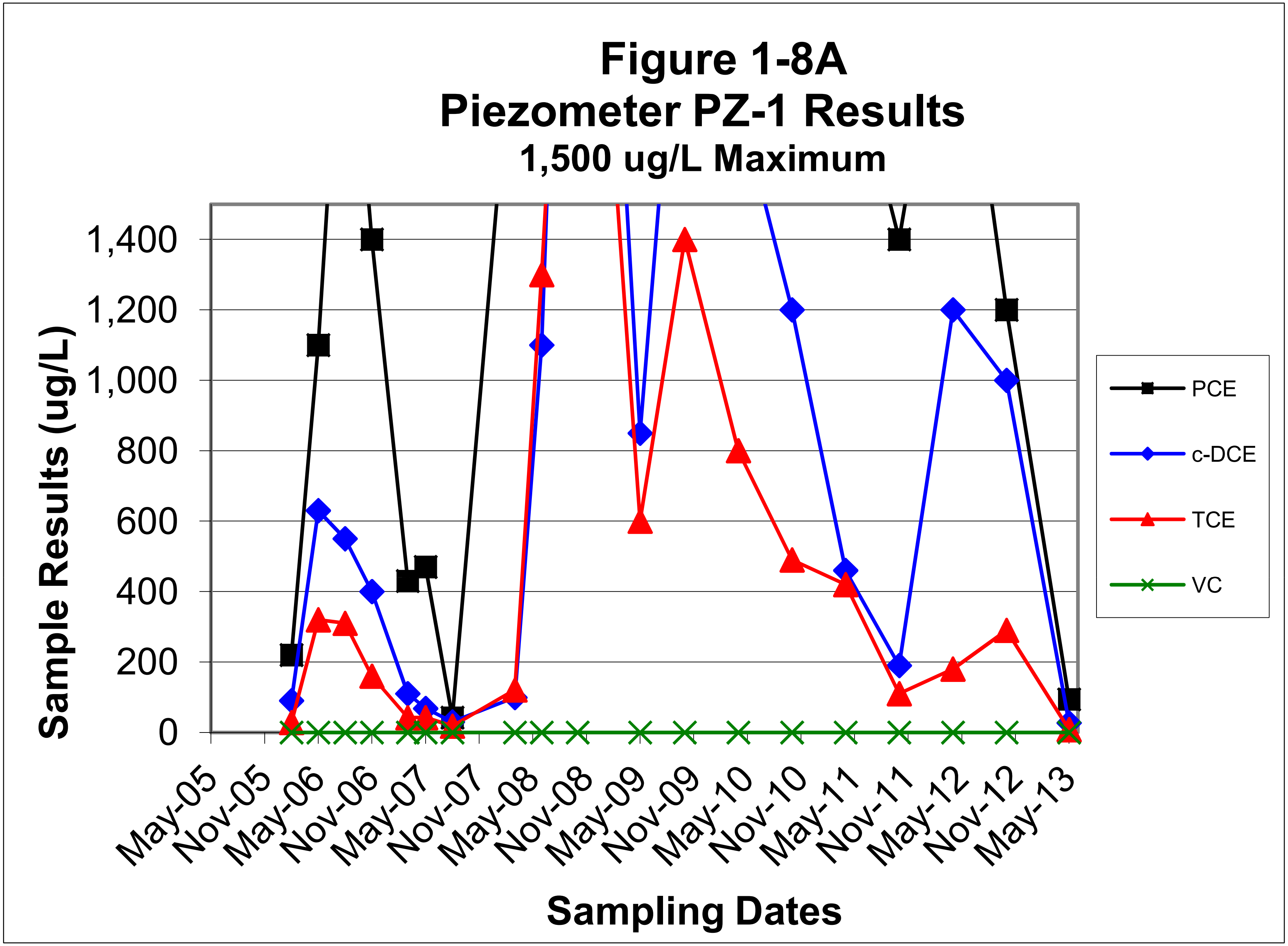

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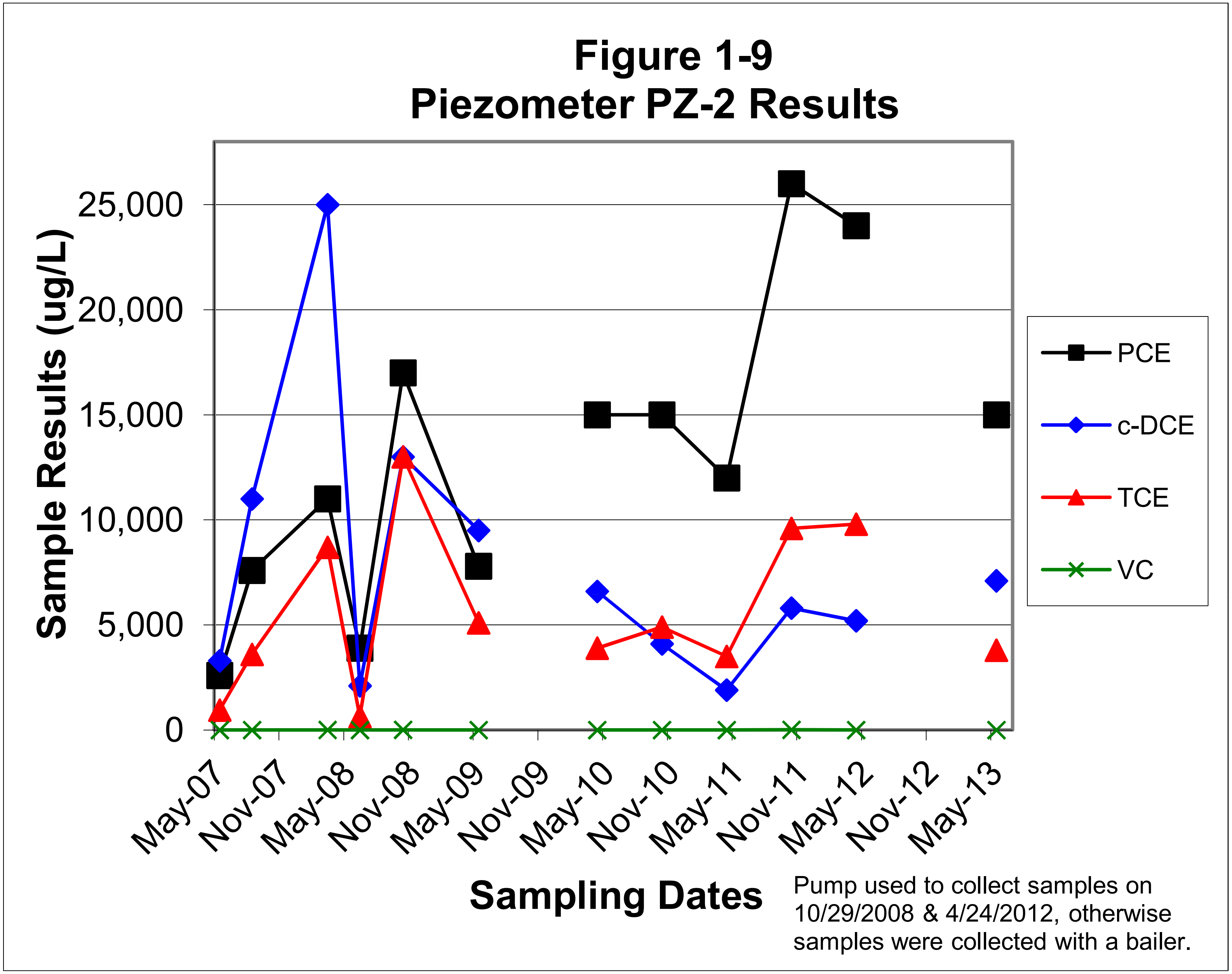

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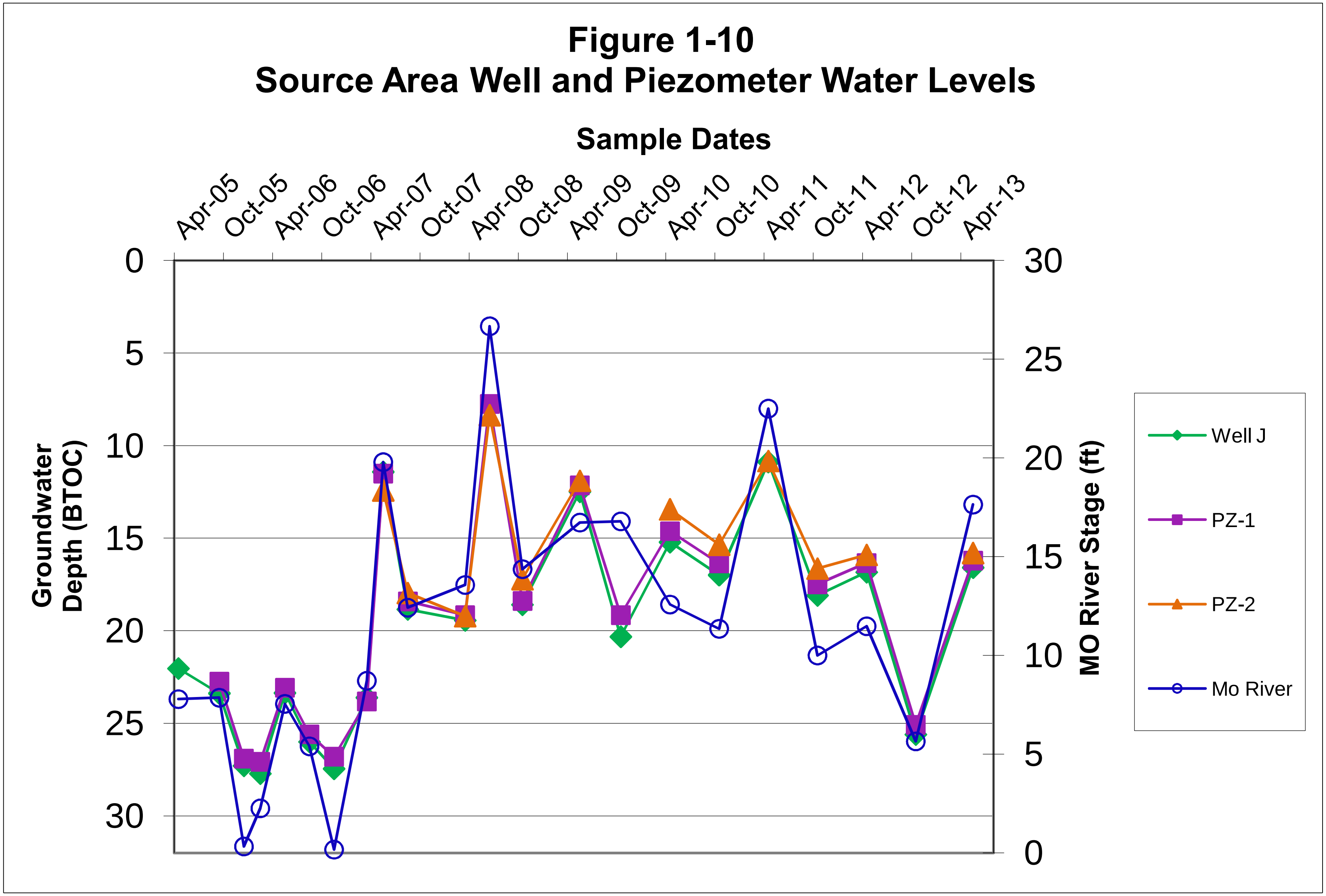

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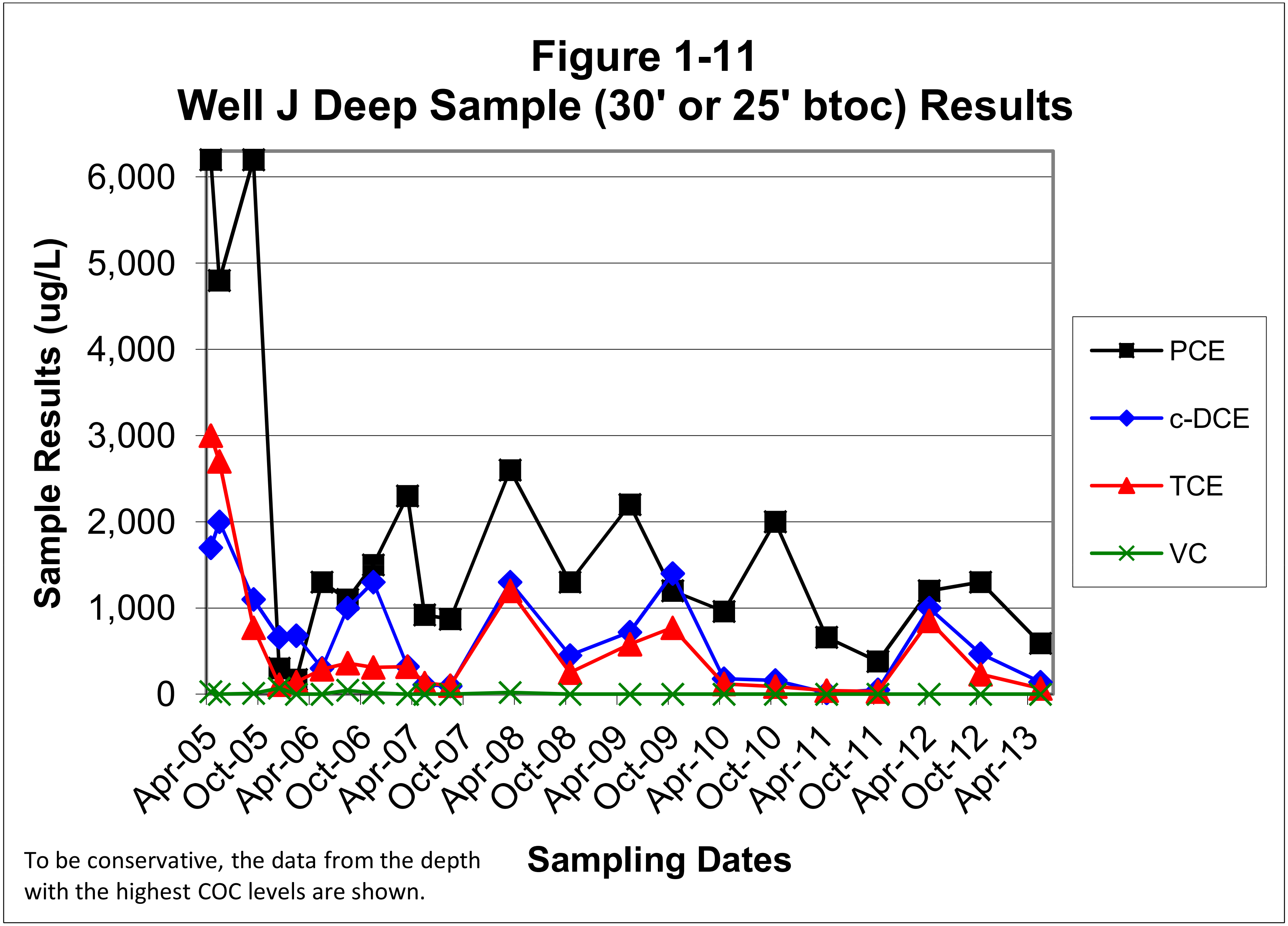

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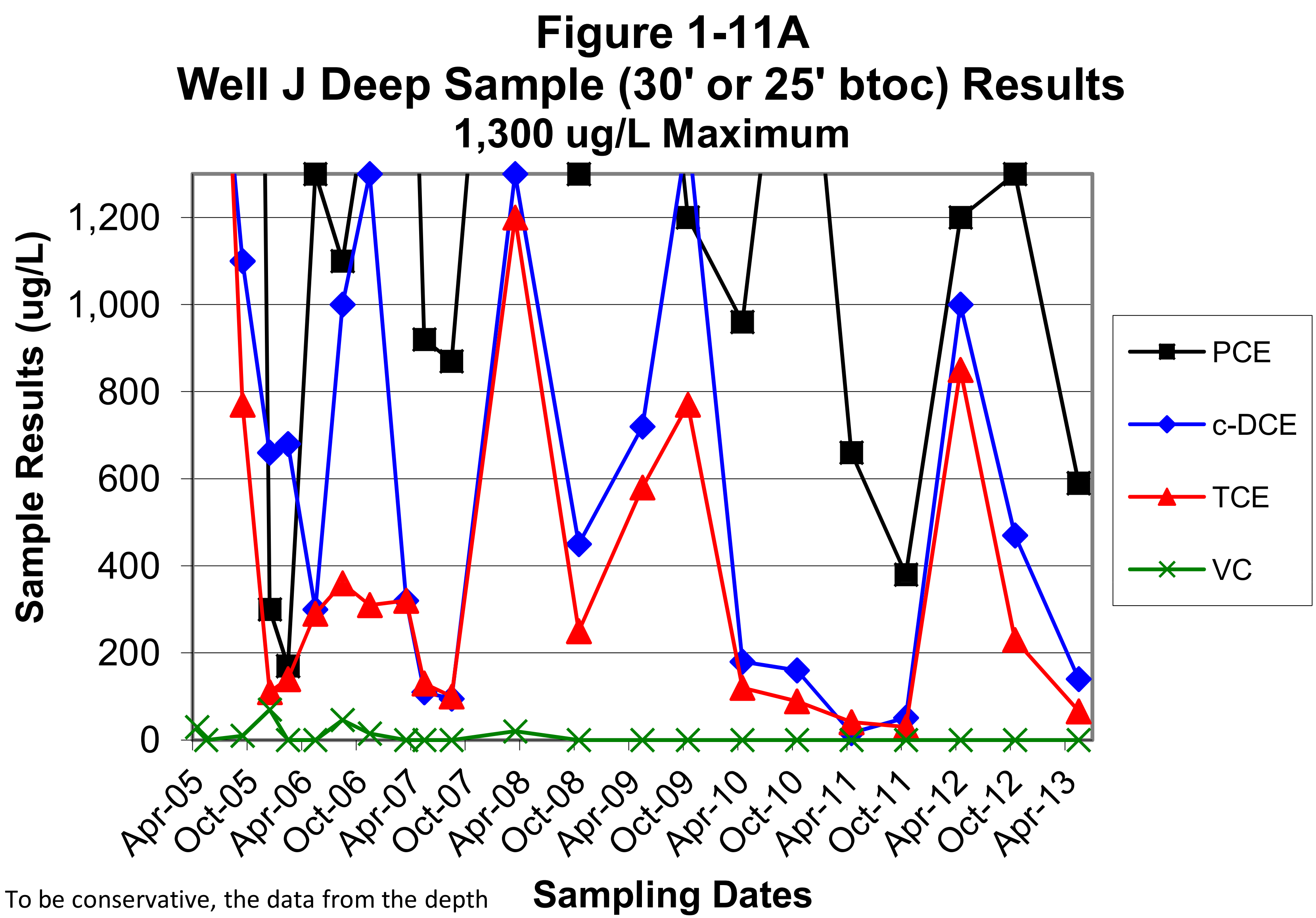
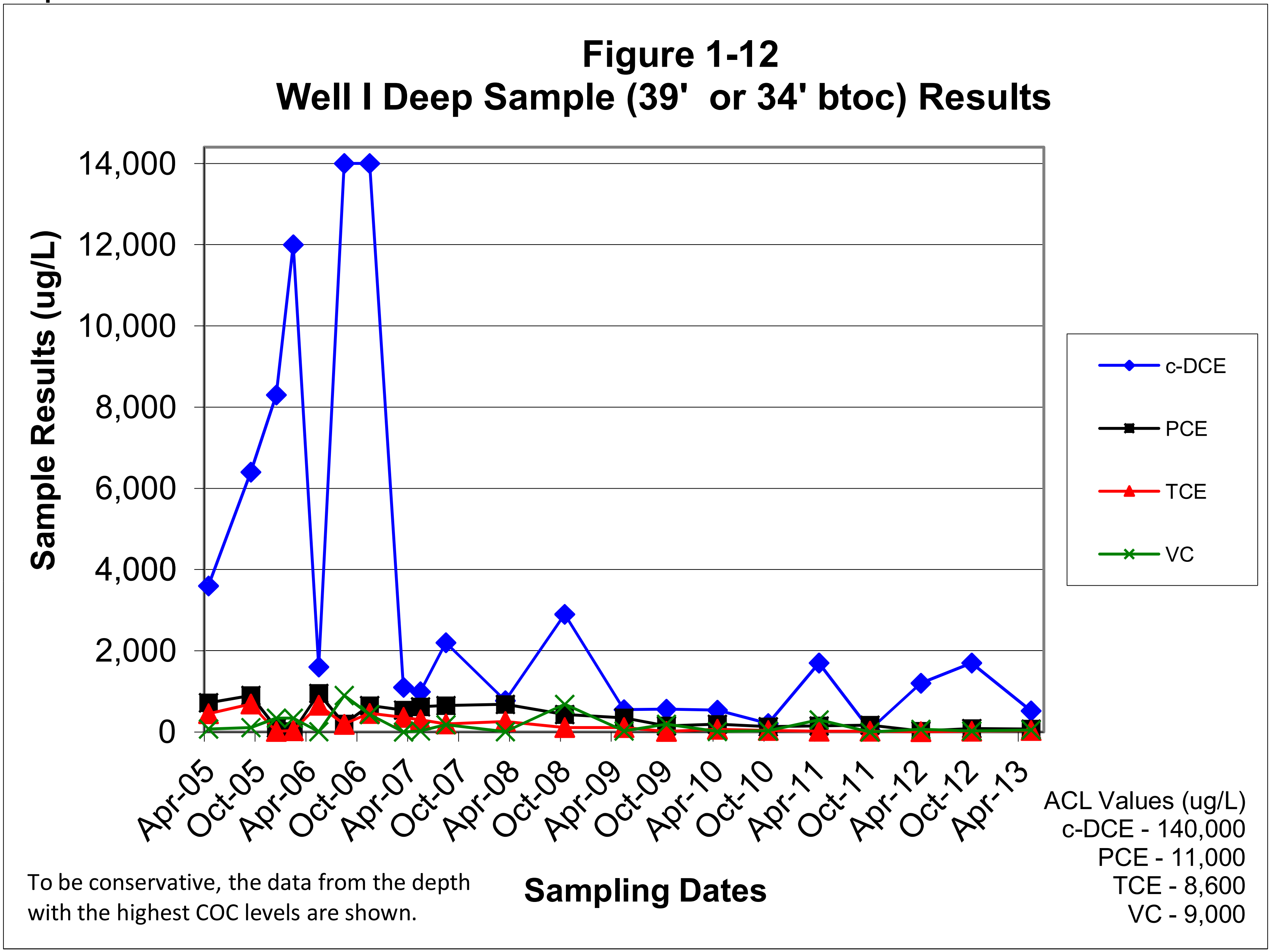


To be conservative, the data from the depth with the highest COC levels are shown.

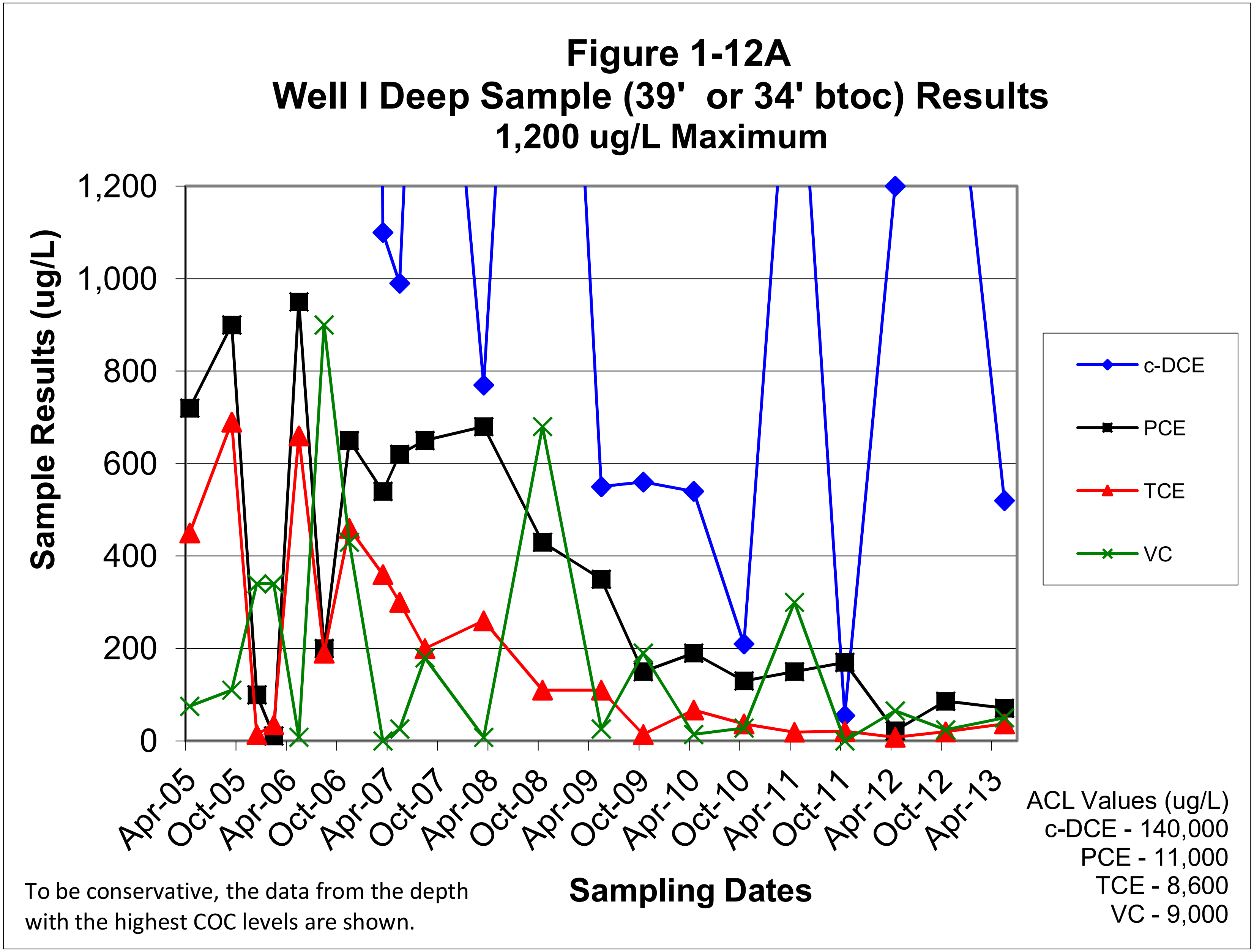
Riverfront Site

Operable Unit No. 1



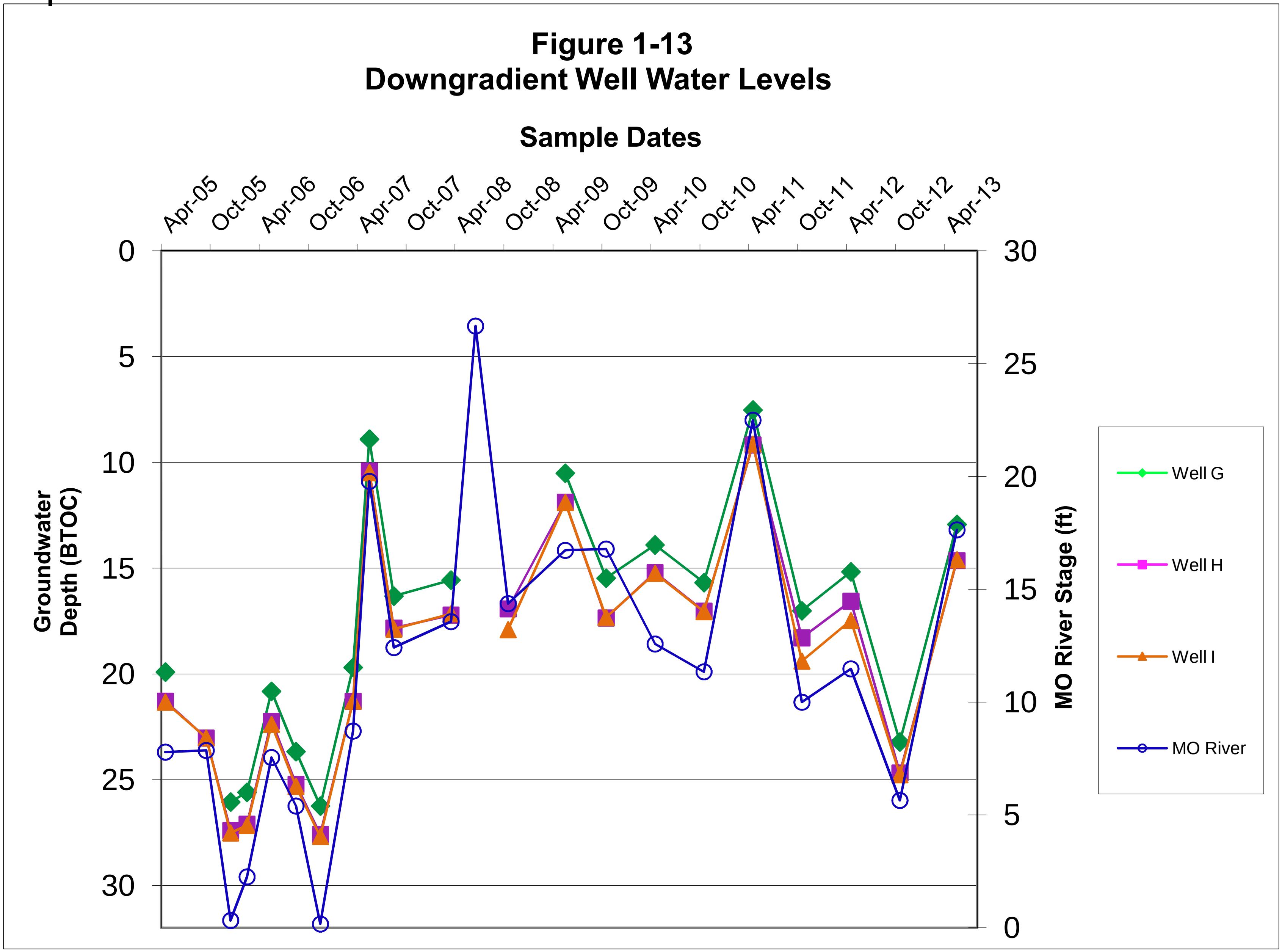
Riverfront Site

Operable Unit No. 1

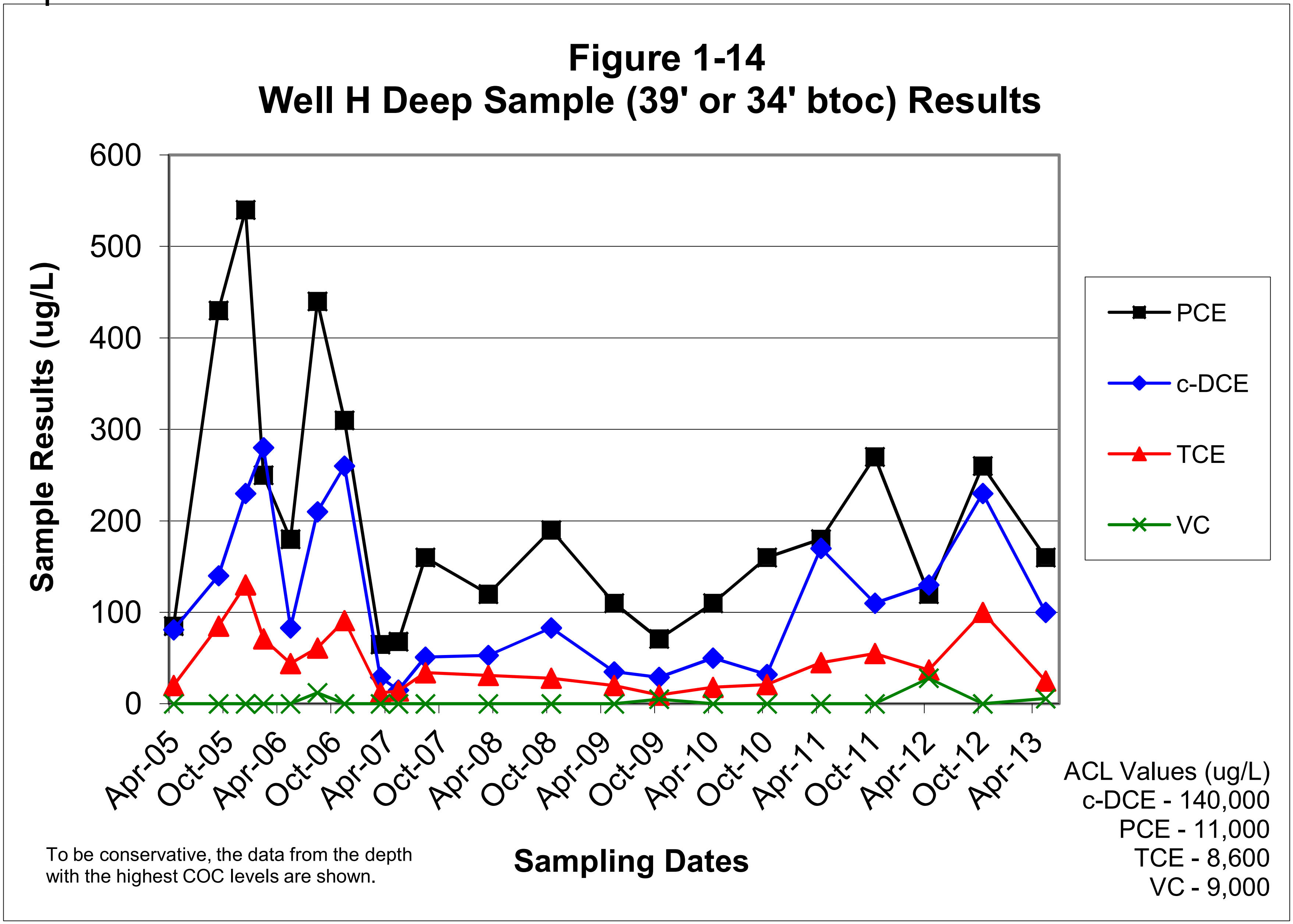


Riverfront Site

Operable Unit No. 1

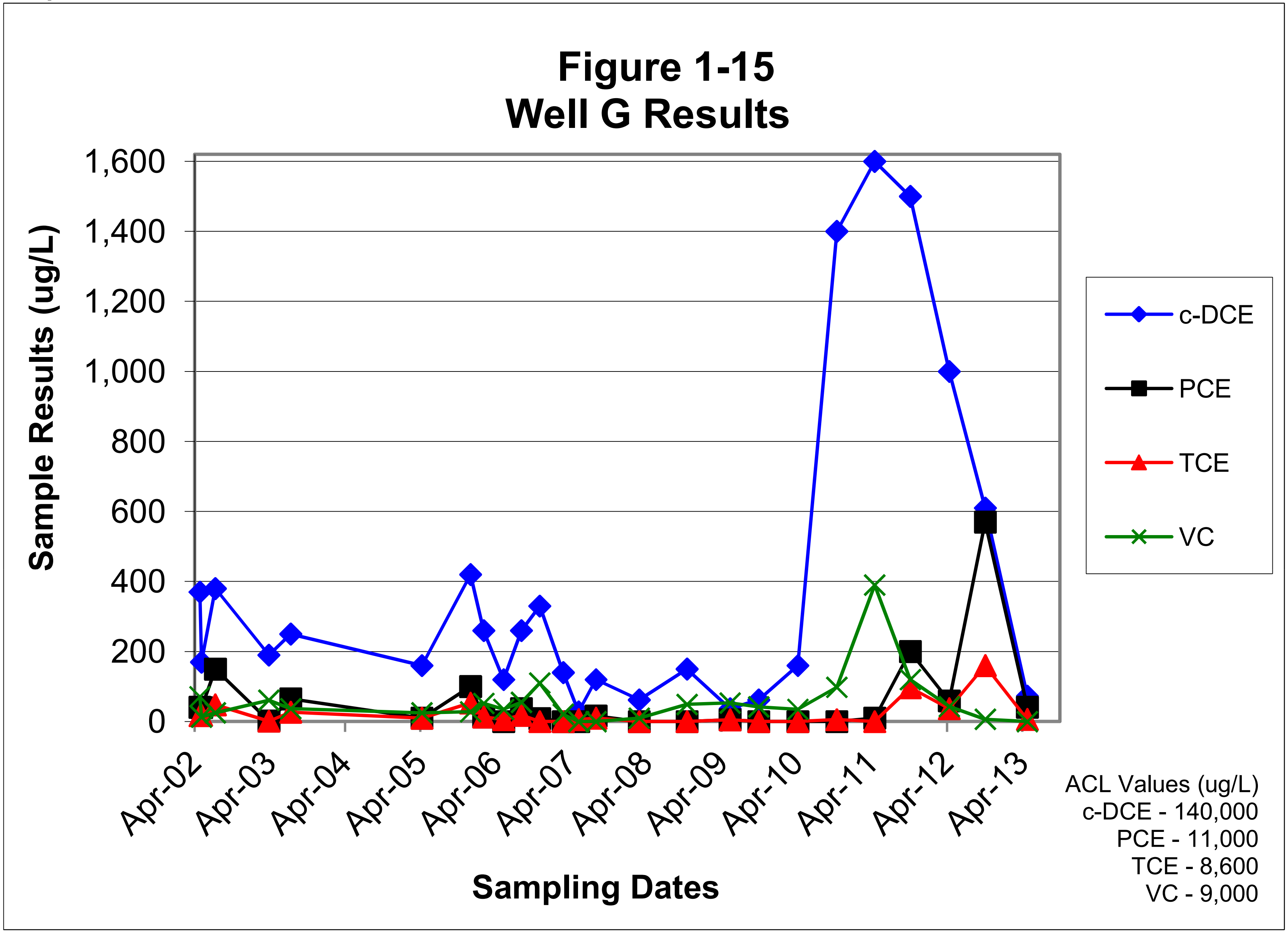


Riverfront Site
Operable Unit No. 1



Riverfront Site

Operable Unit No. 1



ATTACHMENT 4

OU-2/OU-6
Data Tables, Trend Analysis
Industrial Drive Site/Wildcat Creek Estates Site
Riverfront Superfund Site

Riverfront Site

OU2/OU6 Groundwater Data

Table 2
First and Second Round Monitoring Data
2009 and March/April 2010

Lab ID			500-17729-1	500-17702-3	500-24677-6	500-17786-3	500-24697-7	500-17786-2	500-24697-2	500-24541-2	500-18415-1	500-24541-4	500-17843-3	500-18570-3
Sample Date			03/19/09	03/18/09	03/24/10	03/24/09	03/24/10	03/24/09	03/24/10	03/16/10	04/22/09	03/16/10	03/25/09	04/29/09
Sample Depth (feet)			20	52.5	52.5	440	440	260	260		425	425	NA	473
Sample ID			BW20-GW01-090319	BW21A-GW01-090318	BW21A-GW01-100324	BW21-GW01-090324	BW21-GW01-100324	BW22-GW01-090324	BW22-GW01-100324	JS12-GW01-100316	JS15-GW01-090422	JS15-GW01-100316	JS20-GW01-090325	JS25-GW01-090429
Location			BW20	BW21A	BW21A	BW21	BW21	BW22	BW22	JS12	JS15	JS15	JS20	JS25
	Screening Criteria	Units:												
Compounds														
Tetrachloroethene	5	µg/L	**190000** +	**810** +	**710** +	ND	ND	ND	ND	ND	ND	ND	ND	**7.1**
cis-1,2-Dichloroethene		µg/L												
1,2-Dichloroethene, Total	70	µg/L	ND	**78**	**86**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	2,970	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	R	ND	R	R
Chloroform		µg/L			ND		ND		ND	ND		ND		
Methylene Chloride	5	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Ethyl Ketone	3,640	µg/L	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	5	µg/L	ND	**150**	**150** +	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1	µg/L												

Notes:
Screening Criteria: The analytical data were compared to the MO default target levels (Table B-1) or EPA MCLs (as applicable).
There is no screening criterion for 1,2,-DCE(total). The MCL for cis-1,2-DCE was used.
NA: Not Available
Blank Cells: Parameter Not Analyzed
ND: compound was not detected
J: estimated concentration
+: results reported from diluted samples
R: rejected data
Bolded values: detected
Shaded values: exceeded screening criteria

Riverfront Site
OU2/OU6 Groundwater Data

Table 2
First and Second Round Monitoring Data
2009 and March/April 2010

Lab ID			500-18570-4	500-24886-6	500-17843-1	500-24541-6	500-17843-4	500-24886-7	500-17676-1	500-24886-5	500-17676-2	500-24886-3	500-17702-1
Sample Date			04/29/09	04/07/10	03/25/09	03/16/10	03/25/09	4/7/2010	3/17/2009	4/6/2010	3/17/2009	4/6/2010	3/18/2009
Sample Depth (feet)			473	473	385	385	NA		53.5	53.5	56	56	61
Sample ID			JS25-GW02 090429	JS25-GW01-100407	JS39-GW01-090325	JS39-GW01-100316	JS40-GW01-090325	JS40-GW01-100407	MW101-GW01-090317	MW101-GW01-100406	MW102-GW01-090317	MW102-GW01-100406	MW103-GW01-090318
Location			Dup of JS25	JS25	JS39	JS39	JS40	JS40	MW101	MW101	MW102	MW102	MW103
	Screening Criteria	Units:											
Compounds													
Tetrachloroethene	5	µg/L	**7.9**	**7.7**	ND	ND	ND	ND	**16**	**22**	ND	ND	ND
cis-1,2-Dichloroethene		µg/L											
1,2-Dichloroethene, Total	70	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	2,970	µg/L	R	ND	R	ND	R	ND	ND	ND	ND	ND	ND
Chloroform		µg/L		ND		ND		ND		ND		ND	
Methylene Chloride	5	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Ethyl Ketone	3,640	µg/L	ND	ND	ND	ND	ND	ND		ND		ND	
Trichloroethene	5	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1	µg/L							**0.42** J				

Notes:
Screening Criteria: The analytical data were compared to the MO default target levels (Table B-1) or EPA MCLs (as applicable).
There is no screening criterion for 1,2,-DCE(total).
The MCL for cis-1,2-DCE was used.
NA: Not Available
Blank Cells: Parameter Not Analyzed
ND: compound was not detected
J: estimated concentration
+: results reported from diluted samples
R: rejected data
Bolded values: detected
Shaded values: exceeded screening criteria

Riverfront Site
OU2/OU6 Groundwater Data

Table 2
First and Second Round Monitoring Data
2009 and March/April 2010

Lab ID			500-24886-4	500-17587-1	500-17587-3	500-24886-1	500-18900-1		500-24697-1	500-18900-2		500-24697-6	500-17651-4		500-24541-3	500-20828-6 500-21108-1		500-24807-2
Sample Date			4/6/2010	3/11/2009	3/11/2009	4/5/2010	5/14/2009		3/24/2010	5/14/2009		3/24/2010	3/16/2009		3/16/2010	26-Aug-09		4/2/2010
Sample Depth (feet)			61	48	48	48	92.3		92.3	91		91	NA			33.5		
Sample ID			MW103-GW01-100406	MW10UB-GW01-090311	MW10UB-GW02-090311	MW10UB-GW01-100405	MW11-GW01-090514		MW11-GW01-100324	MW12-GW01-090514		MW12-GW01-100324	MW13-GW01-090316		MW13-GW01-100316	MW14US-GW01-033.0-090826		MW14US-GW01-100402
Location			MW103	MW10UB	Dup of MW10UB	MW10UB	MW11		MW11	MW12		MW12	MW13		MW13	MW14US		MW14US
	Screening Criteria	Units:																
Compounds																		
Tetrachloroethene	5	µg/L	ND	ND	ND	ND	ND		ND	ND		ND	ND		ND	ND		ND
cis-1,2-Dichloroethene		µg/L																
1,2-Dichloroethene, Total	70	µg/L	ND	ND	ND	ND	ND		ND	ND		ND	ND		ND	ND		ND
Acetone	2,970	µg/L	ND	ND	ND	ND		R	ND		R	ND		R	ND		R	ND
Chloroform		µg/L	ND			ND			ND			ND			ND			ND
Methylene Chloride	5	µg/L	ND	ND	**3.5**	ND	ND		ND	ND		ND	ND		ND	ND		ND
Methyl Ethyl Ketone	3,640	µg/L	ND	ND	ND	ND	ND		ND	ND		ND			ND	ND		ND
Trichloroethene	5	µg/L	ND	ND	ND	ND	ND		ND	ND		ND	ND		ND	ND		ND
Naphthalene	1	µg/L																

Notes:
Screening Criteria: The analytical data were compared to the MO default target levels (Table B-1) or EPA MCLs (as applicable).
There is no screening criterion for 1,2,-DCE(total).
The MCL for cis-1,2-DCE was used.
NA: Not Available
Blank Cells: Parameter Not Analyzed
ND: compound was not detected
J: estimated concentration
+: results reported from diluted samples
R: rejected data
Bolded values: detected
Shaded values: exceeded screening criteria

Riverfront Site

OU2/OU6 Groundwater Data

Table 2
First and Second Round Monitoring Data
2009 and March/April 2010

Lab ID			500-17651-2	500-17651-3	500-24677-2	500-24677-3	500-17392-2	500-24793-1	500-17448-1	500-24741-1	500-17448-3	500-24677-1	500-17392-1
Sample Date			3/16/2009	3/16/2009	3/23/2010	3/23/2010	3/3/2009	3/31/2010	3/5/2009	3/29/2010	3/5/2009	3/23/2010	3/3/2009
Sample Depth (feet)			29.1	29.1	29.1	29.1	111.2	111.2	75.3	75.3	43.6	43.6	369.8
Sample ID			MW1S-GW01-090316	MW1S-GW02-090316	MW1S-GW01-100323	MW1S-GW02-100323	MW1SW-GW01-090303	MW1SW-GW01-100331	MW1T1-GW01-090305	MW1T1-GW01-100329	MW1UB-GW01-090305	MW1UB-GW01-100323	MW2R-GW01-090303
Location			MW1S	Dup of MW1S	MW1S	Dup of MW1S	MW1SW	MW1SW	MW1T1	MW1T1	MW1UB	MW1UB	MW2R
	Screening Criteria	Units:											
Compounds													
Tetrachloroethene	5	µg/L	**2000** +	**2100** +	**1400** +	**1500** +	**2.3**	**3.9**	**1.6**	**1.8**	**1700** +	**1800** +	ND
cis-1,2-Dichloroethene		µg/L											
1,2-Dichloroethene, Total	70	µg/L	**40**	**41**	**25** +	**26** +	ND	ND	ND	ND	**44**	**36** +	ND
Acetone	2,970	µg/L	R	R	ND	ND	R	ND	ND	ND	ND	ND	R
Chloroform		µg/L			ND	ND		ND		ND		ND	
Methylene Chloride	5	µg/L	**28**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Ethyl Ketone	3,640	µg/L			ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	5	µg/L	**87**	**94**	**59** +	**59** +	ND	ND	ND	ND	**100**	**91** +	ND
Naphthalene	1	µg/L	ND	ND									

Notes:

Screening Criteria: The analytical data were compared to the MO default target levels (Table B-1) or EPA MCLs (as applicable).

There is no screening criterion for 1,2,-DCE(total).

The MCL for cis-1,2-DCE was used.

NA: Not Available

Blank Cells: Parameter Not Analyzed

ND: compound was not detected

J: estimated concentration

+: results reported from diluted samples

R: rejected data

Bolded values: detected

Shaded values: exceeded screening criteria

Riverfront Site
OU2/OU6 Groundwater Data

Table 2
First and Second Round Monitoring Data
2009 and March/April 2010

Lab ID			500-24677-5	500-17392-3		500-17392-4		500-24677-4	500-17362-1	500-24793-4	500-17362-3	500-24793-5	500-17362-2	500-24793-6	500-18900-4	
Sample Date			3/24/2010	3/3/2009		3/3/2009		3/24/2010	3/2/2009	4/1/2010	3/2/2009	4/1/2010	3/2/2009	4/1/2010	5/14/2009	
Sample Depth (feet)			369.8	20.4		20.4		20.4	56.3	56.3	116	116	195	195	28	
Sample ID			MW2R-GW01-100324	MW2S-GW01-090303		MW2S-GW02-090303		MW2S-GW01-100324	MW2SW-GW01-090302	MW2SW-GW01-100401	MW2T2-GW01-090302	MW2T2-GW01-100401	MW2T3-GW01-090302	MW2T3-GW01-100401	MW04A-GW01-090514	
Location			MW2R	MW2S		Dup of MW2S		MW2S	MW2SW	MW2SW	MW2T2	MW2T2	MW2T3	MW2T3	MW04A	
	Screening Criteria	Units:														
Compounds																
Tetrachloroethene	5	µg/L	ND	22		20		9.6	ND	ND	ND	ND	ND	ND	460	+
cis-1,2-Dichloroethene		µg/L														
1,2-Dichloroethene, Total	70	µg/L	ND	**1.6**	J	**1.6**	J	ND	ND	ND	ND	ND	ND	ND	**2.6**	
Acetone	2,970	µg/L	ND		R		R	ND	ND	ND	ND	ND	ND	ND		R
Chloroform		µg/L	ND					ND		ND		ND		ND		
Methylene Chloride	5	µg/L	ND	ND		ND		ND	ND	ND	ND	ND	ND	ND	ND	
Methyl Ethyl Ketone	3,640	µg/L	ND	ND		ND		ND		ND		ND		ND	ND	
Trichloroethene	5	µg/L	ND	**1.5**		**1.4**		ND	ND	ND	ND	ND	ND	ND	14	
Naphthalene	1	µg/L														

Notes:
Screening Criteria: The analytical data were compared
to the MO default target levels (Table B-1)
or EPA MCLs (as applicable).
There is no screening criterion for 1,2,-DCE(total).
The MCL for cis-1,2-DCE was used.
NA: Not Available
Blank Cells: Parameter Not Analyzed
ND: compound was not detected
J: estimated concentration
+: results reported from diluted samples
R: rejected data
Bolded values: detected
Shaded values: exceeded screening criteria

Riverfront Site

OU2/OU6 Groundwater Data

Table 2
First and Second Round Monitoring Data
2009 and March/April 2010

Lab ID			500-24697-5		500-18900-3		500-24697-4	500-21444-1	500-24697-3	500-18573-3	500-17605-1	500-24807-1	500-17508-2	500-24741-5	500-17534-1	500-24793-2
Sample Date			3/24/2010		5/14/2009		3/24/2010	9/30/2009	3/24/2010	4/28/2009	3/12/2009	4/2/2010	3/9/2009	3/30/2010	3/10/2009	3/31/2010
Sample Depth (feet)			28		130		130	382		56	50.8	50.8	450.8	450.8	141	141
Sample ID			MW4A-GW01-100324		MW04B-GW01-090514		MW4B-GW01-100324	MW4-GW01-090930	MW4-GW01-100324	MW04BS-GW01-090428	MW5UB-GW01-090312	MW5UB-GW01-100402	MW6R-GW01-090309	MW6R-GW01-100330	MW6SW-GW01-090310	MW6SW-GW01-100331
Location			MW4A		MW04B		MW4B	MW4	MW4	MW04BS	MW5UB	MW5UB	MW6R	MW6R	MW6SW	MW6SW
	Screening Criteria	Units:														
Compounds																
Tetrachloroethene	5	µg/L	**400**	+	ND		ND	ND	ND	**4.1**	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene		µg/L														
1,2-Dichloroethene, Total	70	µg/L	**2**		ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	2,970	µg/L	ND			R	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform		µg/L	ND				ND		ND			ND		ND		ND
Methylene Chloride	5	µg/L	ND		ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Ethyl Ketone	3,640	µg/L	ND		ND		ND	**28**	**21**	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	5	µg/L	**12**		ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1	µg/L														

Notes:
Screening Criteria: The analytical data were compared to the MO default target levels (Table B-1) or EPA MCLs (as applicable).
There is no screening criterion for 1,2,-DCE(total).
The MCL for cis-1,2-DCE was used.
NA: Not Available
Blank Cells: Parameter Not Analyzed
ND: compound was not detected
J: estimated concentration
+: results reported from diluted samples
R: rejected data
Bolded values: detected
Shaded values: exceeded screening criteria

Riverfront Site

OU2/OU6 Groundwater Data

Table 2
First and Second Round Monitoring Data
2009 and March/April 2010

Lab ID			500-17508-1		500-24793-3	500-17766-3	500-24807-5	500-17651-1		500-24807-3		500-24807-4		500-17766-2	500-24886-2	500-18570-2		500-24741-4
Sample Date			3/9/2009		3/31/2010	3/23/2009	4/2/2010	3/16/2009		4/2/2010		4/2/2010		3/23/2009	4/5/2010	4/28/2009		3/30/2010
Sample Depth (feet)			73		73	94	94	26		26		26		95	95	NA		421.2
Sample ID			MW6US-GW01-090309		MW6US-GW01-100331	MW7SW-GW01-090323	MW7SW-GW01-100402	MW7US-GW01-090316		MW7US-GW01-100402		MW7US-GW02-100402		MW8US-GW01-090323	MW8US-GW01-100405	MW9R-GW01-090428		MW9R-GW01-100330
Location			MW6US		MW6US	MW7SW	MW7SW	MW7US		MW7US		Dup of MW7US		MW8US	MW8US	MW9R		MW9R
	Screening Criteria	Units:																
Compounds																		
Tetrachloroethene	5	µg/L	ND		ND	ND	**3.1**	**750**	+	**650**	+	**590**	+	ND	ND	ND		ND
cis-1,2-Dichloroethene		µg/L																
1,2-Dichloroethene, Total	70	µg/L	ND		ND	ND	ND	**38**		**46**		**46**		ND	ND	ND		ND
Acetone	2,970	µg/L	ND		ND	ND	ND		R	ND		ND		ND	ND	**6.8**	J	ND
Chloroform		µg/L			ND		ND			ND		ND			ND			ND
Methylene Chloride	5	µg/L	ND		ND	ND	ND	ND		ND		ND		ND	ND	ND		ND
Methyl Ethyl Ketone	3,640	µg/L	ND		ND		ND			ND		ND			ND	**46**		ND
Trichloroethene	5	µg/L	ND		ND	ND	ND	**140**	J	**130**	+	**120**	+	ND	ND	ND		ND
Naphthalene	1	µg/L	**0.29**	J				ND						ND				

Notes:

Screening Criteria: The analytical data were compared to the MO default target levels (Table B-1) or EPA MCLs (as applicable).

There is no screening criterion for 1,2,-DCE(total). The MCL for cis-1,2-DCE was used.

NA: Not Available

Blank Cells: Parameter Not Analyzed

ND: compound was not detected

J: estimated concentration

+: results reported from diluted samples

R: rejected data

Bolded values: detected

Shaded values: exceeded screening criteria

Riverfront Site

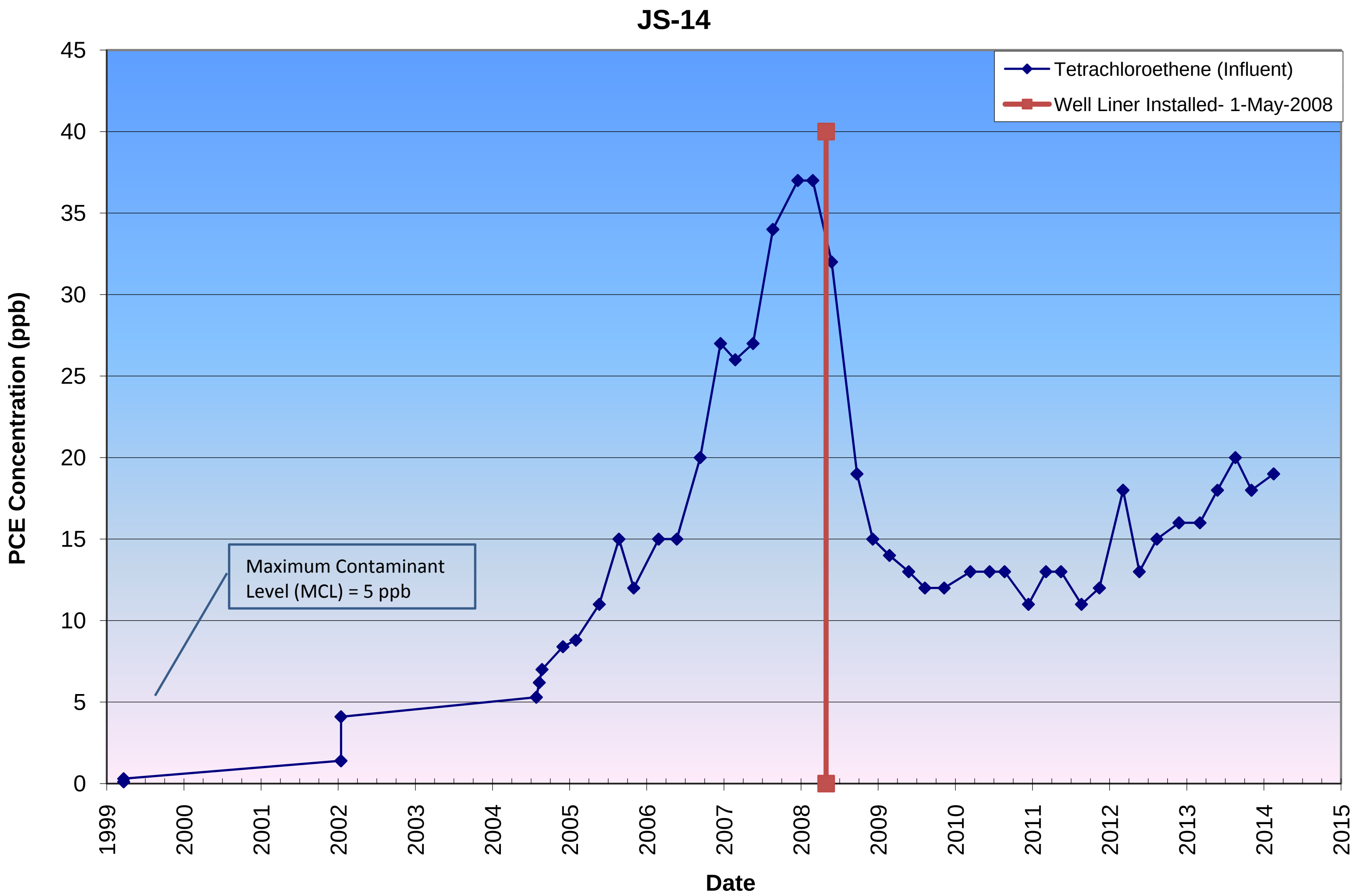
OU2/OU6 Groundwater Data

Table 2
First and Second Round Monitoring Data
2009 and March/April 2010

Lab ID			500-17605-3	500-24741-6	500-17605-4	500-17605-5	500-24741-2	500-24741-3	500-20828-7		500-24541-5
Sample Date			3/12/2009	3/30/2010	3/12/2009	3/12/2009	3/29/2010	3/29/2010	8/26/2009		3/16/2010
Sample Depth (feet)			125	125	57.4	57.4	57.4	57.4	NA		
Sample ID			MW9SW-GW01-090312	MW9SW-GW01-100330	MW9US-GW01-090312	MW9US-GW02-090312	MW9US-GW01-100329	MW9US-GW02-100329	PA53-GW01-090826		PA53-GW01-100316
Location			MW9SW	MW9SW	MW9US	Dup of MW9US	MW9US	Dup of MW9US	PA53		PA53
	Screening Criteria	Units:									
Compounds											
Tetrachloroethene	5	µg/L	**2.4**	**2.8**	**3.4**	**3.4**	**3.4**	**3.3**	ND		ND
cis-1,2-Dichloroethene		µg/L									
1,2-Dichloroethene, Total	70	µg/L	ND	ND	ND	ND	ND	ND	ND		ND
Acetone	2,970	µg/L	ND	ND	ND	ND	ND	ND		R	ND
Chloroform		µg/L		ND			ND	ND			ND
Methylene Chloride	5	µg/L	**5.2**	ND	ND	ND	ND	ND	ND		ND
Methyl Ethyl Ketone	3,640	µg/L	ND	ND	ND	ND	ND	ND	ND		ND
Trichloroethene	5	µg/L	ND	ND	ND	ND	ND	ND	ND		ND
Naphthalene	1	µg/L									

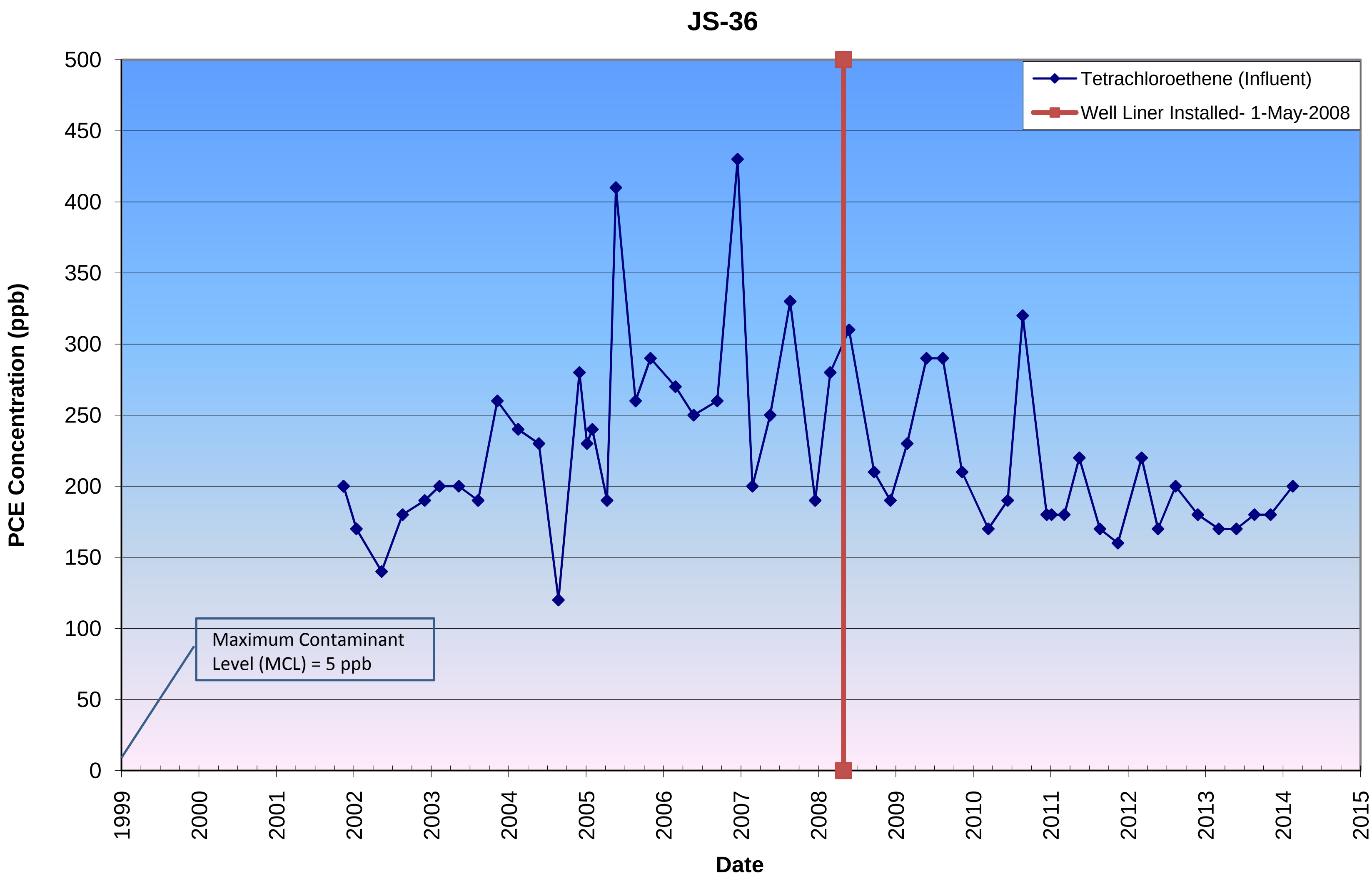
Notes:
Screening Criteria: The analytical data were compared to the MO default target levels (Table B-1) or EPA MCLs (as applicable).
There is no screening criterion for 1,2,-DCE(total).
The MCL for cis-1,2-DCE was used.
NA: Not Available
Blank Cells: Parameter Not Analyzed
ND: compound was not detected
J: estimated concentration
+: results reported from diluted samples
R: rejected data
Bolded values: detected
Shaded values: exceeded screening criteria

Riverfront Site
OU6 (Domestic Supply Well with home treatment system)

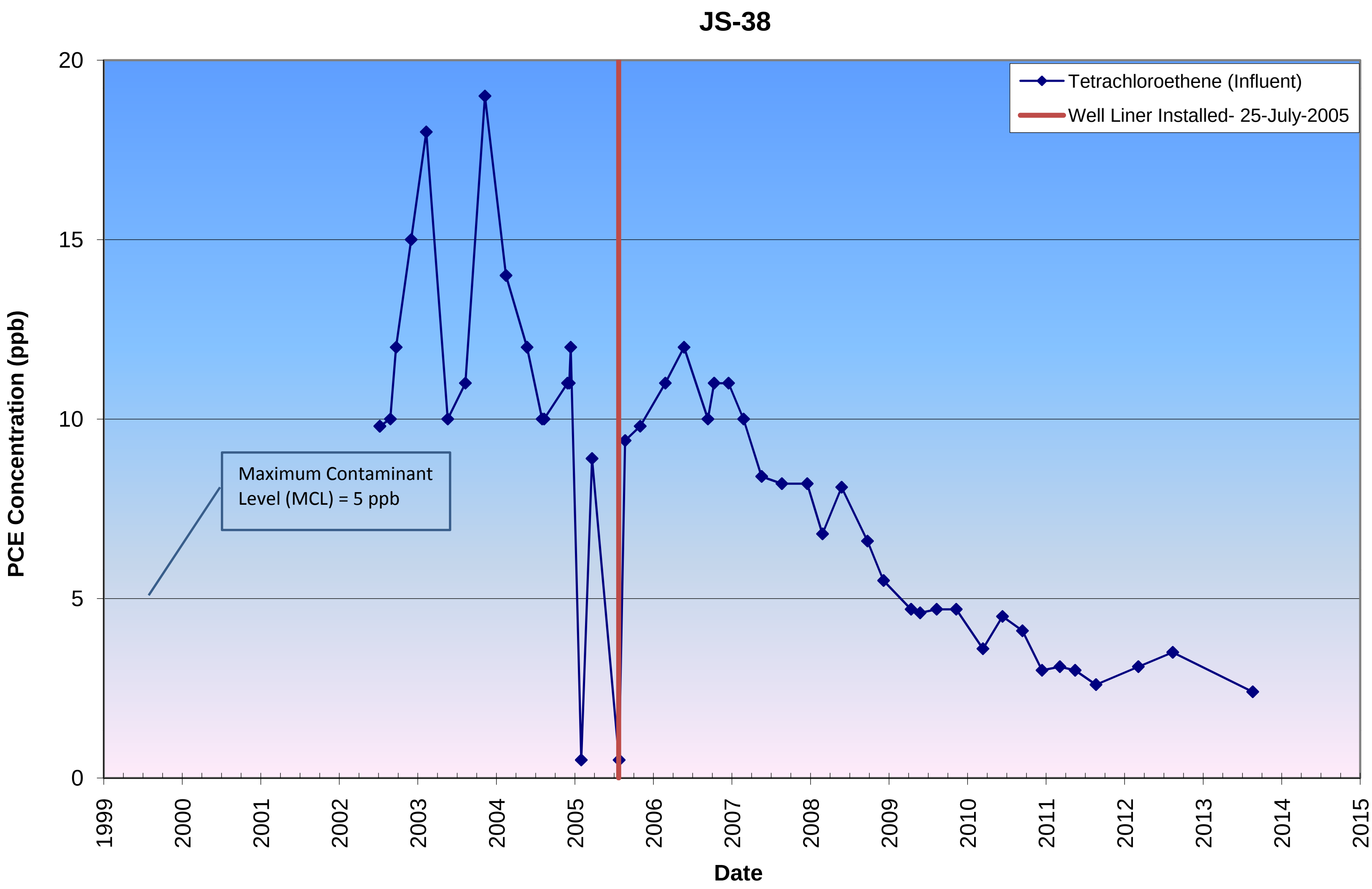


Riverfront Site

OU6 (Domestic Supply Well with home treatment system)

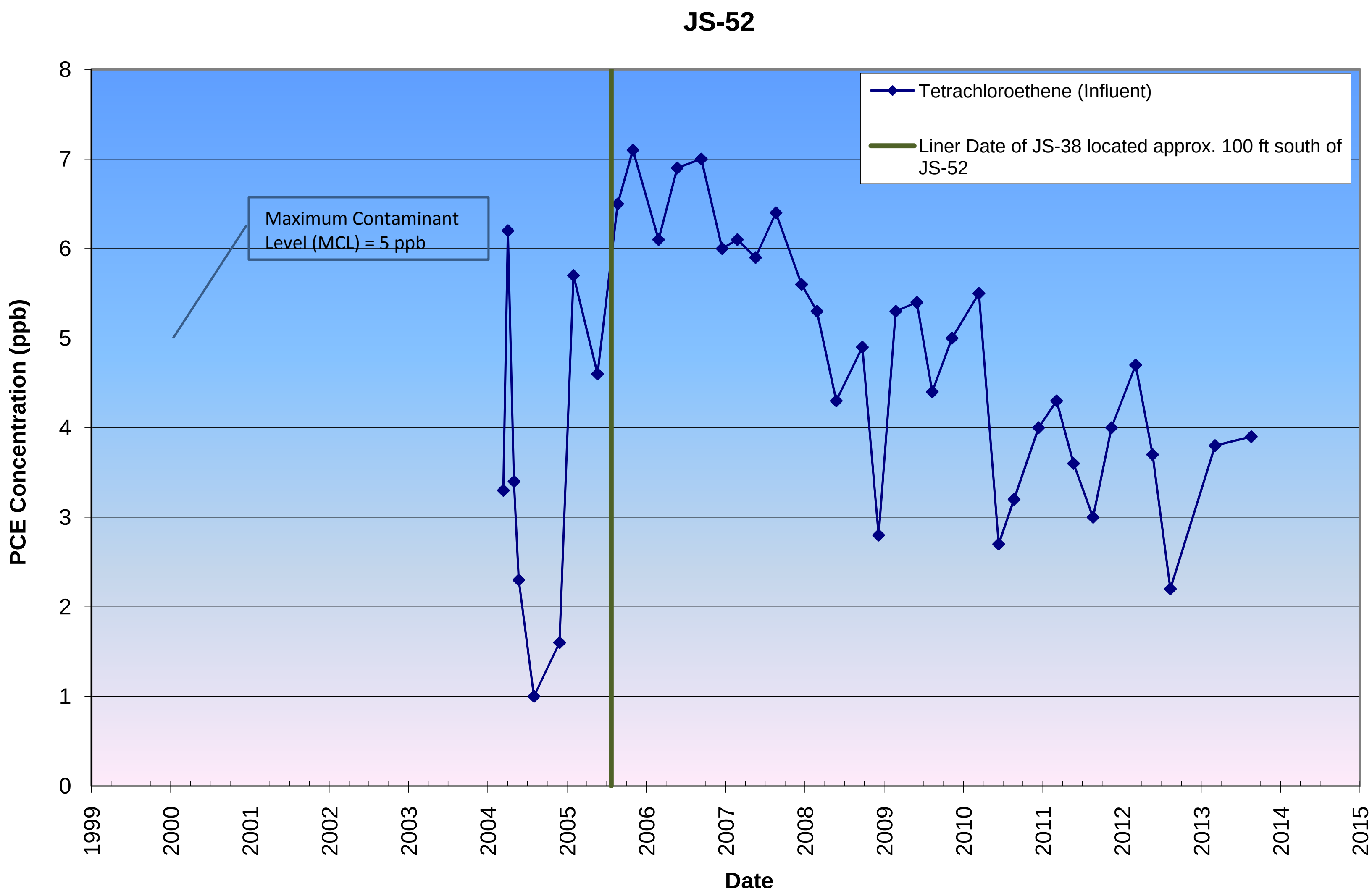


Riverfront Site
OU6 (Domestic Supply Well with home treatment system)



Riverfront Site

OU6 (Domestic Supply Well with home treatment system)



Riverfront Site - OU2

Results from the March 2011 Indoor Air Evaluation Report

TABLE 1
SUB-SLAB VAPOR SAMPLING RESULTS
METALCRAFT ENTERPRISES FACILITY
RIVERFRONT SUPERFUND SITE OU2/OU6
NEW HAVEN, MISSOURI

	Sub-slab Air Screening Level[1] (µg/m³)		Sample ID	SSVI-SV01-000.4-101204	SSVI-SV02-000.4-101204	SSV2-SV01-000.4-101204	SSV3-SV01-000.4-101204	SSV4-SV01-000.4-101204	SSV5-SV01-000.4-101204	SSV6-SV01-000.4-101204	SSV7-SV01-000.4-101204
	1.00E-06	Non-Cancer	Sample Date	4-Dec-10	4-Dec-10	4-Dec-10	4-Dec-10	4-Dec-10	4-Dec-10	4-Dec-10	4-Dec-10
	Cancer Risk	HI = 1	Units	ug/m³	ug/m³	ug/m³	ug/m³	ug/m³	ug/m³	ug/m³	ug/m³
PCE	20.8	11,900		**7,900**	**7,400 D**	**3,400**	**940 D**	**110**	**6,100 D**	**530 D**	**14**
TCE[2]	61.3	440		**770**	**67**	**750**	**210**	**16**	**700**	**1.6**	**3.9**
cis-1,2-DCE[2]	-	2,630		**120**	**11**	**140**	**100**	**25**	**110**	<0.79	**2.4**
trans-1,2-DCE	-	2,630		**87**	**7.3**	<16	<2.5	<0.79	<16	<0.79	<0.79
Vinyl chloride	27.9	4,380		<16	<0.51	<10	<1.6	**3.0**	<10	<0.51	**<0.51**

1 Sub-slab Air Screening Level = Industrial Indoor Air Screening Level/Attenuation Factor (α), where α = 0.1 (USEPA, 2008).

2 TCE's non-cancer screening level derived using NYSDOH's reference concentration of 1E-02 mg/m³ (NYSDOH, 2006).

3 Inhalation toxicity values are not currently available for *cis*-1,2-DCE. *tran*s-1,2-DCE is used as a surrogate.

Bold font indicates positive detection

D Indicates sample diluted to be within range of instrument

Results exceed the Sub-Slab Air Screening Level

Sample SVI-SV02-000.4-101204 is a replicate sample of SSVI-SV01-000.4-101204

TABLE 2
INDOOR AIR SAMPLING RESULTS
METALCRAFT ENTERPRISES FACILITY
RIVERFRONT SUPERFUND SITE OU2/OU6
NEW HAVEN, MISSOURI

	Industrial Indoor Air Screening Level (µg/m^3)			Sample ID	ME0I-IA01-110129	ME02-IA01-110129	ME03-IA01-110129	ME04-IA01-110129	ME05-IA01-110129	ME05-IA02-110129	ME06-IA01-110129	ME07-IA01-110129	ME08-IA01-110129	ME09-IA01-110129	ME01-AM01-110129
				Inlet Height (inches)	61	57	68.5	58	63	63	64.5	71	64.5	56	48
	1.00E-04	1.00E-06	Non-Cancer	Sample Date	Jan 29-30, 2011	Jan 29-30, 2011	Jan 29-30, 2011	Jan 29-30, 2011	Jan 29-30, 2011	Jan 29-30, 2011	Jan 29-30, 2011	Jan 29-30, 2011	Jan 29-30, 2011	Jan 29-30, 2011	Jan 29-30, 2011
	High End Cancer Risk Range	Low End Cancer Risk Range	HI = 1	Units	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3	ug/m^3
PCE	208	2.08	1,190		**19**	**13**	**16**	**11**	**17**	**14**	**21**	**16**	**20**	**24**	< 1.4
TCE[1]	613	6.13	44		**2.4**	**1.9**	**2.2**	**1.3**	**1.8**	**1.6**	**6.2**	**1.3**	**2.1**	**2.6**	< 1.1
cis-1,2-DCE[2]	-	-	263		**2.1**	**1.5**	**1.8**	**0.92**	**1.3**	**1.2**	**2.4**	**0.93**	**1.4**	**0.99**	< 0.79
trans-1,2-DCE	-	-	263		< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79
Vinyl chloride	279	2.79	438		< 0.51	< 0.51	< 0.51	< 0.51	< 0.51	< 0.51	< 0.51	< 0.51	< 0.51	< 0.51	< 0.51

1 TCE's non-cancer screening level derived using NYSDOH's reference concentration of 1E-02 mg/m^3 (NYSDOH, 2006).

2 Inhalation toxicity values are not currently available for *cis*-1,2-DCE. *tran*s-1,2-DCE is used as a surrogate.

Bold font indicates positive detection

D Indicates sample diluted to be within range of instrument

Results within the low end and high end of the cancer Industrial Indoor Air Risk Range

Sample ME05-IA02-110129 is a duplicate sample of ME05-IA01-110129

Sample ME01-AM01-110129 is an ambient sample collected approximately 150 feet west of the Metalcraft Facility.

TABLE 1
INDOOR AIR SAMPLING RESULTS
JANUARY AND JUNE 2011
METALCRAFT ENTERPRISES FACILITY
RIVERFRONT SUPERFUND SITE OU2/OU6
NEW HAVEN, MISSOURI

	Industrial Indoor Air Screening Level (µg/m^3)			Sample ID	ME01-IA01-110129	ME01-IA01-110625	ME02-IA01-110129	ME02-IA01-110625	ME03-IA01-110129	ME03-IA01-110625	ME04-IA01-110129	ME04-IA01-110625	ME05-IA01-110129	ME05-IA01-110625
				Inlet Height (inches)	61	66	57	66	68.5	65	58	60	63	77
	1.00E-04	1.00E-06	Non-Cancer	Sample Date	Jan 29-30, 2011	Jun 25-26, 2011	Jan 29-30, 2011	Jun 25-26, 2011	Jan 29-30, 2011	Jun 25-26, 2011	Jan 29-30, 2011	Jun 25-26, 2011	Jan 29-30, 2011	Jun 25-26, 2011
	High End Cancer Risk Range	Low End Cancer Risk Range	HI = 1	Units	ug/m^3		ug/m^3		ug/m^3		ug/m^3		ug/m^3	
PCE	208	2.08	1,190		**19**	**7**	**13**	**14**	**16**	**14**	**11**	**12**	**17**	**13**
TCE[1]	613	6.13	44		**2.4**	<1.1	**1.9**	<1.1	**2.2**	<1.1	**1.3**	<1.1	**1.8**	<1.1
***cis*-1,2-DCE**[2]	-	-	263		**2.1**	< 0.79	**1.5**	< 0.79	**1.8**	< 0.79	**0.92**	< 0.79	**1.3**	< 0.79
***trans*-1,2-DCE**	-	-	263		< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79
Vinyl chloride	279	2.79	438		< 0.51	<.51	< 0.51	<.51	< 0.51	<.51	< 0.51	<.51	< 0.51	<.51

TABLE 1
INDOOR AIR SAMPLING RESULTS
JANUARY AND JUNE 2011
METALCRAFT ENTERPRISES FACILITY
RIVERFRONT SUPERFUND SITE OU2/OU6
NEW HAVEN, MISSOURI

	Industrial Indoor Air Screening Level (µg/m³)			Sample ID Inlet Height (inches)	ME05-IA02-110129 63	ME05-IA02-110625 77	ME06-IA01-110129 64.5	ME06-IA01-110625 64	ME07-IA01-110129 71	ME07-IA01-110625 72	ME08-IA01-110129 64.5	ME08-IA01-110625 60	ME09-IA01-110129 56	ME09-IA01-110625 48
	1.00E-04	1.00E-06	Non-Cancer	Sample Date	Jan 29-30, 2011	Jun 25-26, 2011	Jan 29-30, 2011	Jun 25-26, 2011	Jan 29-30, 2011	Jun 25-26, 2011	Jan 29-30, 2011	Jun 25-26, 2011	Jan 29-30, 2011	Jun 25-26, 2011
	High End Cancer Risk Range	Low End Cancer Risk Range	HI = 1	Units	ug/m³		ug/m³		ug/m³		ug/m³		ug/m³	
PCE	208	2.08	1,190		**14**	**13**	**21**	**25**	**16**	**8.7**	**20**	**9.3**	**24**	**7.6**
TCE[1]	613	6.13	44		**1.6**	<1.1	**6.2**	**1.9**	**1.3**	<1.1	**2.1**	<1.1	**2.6**	<1.1
cis-1,2-DCE[2]	-	-	263		**1.2**	< 0.79	**2.4**	< 0.79	**0.93**	< 0.79	**1.4**	< 0.79	**0.99**	< 0.79
trans-1,2-DCE	-	-	263		< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79	< 0.79
Vinyl chloride	279	2.79	438		< 0.51	<.51	< 0.51	<.51	< 0.51	<.51	< 0.51	<.51	< 0.51	<.51

1 TCE's non-cancer screening level derived using NYSDOH's reference concentration of 1E-02 mg/m³ (NYSDOH, 2006).
2 Inhalation toxicity values are not currently available for *cis*-1,2-DCE. *trans*-1,2-DCE is used as a surrogate.
Bold font indicates positive detection
D Indicates sample diluted to be within range of instrument
Results within the low end and high end of the cancer Industrial Indoor Air Risk Range
Sample ME05-IA02-110129 is a duplicate sample of ME05-IA01-110129
Sample ME01-AM01-110129 is an ambient sample collected approximately 150 feet west of the Metalcraft Facility.

ATTACHMENT 4

OU-3

Data Tables /Trend Analysis

Old City Dump Site, Riverfront Superfund Site

Table 3-1
New Haven Historical Groundwater Monitoring
New Haven, MO

Location					B-31	B-31	B-31	B-31	B-31	B-31A	B-31A	B-31A		B-31A	B-31A	B-32	B-32	B-32
Date					7/23/2003	12/15/2003	4/14/2004	7/6/2004	5/20/2008	7/23/2003	12/16/2003	4/15/2004		7/7/2004	5/21/2008	7/23/2003	12/15/2003	4/14/2004
Sample Type					N	N	N	N	N	N	N	N	FD	N	N	N	N	N
Parameter	Total or Dissolved	New Haven Background Screening Level	EPA Maximum Contaminant Levels	EPA Secondary Maximum Contaminant Levels														
Effective Date			05/01/2009	6/20/2002														
Exceedance Key			**Bold**	<u>Underline</u>														
General Parameters																		
Nitrate + Nitrite, as N	NA	2 mg/l	**10 mg/l**		5.80 mg/l	5.20 mg/l 5.40 mg/l	6.40 mg/l	6.60 mg/l	5.70 mg/l	< 0.02 mg/l	< 0.02 mg/l	< 0.02 mg/l	< 0.02 mg/l	< 0.02 mg/l	< 0.04 mg/l	2.10 mg/l	3.80 mg/l	2.30 mg/l
Sulfate, as SO4	NA	19 mg/l		<u>250 mg/l</u>	110 mg/l	110 mg/l 110 mg/l	120 mg/l	120 mg/l	127 mg/l	<u>270 mg/l</u>	240 mg/l	220 mg/l	220 mg/l	220 mg/l	181 mg/l	40 mg/l	54 mg/l	41 mg/l
Metals																		
Antimony	Total	1 ug/l	**6 ug/l**		< 1 ug/l	< 1 ug/l < 1 ug/l	< 1 ug/l	< 1 ug/l	< 0.1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 0.1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Arsenic	Total	1 ug/l	**10 ug/l**		< 4 ug/l	< 4 ug/l < 4 ug/l	4 ug/l	5 ug/l	0.5 ug/l	< 4 ug/l	< 4 ug/l	4 ug/l	< 4 ug/l	7 ug/l	0.1 ug/l	< 4 ug/l	< 4 ug/l	< 4 ug/l
Barium	Total	130 ug/l	2000 ug/l		93 ug/l	92 ug/l 89 ug/l	100 ug/l	97 ug/l	96.1 ug/l	40 ug/l	37 ug/l	34 ug/l	34 ug/l	36 ug/l	31.8 ug/l	72 ug/l	47 ug/l	70 ug/l
Boron	Total	13.5 ug/l			468 ug/l	452 ug/l 437 ug/l	529 ug/l	485 ug/l	455 ug/l	22 ug/l	11 ug/l	14 ug/l	13 ug/l	11 ug/l	16.1 ug/l	17 ug/l	12 ug/l	17 ug/l
Cobalt	Total	3 ug/l			< 1 ug/l	< 1 ug/l < 1 ug/l	< 1 ug/l	< 1 ug/l	0.5 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	0.3 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Copper	Total	21 ug/l	1300 TT (7) ug/l	1000 ug/l	< 2 ug/l	< 2 ug/l < 2 ug/l	< 2 ug/l	< 2 ug/l	1.4 ug/l	< 2 ug/l	< 2 ug/l	< 2 ug/l	< 2 ug/l	< 2 ug/l	< 1 ug/l	< 2 ug/l	< 2 ug/l	< 2 ug/l
Lithium	Total	5 ug/l			3 ug/l	4 ug/l 4 ug/l	4 ug/l	3 ug/l	5 ug/l	13 ug/l	7 ug/l	8 ug/l	8 ug/l	5 ug/l	9 ug/l	5 ug/l	7 ug/l	6 ug/l
Manganese	Total	3 ug/l		<u>50 ug/l</u>	4 ug/l	8 ug/l 8 ug/l	2 ug/l	3 ug/l	5 ug/l	45 ug/l	<u>84 ug/l</u>	<u>67 ug/l</u>	<u>67 ug/l</u>	33 ug/l	<u>78 ug/l</u>	18 ug/l	12 ug/l	4 ug/l
Silver	Total	1 ug/l		100 ug/l	< 1 ug/l	< 1 ug/l < 1 ug/l	< 1 ug/l	< 1 ug/l	< 0.1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 0.1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Strontium	Total	78 ug/l			280 ug/l	270 ug/l 270 ug/l	300 ug/l	280 ug/l	308 ug/l	190 ug/l	190 ug/l	180 ug/l	180 ug/l	170 ug/l	167 ug/l	290 ug/l	220 ug/l	270 ug/l
Zinc	Total	100 ug/l		5000 ug/l	< 2 ug/l	5 ug/l 4 ug/l	< 2 ug/l	< 2 ug/l	8.6 ug/l	7 ug/l	2 ug/l	2 ug/l	< 2 ug/l	3 ug/l	7.5 ug/l	< 2 ug/l	3 ug/l	2 ug/l
VOCs																		
1,3,5-Trimethylbenzene	NA				< 1 ug/l	< 1 ug/l < 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Naphthalene	NA				< 1 ug/l	< 1 ug/l < 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	1.0 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Tetrachloroethylene	NA		5 ug/l		< 1 ug/l	< 1 ug/l < 1 ug/l	< 1 ug/l	0.2 j ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	0.55 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Toluene	NA		1000 ug/l		< 1 ug/l	< 1 ug/l < 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l

Riverfront Site
Operable Unit No. 3

Table 3-1
New Haven Historical Groundwater Monitoring
New Haven, MO

				Location	**B-32**	**B-32**	**BW-03**	**BW-03**	**BW-03**	**BW-03**	**BW-03**	**BW-03**	**BW-03**	**BW-03**	**JS-26**	**JS-26**	**JS-26**	**JS-28**	**JS-28**	**JS-28**
				Date	**7/6/2004**	**5/21/2008**	**5/11/2000**	**6/8/2000**	**7/24/2000**	**7/24/2002**	**12/8/2003**	**4/13/2004**	**7/7/2004**	**5/21/2008**	**2/7/2000**	**4/16/2003**	**5/21/2008**	**1/24/2001**	**4/16/2003**	**5/22/2008**
				Sample Type	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**
Parameter	Total or Dissolved	New Haven Background Screening Level	EPA Maximum Contaminant Levels	EPA Secondary Maximum Contaminant Levels																
Effective Date			05/01/2009	6/20/2002																
Exceedance Key			**Bold**	<u>Underline</u>																
General Parameters																				
Nitrate + Nitrite, as N	NA	2 mg/l	**10 mg/l**		2.80 mg/l	1.65 mg/l	--	--	--	5.50 mg/l	3.40 mg/l	5.20 mg/l	5.40 mg/l	5.04 mg/l	1.29 mg/l	1.50 mg/l	1.74 mg/l	--	0.06 mg/l	0.10 mg/l
Sulfate, as SO4	NA	19 mg/l		<u>250 mg/l</u>	47 mg/l	42.2 mg/l	--	--	--	88 mg/l	190 mg/l	74 mg/l	78 mg/l	95.2 mg/l	5.59 mg/l	7 mg/l	7.48 mg/l	--	9.8 mg/l	11 mg/l
Metals																				
Antimony	Total	1 ug/l	**6 ug/l**		< 1 ug/l	< 0.1 ug/l	--	--	--	< 1 ug/l	4 ug/l	< 1 ug/l	< 1 ug/l	< 0.1 ug/l	< 1.00 ug/l	< 1 ug/l	< 0.1 ug/l	--	< 1 ug/l	< 0.1 ug/l
Arsenic	Total	1 ug/l	**10 ug/l**		6 ug/l	0.2 ug/l	--	--	--	< 4 ug/l	**10 ug/l**	< 4 ug/l	6 ug/l	0.3 ug/l	< 2 ug/l	< 4 ug/l	0.1 ug/l	--	< 4 ug/l	0.2 ug/l
Barium	Total	130 ug/l	2000 ug/l		63 ug/l	107 ug/l	--	--	--	130 ug/l	170 ug/l	130 ug/l	120 ug/l	118 ug/l	49.3 ug/l	51 ug/l	49 ug/l	--	140 ug/l	118 ug/l
Boron	Total	13.5 ug/l			15 ug/l	15.1 ug/l	--	--	--	392 ug/l	1540 ug/l	385 ug/l	346 ug/l	379 ug/l	12 e ug/l	8 ug/l	10.4 ug/l	--	10 ug/l	13.2 ug/l
Cobalt	Total	3 ug/l			< 1 ug/l	0.1 ug/l	--	--	--	< 1 ug/l	1.0 ug/l	< 1 ug/l	< 1 ug/l	0.2 ug/l	< 1.00 ug/l	< 1 ug/l	0.1 ug/l	--	< 1 ug/l	0.1 ug/l
Copper	Total	21 ug/l	1300 TT (7) ug/l	1000 ug/l	< 2 ug/l	< 1 ug/l	--	--	--	< 2 ug/l	< 2 ug/l	< 2 ug/l	< 2 ug/l	0.550 e ug/l	10.1 ug/l	7 ug/l	4.87 ug/l	--	< 2 ug/l	1.03 ug/l
Lithium	Total	5 ug/l			6 ug/l	9 ug/l	--	--	--	3 ug/l	13 ug/l	4 ug/l	3 ug/l	5 ug/l	2 e ug/l	2 ug/l	2 ug/l	--	2 ug/l	3 ug/l
Manganese	Total	3 ug/l		<u>50 ug/l</u>	4 ug/l	1 ug/l	--	--	--	2 ug/l	<u>1160 ug/l</u>	3 ug/l	3 ug/l	1.4 ug/l	< 1.0 ug/l	< 1 ug/l	0.3 ug/l	--	< 1 ug/l	0.8 ug/l
Silver	Total	1 ug/l		100 ug/l	< 1 ug/l	< 0.1 ug/l	--	--	--	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 0.1 ug/l	< 1.0 ug/l	< 1 ug/l	< 0.1 ug/l	--	< 1 ug/l	< 0.1 ug/l
Strontium	Total	78 ug/l			240 ug/l	433 ug/l	--	--	--	260 ug/l	510 ug/l	240 ug/l	230 ug/l	271 ug/l	99.6 ug/l	100 ug/l	106 ug/l	--	67 ug/l	69 ug/l
Zinc	Total	100 ug/l		5000 ug/l	6 ug/l	1 e ug/l	--	--	--	4 ug/l	129 ug/l	2 ug/l	5 ug/l	10.9 ug/l	63.5 ug/l	5 ug/l	17.2 ug/l	--	7 ug/l	9.3 ug/l
VOCs																				
1,3,5-Trimethylbenzene	NA				< 1 ug/l	0.15 j ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Naphthalene	NA				< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	0.23 j ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Tetrachloroethylene	NA		5 ug/l		< 1 ug/l	< 1 ug/l	0.22 ug/l	0.8 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Toluene	NA		1000 ug/l		< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l

Table 3-1
New Haven Historical Groundwater Monitoring
New Haven, MO

Location					JS-31	JS-31	PB-17	PB-17	PB-17	Seep M	Seep M	Seep M	Seep M	Seep M	Seep M	Seep M	Seep M	Seep M	Seep M		Seep M	
Date					4/16/2003	5/22/2008	3/31/1999	4/16/2003	5/21/2008	7/16/1999	4/18/2001	6/11/2001	3/13/2002	7/24/2002	4/16/2003	7/23/2003	12/8/2003	4/13/2004	7/6/2004		5/21/2008	
Sample Type					N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	FD	N	FD
Parameter	Total or Dissolved	New Haven Background Screening Level	EPA Maximum Contaminant Levels	EPA Secondary Maximum Contaminant Levels																		
Effective Date			05/01/2009	6/20/2002																		
Exceedance Key			**Bold**	Underline																		
General Parameters																						
Nitrate + Nitrite, as N	NA	2 mg/l	**10 mg/l**		2.3 mg/l	2.77 mg/l	--	1.10 mg/l	1.48 mg/l	**10.00 mg/l**	--	--	--	7.20 mg/l	3.30 mg/l	3.90 mg/l	4.60 mg/l	2.30 mg/l	2.60 mg/l	2.40 mg/l	0.65 mg/l	0.66 mg/l
Sulfate, as SO4	NA	19 mg/l		250 mg/l	17 mg/l	22 mg/l	--	6.6 mg/l	7.38 mg/l	256 mg/l	--	--	--	120 mg/l	210 mg/l	170 mg/l	78 mg/l	240 mg/l	200 mg/l	200 mg/l	235 mg/l	234 mg/l
Metals																						
Antimony	Total	1 ug/l	**6 ug/l**		< 1 ug/l	< 0.1 ug/l	--	< 1 ug/l	< 0.1 ug/l	**82 ug/l**	--	--	--	**13 ug/l**	**7 ug/l**	**6 ug/l**	< 1 ug/l	3 ug/l	2 ug/l	2 ug/l	**15.7 ug/l**	**15.1 ug/l**
Arsenic	Total	1 ug/l	**10 ug/l**		< 4 ug/l	0.2 ug/l	--	< 4 ug/l	0.1 ug/l	< 1 ug/l	--	--	--	< 4 ug/l	< 4 ug/l	< 4 ug/l	< 4 ug/l	< 4 ug/l	7 ug/l	6 ug/l	1 ug/l	0.6 ug/l
Barium	Total	130 ug/l	2000 ug/l		59 ug/l	57 ug/l	--	56 ug/l	46.8 ug/l	111 ug/l	--	--	--	81 ug/l	160 ug/l	100 ug/l	130 ug/l	140 ug/l	120 ug/l	120 ug/l	98 ug/l	97.7 ug/l
Boron	Total	13.5 ug/l			10 ug/l	7.1 ug/l	--	8 ug/l	8.5 ug/l	2710 ug/l	--	--	--	1150 ug/l	1880 ug/l	1430 ug/l	391 ug/l	1650 ug/l	1040 ug/l	983 ug/l	1600 ug/l	1600 ug/l
Cobalt	Total	3 ug/l			< 1 ug/l	0.2 ug/l	--	< 1 ug/l	0.1 ug/l	< 1.00 ug/l	--	--	--	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	2.0 ug/l	1.0 ug/l	1.0 ug/l	0.4 ug/l	0.4 ug/l
Copper	Total	21 ug/l	1300 TT (7) ug/l	1000 ug/l	6 ug/l	--	--	2 ug/l	2.47 ug/l	5 ug/l	--	--	--	< 2 ug/l	< 2 ug/l	2 ug/l	< 2 ug/l	< 2 ug/l	3 ug/l	4 ug/l	2.61 ug/l	2.53 ug/l
Lithium	Total	5 ug/l			2 ug/l	3 ug/l	--	2 ug/l	2 ug/l	13 ug/l	--	--	--	9 ug/l	15 ug/l	12 ug/l	4 ug/l	14 ug/l	8 ug/l	8 ug/l	20 ug/l	20 ug/l
Manganese	Total	3 ug/l		50 ug/l	< 1 ug/l	0.4 ug/l	--	< 1 ug/l	0.2 e ug/l	147 ug/l	--	--	--	81 ug/l	271 ug/l	284 ug/l	2 ug/l	2030 ug/l	559 ug/l	579 ug/l	136 ug/l	139 ug/l
Silver	Total	1 ug/l		100 ug/l	< 1 ug/l	< 0.1 ug/l	--	< 1 ug/l	< 0.1 ug/l	< 1.0 ug/l	--	--	--	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 0.1 ug/l	< 0.1 ug/l
Strontium	Total	78 ug/l			130 ug/l	140 ug/l	--	100 ug/l	102 ug/l	435 ug/l	--	--	--	370 ug/l	490 ug/l	400 ug/l	240 ug/l	490 ug/l	570 ug/l	560 ug/l	489 ug/l	490 ug/l
Zinc	Total	100 ug/l		5000 ug/l	141 ug/l	40 ug/l	--	60 ug/l	23 ug/l	627 ug/l	--	--	--	162 ug/l	287 ug/l	161 ug/l	< 2 ug/l	202 ug/l	130 ug/l	128 ug/l	357 ug/l	359 ug/l
VOCs																						
1,3,5-Trimethylbenzene	NA				< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Naphthalene	NA				< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Tetrachloroethylene	NA		5 ug/l		< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	0.11 ug/l	< 1 ug/l	0.1 j ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l
Toluene	NA		1000 ug/l		< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	0.38 j ug/l	0.5 ug/l	0.1 j ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l	< 1 ug/l

Riverfront Site - Operable Unit No. 3

Table 3-2
Comparison between 2008 and 2013 Groundwater Data
OU3
New Haven, Missouri

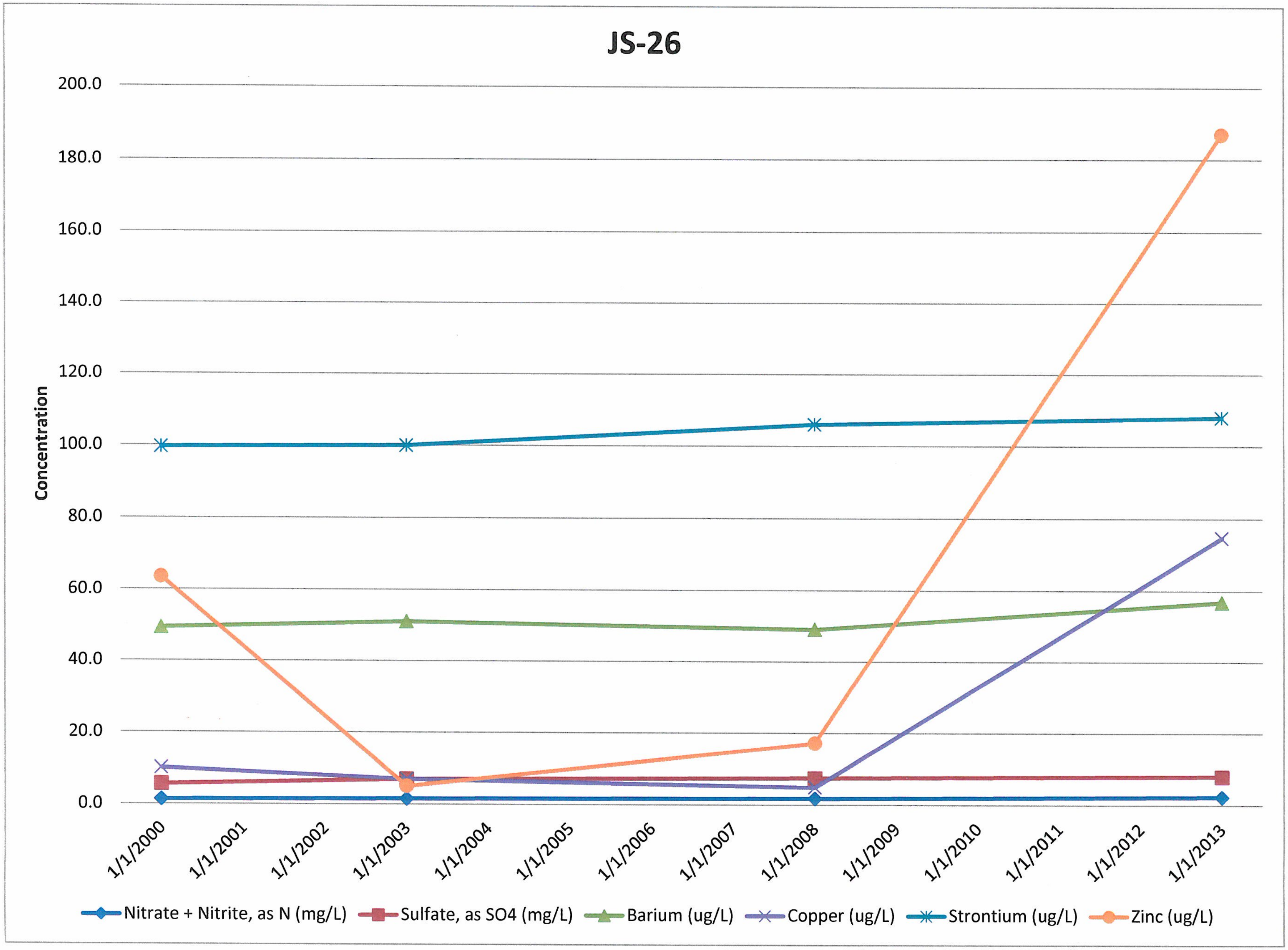
	Date	Time	Water Level	Tetreachloroethene (PCE), ug/L	Toluene (ug/L)	1,3,50 trimethylbenzaene ug/L	Napthalene ug/L	Dissolved Oxygen	pH	pH (lab)	Conductivity	Conductivity Lab	Temp (deg. C)	Calcium mg/L	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	Alkalinity, pH 4.5 mg/L CaCO3	Alkalintiy Titration mg/L CACO3	Bicarbonate, wu, infle ct pt, fld mg/L	Chloride (mg/L)	Fluoride (mg/L)	Silica (mg/L)	Sulfate (mg/L)
EPA Maximum Contaminant Levels	05/01/2009			5	1000																	4		
USEPA secondary standard				-																	250	2		250
Missouri GW standard				-																		4		
Ozark aquifer background (times and others, 1996)				-							510		18	68	41	1.7	8	360	360	438	6.2	0.1		15
Estimated New Haven area groundwater background				-							880			85	51	2.1	10	450	450	548	8	0.2		19
Upper limit (95th percentile) of New Haven area domestic well samples				-	<1	<1	<1	-			783			73	56	1.4	13	404	413	504	17	0.2	14	16
Site name																								
BW-03	5/21/2008	1800	93.53	<1	<1	<1	0.23J	0.2	7	7.1	1615	1650	14.4	130	90.2	2.01	89.3	-	484	591	203	0.16	16.6	95.2
BW-03	9/17/2013	1800		<1	<1	<1	<0.50	4.1	6.9	7.6	938	645	15.71	57.4	56.9	1.99	9.43				4.5	0.23	10.1	9.8
BW-31	5/20/2008	1445	83.7	<1	<1	<1	<1	0.4	7	7.3	1530	1570	15.2	125	93.3	1.68	87.9	-	503	614	155	0.22	19.2	127
BW-31	9/17/2013	1450		<1	<1	<1	<10	1.8	6.83	7.3	1180	965	15.85	114	85.1	1.44	84.0				146	0.26	20.9	120
BW-31-dup	9/17/2013	1455																						
BW-31A	5/21/2008	1400	37.14	<1	<1	<1	1	1	7.1	7.4	1180	1170		113	88.2	1.8	23.9	-	489	597	25.3	0.15	12.7	181
BW-31A	9/17/2013	1555	86.94	<1	<1	<1	<10	3.4	7	7.2	953	924	16.31	108	90.4	2.08	23.4				27.3	<0.20	14.3	189
BW-32	5/21/2008	1300	17.7	<1	<1	0.15 J	<1	3.5	7	7.1	1250	1270	13	123	76.8	0.78	57.8	-	652	795	38.7	0.22	32.9	42.2
BW-32	9/17/2013	1145	23.97	<1	<1	<1	<10	1.97	6.72	7.2	942	990	14.39	120	72.9	1.15	40.4				58.3	0.22	27.5	57.7
Seep M	5/21/2008	1418	-	<1	<1	<1	<1	7	7.4	7.6	1480	1485	16	185	56.3	28.8	59	-	527	643	63.7	E0.12	10.3	235
Seep M-dup	5/21/2008	1419	-	<1	<1	<1	<1	7	7.4	7.6	1480	1485	16	184	55.7	28.4	59.2	-	-		63.6	E0.11	10.4	234
Seep M	10/6/2013	1750	-	<1	<1	<1	<10	-	-	7.7	-	975	-	89.1	50.7	1.03	65.1	-	-	-	97.2	0.2	12.6	19.2
JS-26	5/21/2008	1733		<1	<1	<1	<1	4	7.3	7.6	676	678	14.6	67.7	50.6	1.4	9.76	-	-	-	3.73	0.19	13.8	7.48
JS-26	9/16/2013	1100		<1	<1	<1	<10	6.8	7.19	7.2	573	549	18.95	65.6	50.2	1.44	10.6				4.8	0.21	13.7	8
JS-28	5/22/2008	845		<1	<1	<1	<1	0.6	7.3	7.8	526	539	14.7	53.1	42.2	1.5	2.61	-	298	363	1.7	E0.12	9.84	11
JS-28	9/16/2013	1330		<1	<1	<1	<10	4.9	7.43	7.4	438	542	15.76	52	42.6	1.54	2.58				2.4	<0.20	9.71	11.5
JS-31	8/27/2008	1115						3	7.2	7.3	867	867	15.5	82	60	1.4	18	-	382	466	27	0.19	13.3	22
JS-31	9/16/2013	1230		<1	<1	<1	<10	6.6	7.02	7.4	715	697	16.06	85.3	59.6	1.35	19.6				40	0.21	13.8	22.9
PB-17	5/21/2008	1855							7.4	7.8	669	670		65.3	50.7	1.5	9.99		379	462	4.09	0.17	13.3	7.38
Roblller	9/16/2013	1515		<1	<1	<1	<10	10.1	7.29	7.5	495	540	16.69	43.4	52.5	1.22	10.1				5.1	<0.20	13.9	7.7

Riverfront Site - Operable Unit No. 3

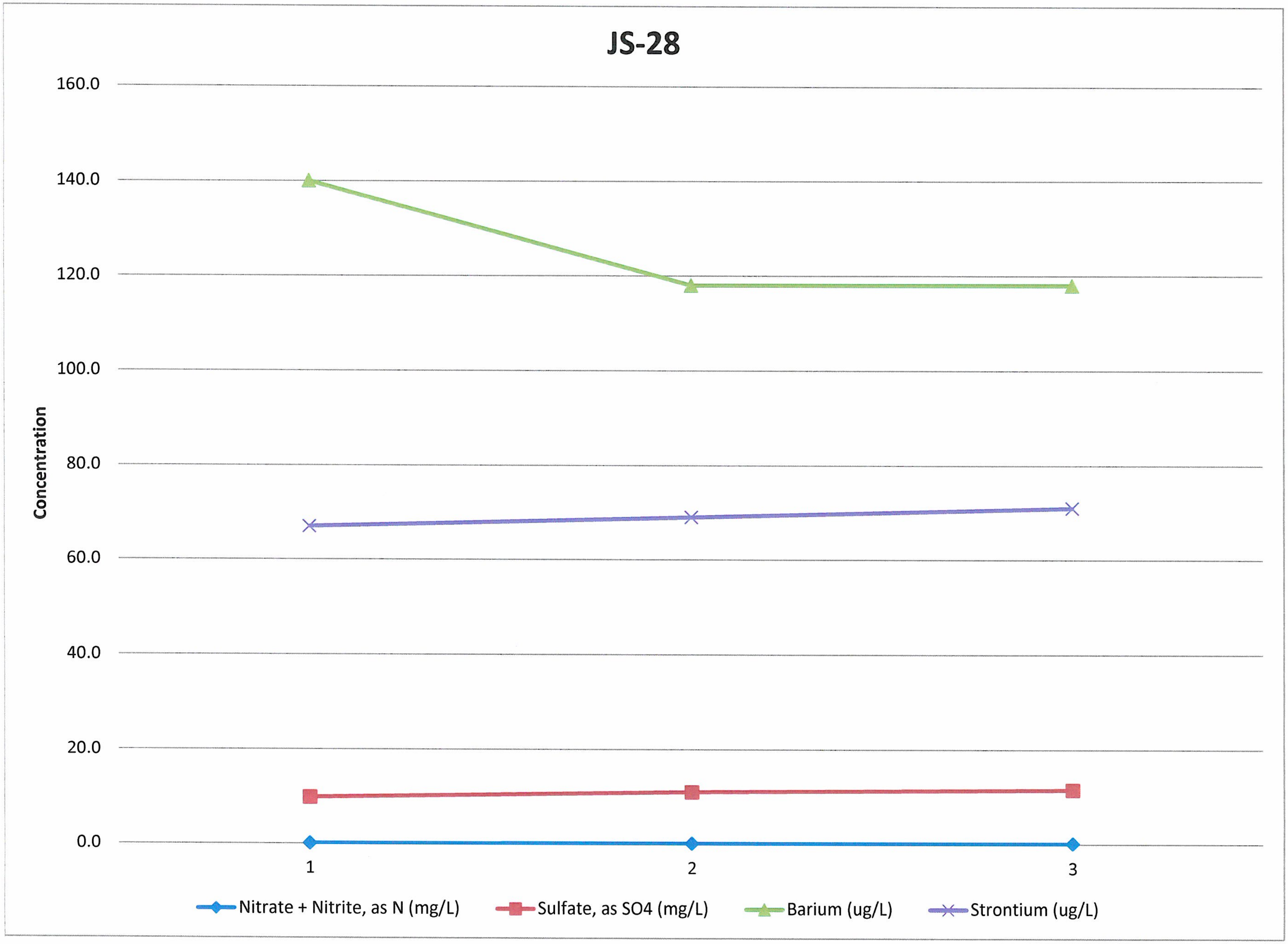
Table 3-2
Comparison between 2008 and 2013 Groundwater Data
OU3
New Haven, Missouri

	Ammonia (mg/L)	NO3+NO2, mg/L as N	Nitrite mg/L as N	Orthophosphate, mg/L as P	Phosphorus (mg/L)	Organic Carbon (mg/L)	Antimony (ug/L)	Arsenic (ug/L)	Barium (ug/L)	Beryllium (ug/L)	Boron (mg/L)	Cadmium (ug/L)	Chromium (ug/L)	Cobalt (ug/L)	Copper (ug/L)	Iron (ug/L)	Lead (ug/L)	Lithium (mg/L)	Manganese (ug/L)	Molybdenum (ug/L)	Nickel (ug/L)	Silver (ug/L)	Strontium (ug/L)	Thallium (ug/L)	Vandium (ug/L)	Zinc (ug/L)
EPA Maximum Contaminant Levels		10	1				6	10	2000	4	-	5	100	-	1300 TT (7) ug/L	-	15 TT (7) ug/L	-	-	-	-	-	-	2	-	-
USEPA secondary standard							-	-	-	-	-	-	-	-	1000	300	-	-	50	-	-	100	-	-	-	5000
Missouri GW standard		10					6	50	2000	4	2000	5	100	1000	1300	300	15	-	50	-	100	50	-	2	-	5000
Ozark aquifer background (times and others, 1996)	0.03	1.5			<0.03	2.8	<1	<1	100	<0.5	<20	<1	<5	<3	17	<64	<10	<7	2	<10	<10	<1	62	<1	<1	<410
Estimated New Haven area groundwater background	0.04	2			<0.03	3.5	<1	<1	130	<1	13.5	<1	<5	<3	21	10	<10	5	3	-	-	<1	78	<2	<1	<100
Upper limit (95th percentile) of New Haven area domestic well samples	0.04	2.1			-	-	<1	<4	124	<1	12	<0.5	<1	<1	10	5	<2	2	<1	<2	<2	<1	124	<2	<1	125
Site Name																										
BW-03	<0.02	5.04	<0.002	E0.005	<0.04	-	< 0.1	0.3	118	< 0.2	379	E0.04	0.4	0.2	E0.550	E6	R	5	1.4	<0.2	3.54	<0.1	271	<0.04	1	5
BW-03	<0.10	<0.10	<0.10	<0.10	<0.10		<10.0	<10.0	64	<1.0	<100	<5.0	<5.0	<5.0	<10.0	<50.0	<5.0	<10.0	5.6	<20.0	<5.0	<7.0	89.9	<20.0	<10.0	<50.0
BW-31	<0.02	5.7	0.003	0.022	E0.03	-	<0.1	0.5	96.1	<0.2	455	E0.04	0.4	0.5	1.4	<8	R	5	5	E0.1	4.1	<0.1	308	E0.02	1	8.6
BW-31	<0.10	5.3	<0.50	<0.10	<0.10		<10.0	<10.0	106	<1.0	508	<5.0	<5.0	<5.0	<10.0	<50.0	<5.0	<10.0	5.6	<20.0	<5.0	<7.0	302	<20.0	<10.0	<50.0
BW-31-dup																										
BW-31A	E0.011	<0.04	0.002	E0.004	<0.04		<0.1	0.1	31.8	<0.2	16.1	E0.02	0.2	0.3	<1	2160	R	9	78	0.2	2.49	<0.1	167	<0.04	1	7.5
BW-31A	<0.10	<0.10	<0.10	<0.10	<0.10		<10.0	<10.0	32.4	<1.0	<100	<5.0	<5.0	<5.0	<10.0	<50.0	<5.0	<10.0	73.4	<20.0	<5.0	<7.0	170	<20.0	<10.0	<50.0
BW-32	<0.02	1.65	<0.002	0.072	0.06		<0.1	0.2	107	<0.2	15.1	E0.03	1.6	0.1	<1	E5	R	9	1	E0.2	2.42	<0.1	433	<0.04	1	E1
BW-32	<0.10	2.6	<0.10	<0.10	<0.10		<10.0	<10.0	69.8	<1.0	<100	<5.0	<5.0	<5.0	<10.0	<50.0	<5.0	<10.0	73.4	<20.0	5.8	<7.0	300	<20.0	<10.0	<50.0
Seep M	0.02	0.65	0.004	0.036	0.05	-	15.7	1	98	<0.2	1600	0.4	E0.1	0.4	2.61	E6	R	20	136	1.1	11.5	<0.1	489	E0.02	2	357
Seep M-dup	0.03	0.64	0.004	0.041	0.05	-	15.1	0.6	97.7	<0.2	1600	0.36	E0.1	0.4	2.53	E6	R	20	139	1	11.5	<0.1	490	<0.04	1	359
Seep M	<0.10	13.2	<0.50	<0.10	<0.10		<10.0	<10.0	92	<1.0	<100	<5.0	<5.0	<5.0	<10.0	<50.0	<5.0	<10.0	25.4	<20.0	5.8	<7.0	235	<20.0	<10.0	<50.0
JS-26	<0.02	1.74	<0.002	E0.004	<0.04	-	<0.1	0.1	49	<0.2	10.4	<0.04	0.3	0.1	4.87	<8	R	2	0.3	E0.1	0.6	<0.1	106	<0.04	0.9	17.2
JS-26	<0.10	2.2	<0.10	<0.10	<0.10	-	<10.0	<10.0	56.8	<1.0	<100	<5.0	<5.0	<5.0	74.7	<50.0	<5.0	<10.0	<5.0	<20.0	5.8	<7.0	108	<20.0	<10.0	187
JS-28	<0.02	0.1	<0.002	E0.004	<0.04	-	<0.1	0.2	118	<0.2	13.2	<0.04	E0.1	0.1	1.03	18	R	3	0.8	0.3	0.59	<0.1	69	<0.04	0.6	9.3
JS-28	<0.10	0.13	<0.10	<0.10	<0.10	-	<10.0	<10.0	118	<1.0	<100	<5.0	<5.0	<5.0	74.7	<50.0	<5.0	<10.0	<5.0	<20.0	5.8	<7.0	71	<20.0	<10.0	<50.0
JS-31	<0.02	2.77	<0.002	E0.005	<0.04	-	<0.1	0.2	57	<2	7.1	0.02	0.3	0.2	-	3	0.3	3	0.4	E0.1	1.5	<0.1	140	<0.04	-	40
JS-31	<0.10	2.8	<0.10	<0.10	<0.10	-	<10.0	<10.0	70.9	<1.0	<100	<5.0	<5.0	<5.0	17.6	<50.0	<5.0	<10.0	<5.0	<20.0	5.8	<7.0	148	<20.0	<10.0	<50.0
PB-17	<0.02	1.48	<0.002	0	<0.04	-	<0.1	0.1	46.8	<0.2	8.5	<0.04	0.2	0.1	2.47	<8	R	2	E0.2	E0.2	0.7	<0.1	102	<0.04	0.8	23
Robller	<0.10	1.7	<0.10	<0.10	<0.10	-	<10.0	<10.0	42.8	<1.0	<100	<5.0	<5.0	<5.0	17.6	<50.0	<5.0	<10.0	<5.0	<20.0	5.8	<7.0	74.4	<20.0	<10.0	<50.0

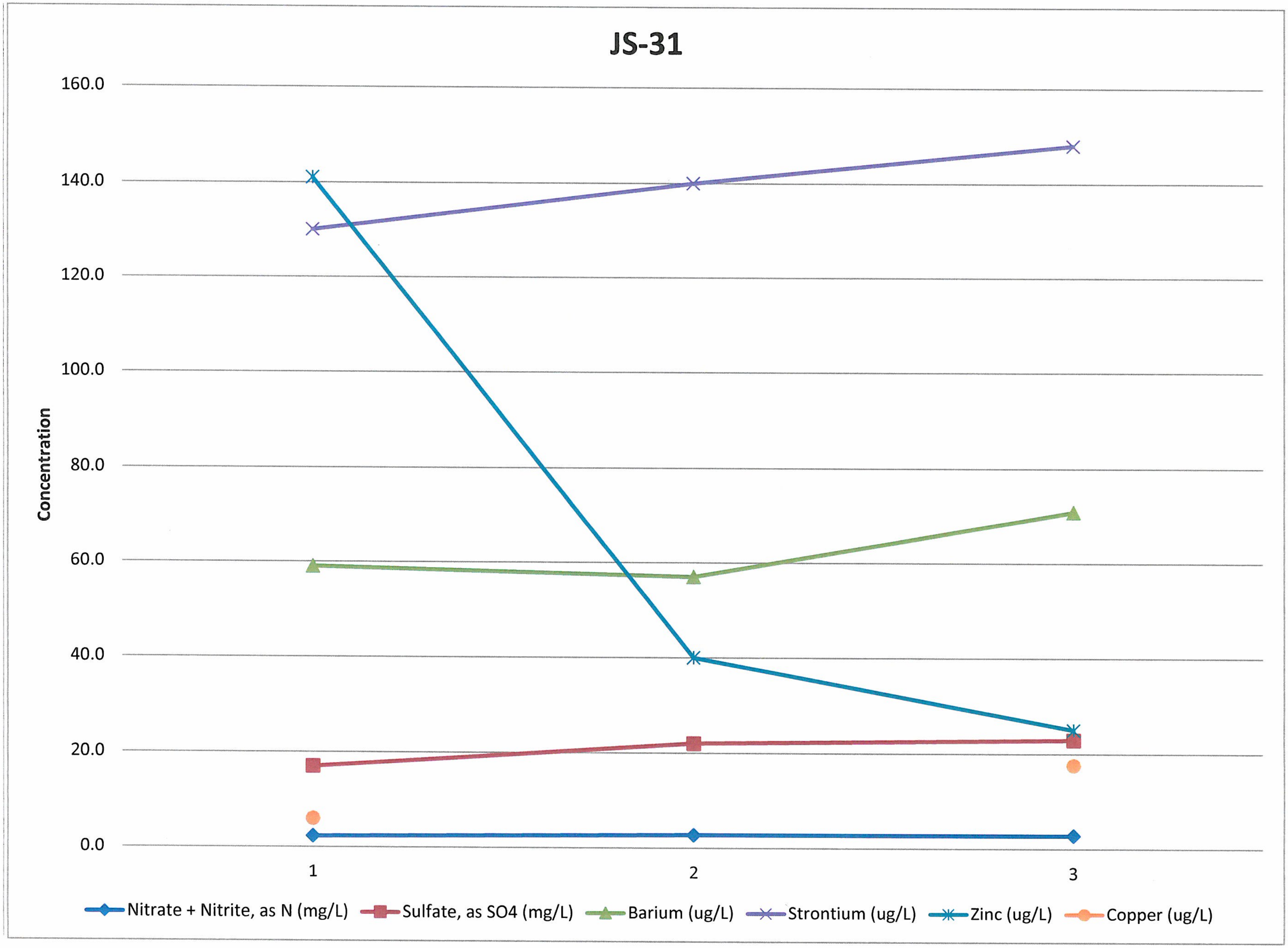
Riverfront Site - OU3 (Concentration Trend for Domestic Well JS-26)



Riverfront Site - OU3 (Concentration Trend for Domestic Well JS-28)

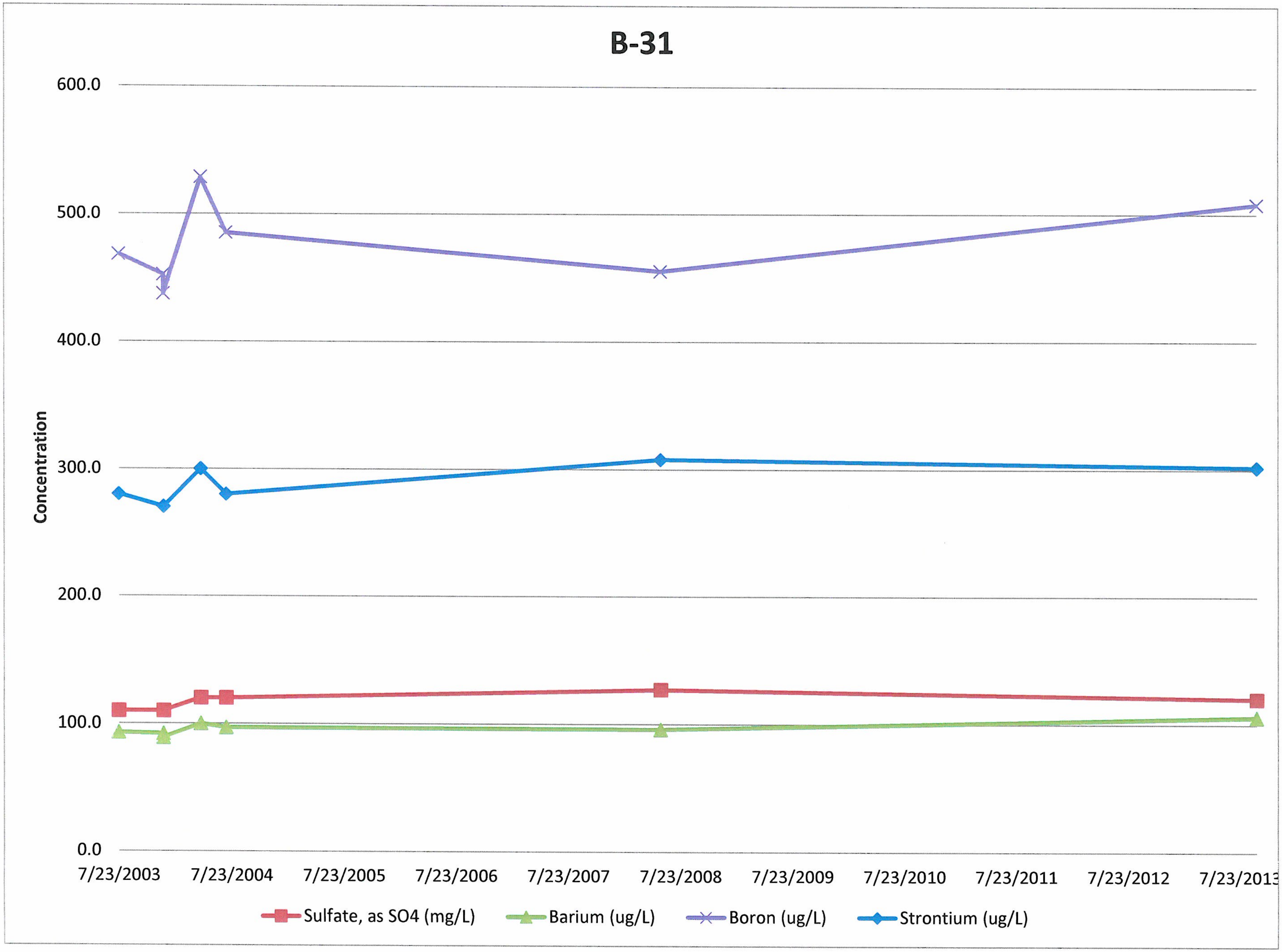


Riverfront Site - OU3 (Concentration Trend for Domestic Well JS-31)



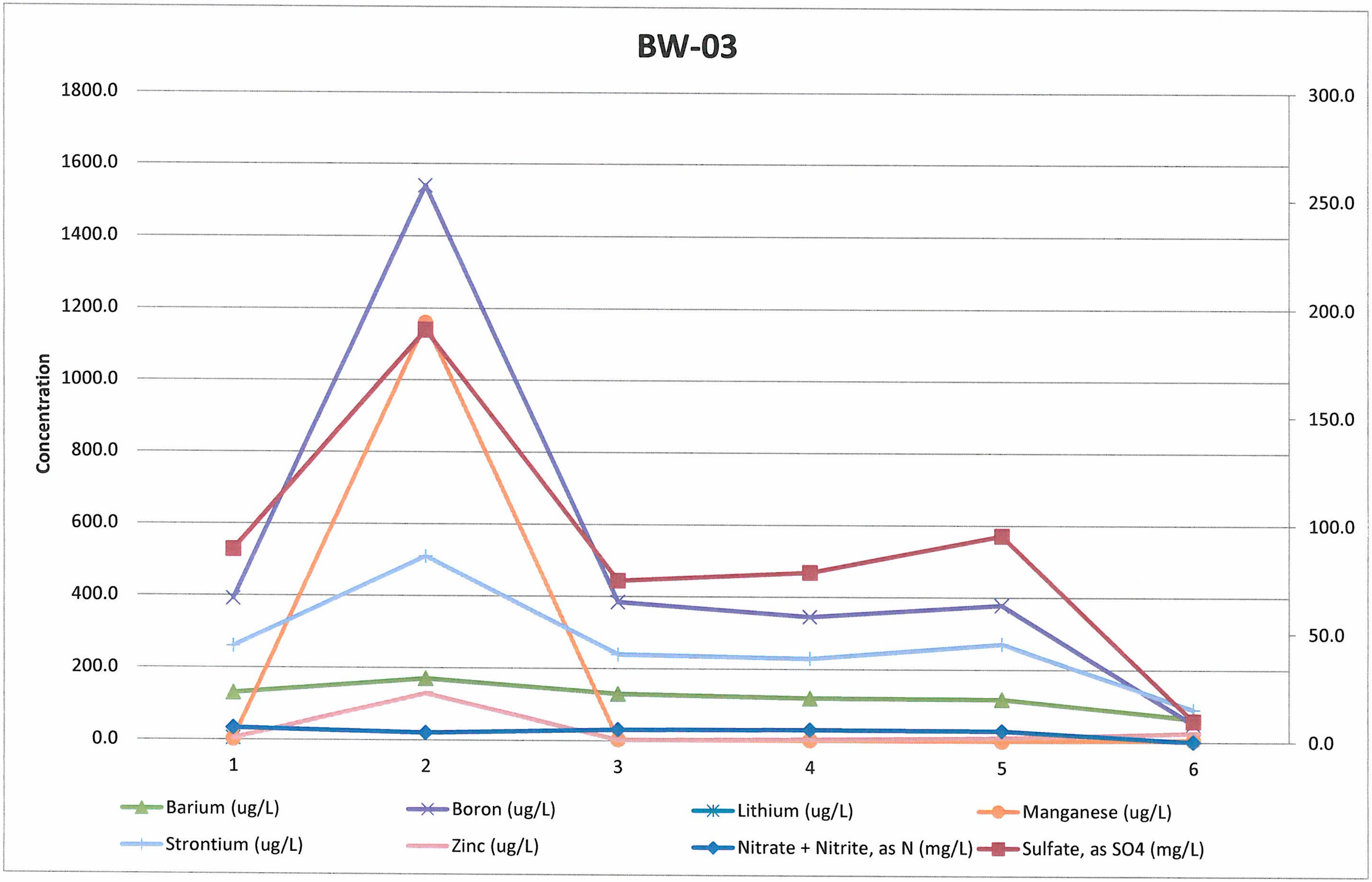
Riverfront Site - OU3 (Concentration Trend for Monitoring Well BW-31A)

Riverfront Site - OU3 (Concentration Trend for Monitoring Well B-31)

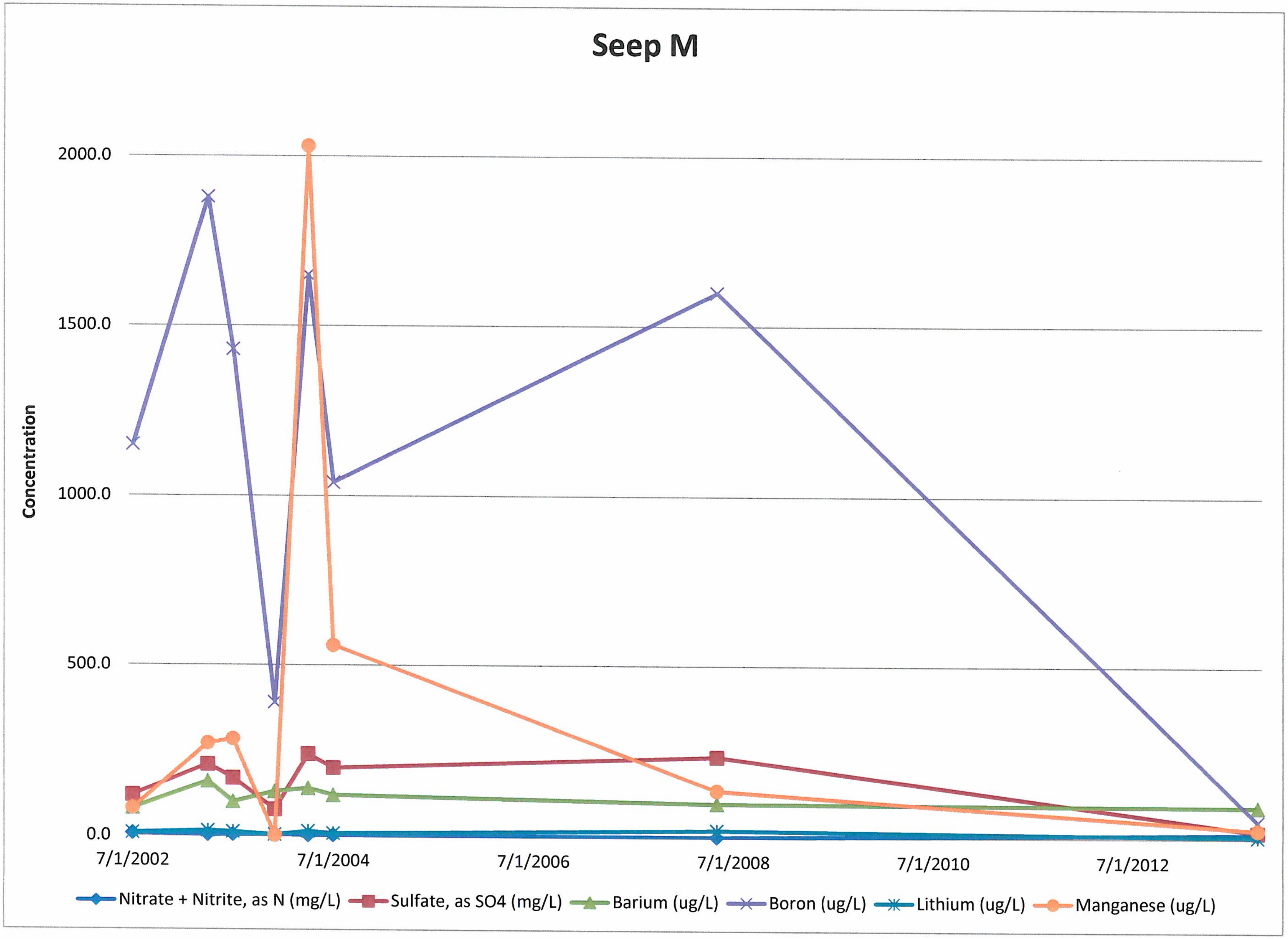


Riverfront Site - OU3 (Concentration Trend for Monitoring Well BW-32)

Riverfront Site - OU3 (Concentration Trend for Monitoring Well BW-03)



Riverfront Site - OU3 (Concentration Trend for Seep M)



ATTACHMENT 4

OU-4

Data Tables

Maiden Lane Site, Riverfront Superfund Site

Riverfront Site
OU4 Historical Soil Sampling Data

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
ML01	9/14/04	0.5	0.5	8.9	0.0		
ML01	9/14/04	2.0	2.0	33.2	26.6		
ML01	9/14/04	4.0	4.0	688.0	158.4		
ML01	9/14/04	6.0	6.0	1,188.0	164.0		
ML01	9/14/04	8.0	8.0	1,652.0	404.2		
ML01	9/14/04	10.0	10.0	1,746.0	532.0		
ML01	9/14/04	12.0	12.0	2,922.0	254.0		
ML01	9/14/04	13.5	13.5	1,674.0	103.4		
ML01	9/14/04	15.2	15.2	2,184.0	65.2		
ML02	9/14/04	2.0	2.0	42.0	0.0		
ML02	9/14/04	3.5	3.5	0.0	0.0		
ML02	9/14/04	6.0	6.0	0.0	0.0		
ML02	9/14/04	8.0	8.0	0.0	0.0		
ML02	9/14/04	10.0	10.0	0.0	0.0		
ML02	9/14/04	11.5	11.5	0.0	0.0		
ML03	9/14/04	2.0	2.0	0.0	0.0		
ML03	9/14/04	3.9	3.9	0.0	0.0		
ML03	9/14/04	5.5	5.5	0.0	0.0		
ML03	9/14/04	7.8	7.8	0.0	0.0		
ML03	9/14/04	10.0	10.0	0.0	0.0		
ML03	9/14/04	11.5	11.5	0.0	0.0		
ML04	9/14/04	2.0	2.0	1.1	0.0		
ML04	9/14/04	4.0	4.0	0.0	0.0		
ML04	9/14/04	6.0	6.0	0.0	0.0		
ML04	9/14/04	9.5	9.5	0.0	0.0		
ML04	10/8/04	11.0	11.0	3.5	0.0		
ML04	10/8/04	13.0	13.0	2.8	0.0		
ML04	10/8/04	14.0	14.0	3.4	0.0		
ML04	10/8/04	16.0	16.0	2.4	0.0		
ML05	9/15/04	2.0	2.0	0.0	0.0		
ML05	9/15/04	3.8	3.8	0.0	0.0		
ML05	9/15/04	6.0	6.0	0.0	0.0		
ML05	9/15/04	8.0	8.0	0.0	0.0		
ML06	9/15/04	0.5	0.5	0.0	0.0		
ML06	9/15/04	2.0	2.0	0.0	0.0		
ML06	9/15/04	4.0	4.0	0.0	0.0		
ML06	9/15/04	6.0	6.0	0.0	0.0		
ML06	9/15/04	8.0	8.0	0.0	0.0		
ML06	9/15/04	9.0	9.0	0.0	0.0		
ML06	9/15/04	11.2	11.2	0.0	0.0		
ML07	9/15/04	0.5	0.5	0.0	0.0		
ML07	9/15/04	2.0	2.0	2.1	0.0		
ML07	9/15/04	4.0	4.0	5.1	0.0		
ML07	9/15/04	6.0	6.0	4.0	0.0		
ML07	9/15/04	8.0	8.0	11.0	82.4		

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
ML08	9/15/04	2.0	2.0	0.0	0.0		
ML08	9/15/04	3.0	3.0	0.0	0.0		
ML08	9/15/04	3.8	3.8	0.0	0.0		
ML08	9/15/04	6.0	6.0	0.9	0.0		
ML08	9/15/04	8.0	8.0	1.1	0.0		
ML08	9/15/04	9.5	9.5	0.0	0.0		
ML08	9/15/04	12.0	12.0	110.0	80.4		
ML08	9/16/04	13.0	13.0	137.0	43.5		
ML08	9/16/04	15.0	15.0	115.0	33.3		
ML09	9/15/04	2.0	2.0	0.0	0.0		
ML09	9/15/04	4.0	4.0	0.0	0.0		
ML09	9/15/04	6.0	6.0	0.0	0.0		
ML09	9/15/04	8.0	8.0	0.0	10.0		
ML09	9/16/04	10.0	10.0	0.0	14.0		
ML09	9/16/04	12.0	12.0	30.9	59.2		
ML09	9/16/04	16.0	16.0	214.0	0.0		
ML11	9/15/04	2.0	2.0	0.0	0.0		
ML11	9/15/04	4.0	4.0	0.0	0.0		
ML11	9/15/04	6.0	6.0	0.0	0.0		
ML12	9/14/04	2.0	2.0	0.0	0.0		
ML12	9/14/04	4.0	4.0	0.0	0.0		
ML12	9/14/04	6.0	6.0	0.0	0.0		
ML12	9/14/04	8.0	8.0	0.0	0.0		
ML12	9/14/04	10.5	10.5	0.0	0.0		
ML13	9/16/04	2.0	2.0	0.0	0.0		
ML13	9/16/04	2.0	2.0	0.0	0.0		
ML13	9/16/04	4.0	4.0	0.0	0.0		
ML13	9/16/04	6.0	6.0	0.0	0.0		
ML13	9/16/04	8.0	8.0	0.0	0.0		
ML13	9/16/04	10.0	10.0	0.0	0.0		
ML13	9/16/04	12.0	12.0	0.0	0.0		
ML13	9/16/04	14.0	14.0	0.0	0.0		
ML201	10/7/04	2.0	2.0	0.0	0.0		
ML201	10/7/04	4.0	4.0	0.0	0.0		
ML201	10/7/04	6.0	6.0	0.0	0.0		
ML201	10/7/04	8.0	8.0	0.0	0.0		
ML202	10/7/04	2.0	2.0	2.7	0.0		
ML202	10/7/04	4.0	4.0	1.2	0.0		
ML202	10/7/04	6.0	6.0	1.4	0.0		
ML202	10/7/04	8.0	8.0	1.2	0.0		

Table 4-1

Riverfront Site

OU4 Historical Soil Sampling Data

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
ML203	10/7/04	2.0	2.0	1.1	0.0		
ML203	10/7/04	4.0	4.0	1.6	0.0		
ML203	10/7/04	6.0	6.0	1.3	4.7		
ML203	10/7/04	8.0	8.0	.9 J	0.0		
ML203	10/7/04	11.0	11.0	86.1	46.6		
ML203	10/7/04	11.0	11.0	90.0	70.4		
ML204	10/07/04	2	2	5,006.0	586.0		
ML204	10/07/04	4	4	8,963.0	5,605.0		
ML204	10/07/04	5.5	5.5	3,500.0	3,460.0		
ML204	10/07/04	7	7	180,000.0	3,320.0		
ML204	10/07/04	9	9	860,000.0	5,850.0		
ML204	10/07/04	10.7	10.7	1,400,000.0	8,081.0		
ML204	10/07/04	11	11	142,100.0	0.0		
ML204	10/07/04	13.5	13.5	500,000.0	854.0		
ML204B	11/20/08	2	2	8,093.3	1,029.3		
ML204B	11/20/08	4	4	2,161,800.0	52,200.0		
ML204B	11/20/08	4.5	5.5			200,000.0	2,600.0
ML204B	11/20/08	7.8	7.8	106,600.0	3,620.0		
ML204B	11/20/08	11	11	183,000.0	4,220.0		
ML204B	11/20/08	13	13.5			320,000.0	0.0
ML204B	11/20/08	14.2	14.2	4,914,800.0	12,460.0		
ML205	10/07/04	2	2	168.0	42.4		
ML205	10/07/04	4	4	4.9	39.0		
ML205	10/07/04	6	6	15.9	298.2		
ML205	10/07/04	7.5	7.5	0.0	554.6		
ML205	10/07/04	11	11	345.0	1,452.6		
ML205	10/07/04	12	12	1,174.8	2,645.6		
ML205	10/07/04	14.5	14.5	26,000.0	2,196.0		
ML205	10/07/04	16	16	15,600.0	1,055.0		
ML205	10/07/04	17.5	17.5	18,600.0	602.7		
ML205B	11/20/08	11	11	890.0	217.0		
ML205B	11/20/08	12	12	629.0	135.0		
ML205B	11/20/08	14	14	1,850.0	511.0		
ML205B	11/20/08	15.5	15.5	222.0	0.0		
ML205B	11/20/08	16.5	17			1.1	0.0
ML205B	11/20/08	17	17	306.0	0.0		
ML206	10/7/04	1.5	2.0	51.8	0.0		
ML206	10/7/04	2.0	2.0	0.0	0.0		
ML206	10/7/04	4.0	4.0	62.8	2.5		
ML206	10/7/04	6.0	6.0	179.6	11.4		
ML206	10/7/04	8.0	8.0	223.2	12.3		
ML206	10/7/04	10.0	10.0	144.4	12.3		
ML206	10/7/04	12.0	12.0	500.2	35.9		
ML206	10/7/04	15.0	15.0	1,283.2	61.3		

Riverfront Site
OU4 Historical Soil Sampling Data

Table 4-1

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
ML401	11/2/05	1.0	1.0	19.2	0.3		
ML401	11/2/05	2.5	2.5	1.0	0.3		
ML401	11/2/05	6.0	6.0	0.0	0.3		
ML401	11/2/05	8.0	8.0	0.0	0.0		
ML401	11/2/05	9.0	9.0	0.0	0.0		
ML401	11/2/05	11.0	11.0	1.4	8.0		
ML402	11/2/05	1.0	1.0	20.8	12.8		
ML402	11/2/05	2.5	2.5	51.2	19.7		
ML402	11/2/05	5.5	5.5	25.6	215.2		
ML402	11/2/05	6.5	7.0	236.0	235.2		
ML402	11/2/05	9.0	9.0	8,560.0	1,824.0		
ML402	11/2/05	11.0	11.0	37,120.0	4,960.0		
ML403	11/2/05	1.0	1.0	93.6	31.2		
ML403	11/2/05	2.0	2.0	118.0	84.8		
ML403	11/2/05	4.0	4.0	315.0	177.0		
ML403	11/2/05	6.0	6.0	421.0	307.0		
ML403	11/2/05	7.0	7.0	573.0	457.0		
ML403	11/2/05	9.0	9.0	531.0	248.0		
ML403	11/2/05	11.0	11.0	1,385.0	293.0		
ML403	11/2/05	13.0	13.0	1,696.0	146.0		
ML404	11/7/05	0.5	1.0	6.7	0.0		
ML404	11/7/05	4.0	4.0	20.6	1.1		
ML404	11/7/05	6.0	6.0	176.0	56.8		
ML404	11/7/05	8.0	8.0	222.0	72.8		
ML404	11/7/05	11.0	11.0	65.6	25.6		
ML404	11/7/05	13.3	13.3	16.6	33.3		
ML405	11/7/05	1.0	1.0	0.0	0.0		
ML405	11/7/05	3.9	3.9	0.0	0.0		
ML405	11/7/05	5.5	6.0	0.0	0.0		
ML405	11/7/05	8.0	8.0	0.0	0.0		
ML405	11/7/05	10.0	10.0	316.8	1,994.0		
ML405	11/7/05	11.3	11.3	3,530.7	1,984.0		
ML405	11/7/05	12.0	12.0	7,520.0	2,860.0		
ML405	11/7/05	13.5	13.5	664.0	272.0		
ML406	11/07/05	1.5	2	520.0	170.0	1,300.0	400.0
ML406	11/07/05	4	4	300,000.0	5,240.0		
ML406	11/07/05	6	6	57,200.0	1,900.0		
ML406	11/07/05	8	8	230,400.0	1,840.0		
ML406	11/07/05	10	10	76,400.0	1,400.0		
ML406	11/07/05	12	12	64,400.0	720.0		
ML406	11/07/05	14	14	240,000.0	848.0		
ML406	11/07/05	15.4	15.8	2,000,000.0	11,200.0	890,000.0	0.0
ML406	11/07/05	16	16	8,000,000.0	42,800.0		
ML406	11/07/05	17	17	4,000,000.0	13,000.0		

Riverfront Site

Table 4-1

OU4 Historical Soil Sampling Data

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
ML407	11/08/05	1	1	0.0	0.0		
ML407	11/08/05	4	4	0.0	2.2		
ML407	11/08/05	6	6	0.0	1.8		
ML407	11/08/05	8	8	195.0	806.0		
ML407	11/08/05	12	12	856.0	1,094.0		
ML407	11/08/05	15.5	16			680.0	57.0
ML407B	11/19/08	1	1	0.0	0.0		
ML407B	11/19/08	4	4	110.0	750.0		
ML407B	11/19/08	8	8	2,130.0	4,480.0		
ML407B	11/19/08	13.5	13.5	2,160.0	8,800.0		
ML407B	11/19/08	17	17.5			820.0	59.0
ML407B	11/19/08	17.5	17.5	8,700.0	430.0	0.0	0.0
ML408	11/08/05	0.5	1	1,676.0	252.0	1,500.0	130.0
ML408	11/08/05	4	4	85,900.0	1,374.0		
ML408	11/08/05	5.8	6.3	778,600.0	4,274.0	670,000.0	0.0
ML408	11/08/05	8	8	2,759,200.0	14,420.0		
ML408	11/08/05	12	12	2,798,800.0	15,520.0		
ML408	11/08/05	16	16	3,012,800.0	14,404.0		
ML408	11/08/05	17.2	18			6,100,000.0	0.0
ML408	11/08/05	19	19	2,839,600.0	7,200.0		
ML408B	11/20/08	1	1	1,365.0	201.5		
ML408B	11/20/08	3	3	550,000.0	3,430.0		
ML408B	11/20/08	6	6	390,500.0	1,770.0		
ML408B	11/20/08	5.8	6.3			240,000.0	0.0
ML408B	11/20/08	8	8	1,086,600.0	0.0		
ML408B	11/20/08	12	12	1,727,200.0	9,740.0		
ML408B	11/20/08	16.7	16.7	1,813,400.0	2,180.0		
ML408B	11/20/08	16.7	17.2			1,600,000.0	0.0
ML409	11/8/05	1.0	1.0	0.0	0.5		
ML409	11/8/05	4.0	4.0	0.0	0.0		
ML409	11/8/05	7.8	7.8	0.0	0.0		
ML409	11/8/05	11.5	11.5	11.2	0.0		
ML409	11/8/05	14.2	14.2	320.0	57.6		
ML410	11/8/05	1.0	1.5	0.0	0.0		
ML410	11/8/05	4.0	4.0	0.0	0.0		
ML410	11/8/05	7.5	7.5	0.0	0.0		
ML410	11/8/05	8.5	8.5	0.0	0.0		
ML410	11/8/05	10.0	10.0	42.7	0.0		
ML410	11/8/05	11.0	11.0	128.0	30.4		
ML410	11/8/05	15.5	15.5	17.9	17.6		
ML410	11/8/05	17.0	17.0	0.0	0.0		

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
ML411	11/08/05	1	1	0.0	0.0	0.0	0.0
ML411	11/08/05	4	4	0.0	11.2	0.0	0.0
ML411	11/08/05	8	8	56.3	23.5	0.0	0.0
ML411	11/08/05	11	11	348.3	34.6	0.0	0.0
ML411	11/08/05	12	12	184.8	17.6	0.0	0.0
ML411B	11/19/08	1	1	0.0	0.0		
ML411B	11/19/08	2	2	0.0	0.0		
ML411B	11/19/08	4	4	0.0	0.0		
ML411B	11/19/08	6	6	43.3	6.7		
ML411B	11/19/08	7.5	7.5	55.0	4.0		
ML411B	11/19/08	9.5	9.5	224.0	16.0		
ML411B	11/19/08	11.5	11.5	6.0	0.0		
ML411B	11/19/08	13.2	13.2			18.0	1.6
ML411B	11/19/08	14.6	14.6	0.0	0.0		
ML502	1/30/07	6.0	6.0	18.0	2,460.0		
ML502	1/30/07	8.9	8.9	727.2	1,650.0		
ML502	1/30/07	11.7	11.7	6,360.0	4,020.0		
ML502	1/30/07	13.0	13.0	15,900.0	6,350.0		
ML502	1/30/07	15.0	15.0	26,000.0	2,250.0		
ML504	1/30/07	8.0	8.0	762,000.0	10,200.0		
ML504	1/30/07	11.0	11.0	63,500.0	1,200.0		
ML505	1/30/07	12.0	12.0	1,640.0	700.0		
ML601	11/20/08	10.8	10.8	17,200.0	495.0		
ML601	11/20/08	13	13	397,600.0	430.0		
ML601	11/20/08	15	15	800,000.0	0.0		
ML601	11/20/08	17	17	2,388,000.0	0.0		
ML601	11/20/08	16.5	17			9,400.0	46.0
ML601	11/20/08	18	18	42,400.0	0.0		
ML602	11/19/08	1	1	316.7	70.0		
ML602	11/19/08	1	1.5			920.0	180.0
ML602	11/19/08	3.8	3.8	5,150.0	448.0		
ML602	11/19/08	5.5	5.5	8,640.0	920.0		
ML602	11/19/08	7.5	7.5	6,450.0	1,300.0		
ML602	11/19/08	9.5	9.5	7,625.0	1,881.3		
ML602	11/19/08	11.5	11.5	3,540.0	5,480.0		
ML602	11/19/08	12.9	13.9			24.0	1.4
ML602	11/19/08	13.9	13.9	16,333.3	458.3		
ML603	11/19/08	1	2			87.0	140.0
ML603	11/19/08	2	2	320.0	670.0		
ML603	11/19/08	3.6	3.6	2,380.0	589.0		
ML603	11/19/08	6	6	2,080.0	950.0		
ML603	11/19/08	7.5	7.5	7,940.0	1,900.0		
ML603	11/19/08	11.5	11.5	2,380.0	640.0		
ML603	11/20/08	13.5	13.5	10,100.0	680.0		
ML603	11/20/08	13.5	14.3			680.0	25.0

Riverfront Site

OU4 Historical Soil Sampling Data

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
ML604	11/19/08	1	1	24.0	9.0		
ML604	11/19/08	1	1.5			31.0	5.6
ML604	11/19/08	4	4	2,568.0	552.0		
ML604	11/19/08	7.3	7.3	36,300.0	750.0		
ML604	11/19/08	7.5	8.5			1,100.0	53.0
ML604	11/19/08	9.8	9.8	2,084.0	60.0		
ML604	11/19/08	11.5	11.5	1,200.0	12.0		
ML604	11/19/08	14.4	14.4	60.0	0.0		
ML605	11/19/08	1	1	0.0	0.0		
ML605	11/19/08	2	2.5			8.7	0.6
ML605	11/19/08	4	4	0.0	0.0		
ML605	11/19/08	7	7	0.0	0.0		
ML605	11/19/08	10	10	0.0	0.0		
ML605	11/19/08	12	12	0.0	0.0		
ML605	11/19/08	14	14.5			44.0	43.0
ML605	11/19/08	15.2	15.2	0.0	0.0		
ML6A	10/8/04	1.0	1.0	1.5	0.0		
ML6A	10/8/04	4.0	4.0	2.5	0.0		
ML6A	10/8/04	5.5	5.5	7.7	0.9		
ML6A	10/8/04	7.0	7.0	7.8	23.5		
ML6A	10/8/04	10.0	10.0	2.0	1.4		
ML6A	10/8/04	13.3	13.3	1.7	1.0		
ML6A	10/8/04	15.3	15.3	1.7	11.5		
ML6A	10/8/04	17.0	17.0	1.9	18.3		
ML6A	10/8/04	19.0	19.0	5.9	27.3		
ML6A	10/8/04	19.5	19.5	14.4	31.9		
ML6A	10/8/04	21.0	21.0	39.3	20.1		
ML6A	10/8/04	23.0	23.0	70.0	0.0		
P10	11/13/2009	2	2.00	1,938,000.0	29,600.0		
P10	11/13/2009	4	4.00	10,000,000.0	488,000.0		
P10	11/13/2009	8	8.00	22,000,000.0	260,000.0		
P10	11/13/2009	12	12.00	91,075,000.0	65,000.0		
P4	11/12/2009	2	2.00	0.0	0.0		
P4	11/12/2009	6	6.00	0.0	0.4		
P4	11/12/2009	8	8.00	19.3	1.9		
P4	11/12/2009	9.8	9.80	90.0	14.8		
Q6	11/12/2009	2	2.00	306.7	308.0		
Q6	11/12/2009	4	4.00	1,560.0	434.0		
Q6	11/12/2009	6	6.00	1,120.0	249.3		
Q6	11/12/2009	8	8.00	1,416.0	434.0		
Q6	11/12/2009	9.7	9.70	1,773.3	575.3		
Q6	11/12/2009	11.4	11.40	54,300.0	6,760.0		

Riverfront Site

OU4 Historical Soil Sampling Data

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
Q8	11/12/2009	2	2.00	59,800.0	4,040.0		
Q8	11/12/2009	4	4.00	51,750.0	10,725.0		
Q8	11/12/2009	6	6.00	29,400.0	10,980.0		
Q8	11/12/2009	8	8.00	264,750.0	12,150.0		
Q8	11/13/2009	11.5	11.50	1,500,000.0	570.0		
R3	11/13/2009	2	2.00	148.0	0.0		
R3	11/13/2009	4	4.00	4,140.0	1,060.0		
R3	11/13/2009	8	8.00	132.8	24.0		
R3	11/13/2009	12	12.00	536.0	68.0		
R5	11/13/2009	2	2.00	170.0	260.0		
R5	11/13/2009	4	4.00	1,710.0	608.0		
R5	11/13/2009	8	8.00	3,440.0	670.0		
R5	11/13/2009	8.8	8.80	6,390.0	560.0		
R5	11/13/2009	10.8	10.80	870.0	33.0		
S6	11/13/2009	1	1.00	474,000.0	31,400.0		
S6	11/12/2009	2	2.00	88,200.0	1,280.0		
S6	11/12/2009	6	6.00	10,000,000.0	13,000.0		
T1	11/13/2009	2	2.00	340.0	0.0		
T1	11/13/2009	4	4.00	80.0	40.0		
T1	11/13/2009	8	8.00	680.0	246.7		
T1	11/13/2009	10	10.00	966.7	86.7		
T1	11/13/2009	14	14.00	109,133.3	293.3		
T3	11/12/2009	2	2.00	98.0	712.0		
T3	11/12/2009	4	4.00	5,640.0	1,188.0		
T3	11/12/2009	6	6.00	8,720.0	540.0		
T3	11/12/2009	8	8.00	860,000.0	7,125.0		
T3	11/12/2009	10	10.00	25,000,000.0	69,500.0		
T3	11/12/2009	12	12.00	27,500,000.0	74,250.0		
T3	11/12/2009	13.8	13.80	56,500.0	250.0		
T8	11/13/2009	2	2.00	66.0	120.0		
T8	11/13/2009	4	4.00	962.0	336.0		
T8	11/13/2009	8	8.00	2,460.0	68.0		
T8	11/13/2009	12	12.00	0.0	0.0		
U5	11/13/2009	2	2.00	2,016.0	288.0		
U5	11/13/2009	4	4.00	5,850.0	375.0		
U5	11/13/2009	8	8.00	5,850.0	110.0		
U5	11/13/2009	11.7	11.70	9,510.0	160.0		
V0	11/13/2009	2	2.00	165.5	53.5		
V0	11/13/2009	4	4.00	360.4	76.0		
V0	11/13/2009	8	8.00	5,033.3	328.7		
V0	11/13/2009	10.7	10.70	0.0	0.0		

Table 4-1

Riverfront Site

OU4 Historical Soil Sampling Data

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
V3	11/13/2009	2	2.00	5,080.0	1,248.0		
V3	11/13/2009	4	4.00	1,000.0	78.8		
V3	11/13/2009	8	8.00	1,754.0	140.0		
V3	11/13/2009	12	12.00	1,944.0	86.4		
V3	11/13/2009	13	13.00	640.0	30.0		
V3	11/13/2009	14	14.00	12,160.0	78.8		
D14	11/18/2009	1	1.00	105.0	41.0		
D14	11/18/2009	4	4.00	680.0	250.0		
D16	11/18/2009	0.5	0.50	281.0	0.0	12.0	
D16	11/18/2009	1.5	1.50	31.6	0.0		
D16	11/18/2009	4	4.00	46.4	46.0		
D16	11/18/2009	6	6.00	0.1	0.0		
D16	11/18/2009	10	10.00	60.0	300.0		
D16	11/18/2009	14	14.00	690.0	30.7		
D16	11/18/2009	16	16.00	10,450.0	115.0		
D16	11/18/2009	19.5	19.50	22,000.0	200.0		
D18	11/18/2009	1	1.00	37.2	0.0		
D18	11/18/2009	4	4.00	47.0	160.0		
F16	11/18/2009	1	1.00	680.0	23.0	91.0	8.5
F16	11/18/2009	4	4.00	130.0	0.0		
F16	11/18/2009	8	8.00	0.1	0.0		
F16	11/18/2009	12	12.00	0.1	185.0		
F16	11/18/2009	16	16.00	1,605.0	220.0		
F16	11/18/2009	18.5	18.50	7,690.0	83.0		
H13	11/18/2009	2	2.00	0.1	0.0		
H13	11/18/2009	4	4.00	0.1	0.0		
H13	11/18/2009	6	6.00	0.1	0.0		
H13	11/18/2009	8	8.00	0.1	0.0		
H13	11/18/2009	12	12.00	0.1	6.7		
H13	11/19/2009	14	14.00	0.1	0.0		
H13	11/19/2009	16	16.00	0.1	0.0	0.1	
I14	11/18/2009	1	1.00	0.1	0.0		
I14	11/18/2009	4	4.00	22.0	0.0		
I14	11/18/2009	6	6.00	0.1	0.0		
I14	11/18/2009	8	8.00	0.1	0.0	1.3	
I15	11/19/2009	2	2.00	0.1	0.0		
I15	11/19/2009	4	4.00	1,790.0	630.0		
I15	11/19/2009	6	6.00	23.0	450.0		
I15	11/19/2009	8	8.00	4,175.0	3,300.0		
I15	11/19/2009	10	10.00	301,000.0	27,750.0		
I15	11/19/2009	12	12.00	10,000,000.0	87,200.0	210000.0	770.0
I18	11/19/2009	1.5	1.50	0.1	23.0		
I18	11/19/2009	4	4.00	123,800.0	53,300.0		
I18	11/18/2009	6	6.00	17,750,000.0	877,500.0	230000.0	
I18	11/18/2009	12	12.00	49,590,000.0	54,000.0		

Riverfront Site

OU4 Historical Soil Sampling Data

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
J15	11/19/2009	2	2.00	5,200.0	148.0		
J15	11/19/2009	4	4.00	7,840,000.0	9,500.0		
J15	11/19/2009	6	6.00	13,250,000.0	43,500.0		
J15	11/18/2009	8	8.00	2,817,500.0	2,000.0	43000.0	
J18	11/19/2009	2	2.00	120.0	7.0		
J18	11/19/2009	4	4.00	0.1	0.0		
J18	11/19/2009	6	6.00	15,000.0	32,750.0		
J18	11/19/2009	8	8.00	215.0	800.0		
J18	11/19/2009	12	12.00	10,750.0	48,750.0		
K15	11/19/2009	2	2.00	460.0	2,120.0		
K15	11/19/2009	4	4.00	47,500.0	10,100.0		
K15	11/19/2009	6	6.00	236,250.0	19,625.0		
K15	11/19/2009	8	8.00	1,622,500.0	0.0		
L15	11/19/2009	2	2.00	216.0	290.0		
L15	11/19/2009	4	4.00	0.1	101.0		
L15	11/19/2009	6	6.00	8,710.0	3,210.0		
L15	11/19/2009	8	8.00	149,000.0	26,500.0		
L15	11/19/2009	10	10.00	17,250.0	2,800.0		
L15	11/19/2009	12	12.00	40,600.0	160,600.0		
M15	11/19/2009	2	2.00	240.0	22.0		
M15	11/19/2009	4	4.00	240.0	480.0		
M15	11/19/2009	6	6.00	100.0	2,320.0		
M15	11/19/2009	8	8.00	1,800.0	4,275.0		
N15	11/19/2009	2	2.00	70.0	8.0		
N15	11/19/2009	4	4.00	2,280.0	540.0		
N15	11/19/2009	6	6.00	950.0	540.0		
N15	11/19/2009	8	8.00	71,400.0	10,220.0		
N15	11/19/2009	10	10.00	3,804,000.0	24,200.0	21000.0	600.0
N15	11/19/2009	12	12.00	177,500.0	2,775.0		
O15	11/19/2009	2	2.00	130.0	39.0		
O15	11/19/2009	4	4.00	7,880.0	1,410.0		
O15	11/19/2009	6	6.00	37,400.0	2,060.0		
O15	11/19/2009	8	8.00	12,500,000.0	122,250.0	300000.0	1200.0
P15	11/19/2009	2	2.00	0.1	0.0		
P15	11/19/2009	4	4.00	0.1	18.0		
P15	11/19/2009	6	6.00	1,940.0	832.0		
P15	11/19/2009	8	8.00	13,500.0	2,880.0		
P4	11/12/2009	2	2.00	0.1	0.0		
P4	11/12/2009	6	6.00	0.1	0.4		
P4	11/12/2009	8	8.00	19.3	1.9		
P4	11/12/2009	9.8	9.80	90.0	14.8		

Table 4-1

Riverfront Site

OU4 Historical Soil Sampling Data

LOCATION	Date	Top	Bottom	PCE	TCE	PCE Lab	TCE Lab
R0	9/1/2010	2	2.00	13.7	0.4		
R0	9/1/2010	4	4.00	3.0	0.0		
R0	9/1/2010	6	6.00	57.6	0.0		
R0	9/1/2010	8	8.00	112.8	0.5		
R0	9/1/2010	11.2	11.20	140.4	0.5		
R0	9/1/2010	9.5	9.50	256.8	1.5		
W0	9/1/2010	2	2.00	92.8	19.4		
W0	9/1/2010	4	4.00	6.0	6.6		
W0	9/1/2010	5.7	5.70	6.0	6.8		
W0	9/1/2010	7.4	7.40	4.0	4.0		
W0	9/1/2010	10	10.00	314.7	9.3		
W0	9/1/2010	11.5	11.50	2,480.0	58.0		
T-2	9/1/2010	2	2.00	15.3	0.0		
T-2	9/1/2010	4	4.00	28.0	0.0		
T-2	9/1/2010	6	6.00	17.0	1.9		
T-2	9/1/2010	8	8.00	16.0	5.6		
T-2	9/1/2010	10.5	10.50	3.8	1.4		
T-2	9/1/2010	9	9.00	2.8	6.8		
V-2	9/1/2010	2	2.00	0.0	0.0		
V-2	9/1/2010	4	4.00	3.7	0.0		
V-2	9/1/2010	6	6.00	0.0	0.0		
V-2	9/1/2010	7.7	7.70	0.0	0.0		
V-2	9/1/2010	10	10.00	0.0	0.0		
V-2	9/1/2010	11.5	11.50	533.6	73.6		
V-2	9/1/2010	11.8	11.80	548.0	24.0		
X-2	9/1/2010	2	2.00	63.6	2.3		
X-2	9/1/2010	4	4.00	18.0	0.0		
X-2	9/1/2010	6	6.00	116.8	0.0		
X-2	9/1/2010	8	8.00	0.0	0.0		
X-2	9/1/2010	10	10.00	0.0	0.0		
X-2	9/1/2010	11.5	11.50	89.0	27.0		
L22	9/2/2010	2	2.00	0.0	0.0		
L22	9/2/2010	4	4.00	0.0	0.0		
L22	9/2/2010	6	6.00	3.2	0.0		
L22	9/2/2010	7.5	7.50	0.0	0.0		
L22	9/2/2010	10	10.00	0.0	0.0		
L22	9/2/2010	14	14.00	1,664.0	3,040.0		
L22	9/2/2010	15.9	15.90	6,640.0	6,240.0		
L22	9/2/2010	18	18.00	4,280.0	1,036.0		

ATTACHMENT 4

OU-5

Data Tables

Old Hat Factory Site, Riverfront Superfund Site

Table 5-1
COC Results Summary
Riverfront OU5 Site

Well Number	Sample Date	Method of Collection	Depth (ft btoc)	PCE (ug/L)		Carbon Tetrachloride (ug/L)		TCE (ug/L)	
BW-09	10/27/2004 [1]	submersible pump	NA	0.46	J	1	U	1	U
	2/1/2005 [1]			0.49	J	1	U	1	U
	9/21/2005 [1]			0.70	J	1	U	1	U
	10/29/2007 [1]			2.3		1	U	1	U
	10/23/2008 [1]			0.87	J	1	U	1	U
	10/28/2008	passive diffusion bag	166.1	0.59		0.5	U	0.5	U
	5/27/2009			0.50	U	0.5	U	0.5	U
	10/13/2009			1	U	1	U	1	U
	4/20/2010			0.80		0.5	U	0.5	U
	10/25/2010			0.84	J	0.5	U	0.5	U
	10/17/2011			1.40	J*	1	U	1	U
	10/15/2012			3.70		1	U	1	U
	10/22/2013			2.6	J	1	U	1	U
BW-09A	7/29/2002 [1]	bailer	NA	***49***		ND		ND	
	8/12/2003 [1]			***37***		ND		ND	
	8/19/2004 [1]			***27***		1	U	1	U
	2/1/2005			***110***		1	U	1	U
	6/14/2005 [1]			***52***		2	U	2	U
	9/21/2005 [1]			***47***		2	U	2	U
	10/25/2007 [1]			***24***		1	U	1	U
	10/28/2008	passive diffusion bag	39.7	***30 (26)***		0.5	U	3.2 (3.1)	
	5/27/2009			***7.9***		0.5	U	1.8	
	10/13/2009			***19***	***J***	1	U	2.8	
	4/20/2010			***35***		0.5	U	***7.1***	
	10/25/2010			***19***	***J***	0.5	U	***7.5***	
	10/17/2011			***24***	***J****	1	U	***7.0***	
	10/15/2012			***19***		1	U	***7.1***	
	10/22/2013			***15***	***J***	1	U	***5.6***	***J***
BW-12A	4/26/2004 [1]	submersible pump	NA	1	U	ND		ND	
	8/19/2004 [1]			0.49	J	1	U	1	U
	2/1/2005 [1]			0.23	J	1	U	1	U
	9/21/2005 [1]			1	U	1	U	1	U
	9/20/2006 [1]			1	U	1	U	1	U
	10/28/2008	passive diffusion bag	40	0.5	U	0.5	U	0.5	U
	5/27/2009			0.5	U	0.5	U	0.5	U
	10/13/2009			1	U	1	U	1	U
	4/20/2010			0.5	U	0.5	U	0.5	U
	10/25/2010			0.5	U	0.5	U	0.5	U
	10/17/2011			1	U	1	U	1	U
	10/15/2012			1	U	1	U	1	U
	10/22/2013			1	U	1	U	1	U

See notes at bottom of next page.

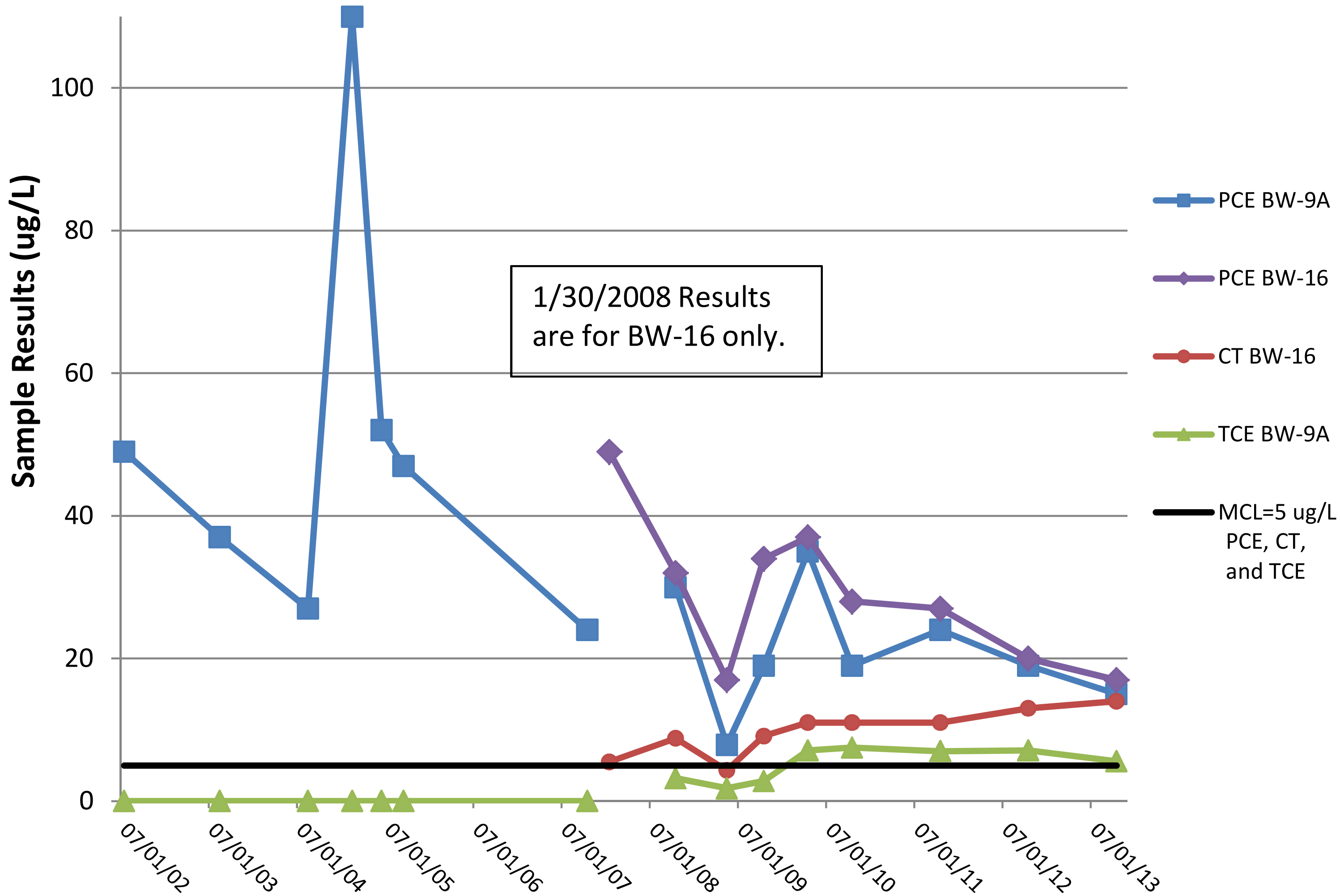
Table 5-1
COC Results Summary
Riverfront OU5 Site

Well Number	Sample Date	Method of Collection	Depth (ft btoc)	PCE (ug/L)	Carbon Tetrachloride (ug/L)	TCE (ug/L)
BW-15	1/30/2008	bailer	NA	0.5 U	0.5 U	
	10/28/2008	passive diffusion bag	70.5	NS	NS	NS
			73.5	0.5 U	0.5 U	0.5 U
			76.5	0.5 U	0.5 U	0.5 U
			79.5	0.5 U	0.5 U	0.5 U
	5/27/2009		70.5	NS	NS	NS
			73.5	0.5 U	0.5 U	0.5 U
			76.5	0.5 U	0.5 U	0.5 U
			79.5	0.5 U	0.5 U	0.5 U
	10/13/2009		70.5	1 U	1 U	1 U
			73.5	1 U	1 U	1 U
			76.5	1 U	1 U	1 U
			79.5	1 U	1 U	1 U
	4/20/2010		70.5	0.5 U	0.5 U	0.5 U
			73.5	0.5 U	0.5 U	0.5 U
			76.5	0.5 U	0.5 U	0.5 U
			79.5	0.5 U	0.5 U	0.5 U
	10/25/2010		76.5	0.5 UJ	0.5 U	0.5 U
	10/17/2011		76.5	1 U	1 U	1 U
	10/15/2012		79.5	1 U	1 U	1 U
	10/22/2013		79.5	1 U	1 U	1 U
BW-16	1/30/2008	bailer	NA	***49 (19)***	***5.5 (5.0)***	
	10/28/2008	passive diffusion bag	70	NS	NS	NS
			73	***27***	***7.7***	0.5 U
			76	***32***	***8.8***	0.5 U
	5/27/2009		70	***17***	4.2	0.5 U
			73	***17***	4.3	0.5 U
			76	***15 (17)***	4.2 (4.5)	0.5 U
	10/13/2009		70	***33***	***7.4***	1 U
			73	***34***	***7.7***	1 U
			76	***29 (30)***	***9.1 (9.1)***	1 U
	4/20/2010		70	***37***	***9.1***	0.5 U
			73	***37 (38)***	***8.5 J (9.6)***	0.5 U
			76	***31***	***11***	0.5 U
	10/25/2010		73	***28 (27) J***	***11 (8.0)***	1.2 (1.1)
	10/17/2011		73	***27 (19) J****	***11 (7.2) J****	1.1 (1 U)
	10/15/2012		76	***20 (21)***	***13 (14)***	1.1 (1.2)
	10/22/2013		76	***17 (19)***	***14 (16)***	1.1 J (1.3 J)

Notes:

1 - Provided by USGS 2009a.
U = Not detected at or above the reportable level shown.
J = The associated numerical value is an estimated quantity.
J * = Result estimated due to relative percent difference (RPD) out of range.
NS = Not sampled because PDB not covered by groundwater.
ft btoc = feet below top of casing.
ug/L = micrograms per liter.
ND = Non-detect result.
Italic BOLD results indicate contaminant was detected above the PCE, TCE and CT cleanup levels (5 ug/L).
Duplicate results are shown in parentheses.
The OU5 COC chloroform was not detected in any of the Fall 2008, Spring 2009, and Fall 2009/2011/2012/2013 samples.
In April 2010 chloroform was detected at 0.62 ug/L in the 76 ft btoc sample in BW-16.
In October 2010 chloroform was detected at 0.60 ug/L in the primary sample and at 0.61 ug/L in the duplicate sample from 73 ft btoc in well BW-16.
Two other VOCs have been detected once each at low concentrations since October 2008.
In October 2009 cyclohexane was detected at 1 ug/L in the 76 ft btoc sample in BW-16.
In October 2010 methyl acetate was detected at 0.78 ug/L in the 39.7 ft btoc sample in BW-9A.

Figure 5-2
Riverfront OU5 Contaminants of Concern
Well BW-09A & BW-16 Results



Attachment 5
Institutional Control Documents

Rules of the Department of Natural Resources
Division 23, Chapter 3

Title 10 CSR 23-3.010 Location of Wells

10 CSR 23-3.100 Sensitive Areas

Applies to OU1, OU2, OU3, OU4, OU5, and OU6

Rules of
Department of Natural Resources
Division 23—Division of Geology and Land Survey
Chapter 3—Well Construction Code

Title 10—DEPARTMENT OF NATURAL RESOURCES
Division 23—Division of Geology and Land Survey
Chapter 3—Well Construction Code

10 CSR 23-3.010 Location of Wells

Editor's Note: Area maps mentioned in the rule may be found following 10 CSR 23-3.110.

PURPOSE: This rule sets criteria as to the areas a well should be placed.

(1) A well shall be located consistent with the general layout and surrounding area giving due consideration of the size of the lot, contour of the land, the water table, soil deposits, rock formation, local groundwater conditions and other factors necessary to implement the basic policies that follow:

(A) A well shall be—

1. Located on a site which has good surface drainage and, if possible, at a higher elevation than possible sources of contamination. The top of the casing shall extend at least one foot (1') above the finished surface grade;

2. Located so that the well and its surrounding area can be kept in a sanitary condition and provide ready access for repairs, maintenance and inspection;

3. Adequately sized, designed and developed for the intended use;

4. Constructed so as to maintain existing natural protection against pollution of water-bearing formations and to exclude all known sources of contamination from the well including sources of contamination from adjacent property;

5. Located so that proper drainage in the vicinity of the well shall be provided so as to prevent the accumulation and ponding of surface water within ten feet (10') of the well; and

6. If at all possible, located in areas that do not flood. If no reasonable alternative site exists, wells may be constructed in floodplains provided special construction is included. The casing of the well shall terminate not less than two feet (2') above the maximum known floodwater elevation or when flooding is eminent, well vent must be sealed and well discontinued from operation until floodwater subsides.

(2) Lateral distances from Pollution or Contamination Sources.

(A) A well shall be at least—

1. Three hundred feet (300') from a storage area for commercial fertilizers or chemicals, landfill, lagoon, above ground or underground storage, tank distribution lines for liquid petroleum, petroleum products or chemicals. Petroleum or petroleum products that are not liquid at standard temperatures and pressure are exempt from these set-back requirements;

2. Three hundred feet (300') from earthen, concrete or other manure storage structures or lagoons, from land application areas for domestic or animal waste and from animal composting facilities except as stated in paragraph (2)(A)4. of this rule;

3. One hundred feet (100') from cesspools and unplugged abandoned wells, except as noted in paragraph (2)(A)6. of this rule;

4. One hundred feet (100') from a subsurface disposal field, grave, single family lagoon, building or yard used for livestock or poultry, bird composting facility constructed with a concrete floor cell design covered with a roof, dry litter storage within a poultry building as accumulation of litter occurs during normal facility operations, privy or other contaminants that may drain into the soil;

5. Fifty feet (50') from a buried sewer, septic tank or sewer holding tank, a pit or unfilled space below ground surface, a sump, an existing operating well, except that a well may be drilled closer than fifty feet (50') to a basement and an above ground petroleum storage tank if it is necessary for the operation of the well pump;

6. Wells with casings less than eighty feet (80') in depth and not encountering at least ten feet (10') of impervious material shall be located at least one hundred fifty feet (150') from cesspools and unplugged abandoned wells and at least one hundred fifty feet (150') from a subsurface disposal field, and septic tank, manure storage pile or similar source of contamination. For example, a manure storage pile would be considered as a potential source of contamination to the well; however, the presence of animals in open pasture in an area would not necessarily concentrate contaminants to the degree that would cause contaminants to enter the groundwater; and

7. Ten feet (10') from the right-of-way of any federal, state or county road.

(B) Waste landfill or lagoons. The safe distance that a well should be located from a waste landfill or waste stabilization ponds (lagoon) cannot be assigned a fixed number because of the varieties of hydrologic and geologic parameters associated with the undetermined types and amounts of materials that may be carried by groundwater from leachates discharged from the waste landfill or waste stabilization ponds (lagoon). It is recommended that wells not be located in an area between the landfill or waste stabilization ponds (lagoons) sites and the point of groundwater discharge to a surface water source. Any well that may intercept leachates from a waste landfill or waste stabilization pond (lagoon) by water withdrawal from the well shall not be used for human consumption and must be plugged unless it is used for a monitoring well.

(C) Irrigation wells require increased setbacks and shall be at least two hundred feet (200') from—

1. Sewer lines, septic tanks, lateral fields, pit privy, seepage pits, feed lots, barnyards, fuel, fertilizer and pesticide storage. Fuel, fertilizer and pesticide tanks up to one thousand gallons (1000 gals.) in capacity will be allowed at well while irrigating and chemigating but must be removed from well site when not is use; and

2. Any well producing potable water.

AUTHORITY: sections 256.606 and 256.626, RSMo 1994. Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994. Amended: Filed Nov. 1, 1995, effective June 30, 1996.*

**Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

10 CSR 23-3.020 General Protection of Groundwater Quality and Resources

PURPOSE: This rule is for the overall protection of water quality and resources in Missouri.

(1) Reuse of Water, Disposal, Recharge or Gas Storage Wells.

(A) A well for the storage of gas or liquid under pressure may not be drilled without first having secured a permit from the Department of Natural Resources in accordance with the Missouri Statutes.

(B) Water used for cooling parts of engines, air compressors or other equipment shall not be returned to any part of the groundwater system. A well shall not be used for disposal or injection of any substance, including surface water, groundwater or any liquid, gas or chemical associated with the drilling of an oil or gas well, including coal bed methane wells, without first receiving a permit from the Underground Injection Control Program's rules and 10 CSR 50-2, Oil and Gas Council, Oil and Gas Drilling and Production. A permit through the Division of Environmental Quality, Water Pollution Control Program may be required.

AUTHORITY: sections 256.606 and 256.626, RSMo Supp. 1991. Original rule filed April 2, 1987, effective July 27, 1987. Emergency amendment filed Nov. 16, 1993, effective Dec. 11, 1993, expired April 9, 1994. Amended: Filed Aug. 17, 1993, effective March 10, 1994.*

**Original authority: 256.606, RSMo 1991 and 256.626, RSMo 1985, amended 1991.*

10 CSR 23-3.100 Sensitive Areas

PURPOSE: This rule sets specific additional construction standards for sensitive areas shown on the map that have been designated on the basis of either naturally occurring problems caused by unique groundwater chemistry, anthropogenic contamination, or because they are located in a fragile groundwater environment which is experiencing rapid population growth or urbanization.

(1) Sensitive Area A. All persons engaged in drilling wells in this area (Figure 8) and encounter Pennsylvanian shales and/or sandstones shall—

(A) Set no less than eighty feet (80') of casing extending not less than thirty feet (30') into bedrock where Pennsylvanian shale and sandstone are not present and no less than one hundred fifty feet (150') of casing extending not less than thirty feet (30') into bedrock where the Pennsylvanian shale and sandstone are present;

(B) Construct the drillhole a minimum of eight and five-eighths inches (8 5/8") in diameter to the surface casing point;

(C) Install new steel or plastic casing as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);

(D) Install and seal casing as follows:

1. Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost thirty feet (30') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space—

A. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes; and

B. If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and

2. The following times must be followed for curing grout when no packer is used:

A. Hi-early cement—minimum set time of twelve (12) hours;

B. Portland Type I cement—minimum set time of seventy-two (72) hours;

C. Chipped bentonite—minimum hydration time of four (4) hours; and

D. High solids bentonite slurry—varies based on additives and manufacturer's specifications.

(2) Sensitive Area B. Wells drilled within one-quarter (1/4) mile of the major lakes in Missouri (Figure 8) (see list of lakes) must be cased so that they do not produce lake water into their wells. Wells drilled within one-quarter (1/4) mile of the major lakes that are not drilled below normal pool level of the lake are not required to meet sensitive Area B requirements. These wells must be constructed to Area 1 requirements stated in 10 CSR 23-3.090(1). The following specifications shall be followed:

(A) List of Lakes—

1. Truman;
2. Stockton;
3. Table Rock;
4. Bull Shoals;
5. Lake of the Ozarks;
6. Wappappello;
7. Pomme de Terre;
8. Norfolk; and
9. Clearwater.

(B) If the well is to be drilled closer than one-quarter (1/4) mile to the shoreline of the lake, casing must be set to a point fifty feet (50') below the bottom of the lake. The deepest part of the lake within one-quarter (1/4) mile radius from the well location shall be used in this determination. Example: If the drill site is located one thousand feet (1,000') from the lake, is located fifty feet (50') higher in elevation than the shoreline and the deepest estimated bottom of the lake within one-quarter (1/4) mile from the well is thirty feet (30') deep, then one hundred and thirty feet (130') of casing must be set. Fifty feet (50') (elevation above lake) + thirty feet (30') (depth of water) + fifty feet (50') (below lake bottom) = one hundred thirty feet (130') casing;

(C) It is highly recommended that before a well is drilled that is located closer than one-quarter (1/4) mile to the shoreline of any major lake, a casing point request form (supplied by the division) be submitted to the division. The casing point request form will be used to establish the required amount of casing and will supply information on requested water yield amounts and corresponding total depth of well. To ensure the location of the proposed drill site a copy of the landowner's property deed showing detailed location information and a copy of the landowner's plat (if available) showing proposed drilling site location, must be attached to completed casing point request form. The casing point request form will be processed quickly and returned to the landowner or driller, or both. After the well is drilled the casing point request form must be submitted with the certification form. If a well is drilled within one-quarter (1/4) mile of one (1) of the lakes contained in section (2) and less than the required amount of casing is set, the well installation contractor must bring the well up to the standards set in this rule and will be subject to disciplinary action deemed necessary by the division;

(D) A minimum of eighty feet (80') of casing must be set;

(E) The drill hole shall be constructed a minimum of eight and five-eighths inches (8 5/8") in diameter to the surface casing point;

(F) The new steel or plastic casing shall be installed as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);

(G) The casing shall be installed and scaled as follows:

1. Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost thirty feet (30') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space;

A. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

B. If plastic casing is used, a packer, coupling or inverted bell is required near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes;

C. The following time must be followed for curing grout when no packer is used:

(I) Hi-early cement—minimum set time of twelve (12) hours;

(II) Portland Type I cement—minimum set time of seventy-two (72) hours;

(III) Chipped bentonite—minimum hydration time of four (4) hours; and

(IV) High solids bentonite slurry—varies based on additives and manufacturer's specifications; and

(H) In areas that have water quality problems that would be aggravated by the use of steel casing, plastic casing is recommended. If it is necessary to set steel casing due to geologic reasons, the following may substitute for casing:

1. Set no less than eighty feet (80') of casing; and

2. Liner must be set through the casing to point as determined in subsection (1)(C). Example: If the casing point was determined to be one hundred and eighty feet (180'), one hundred and eighty feet (180') of liner must be set. The liner must meet all requirements as stated in 10 CSR 23-3.080, including grouting.

(3) Sensitive Area C. The Springfield area is one in which urbanization is occurring at a rapid rate in an extremely sensitive and fragile geologic and hydrologic setting. The area is underlain by fractured, and cavernous limestone and pollutants are able to migrate quickly, both vertically and horizontally. Because of these factors, it is necessary to treat this area differently than surrounding areas and have stricter well construction standards. All persons engaged in drilling of wells in the sensitive area C (Figure 8) shall—

(A) The casing shall be set as determined by Area C casing depth map. When drilling in Sensitive Area C, it is strongly recommended that a casing point request be submitted so that the exact amount of casing can be set, limiting the amount of grout required. Approval must be obtained before drilling begins. Area C casing depth map sets the minimum amount of required casing that will extend at least ten feet (10') below the Northview Shale. Due to surface elevation changes within the quarter (1/4) section (one-quarter (1/4) mile), the amount of casing stated on the casing depth map may extend more than ten feet (10') below the bottom of the Northview Shale. In those instances, where the casing extends more than ten feet (10') below the bottom of the Northview Shale, more than thirty feet (30') of grout is required to seal off the Northview Shale. See 10 CSR 23-3.100(3)(D);

(B) The drillhole shall be constructed a minimum of eight and five-eighths inches (8 5/8") in diameter to the surface casing point;

(C) New steel or plastic casing shall be installed as specified in 10 CSR 23-3.030 (steel) or 10 CSR 23-3.070 (plastic);

(D) Full-length grout is preferred and will ensure a better annular seal but sealing the lowermost thirty feet (30') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required if the casing does not go more than ten feet (10') below the bottom of the Northview Shale. Due to surface elevation changes within the quarter (1/4) section (one-quarter (1/4) mile), the amount of casing required is calculated at the highest elevation. Therefore, if a well is drilled in a lower elevation area, the required casing will go more than ten feet (10') below the bottom of the Northview Shale. In many cases, thirty feet (30') of grout will not seal off the Northview Shale since the bottom of the casing is much deeper. The Northview Shale interval must be grouted from ten feet (10') below to the top of the shale regardless of the amount of casing set. A minimum of thirty feet (30') of grout is required. Drill cuttings and a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space. Install and seal casing as follows:

1. If steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure before drilling resumes;

2. If plastic casing is used, a packer, coupling or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. No packer, coupling or inverted bell is required if grout is allowed to cure before drilling resumes; and

3. The following times must be followed for curing grout when no packer is used:

A. Hi-early cement—minimum set time of twelve (12) hours;

B. Portland Type I cement—minimum set time of seventy-two (72) hours;

C. Chipped bentonite—minimum hydration time of four (4) hours; and

D. High solids bentonite slurry—varies based on additives and manufacturer's specifications; and

(E) In areas that have water quality problems that would be aggravated by the use of steel casing, plastic casing is recommended. If it is necessary to set steel casing due to geologic reasons, the following may substitute for casing:

1. No less than one hundred feet (100') of casing shall be set. The drill hole shall be constructed a minimum of eight and five-eighths inches (8 5/8") in diameter and new six-inch (6") inside diameter steel casing shall be installed as specified in 10 CSR 23-3.030. A six-inch (6") hole is then drilled to total depth and a plastic liner having an outside diameter no greater than four and one-half inches (4 1/2") shall be secured into place. No variances will be issued for this requirement; and

2. Liner must be set through the casing to the required casing point. The liner must be set to the casing depth as determined by Area C casing depth map. The liner must meet all requirements as stated in 10 CSR 23-3.080 concerning liners, including grouting. More than sixty feet (60') of grout may be required as stated in 10 CSR 23-3.100(3)(D).

(4) Special Area. Due to the unique and varied geological conditions present because the bedrock is deeply weathered and often highly fractured, openings filled with mud may extend deep into the bedrock. Caving-in of the hole during drilling and after well construction is a problem. The following rules are the minimum that are required but in many cases much more steel casing may be necessary to secure the well bore. Also, in some cases plastic liner is not strong enough to hold the well bore open and steel should be used. All persons engaged in the drilling of a domestic well in special area 1 (see Figure 1 and Figure 7 included herein) shall—

(A) Set no less than eighty feet (80') of casing. The hole shall be cased fifteen feet (15') below residuum, broken rock, or mud pockets into solid bedrock or if rock is not encountered within one hundred and fifty feet (150') consult the division for further instructions concerning a variance, unless casing will be set into deeper bedrock;

(B) Construct the drill hole a minimum of eight and five-eighths inches (8 5/8") in diameter to the surface casing point;

(C) Install new steel casing as specified in 10 CSR 23-3.030. Plastic casing of any type will not be allowed in this area; and

(D) Install and seal casing as follows:

1. Full-length grout is highly recommended and will ensure a better annular seal but sealing the lowermost thirty feet (30') of casing using approved grout materials and procedures set out in 10 CSR 23-3.030 is required. Drill cuttings with a drive shoe or drill cuttings used by themselves are not approved grout materials. Drill cuttings may be placed above grouted interval to fill in the annular space;

2. A drive shoe is required except on wells where the grout is allowed to cure before drilling resumes.

A. The following times must be followed for curing grout when no packer is used:

(I) Hi-early cement—minimum set time of twelve (12) hours;

(II) Portland Type I cement—minimum set time of seventy-two (72) hours;

(III) Chipped bentonite—minimum hydration time of four (4) hours;

(IV) High solids bentonite slurry—varies based on additives and manufacturer's specifications; and

3. If drilling conditions do not permit a bottom seal, then the casing must be driven and grouting material introduced around the

outside casing while the casing is being driven. If the casing cannot be sealed to prevent surface contamination from entering the well, a liner must be set and sealed according to 10 CSR 23-3.080.

(E) In areas where poor drilling conditions exist and it is necessary to drive multiple strings of smaller diameter casing through the surface casing, each succeeding liner should extend into the preceding liner or casing at least twenty feet (20') and the annulus created between the casing and liner must be grouted.

(F) In wells where it is necessary to set casing below static water levels, it may be advisable to set plastic liner as stated in 10 CSR 23-3.080 from the surface to a point below the pumping water level to avoid excessive iron in the produced well water.

(5) Special Area 2 Definitions.

(A) "Lower aquifer" means that portion of transmissive, water-bearing geologic material extending from the Cotter Dolomite to igneous bedrock. The lower aquifer includes all formations constituting the Ozark Aquifer and the St. Francois Aquifer in the southwestern portion of the state.

(B) "Low-permeability bedrock" means that portion of geologic material between the lower aquifer and upper aquifer that does not readily transmit water in sufficient quantities to supply a well. The Northview Formation, the Chattanooga Shale, and the upper thirty feet (30') of the Cotter Dolomite shall constitute the low-permeability bedrock. The low-permeability bedrock serves as a natural barrier to groundwater mixing between the upper aquifer and lower aquifer. See Figure 7A included herein for an illustration of geology in Special Area 2.

(C) "Upper aquifer" means that portion of the transmissive, water-bearing geologic material above the top of the low-permeability bedrock. The upper aquifer includes all formations constituting the Springfield Plateau Aquifer in the southwestern portion of the state.

(D) "Maximum contaminant level (MCL)" is the maximum permissible concentration of a contaminant in drinking water as listed by the National Primary Drinking Water Regulations (NPDWR).

(E) "Action level (AL)" is the maximum permissible concentration of lead in drinking water as specified in the *Code of Federal Regulations*. ALs are levels used for contaminants that do not have established MCLs.

(F) "TCE" shall mean the organic chemical trichloroethylene (a common solvent) and its known degradation products, including but not limited to dichloroethylene and vinyl chloride.

(G) "Impact area" is defined as that land surface area that is underlain or surrounded by water-bearing units that contain groundwater above the MCL or AL for at least one (1) contaminant of concern (lead, cadmium, TCE or TCE degradation products, or other contaminants of the NPDWR). Standard contouring methodology shall be used to delineate the MCL and AL isoconcentration line, which will define the geographic limit of an impact area.

(6) Special Area 2. All of Newton County and Jasper County shall be listed as Special Area 2 (Figure 7B included herein) due to the contamination of portions of the upper aquifer by one (1) or more of the following: lead, cadmium, TCE, TCE degradation products or other contaminants of the NPDWR. The upper aquifer and lower aquifer are separated by a thickness of low-permeability bedrock (Figure 7A). This low-permeability bedrock limits migration of groundwater and any associated contamination from the upper aquifer to the lower aquifer. Wells that penetrate the low-permeability bedrock without an adequate length of surface casing which has had the annulus sealed by approved methods through the low-permeability bedrock may place the lower aquifer at risk to future contamination. Due to chemical and metal contamination present in the upper aquifer in portions of this area, it is necessary to require more stringent well construction standards for new wells that are drilled into the lower aquifer, to cease construction of additional upper aquifer wells in impact areas, and to limit deepening of existing upper aquifer wells in impact areas. New wells constructed outside of the impact area shall be constructed to standards that are no less stringent than the minimum well construction requirements for Area 1. All persons engaged in drilling wells in Special Area 2 shall—

(A) Before beginning construction of the well, determine if the well to be drilled is located within the impact area as shown on maps provided by the division or as determined by division staff. If data indicate change in impact area status, the impact area map may be modified by the division during January of the calendar year and that map will be maintained and available at: Department of Natural Resources, PO Box 250, Rolla, MO 65402-0250.

(B) Drill new wells within the impact area to a depth required to produce water from the lower aquifer. All new wells drilled in the impact area shall have steel or plastic casing properly installed and grouted to the depth determined by the Special Area 2 casing depth map.

1. The drill hole shall be a minimum of eight and five-eighths inches (8 5/8") in diameter to the surface casing point;

2. New steel casing shall be installed as specified in 10 CSR 23-3.030 (steel);

3. The well must be sealed by positive displacement grouting with high-solids bentonite slurry. The annulus between the casing and the borehole wall shall be grouted from the base of the borehole. The volume of grout shall be no less than the calculated volume necessary to accomplish full-length grouting of the annulus. Alternatively, full-length pressure grouting (10 CSR 23-3.030(3)(A)4.) with high-solids bentonite slurry or neat cement meets the requirements of this rule. In addition, casing must be sealed as follows:

A. When steel casing is used, a drive shoe is required except on wells where the grout is allowed to cure as specified in subparagraph (6)(B)3.C. of this rule before drilling resumes;

B. If plastic casing is used, a drill hole shall be constructed a minimum of ten inches (10") in diameter to the casing point. Plastic casing shall be installed as specified in 10 CSR 23-3.070 (plastic) and, a packer, coupling, or inverted bell is required to be secured near the bottom of the casing and must hold the grout in place while drilling continues. PVC and ABS plastic casing shall not be used when known gasoline or solvent contamination exists within the impact area. The annular space shall be sealed as specified in paragraph (6)(B)3. of this rule. No packer, coupling, or inverted bell is required on wells where the grout is allowed to cure as specified in subparagraph (6)(B)3.C. of this rule before drilling resumes; and

C. The following times must be allowed for curing grout when no packer is used:

(I) High-solids bentonite slurry—varies based on additives and manufacturer's specifications. At least one hour of curing after initial slurry placement is suggested. This amount of curing time should elapse during casing placement.

(C) Uncontaminated upper aquifer wells in impact areas of Special Area 2 existing before the date of this rule may be deepened to the top of the low-permeability bedrock.

(D) Water from all new wells and deepened old wells throughout Special Area 2 shall be sampled and analyzed for lead and cadmium, plus TCE and its degradation products within TCE impact areas. Where indicated by objective factors, the division may require sampling and analysis for other contaminants listed in the NPDWR. Qualified and properly trained persons must complete sample collection. The laboratory that analyzes the sample must be approved by the EPA for such analysis. A copy of the chain of custody form shall be submitted to the division with the well certification report form to document sampling has occurred. An appropriate chain of custody form will be available from the division.

1. In order to ensure proper well development, the well pump must run continuously for five (5) hours or until the water clears, whichever occurs first, but in no case shall the well be pumped less than two (2) continuous hours.

2. After proper well development, water samples shall be collected from the tap nearest the well.

3. All new and deepened old wells in Special Area 2 shall be constructed with a sampling port or tap within ten feet (10') of the wellhead. Water must be purged from the sampling port prior to collection of a sample.

4. Water from all new wells in Special Area 2 with less than three (3) times the applicable maximum contaminant level (MCL) or action level (AL) may be retested over a one (1)-month period following pump installation and development to assess water quality changes that may have resulted from drilling and/or well construction. The well cannot be used for human consumption until contaminant levels are below MCLs or ALs. Qualified and properly trained persons must complete sample collection. The laboratory that analyzes the sample must be approved by the EPA for such analysis. A copy of the chain of custody form shall be submitted to the division with the well certification report form to document sampling has occurred. An appropriate chain of custody form will be available from the division. The division may require any new well, whose contaminant levels do not fall below MCLs or ALs after the retest period, to be plugged.

5. Properly constructed new lower aquifer wells that are determined to be contaminated may be allowed to use water treatment systems on a variance basis, if other domestic water sources are not available at the time of well construction. Otherwise, the well must be plugged by using full-length, high-solids bentonite grout emplaced by tremie pipe which extends to within twenty-five feet (25') of the bottom of the borehole. Grout, extending from the bottom of the borehole to within two feet (2') of land surface and finished per 10 CSR 23-3.110 (2)(A)3.G., is preferred; in any case, the minimum volume of grout shall be no less than the volume calculated as necessary to accomplish full length plugging of the well.

6. Existing wells that extend uncased and/or unsealed through the low-permeability bedrock and that are found to be contaminated with lead, or cadmium, or TCE, TCE degradation products, or other contaminants of the NPDWR may be required to be plugged full-length with high-solids bentonite grout, emplaced by tremie pipe, which extends to within twenty-five feet (25') of the bottom of the borehole. Grout, extending from the bottom of the borehole to within two feet (2') of land surface and finished per 10 CSR 23-3.110(2)(A)3.G., is preferred; in any case, the minimum volume of grout shall be no less than the volume calculated as necessary to accomplish full-length plugging of the well.

(7) Special Area 3. Portions of Franklin County within and south of the city of New Haven shall be listed as Special Area 3 (Figures 7B and 7C included herein) due to the contamination of portions of the aquifer by one (1) or more of the following chemicals of concern: tetrachloroethylene (PCE), trichloroethylene (TCE), perchloroethylene (PCE) degradation products, TCE degradation products or other contaminants of the National Public Drinking Water Regulations (NPDWR). In this area it is necessary to utilize more stringent well construction standards for new wells that are drilled into the aquifer and to limit the deepening of existing upper aquifer wells.

(A) The division shall be consulted before constructing a new well in Special Area 3. The division will provide specific guidance on well drilling protocol and construction specifications on a case-by-case basis. The division must provide written approval for all new wells prior to construction.

(B) Before deepening a well in Special Area 3, groundwater sampling and analysis for the chemicals of concern must be conducted by qualified and properly trained individuals and the data submitted within sixty (60) days of the sampling event by the well installation contractor to the division. The division must provide written approval for the deepening of all new wells in Special Area 3. Wells that have been sampled and analyzed and are contaminated with chemicals of concern exceeding maximum contaminant levels (MCLs) and/or action levels (ALs) shall not be deepened.

(C) In addition to specific instructions that are provided by the division pursuant to 10 CSR 23-3.100(7)(A) and (B), the following must be performed at all new wells installed in Special Area 3:

1. All drilling-derived fluids and solid materials shall be containerized and sampled before disposal in an appropriate location based on analytical results;

2. All new and deepened old wells in Special Area 3 shall be constructed with a sampling port or tap within ten feet (10') of the wellhead. Water must be purged from the sampling port prior to collection of a sample;

3. After proper well development, water from all new wells located in Special Area 3 shall be sampled and analyzed for the chemicals of concern, as determined by the division. Qualified and properly trained persons must complete sample collection. In order to document sampling has occurred, a copy of the chain of custody form shall be submitted by the pump installation contractor to the division within sixty (60) days of pump installation; and

4. The data report from all analyses shall be made available by the pump installation contractor to the division and the well owner within sixty (60) days of the sampling event.

(D) At any well being drilled, per division guidance, in which PCE and/or TCE is encountered in a pure-product phase (also known as dense non-aqueous phase liquid or DNAPL), drilling shall cease and the division shall be notified immediately. The division will determine further action.

(E) Properly constructed new or deepened wells that, upon sampling and analysis, are contaminated at levels exceeding MCLs or ALs shall:

1. Be plugged full-length using high-solids bentonite slurry, six percent (6%) bentonite cement or neat cement grout placed under pressure via tremie pipe which extends to within twenty-five feet (25') of the bottom of the borehole. Grout shall extend from the bottom of the borehole to within two feet (2') of land surface. Prior to plugging, all pumps and debris must be removed from the wells. Any liner must be removed or perforated if possible. Casing must be cut at least three feet (3') below ground surface. A registration report and fee (if required) must be submitted within sixty (60) days of abandonment; or

2. With approval from the division, the well owner shall be allowed to install a water treatment system that is designed to properly treat the chemical(s) of concern. The well shall not be used for human consumption until sampling and analysis demonstrates that the water treatment system reduces contaminant levels below MCLs and/or ALs for all chemicals of concern. The division shall be provided a copy of the post-treatment analytical data by the pump contractor within sixty (60) days of the sampling event.

(8) Special Area 4. Portions of St. Charles County west of the city of Weldon Spring shall be listed as Special Area 4 (Figure 7D included herein) due to the contamination of portions of the aquifer by one (1) or more of the following chemicals of concern: trinitrotoluene (TNT) and dinitrotoluene (DNT) at the U.S. Army Corps of Engineers (COE) site, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, dinitrobenzene (1,3-DNB), nitrobenzene (NB),

nitrate, uranium, and trichloroethylene (TCE) at the Department of Energy (DOE) Main Site, uranium, and 2,4-DNT, at the DOE Quarry, or other contaminants of the National Public Drinking Water Regulations (NPDWR). In this area it is necessary to utilize more stringent well construction standards for new wells that are drilled into the aquifer and to limit the deepening of existing upper aquifer wells.

(A) The division shall be consulted before constructing a new well in Special Area 4. The division will provide specific guidance on well drilling protocol, construction specifications and groundwater sampling on a case-by-case basis. The division must provide written approval for all new wells prior to construction.

(B) Before deepening a well in Special Area 4, groundwater sampling and analysis for the chemicals of concern must be conducted by qualified and properly trained individuals and the data submitted within sixty (60) days of the sampling event by the well installation contractor to the division. The division must provide written approval for the deepening of all new wells in Special Area 4. Wells that have been sampled and analyzed and are contaminated with chemicals of concern exceeding maximum contaminant levels (MCLs), action levels (ALs), and/or remediation goals included in the DOE/COE Record of Decision (ROD) for the Weldon Spring sites shall not be deepened.

(C) In addition to specific instructions that are provided by the division pursuant to 10 CSR 23-3.100(8)(A) and (B), the following must be performed at all new wells installed in Special Area 4:

1. All new and deepened old water wells in Special Area 4 shall be constructed with a sampling port or tap within ten feet (10') of the wellhead. Water must be purged from the sampling port prior to collection of a sample;

2. After proper well development, water from all new wells located in Special Area 4 shall be sampled and analyzed for the chemicals of concern, as determined by the division. Qualified and properly trained persons must complete sample collection. Sampling qualifications and training requirements will be determined in advance of sampling by the division and approval will be issued in written format. In order to document sampling has occurred, a copy of the chain of custody form shall be submitted by the pump installation contractor to the division within sixty (60) days of pump installation; and

3. The data report from all analyses shall be made available by the pump installation contractor to the division and the well owner within sixty (60) days of the sampling event.

(D) Properly constructed new or deepened wells that, upon sampling and analysis, are contaminated at levels exceeding MCLs, ALs, and/or remediation goals included in the DOE/COE ROD for the Weldon Spring sites shall:

1. Be plugged full-length using high-solids bentonite slurry, six percent (6%) bentonite cement or neat cement grout placed under pressure via tremie pipe which extends to within twenty-five feet (25') of the bottom of the borehole. Grout shall extend from the bottom of the borehole to within two feet (2') of land surface. Prior to plugging all pumps and debris must be removed from the wells. Any liner must be removed or perforated if possible. Casing must be cut at least three feet (3') below ground surface. A registration report and fee (if required) must be submitted within sixty (60) days of abandonment; or

2. With prior approval from the division, the well owner shall be allowed to install a water treatment system that is designed to properly treat the chemical(s) of concern. The well shall not be used for human consumption until sampling and analysis demonstrates that the water treatment system reduces contaminant levels below MCLs, ALs, and/or remediation goals included in the DOE/COE ROD for the Weldon Spring sites for all chemicals of concern. The division shall be provided a copy of the post-treatment analytical data by the pump contractor within sixty (60) days of the sampling event.

(E) Notwithstanding these provisions, the federal government does not waive its rights and authority under federal law, regulations, or executive order within the boundaries and applicable jurisdiction of federal property.

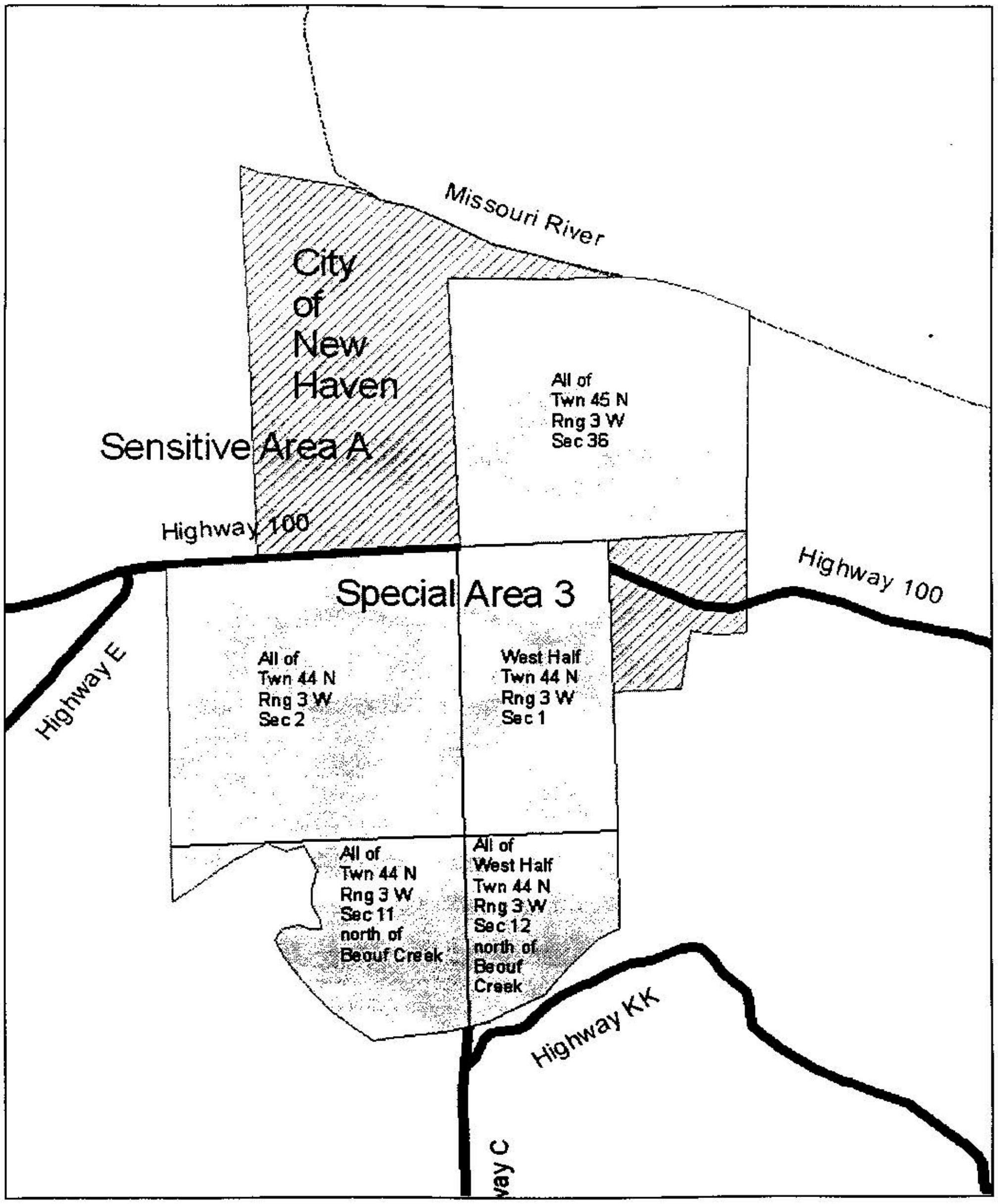


Figure 7C. Special Area 3 and Sensitive Area A

3-49 Missouri Wel Construction Rules (2-05)

Operable Unit No. 1

Agreement and Covenant Not to Sue

Entered into by and between

The United States Environmental Protection Agency,

The State of Missouri, and

The Industrial Development Authority of the City of New Haven

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

Site RIVERFRONT OU#1
ID # MAD981720246
Break 10.6
Other. OU# 1
2/23/04 07PY

February 23, 2004

VIA FEDEX

Warren Bauche
New Haven Lumber
117 Circle Drive
New Haven, MO 63068

Re Riverfront Superfund Site, Operable Unit No 1

Dear Mr Bauche

Enclosed is the fully executed Agreement and Covenant Not to Sue with regard to the acquisition by The Industrial Development Authority of the City of New Haven, Missouri (IDA), of the Wiser property ***In accordance with Section XVII, the effective date of this Agreement is February 23, 2004.***

Please note the obligations assumed by the IDA pursuant to this Agreement found particularly in Sections IV, V, and VI The IDA is required to file a Restrictive Covenant and Easement against the Property as provided in paragraph 20 of the Agreement within 15 day of the effective date

It was a pleasure working with you and Mr Menke on this matter and I wish you well in the City's redevelopment of this area

If you have any questions regarding this matter please contact me at 913-551-7503

Sincerely,

David A Hoefer
Attorney
Office of Regional Counsel

Enc

cc Shelley Woods, Missouri Attorney General's Office

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
901 NORTH 5th STREET
KANSAS CITY, KANSAS 66101

04 FEB 23 AM 8 11

ENVIRONMENTAL PROTECTION AGENCY-REGION VII
REGIONAL HEARING CLERK

IN THE MATTER OF RIVERFRONT SUPERFUND SITE OPERABLE UNIT NO 1 THE INDUSTRIAL DEVELOPMENT AUTHORITY OF THE CITY OF NEW HAVEN, MISSOURI Settling Respondent Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U S C §§ 9601-9675, as amended	)	EPA Docket No CERCLA-07-2004-0004

AGREEMENT AND COVENANT NOT TO SUE

10/16/03

TABLE OF CONTENTS

I. INTRODUCTION

1 This Agreement and Covenant Not to Sue ("Agreement") is made and entered into by and between the United States Environmental Protection Agency ("EPA"), the state of Missouri ("State"), and The Industrial Development Authority of the City of New Haven, a Missouri industrial development corporation in good standing ("Settling Respondent") For convenience, EPA, the State, and Settling Respondent will be referred to collectively in this Agreement as the "Parties"

2 This Agreement is entered into pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U S C § 9601 *et seq* , the authority of the Attorney General of the United States and the State of Missouri to compromise and settle claims, and Mo Rev Stat § 260 500, *et seq*

3 Settling Respondent expects to acquire the Property (as defined below), and commit the Property for use in perpetuity for civic, park and/or parking purposes

4 The Parties agree to undertake all actions required by the terms and conditions of this Agreement The purpose of this Agreement is to settle and resolve, subject to reservations and limitations contained in Sections VII, VIII, IX, X, and XI, the potential liability of Settling Respondent for the Existing Contamination at the Property which may otherwise result from Settling Respondent becoming the owner of the Property

5 The Parties agree that Settling Respondent's entry into this Agreement, and the actions undertaken by Settling Respondent in accordance with the Agreement, do not constitute an admission of any liability by Settling Respondent

6 The resolution of this potential liability, in exchange for Settling Respondent providing to EPA and the State a substantial benefit, is in the public interest

II. DEFINITIONS

7 Unless otherwise expressly provided herein, terms used in this Agreement which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations, including any amendments thereto Whenever the terms listed below are used in this Agreement, the following definitions shall apply

a "EPA" shall mean the Umted States Envıronmental Protectıon Agency and any successor departments or agencıes of the Umted States

b "Exıstıng Contamınatıon" shall mean any hazardous substances, pollutants or contamınants present or exıstıng on or undeı the Property as of the effectıve date of thıs Agıeement

c "OU1" shall mean the Rıveıfront Supeıfund Sıte, Operable Unıt Number 1 consıstıng of appıoxımately 2 acıes located ın the aıea of the northeast corneı of Front Street and Cottonwood Street ın downtown New Haven Franklın County Mıssourı OU1 ıs generally depıcted on <u>Attachment 1</u> to thıs Agreement

d "Pıoperty" shall mean that portıon of the OU1 whıch ıs legally descrıbed ın the Restııctıve Covenant and Easement whıch ıs attached as <u>Attachment 2</u> to thıs Agreement

e "Sectıon" shall mean a portıon of thıs Agıeement ıdentıfied by a capıtalızed Roman numeıal

f "Settlıng Respondent" shall mean The Industrıal Development Authorıty of the Cıty of New Haven, Mıssourı, a Mıssouıı ındustrıal development corporatıon

g "Sıte" shall mean the Rıveıfront Superfund Sıte, located ın New Haven, Franklın County, Mıssourı, whıch ıs compıısed of sıx operable unıts and as ıt ıs generally depıcted on <u>Attachment 3</u> to thıs Agreement The Sıte, whıch coveıs over 325 acres, ıncludes OU1 and the Property, and all areas to whıch hazardous substances and/or pollutants oı contamınants, have come to be located

h "State" shall mean the state of Mıssourı

ı "Submıt" shall mean any of the followıng (1) place ın first class maıl ın a properly addıessed envelope wıth suffıcıent postage, (2) tender to an overnıght courıer ın a properly addressed envelope, and prepay the delıvery fees, or (3) hand delıver and obtaın sıgnature of recıpıent

J "Unıted States" shall mean the Unıted States of Amerıca, ıts departments, agencıes, and ınstrumentalıtıes

III. STATEMENT OF FACTS

8 New Haven, Missouri is a city with a population of approximately 1,700 located along the southern bank of the Missouri River in Franklin County, Missouri, approximately 40 miles west of St Louis, Missouri

9 In 1986, the volatile organic compound tetrachloroethene ("PCE") was detected during routine public-supply well testing in two public-supply groundwater wells in the northern part of New Haven PCE is a "hazardous substance" as defined by Section 101(14) of CERCLA 42 U S C § 9601(14) Following this discovery, two new public-supply wells were installed in the southern part of the city, and several investigations were conducted by the Missouri Department of Natural Resources and EPA The Site became known as the Riverfront Superfund Site, and in December 2000, the PCE contamination prompted the listing of the Site on the National Priorities List (The National Priorities List is a list compiled by EPA pursuant to Section 105 of CERCLA, 42 U S C § 9605, of uncontrolled hazardous substance releases in the United States that are priorities for long-term remedial evaluation and response)

10 The Site is comprised of six operable units The subject of this Agreement is Operable Unit No 1 ("OU1") OU1 is located in the area of the northeast corner of Front Street and Cottonwood Street, just east of downtown New Haven Located on OU1 is a 15,000 square foot, one story, concrete block building The highest PCE concentrations for OU1 have been detected in the soils beneath Front Street along the south side of the building A plume of groundwater contaminated with PCE and its degradation products trichloroethene ("TCE"), cis-1,2-dichloroethene ("cis-DCE"), and vinyl chloride ("VC") emanates from this area of soil contamination and extends northward in the alluvium to the Missouri River where it discharges

11 EPA initiated a Remedial Investigation ("RI") for OU1 in 1999, and a Feasibility Study ("FS") in 2002 As part of the RI, samples were collected from soils and groundwater at, and in the vicinity of OU1, to define the extent of soil and groundwater contamination PCE was detected in 128 of the 144 soil sampling locations The concentrations of PCE vary substantially with depth and the boring's location across OU1 The maximum PCE concentration detected was 6,200,000 micrograms per kilogram found in a sample collected four feet beneath Front Street Based on the sampling results, EPA has estimated that there are approximately 34,000

cubic yards of soil contaminated with some level of PCE at OU1

12 Four phases of groundwater sampling were conducted at OU1 as part of the RI In Phases I and II, six monitoring wells were installed in the alluvium and four monitoring wells were installed in the bedrock During Phases III and IV, direct push temporary wells (21 in Phase III and 6 in Phase IV) were installed PCE, TCE, cis-DCE, and VC were detected in many of these samples The maximum PCE concentration detected in the groundwater at OU1 was 11 000 micrograms per liter Based on the sampling results the PCE plume is known to extend from Front Street to the Missouri River, and EPA estimates that it contains approximately 5 8 million gallons of water Plumes of degradation products are located within the PCE plume Samples were collected from the Missouri River and from the sediment in the Missouri River channel PCE and its degradation products were not detected in any of the water or sediment samples from the river This plume is not contributing to the PCE contamination which affected the city's closed public water supply wells The OU1 plume is not adversely affecting any other drinking water sources or water quality in the Missouri River Contamination in soil is limited to subsurface soils in the immediate vicinity of the Front Street facility at depths of two feet or greater There is no current exposure to contaminated soils associated with OU1

13 Since completion of the sampling that characterized the extent of groundwater contamination associated with OU1, additional sampling has been performed by EPA in the two residences located above or adjacent to the groundwater plume to determine if indoor air quality is being adversely affected by organic vapors emanating from the plume This sampling has identified the presence of elevated organic vapors in one of these residences, which may be related to vapor intrusion from contaminated groundwater beneath the home Additional sampling is ongoing to determine if indoor air quality is, in fact, being impacted by the contaminated groundwater plume and if health-based levels are exceeded

14 Investigations conducted by EPA indicate that the hazardous substances found at OU1 were likely disposed of by entities who owned and occupied the Property during the 1950s through the 1980s

15 In July 2003, EPA issued a Proposed Plan describing the remedial alternatives considered by EPA for OU1 On September 30, 2003, the EPA issued a Record of Decision

("ROD") for OU1 The ROD provides for the implementation of a remedial action to address contamination at OU1 The selected remedial action includes the treatment of source soils and the head of the groundwater plume groundwater monitoring, and institutional controls The State has concurred on this ROD

16 Settling Respondent represents, and for the purposes of this Agreement EPA and the State rely on those representations, that Settling Respondent has no affiliation with the predecessor owners or operators who contributed to the contamination present at OU1

IV. UNDERTAKINGS

17 Contaminated Soils Settling Respondent shall generally use the Property for surficial uses only Settling Respondent may demolish and remove any structures located on the Property If it appears that the removal of structures will involve exposing contaminated soils to ambient conditions, Settling Respondent shall consult with EPA and the State prior to conducting such activities Settling Respondent shall not conduct any other activities at the Property which would disturb contaminated soils (e g , placement of a foundation or footings, utility installation and maintenance), unless Settling Respondent obtains written consent from EPA and the State prior to conducting such activities

18 Groundwater Settling Respondent shall not place any groundwater wells at the Property, and shall not use, or allow the groundwater at the Property to be used, for any purpose unless Settling Respondent first obtains written consent from EPA and the State Settling Respondent also shall not penetrate, or allow others to penetrate, the contaminated groundwater bearing unit(s) at the Property

V. ACCESS/NOTICE TO SUCCESSORS IN INTEREST

19 Commencing upon the date that it acquires title to the Property Settling Respondent agrees to provide to EPA and the State and their authorized officers, employees, agents, representatives, and all other persons performing response actions under EPA and/or State oversight, an irrevocable right of access at all reasonable times to the Property and to any other property owned or controlled by Settling Respondent to which access is required for sampling, monitoring, or the implementation of response actions at OU1, for the purpose of performing and overseeing response actions at the Site under federal and state law Settling Respondent shall

ensure that its assignees, successors in interest, lessees, and sublessees provide the same access and cooperation EPA agrees to provide reasonable notice to Settling Respondent of the timing of response actions to be undertaken at the Property Notwithstanding any provision of this Agreement, EPA and the State retain all of their access authorities and rights, including enforcement authorities related thereto, under CERCLA, the Resource Conservation and Recovery Act ("RCRA"), 42 U S C § 6901 *et seq* , the Missouri Hazardous Waste Management Law Mo Rev Stat § 260 350 *et seq* , the Missouri "Spill Bill", Mo Rev Stat § 260 500 *et seq* and any other applicable statute or regulation, including any amendments thereto.

20 Within 15 days after the effective date of this Agreement or the date that Settling Respondent acquires the Property, whichever date is later, Settling Respondent shall record a copy of this Agreement with the Recorder's Office in Franklin County, Missouri Attached to the recorded Agreement shall be the Restrictive Covenant and Easement, duly executed by Settling Respondent, which is attached as Attachment 2 Thereafter, each deed, title, or other instrument conveying an interest in the Property shall contain a notice stating that the Property is subject to this Agreement and the Restrictive Covenant and Easement Settling Respondent shall submit to EPA and the State a copy of the Agreement evidencing recordation within 10 days of the date that Settling Respondent records the Agreement

21 Settling Respondent shall ensure that assignees, successors in interest, lessees, and sublessees of the Property shall comply with this Section and Section IV (Undertakings) Settling Respondent shall ensure that a copy of this Agreement is provided to any current lessee or sublessee on the Property as of the effective date of this Agreement and shall ensure that any subsequent leases, subleases, assignments, or transfers of the Property or an interest in the Property are consistent with this Section, Section IV (Undertakings), and Section XII (Parties Bound/Transfer of Covenant) of this Agreement

VI. DUE CARE/COOPERATION

22 Settling Respondent shall exercise due care at the Property with respect to the Existing Contamination and shall comply with all applicable local, State, and federal laws and regulations Settling Respondent recognizes that the implementation of response actions at the Site may interfere with Settling Respondent's use of the Property and may require closure of its

operations or a part thereof Settling Respondent agrees to cooperate fully with EPA and the State in the implementation of response actions at the Site and further agrees not to interfere with such response actions EPA and the State agree consistent with their responsibilities under applicable law, to use reasonable efforts to minimize any interference with Settling Respondent's use of the Property by such entry and response In the event that Settling Respondent becomes aware of any action or occurrence which causes or threatens a release of hazardous substances, pollutants or contaminants at or from the Site that constitutes an emergency situation or may present an immediate threat to public health or welfare or the environment Settling Respondent shall immediately take all appropriate action to prevent, abate, or minimize such release or threat of release. and shall, in addition to complying with any applicable notification requirements under Section 103 of CERCLA, 42 U S C § 9603, or any other law, immediately notify EPA and the State of such release or threatened release

VII. CERTIFICATION

23 By entering into this Agreement, Settling Respondent certifies that to the best of its knowledge and belief it has fully and accurately disclosed to EPA and the State all information known to Settling Respondent and all information in the possession or control of its officers, directors, employees, contractors, and agents which relates in any way to any Existing Contamination or any past or potential future release of hazardous substances, pollutants or contaminants at or from the Property and to its qualification for this Agreement Settling Respondent also certifies that to the best of its knowledge and belief it has not caused or contributed to a release or threat of release of hazardous substances or pollutants or contaminants at the Site If the United States and/or the State determine(s) that information provided by Settling Respondent is not materially accurate and complete, the Agreement, within the sole discretion of the United States and/or the State, shall be null and void and the United States and/or the State reserve(s) all rights that it/they may have

VIII. UNITED STATES' COVENANT NOT TO SUE

24 Subject to the Reservation of Rights in Section X of this Agreement, and upon EPA's receipt of the recorded copy of this Agreement in accordance with paragraph 20 above, the United States covenants not to sue or take any other civil or administrative action against Settling

Respondent for any and all civil liability for injunctive relief or reimbursement of response costs pursuant to Sections 106 or 107(a) of CERCLA, 42 U S C §§ 9606 or 9607(a) with respect to the Existing Contamination

IX. STATE'S COVENANT NOT TO SUE

25 Subject to the Reservation of Rights in Section X of this Agreement, and upon the State s receipt of the recorded copy of this Agreement in accordance with paragraph 20 above, the state of Missouri covenants not to sue or take any other civil or administrative action against Settling Respondent for any and all civil liability for injunctive relief or reimbursement of response costs pursuant to Sections 106 or 107(a) of CERCLA, 42 U S C §§ 9606 or 9607(a) with respect to the Existing Contamination

X. RESERVATION OF RIGHTS

26 The covenants not to sue set forth in Sections VIII and IX above do not pertain to any matters other than those expressly specified in Section VIII (United States' Covenant Not to Sue) and Section IX (State's Covenant Not to Sue) The United States and the state of Missouri reserve and this Agreement is without prejudice to all rights against Settling Respondent with respect to all other matters, including but not limited to, the following

a claims based on a failure by Settling Respondent to meet a requirement of this Agreement, including but not limited to Section IV (Undertakings), Section V (Access/Notice to Successors in Interest), and Section VI (Due Care/Cooperation),

b any liability resulting from past or future releases of hazardous substances, pollutants or contaminants, at or from the Site caused or contributed to by Settling Respondent, its successors, assignees, lessees or sublessees

c any liability resulting from past or future releases of hazardous substances, pollutants or contaminants, at or from any operable unit at the Site other than OU1 caused or contributed to by Settling Respondent, its successors, assignees, lessees or sublessees,

d any liability resulting from the exacerbation by Settling Respondent, its successors, assignees, lessees or sublessees, of Existing Contamination, e any liability resulting from the release or threat of release of hazardous substances, pollutants or contaminants, at the Site after the effective date of this Agreement, not within the definition of Existing Contamination,

f criminal liability,

g liability for damages for injury to, destruction of or loss of natural resources, and for the costs of any natural resource damage assessment incurred by federal agencies other than EPA, and

h liability for violations of local, State or federal law or regulations

27 With respect to any claim or cause of action asserted by the United States and/or the State, Settling Respondent shall bear the burden of proving that the claim or cause of action, or any part thereof, is attributable solely to Existing Contamination

28 Nothing in this Agreement is intended as a release or covenant not to sue for any claim or cause of action, administrative or judicial, civil or criminal past or future, in law or in equity, which the United States or the State may have against any person, firm, corporation or other entity not a party to this Agreement

29 Nothing in this Agreement is intended to limit the right of EPA or the State to undertake future response actions at OU1 or to seek to compel parties other than Settling Respondent to perform or pay for response actions at OU1

30 Nothing in this Agreement shall in any way restrict or limit the nature or scope of response actions which may be taken or be required by EPA in exercising its authority under federal law Settling Respondent acknowledges that it is acquiring Property where response actions may be required

XI. SETTLING RESPONDENT'S COVENANT NOT TO SUE

31 In consideration of the United States' Covenant Not To Sue in Section VIII and the State's Covenant Not to Sue in Section IX of this Agreement, Settling Respondent hereby covenants not to sue and not to assert any claims or causes of action against the United States or the State, their authorized officers, employees, or representatives with respect to the Site or this Agreement, including but not limited to, any direct or indirect claims for reimbursement from the Hazardous Substance Superfund established pursuant to the Internal Revenue Code, 26 U S C §

9507, through Sections 106(b)(2), 111, 112, 113 of CERCLA, or any other provision of law, any claim against the United States or the State, including any department, agency or instrumentality of the United States or the State under Sections 107 or 113 of CERCLA related to the Site, or any claims arising out of response activities at the Site, including claims based on EPA's or the State's oversight of such activities or approval of plans for such activities

32 Settling Respondent reserves, and this Agreement is without prejudice to actions against the United States based on negligent actions taken directly by the United States, not including oversight or approval of Settling Respondent's plans or activities, that are brought pursuant to any statute other than CERCLA or RCRA and for which the waiver of sovereign immunity is found in a statute other than CERCLA or RCRA Nothing herein shall be deemed to constitute preauthorization of a claim within the meaning of Section 111 of CERCLA 42 U S C § 9611, or 40 C F R § 300 700(d)

33 Settling Respondent reserves, and this Agreement is without prejudice to, actions against the State based on Mo Stat Ann § 537 600, not including oversight or approval of Settling Respondent s plans or activities

XII. PARTIES BOUND/TRANSFER OF COVENANT

34 This Agreement shall apply to and be binding upon the United States and the State, and shall apply to and be binding on Settling Respondent, its officers, directors, and employees The United States' Covenant Not to Sue in Section VIII, the State's Covenant Not to Sue in Section IX, and Contribution Protection in Section XIX shall apply to Settling Respondent's officers, directors, and employees to the extent that the alleged liability of the officer, director, or employee is based on its status and in its capacity as officer, director or employee of Settling Respondent, and not to the extent that the alleged liability arose independently of the alleged liability of the Settling Respondent Each signatory of a Party to this Agreement represents that he or she is fully authorized to enter into the terms and conditions of this Agreement and to legally bind such Party

35 Notwithstanding any other provisions of this Agreement, all of the rights, benefits, and obligations conferred upon Settling Respondent under this Agreement may be assigned or transferred to any person with the prior written consent of EPA and the State in their sole

discretion

36 Settling Respondent agrees to pay the reasonable costs incurred by EPA and the State to review any subsequent requests for consent to assign or transfer the Property

37 In the event of an assignment or transfer of the Property or an assignment or transfer of an interest in the Property, the assignor or transferor shall continue to be bound by all of the terms and conditions, and subject to all the benefits, of this Agreement except as EPA, the State and the assignor or transferor agree otherwise and modify this Agreement in writing accordingly Moreover, prior to or simultaneous with any assignment or transfer of the Property, the assignee or transferee must consent in writing to be bound by the terms of this Agreement including, but not limited to, the certification requirement in Section VII of this Agreement for the Covenant Not to Sue in Sections VIII and IX to be available to that party The Covenant Not To Sue in Sections VIII and IX shall not be effective with respect to any assignees or transferees who fail to provide such written consent to EPA and the State

XIII. DISCLAIMER

38 This Agreement in no way constitutes a finding by EPA or the State as to the risks to human health and the environment which may be posed by contamination at the Property or the Site nor constitutes any representation by EPA or the State that the Property or the Site is fit for any particular purpose

XIV. DOCUMENT RETENTION

39 Settling Respondent agrees to retain and make available to EPA and the State all business and operating records, contracts, site studies and investigations, and documents relating to operations at the Property, for at least 10 years, following the effective date of this Agreement unless otherwise agreed to in writing by the Parties At the end of 10 years, Settling Respondent shall notify EPA and the State of the location of such documents and shall provide EPA and the State with an opportunity to copy any documents at the expense of EPA or the State

XV. PAYMENT OF COSTS

40 If Settling Respondent fails to comply with the terms of this Agreement, including, but not limited to, the provisions of Section IV (Undertakings) of this Agreement, it shall be liable for all litigation and other enforcement costs and expenses incurred by the United States

and/or the State to enforce this Agreement or otherwise obtain compliance

XVI. NOTICES AND SUBMISSIONS

41 Whenever, pursuant to the terms of this agreement written notice is required to be given or a report or other document is required to be provided by one party to another it shall be directed to the individuals at the addresses specified below, unless those individuals or their successors give notice of a change to the other Parties in writing

As to EPA

Director, Superfund Division
U S Environmental Protection Agency, Region VII
901 North 5th Street
Kansas City, Kansas 66101

As to the State

Director
Hazardous Waste Program
Missouri Department of Natural Resources
P O Box 176
Jefferson City, Missouri 65102-0176

As to Settling Respondent

The Industrial Development Authority of the City of New Haven, Missouri
c/o E H Anderson, Registered Agent
1100 Olive
New Haven, Missouri 63068

XVII. EFFECTIVE DATE

42 The effective date of this Agreement shall be the date upon which EPA issues written notice to Settling Respondent that EPA and the State have fully executed the Agreement after review of and response to any public comments received

XVIII. TERMINATION

43 If any Party believes that any or all of the obligations under Section V (Access/Notice to Successors in Interest) are no longer necessary to ensure compliance with the requirements of the Agreement, that Party may request in writing that the other Parties agree to terminate the provision(s) establishing such obligations, provided, however, that the provision(s) in question

shall continue in force unless and until the party requesting such termination receives written agreement from the other Parties to terminate such provision(s)

XIX. CONTRIBUTION PROTECTION

44 With regard to claims for contribution against Settling Respondent the Parties hereto agree that Settling Respondent is entitled to protection from contribution actions or claims as provided by Section 113(f)(2) of CERCLA, 42 U S C § 9613(f)(2) for matters addressed in this Agreement The matters addressed in this Agreement are all response actions taken or to be taken and response costs incurred or to be incurred by the United States or any other person for the Property with respect to the Existing Contamination

45 Settling Respondent agrees that with respect to any suit or claim for contribution brought by it for matters related to this Agreement it will notify the United States in writing no later than 60 days prior to the initiation of such suit or claim

46 Settling Respondent also agrees that with respect to any suit or claim for contribution brought against it for matters related to this Agreement it will notify in writing the United States within 10 days of service of the Complaint on it

XX. REMOVAL OF LIEN

47 Subject to the Reservation of Rights in Section X of this Agreement, upon EPA's receipt of the recorded copy of this Agreement in accordance with paragraph 20 above, EPA agrees that any lien that it may have on the Property under Section 107(l) of CERCLA, 42 U S C § 9607(l), as a result of response actions conducted or to be conducted by EPA at the Property, is released

XXI. PUBLIC COMMENT

48 This Agreement shall be subject to a 15 day public comment period, after which EPA and the State may modify or withdraw their consent to this Agreement if comments received disclose facts or considerations which indicate that this Agreement is inappropriate, improper or inadequate

IT IS SO AGREED:

FOR THE UNITED STATES OF AMERICA

By ____________________ Date 2/18/04

CATHERINE R McCABE
Deputy Chief
Environment and Natural Resources Division
Environmental Enforcement Section
Post Office Box 7611
Washington, D C 20044-7611

By ____________________ Date 2/04/04

ROBIN E LAWRENCE
Senior Counsel
United States Department of Justice
Environment and Natural Resources Division
Environmental Enforcement Section
Post Office Box 7611
Washington, D C 20044-7611

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

By [signature] Date 11/6/03

JAMES B GULLIFORD
Regional Administrator
U S Environmental Protection Agency
901 North 5th Street
Kansas City, Kansas 66101-2798

By [signature] Date 10/29/03

DAVID A HOEFER
Attorney
Office of Regional Counsel
U S Environmental Protection Agency
901 North 5th Street
Kansas City, Kansas 66101-2798

FOR THE STATE OF MISSOURI

By ______________________ Date 12 Nov 2003

JAMES WERNER
Director
Air and Land Protection Division
Missouri Department of Natural Resources

By ______________________ Date October 31, 2003

JEREMIAH W (JAY) NIXON
Attorney General
Shelley A Woods, Assistant Attorney General

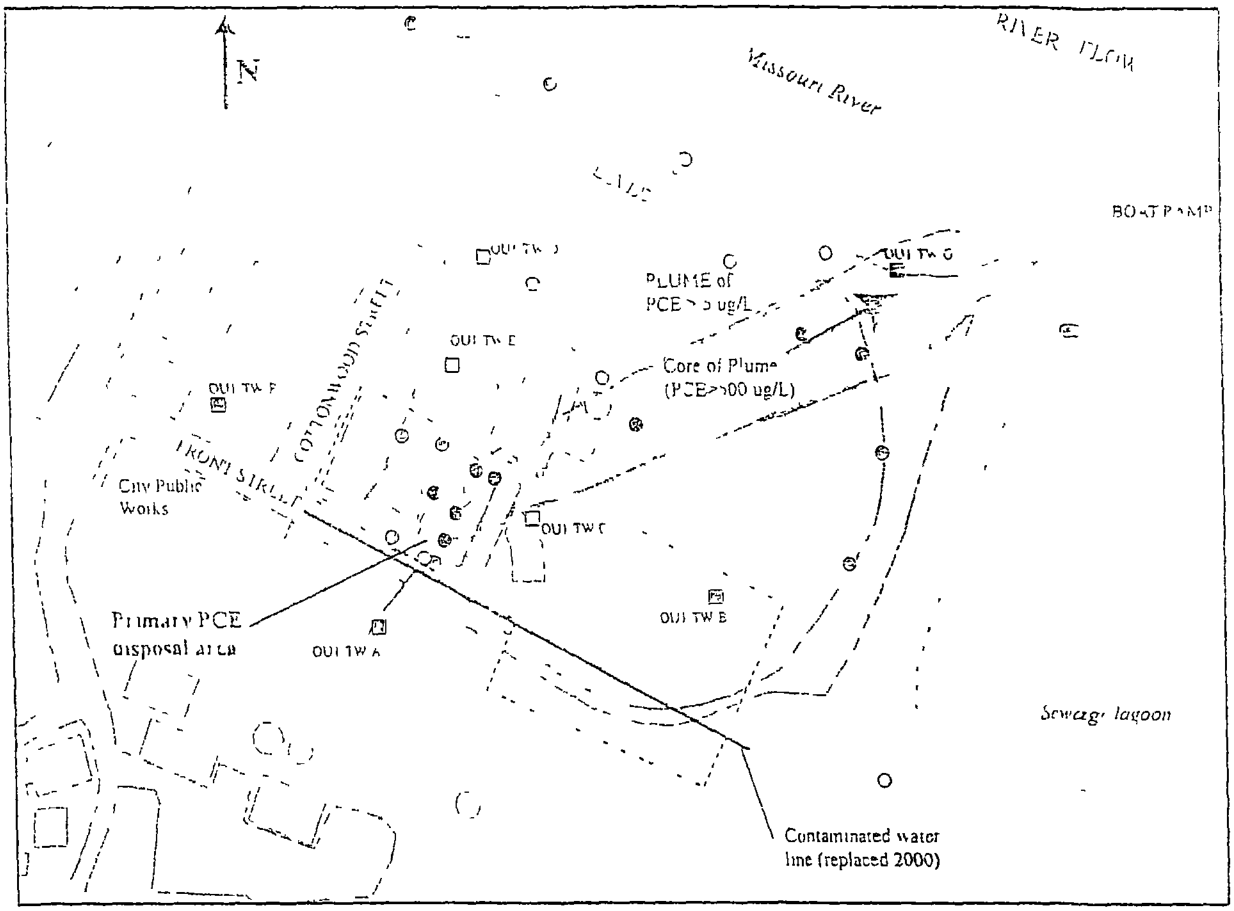
FOR THE INDUSTRIAL DEVELOPMENT AUTHORITY OF THE CITY OF NEW HAVEN, MISSOURI

By Warren Bauche Date 10/29/03

Name (print) WARREN BAUCHE
Title DIRECTOR
Address 117 CIRCLE DRIVE
NEW HAVEN, MO 63068

ATTACHMENT 1

DEPICTION OF OU1



Base from U.S. Geological Survey digital data 1:100,000 1927 Universal Transverse Mercator projection Zone 15

SCALE

0 100 200 FEET

EXPLANATION

- STREAM
- ROAD OR CONCRETE PAD
- BUILDING
- FRONT STREET SITE PROPERTY LINE
- APPROXIMATE AREA CONTAINING PCE ABOVE THE MCL OF 5.0 MICROGRAMS PER LITER
- TEMPORARY WELL SCREEN
- OU1 TW A MONITORING WELL AND NUMBER

COLOR OF TEMPORARY WELL SCREEN OR WELL INDICATES PCE CONCENTRATION

BLUE	NOT DETECTED
GREEN	BELOW MCL (5 UG/l)
YELLOW	1 TO 10 TIMES MCL
ORANGE	10 TO 100 TIMES MCL
RED	MORE THAN 100 TIMES MCL

ATTACHMENT 2

RESTRICTIVE COVENANT AND EASEMENT

The Industrial Development Authority of the City of New Haven Missouri ("Industrial Development Authority") a Missouri industrial development corporation has entered into an Agreement and Covenant Not to Sue ("Agreement") with the State of Missouri ("State") and the U S Environmental Protection Agency ("EPA"), pursuant to Mo Rev Stat § 260 500, et seq and the Comprehensive Environmental Response Compensation and Liability Act, 42 U S C §§ 9601-9675, as amended, with regard to the Riverfront Superfund Site Operable Unit No 1, located in New Haven, Franklin County, Missouri, and legally described as

> Part of Lot Two (2) of the Subdivision of Phillip Miller s Estate, as per plat of record , and a portion of the Missouri Pacific Railroad right of way as described in deed of record in Volume 6, page 60 in the Office of the Recorder of Deeds, in the City of New Haven, described as follows Beginning at the Southeast corner of Lot 26 of the Original Town (now City) of New Haven, as per plat of record, and run thence South 59 ° 45' East 46 feet, thence South 64° 30' East 201 4 feet to a point in the West line of a roadway as described in deeds of record in Book 255, page 192 and 194, thence on said roadway line South 26° 29' West 189 feet to a point in the present North right of way line of the Missouri Pacific Railroad, thence on said right of way line North 70° 30' West 192 9 feet to property corner, thence North 29° 30' East 50 feet to the property corner, thence North 60° 30' West 50 feet to a point where the West line of said Lot 2 intersects, thence on said lot line North 25° 15' East 157 5 feet to the point of beginning, reference being made to survey by E F Kappelmann, County Surveyor, executed during the month of September 1968
>
> Lots Twenty-seven (27) Twenty-eight (28), Part of Lots Twenty-nine (29) and Thirty (30), described as follows Beginning at the Southeast corner of said Lot 29, thence North 26° 15' East on the East line thereof 54 feet to the Southeast corner of a parcel conveyed to Leader Publishing Co by deed of record in Book 568, page 623, thence North 59° 45' West on the South line of the Leader Publishing parcel 90 02 feet to the Southwest corner of said parcel, thence South 26° 15' West 49 5 feet to a point in the South line of Lot 30, thence South 59° 30' East on the South lines of Lots 30 and 29 a distance of 90 feet to the point of beginning,
>
> All of the original Town (now City) of New Haven, as per plat of record in the Office of the Recorder of Deeds
>
> the "Property "

Paragraph 20 of the Agreement requires that the Industrial Development Authority file this Restrictive Covenant and Easement with the Recorder of Deeds for Franklin County, Missouri with regard to the Property

Because contaminants of concern will remain at levels above those appropriate for unrestricted use of the Property, this Restrictive Covenant is being recorded with the Franklin County Recorder of Deeds for the purposes of protecting public health and safety, the environment, and to prevent interference with the performance, operation and maintenance of any response activities selected and/or undertaken by the EPA and/or the State any party acting as an agent for the EPA and/or the State, or any party acting pursuant to a work plan approved by the EPA and/or the State

If any provision of this Restrictive Covenant and Easement is the subject of any laws or regulations established by any federal, state, or local government, the stricter of the two standards shall prevail

NOW THEREFORE, the Industrial Development Authority (hereinafter referred to as the "Owner"), hereby imposes restrictions on the Property and covenants and agrees that

1. Purpose

In accordance with the Agreement, the purpose of this Restrictive Covenant is to assure

A That groundwater at the Property is not used for drinking or bathing,

B That humans are not exposed to soils containing hazardous substances at the Property,

C That buildings are not constructed over soils or groundwater at the Property which would result in the exposure of humans to hazardous substances, and

D That any engineered control put into place at the Property by the EPA or the State as part of a response action to address hazardous substances at the Property is not disturbed

2. Restrictions Applicable to the Property

In furtherance of the purposes of this Restrictive Covenant, Owner shall assure that use, occupancy, and activity of and at the Property are restricted as follows

The Property currently meets the State's standards for restricted use and based on information on file at the Missouri Department of Natural Resources' ("MDNR") offices in Jefferson City, Missouri, the hazardous substances present pose no significant present or future risk to human health or the environment based on restricted use of the Property The Property is protective for restricted use as long as the cap or other cover is maintained to prevent exposure The Property shall not be used for purposes other than for civic uses, as "greenspace," a park, or for parking If any person desires in the future to use the Property for residential or other purposes constituting unrestricted use, the State and EPA must be notified at least 120 days in advance and further analyses and, as necessary, response actions may be necessary prior to such use

The groundwater beneath the Property contains hazardous substances identified in information on file at the MDNR's offices in Jefferson City, Missouri and the EPA's offices in Kansas City, Kansas Therefore, the owner and operator of the Property must prevent use of and exposure to the groundwater, any artificial penetration of the groundwater-bearing unit(s) containing hazardous substances which could result in cross-contamination of clean groundwater-bearing units, installation of any new groundwater wells on the Property except those used for investigative purposes, and use of groundwater for drinking or other domestic purposes

Soil at the Property contains hazardous substances as identified in information on file at the MDNR's offices in Jefferson City, Missouri and the EPA's offices in Kansas City, Kansas, at concentrations exceeding the State's clean up standards for unrestricted use Therefore, soil at the Property shall not be excavated or otherwise disturbed in any manner without the written permission of the State and EPA Should the owner or operator desire to disturb soil at the Property, it shall request permission to do so from the State and the EPA at least 60 days before the soil disturbance activities are to begin Based on the potential hazards associated with the soil disturbance activities, the State and/or the EPA may deny the request to disturb the soils or may require specific protective or remedial actions before allowing such soil disturbance activities to occur

Soil at the Property contains hazardous substances as identified in information on file at the MDNR's offices in Jefferson City, Missouri and the EPA's offices in Kansas City, Kansas, at concentrations exceeding the State's clean up standards for unrestricted use Therefore, no buildings may be constructed on the Property except with the written permission of the State and EPA Should the owner or operator desire to construct a building on the Property, it shall request permission from the State and EPA at least 60 days before construction is anticipated to begin Based on the potential hazards associated with the construction activities, the State and/or EPA may deny the request to construct or may require specific protective or remedial actions before allowing such construction activities to occur

The Owner shall prohibit all activities as presented above that will result in human exposures above those specified in the cleanup assessment or risk assessment performed or approved by the Missouri Department of Health for the Property or that would result in the release of a hazardous substance that was contained as a part of the remedial action

3. Potential Hazards

Except as provided in paragraph 4 below, no action shall be taken, allowed, suffered, or omitted if such action or omission is reasonably likely to interfere with any action taken or to be taken by the EPA or the State in responding to the release of a hazardous substance from the Property

4. Emergencies.

In the event of an emergency which presents a significant risk to human health or the environment the application of paragraph 3 above may be suspended provided such risk cannot be abated without suspending such paragraph, and the Owner

A Immediately notifies the EPA and State of the emergency

B Limits both the extent and duration of the suspension to the minimum reasonably necessary to adequately respond to the emergency,

C Implements all measures necessary to limit actual and potential present and future risk to human health and the environment resulting from such suspension and

D Implements a plan approved in writing by the EPA and State, on a schedule approved by the EPA and the State, to ensure that the Property is remediated or restored to its condition prior to such emergency

5. Alterations of Property

Owner shall not make, or allow or suffer to be made, any alteration of any kind in, to, or about any portion of the Property inconsistent with this Restrictive Covenant unless the Owner has first recorded the written approval of the State and the EPA of such alteration upon the land records of Franklin County, Missouri

6. Grant of Easement to the State

Owner hereby grants and conveys to the State and its agents, contractors, and employees, and to any person performing pollution remediation activities under the direction thereof, a non-exclusive easement (the "Easement") over the Property and over such other parts of the Property as are necessary for access to the Property or for carrying out any actions to abate a threat to human health or the environment related to a State or Federal-approved remedial action plan Pursuant to this Easement, the State and/or the EPA, their agents, contractors, and employees, and any person performing pollution remediation activities under the direction thereof, may enter upon and inspect the Property and perform such investigations and actions as the State and/or the EPA deem(s) necessary for any one or more of the following purposes

A Ensuring that use, occupancy, and activities of and at the Property are consistent with this Restrictive Covenant,

B Ensuring that any remediation implemented complies with state and federal law, and

C Performing any additional investigations or remediation necessary to protect human health and the environment as related to the approved remedial action plan

7. Notice and Time of Entry onto Property

Entry onto the Property by the State and/or the EPA and their agents contractors, and employees, pursuant to this Easement shall be at reasonable times, provided that entry shall not be subject to these limitations if the State and/or the EPA determine(s) that immediate entry is necessary to protect human health or the environment

8. Notice to Lessees and Other Holders of Interest in the Property

Owner, or any future holder of any interest in the Property, shall cause any lease, grant, or other transfer of any interest in the Property to include a provision expressly requiring the lessee or transferee to comply with this Restrictive Covenant and Easement The failure to include such provision shall not affect the validity or applicability to the Property of this Restrictive Covenant and Easement

9. Persons Entitled to Enforce Restrictions - EPA as Third-Party Beneficiary.

The restrictions in this Restrictive Covenant on use, occupancy, and activity of and at the Property shall be enforceable in an appropriate Court by Owner and/or by the State, the EPA and their respective successors, transferees, and assigns As the benefits provided by this Restrictive Covenant accrue to the EPA as well as the State, the EPA is hereby designated and the parties agree that the EPA is a third-party intended beneficiary of this Restrictive Covenant and Easement and that the EPA may enforce the terms of this Restrictive Covenant and Easement independently of the State

10. Interfering Activities.

The Owner shall prohibit all activities on the Property which may interfere with the response activities, operation and maintenance, long-term monitoring, or measures necessary to assure the effectiveness of the remedial action

11. Written Notice Required.

The Owner shall provide written notice as provided in paragraph 41 of the Agreement to the MDNR and the EPA of the intent to transfer an interest in the Property not less than 14 days prior to the expected date of transfer

12. Property Conveyance.

The Owner shall not convey any title, easement, or other interest in the Property without adequate and complete provision for the continued implementation, operation, and maintenance of any remedial action that has been implemented on the Property and without assuring prevention of the releases and exposures described in the provisions of paragraph 8, above

13. Duration.

The restrictions and other requirements described in this Restrictive Covenant and Easement shall run with the land and shall be binding upon any future Owners, heirs successors, lessees, or assigns and their authorized agents, employees, or persons acting under their direction or control This Restrictive Covenant and Easement shall continue into perpetuity unless and until rescinded by the State and EPA A copy of this Restrictive Covenant and Easement shall be provided to all heirs, successors, assigns, and transferees of Owner If any provision of this Restrictive Covenant and Easement is held invalid by any Court of competent jurisdiction, invalidity of any such provision shall not affect the validity of any other provisions hereof Also such provisions shall continue unimpaired in full force and effect

14. Amending, Modifying, or Rescinding the Restrictive Covenant

This Restrictive Covenant and Easement shall not be amended, modified or terminated except by a written instrument executed by and between the Owner at the time of the proposed amendment, modification, or termination, the State and the EPA Within five (5) days of executing an amendment, modification, or termination of this Restrictive Covenant and Easement, the Owner shall record such amendment, modification, or termination, on the appropriate form provided by the EPA and State, with the Franklin County Recorder of Deeds, and within five (5) days thereafter, the Owner shall provide a true copy of the recorded amendment, modification, or termination to the State and the EPA In the event the State and/or the EPA determine(s) that risks posed by the Property have substantially changed subsequent to the execution of this Restrictive Covenant and Easement (e g , contaminant levels at the site change, or cleanup levels change), the State and the EPA may rescind this Restrictive Covenant and Easement

15. SIGNATURE

The undersigned property owner or person executing this Restrictive Covenant and Easement on behalf of the Owner represents and certifies that it is truly authorized and empowered to execute and deliver this Restrictive Covenant and Easement

**FOR THE INDUSTRIAL DEVELOPMENT AUTHORITY
OF THE CITY OF NEW HAVEN, MISSOURI**

By ______________________________ Date ___________________________
Name (print) ____________________
Title ___________________________
Address _________________________
____
____
____

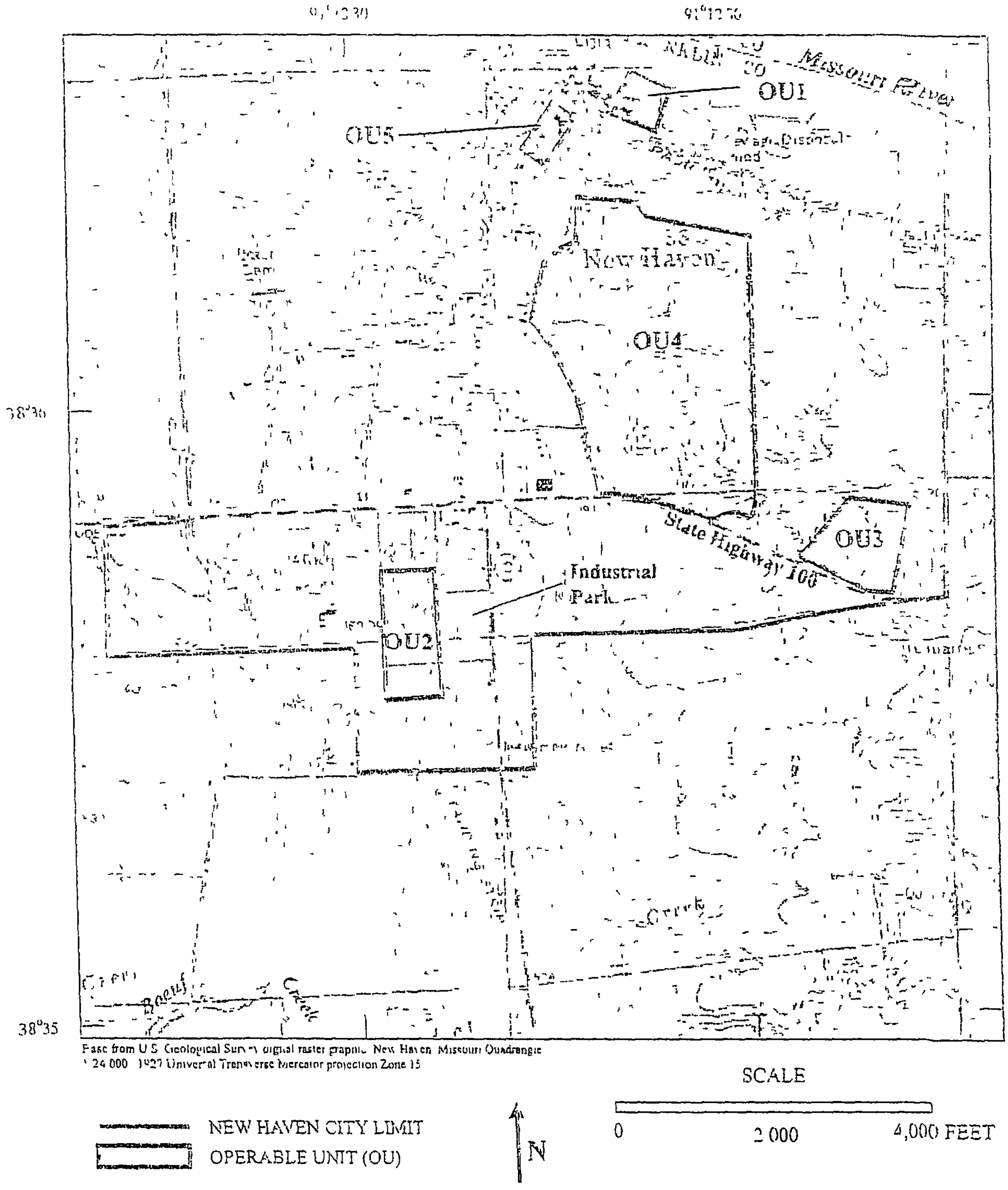
STATE OF MISSOURI)
)
COUNTY OF _______________)

On this ___ day of ____________, 2003, before me a Notary Public in and for said state, personally appeared __________________ _______________ of The Industrial Development Authority of the City of New Haven Missouri, known to me to be the person who executed the within Restrictive Covenant and Easement in behalf of said corporation and acknowledged to me that he executed the same for the purposes therein stated

____
Notary Public

ATTACHMENT 3

DEPICTION OF SITE



Base from U S Geological Survey digital raster graphic New Haven Missouri Quadrangle 1 24 000 1927 Universal Transverse Mercator projection Zone 15

Operable Unit No. 3

Environmental Covenant

Entered into by

The City of New Haven, Missouri and

The Missouri Department of Natural Resources

0806951.001

CK# 58788 48.00

(ABOVE SPACE RESERVED FOR RECORDER'S USE)

Document Title:	Environmental Covenant
Document Date:	4-14, 2008
Grantor:	City of New Haven, Missouri 101 Front Street New Haven, MO 63068
Holder:	Missouri Department of Natural Resources Hazardous Waste Program P.O. Box 176 1730 East Elm Street Jefferson City, MO 65101
Legal Description:	Part of Lot 2 of the northeast Quarter of Section 1, Township 44 north, Range 3 west, described as follows: Commencing at an old fence corner in the northeast corner of Section 1, thence south 87 degrees, 30 minutes west on the township line 2,180.6 feet to a point, thence south 6 degrees 30 minutes west 510 feet, thence south 64 degrees east 423.2 feet, thence south 57 degrees 40 minutes east 475.3 feet, thence south 36 degrees 10 minutes east 95.7 feet to an iron pipe in the north right-of-way line of Missouri State Highway 100, being the point of beginning herein described, thence on the north line of said highway south 66 degrees 4 minutes east 322.5 feet and thence along a curve of said right-of-way, having a radius of 1,432.69 feet, a distance of 219.6 feet to an iron pipe, thence running north 6 degrees 30 minutes east 510 feet to an iron pipe, and north 83 degrees 30 minutes west 519.2 feet to an iron pipe, thence south 6 degrees 30 minutes west 355.5 feet to the point of beginning.

10.3

ENVIRONMENTAL COVENANT

This Environmental Covenant is entered into by the CITY OF NEW HAVEN, MISSOURI, as the Grantor of this Environmental Covenant and the Owner of the Property (as defined below), and the MISSOURI DEPARTMENT OF NATURAL RESOURCES, as the "Holder" of this Environmental Covenant as provided for in the Missouri Environmental Covenants Act, Sections 260.1000 through 260.1039, RSMo.

RECITALS

WHEREAS, the City of New Haven, whose mailing address is 101 Front Street, New Haven, MO 63068, is the owner in fee simple of the following real property located in Franklin County, Missouri:

> Part of Lot 2 of the northeast Quarter of Section 1, Township 44 north, Range 3 west, described as follows: Commencing at an old fence corner in the northeast corner of Section 1, thence south 87 degrees, 30 minutes west on the township line 2,180.6 feet to a point, thence south 6 degrees 30 minutes west 510 feet, thence south 64 degrees east 423.2 feet, thence south 57 degrees 40 minutes east 475.3 feet, thence south 36 degrees 10 minutes east 95.7 feet to an iron pipe in the north right-of-way line of Missouri State Highway 100, being the point of beginning herein described, thence on the north line of said highway south 66 degrees 4 minutes east 322.5 feet and thence along a curve of said right-of-way, having a radius of 1,432.69 feet, a distance of 219.6 feet to an iron pipe, thence running north 6 degrees 30 minutes east 510 feet to an iron pipe, and north 83 degrees 30 minutes west 519.2 feet to an iron pipe, thence south 6 degrees 30 minutes west 355.5 feet to the point of beginning.

the "Property;"

WHEREAS, the Property is the location of a landfill which was used for the disposal of household, commercial, and industrial wastes from the mid-1950s until 1974; and

WHEREAS, in 1986 certain hazardous substances were detected in two municipal water wells serving the residents of New Haven. As a result, the United States Environmental Protection Agency ("EPA") and the Missouri Department of Natural Resources ("MDNR") began investigations to determine the origin, rate, and extent of the contamination; and

WHEREAS, in December 2004, the Property, along with other areas in and around New Haven, were listed on EPA's National Priorities List as the "Riverfront" Superfund Site, and the Property become known as Operable Unit No. 3 ("OU3"); and

WHEREAS, EPA conducted a remedial investigation/feasibility study, and on September 30, 2003, issued a Record of Decision ("ROD") for OU3. The ROD called for the continued monitoring of the groundwater and seeps in and around OU3, and the imposition of activity and use limitations on the Property; and

WHEREAS, by Consent Decree entered on September 6, 2007, by the United States District Court for the Eastern District of Missouri, Eastern Division, in Case No. 4:06CV01429ERW, the City of New Haven agreed to implement the environmental response project selected in the ROD, which includes the imposition of the activity and use limitations provided for herein; and

WHEREAS, Owner desires to grant to MDNR as Holder, this Environmental Covenant for the purpose of subjecting the Property to certain activity and use limitations as provided in the Missouri Environmental Covenants Act, and grants to MDNR and EPA certain rights and powers as herein provided.

NOW THEREFORE, the parties hereto agree as follows:

1. <u>Parties</u>. The parties hereto are:

   a. the City of New Haven, Missouri is the Grantor/Owner of the Property.
   b. the Missouri Department of Natural Resources is the "Holder" of this Environmental Covenant, as "Holder" is defined at Section 260.1003(6) of the Missouri Environmental Covenants Act.
   c. the United States Environmental Protection Agency is a "Department" as that term is defined at Section 260.1003(2) of the Missouri Environmental Covenants Act.

2. <u>Activity and Use Limitations</u>. As part of the environmental response project to be implemented at the Property, the City of New Haven agrees to prohibit any uses of the Property which would be inconsistent with the environmental response project provided for in the ROD. It also agrees to subject the Property to, and agrees to comply with, the following activity and use limitations:

<u>Soil</u>: A landfill containing unknown household, commercial, and industrial wastes is located on the Property. The landfill is covered with a layer of soil, demolition, yard and compost wastes. Except for minor excavations into the landfill (to 24 inches deep), there shall be no excavations into, or penetration of, the landfill without the prior written consent of EPA and MDNR. Based on the potential hazards associated with the disturbance of the landfill, EPA and MDNR may deny a request to disturb the soils or may require protective actions before allowing such soil disturbance to occur.

Groundwater: The groundwater beneath the Property contains hazardous substances. As the contents of the landfill are unknown, the disturbance of the landfill may result in the additional release of hazardous substances into the groundwater. Except as approved by EPA and MDNR, there shall be no groundwater wells installed on the Property.

3. Running with the Land. This Environmental Covenant shall be binding upon the City of New Haven and its successors, assigns, and any party that receives any conveyance of any interest in the Property ("Transferee"), and shall run with the land, as provided in Section 260.1012, RSMo, subject to amendment or termination as set forth herein. The term "Transferee," as used in this Environmental Covenant, shall mean any future owner of any interest in the Property or any portion thereof, including, but not limited to, owners of an interest in fee simple, mortgagees, easement holders, and/or lessees.

4. Location of Administrative Record for the Environmental Response Project. The administrative record for the environmental response project for the Property is located at EPA's Regional Office at 901 North 5th Street, Kansas City, Kansas, and at the New Haven Scenic Regional Library at 109 Maupin Avenue, New Haven, Missouri.

5. Enforcement. Compliance with this Environmental Covenant may be enforced as provided in Section 260.1030, RSMo. Failure to timely enforce compliance with this Environmental Covenant or the activity and use limitations contained herein by any party shall not bar subsequent enforcement by such party and shall not be deemed a waiver of the party's right to take action to enforce any non-compliance. Nothing in this Environmental Covenant shall restrict any person from exercising any authority under any other applicable law.

6. Right of Access. Owner hereby grants to each of Holder and Department, and their respective agents, contractors, and employees, the right of access at all reasonable times to the Property for implementing, monitoring, and/or enforcing this Environmental Covenant. Nothing herein shall be deemed to limit or otherwise affect any right of access and entry available to Holder or Department under federal or state law.

7. Notice upon Conveyance. Each instrument hereafter conveying any interest in the Property or any portion of the Property shall contain a notice of the activity and use limitations set forth in this Environmental Covenant, and provide the recording references for this Environmental Covenant. The notice shall be substantially in the following form:

THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL COVENANT, DATED __________,2008, RECORDED IN THE OFFICE OF THE RECORDER OF DEEDS OF FRANKLIN COUNTY, MISSOURI, ON __________, 2008, AS DOCUMENT ____, BOOK___, PAGE ____.

Owner/Transferee shall notify Holder and Department within ten (10) days following each conveyance of any interest in any portion of the Property. The notice shall include the name, address, and telephone number of the Transferee, and a copy of the deed or other documentation evidencing the conveyance.

8. Notification Requirement. Owner/Transferee shall notify Holder and Department of any proposed changes in the use of the Property, or of any applications for building permits for work on the Property.

9. Representations and Warranties. The City of New Haven hereby represents and warrants to Holder and Department that it has the power and authority to enter into this Environmental Covenant, to grant the rights and interests herein provided and to carry out all obligations required of it hereunder.

10. Amendment or Termination. This Environmental Covenant may be amended or terminated as provided for in Section 260.1027 RSMo. Within thirty (30) days of signature by all requisite parties on any amendment or termination of this Environmental Covenant, Owner/Transferee shall file such instrument for recording with the office of the recorder of deeds for Franklin County, Missouri.

11. Severability. If any provision of this Environmental Covenant is found to be unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions shall not in any way be affected or impaired.

12. Governing Law. This Environmental Covenant shall be governed by and interpreted in accordance with the laws of the State of Missouri.

13. Recordation. Within thirty (30) days after the date of the final required signature upon this Environmental Covenant, Owner shall record this Environmental Covenant with the office of the recorder of deeds for Franklin County, Missouri.

14. Effective Date. The effective date of this Environmental Covenant shall be the date upon which the fully executed Environmental Covenant has been recorded with the office of the recorder of deeds for Franklin County, Missouri.

15. Distribution of Environmental Covenant. Within thirty (30) days following the recording of this Environmental Covenant, or any amendment or termination of this Environmental Covenant, Owner/Transferee shall, in accordance with Section 260.1018, RSMo, distribute a file- and date-stamped copy of the recorded Environmental Covenant to: (a) each signatory hereto; (b) each person holding a recorded interest in the Property; and (c) each person in possession of the Property.

16. Notice. Any document or other item required by this Environmental Covenant to be given to another party hereto shall be sent to:

If to Owner:

City Manager
City of New Haven, Missouri
101 Front Street
New Haven, Missouri 63068

If to Holder/MDNR:

Missouri Department of Natural Resources
Section Chief, Superfund Program
Hazardous Waste Program
P.O. Box 176
1738 East Elm Street
Jefferson City, MO 65101

If to EPA/Department:

Director, Superfund Division
United States Environmental Protection Agency
901 North 5th Street
Kansas City, Kansas 66101

0806951.007

FOR THE CITY OF NEW HAVEN, MISSOURI

By: ________________ Date: 3.19.08

Name (print): ~~GEORGE PANHORST~~

Title: MAYOR

Address: 101 Front St.

~~New Haven, Missouri 63068~~

SEAL OF CITY OF NEW HAVEN MISSOURI

STATE OF MISSOURI)
)
COUNTY OF FRANKLIN)

On this 19 day of March, 2008, before me a Notary Public in and for said state, personally appeared George Panhorst, Mayor of the City of New Haven, Missouri, known to me to be the person who executed the within Environmental Covenant in behalf of the City of New Haven, Missouri and acknowledged to me that he/she executed the same for the purposes therein stated.

Carolyn E Scheer

Notary Public

CAROLYN E. SCHEER

CAROLYN E SCHEER
Notary Public - Notary Seal
State of Missouri
Commissioned for Franklin County
My Commission Expires: March 09, 2012
Commission Number: 08484049

0806951.008

FOR THE MISSOURI DEPARTMENT OF NATURAL RESOURCES

By: Dennis Stinson   Date: 4/8/2008

Name: Dennis Stinson
Chief, Superfund Section
Hazardous Waste Program
Division of Environmental Quality

STATE OF MISSOURI)
)
COUNTY OF COLE)

On this 8th day of April, 2008, before me a Notary Public in and for said state, personally appeared the Chief of the Superfund Section of the Hazardous Waste Program, Division of Environmental Quality (or his/her designee) of the Missouri Department of Natural Resources, known to me to be the person who executed the within Environmental Covenant in behalf of said party and acknowledged to me that he/she executed the same for the purposes therein stated.

Desiree Pigford
Notary Public

DESIREE M. PIGFORD

STATE OF MISSOURI NOTARY SEAL
DESIREE M. PIGFORD
Notary Public, State of Missouri
Callaway County
My Commission #06892137
Expires May 29, 2010

0805951.009

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

By: ________________ Date: 3/31/08

Name: Cecilia Tapia
Director, Superfund Division
United States Environmental Protection Agency
901 North 5th Street
Kansas City, Kansas 66101

STATE OF KANSAS)
)
COUNTY OF WYANDOTTE)

On this 1st day of April, 2008, before me a Notary Public in and for said state, personally appeared the Director of the Superfund Division (or his/her designee) of the United States Environmental Protection Agency, Region VII, known to me to be the person who executed the within Environmental Covenant in behalf of said party and acknowledged to me that he/she executed the same for the purposes therein stated.

____
Notary Public
KENT JOHNSON

KENT JOHNSON
NOTARY PUBLIC
STATE OF KANSAS
My Appt. Exp. 7/23/11