

**Third
Five-Year Review Report**

**Shaw Avenue Dump Site
Charles City
Floyd County, Iowa**



August 2015

**Region 7
United States Environmental Protection Agency
Lenexa, Kansas**

Approved by:

Mary P. Peterson
Mary P. Peterson
Director, Superfund Division
U.S. EPA, Region 7

8/21/2015
Date

[Intentionally Blank]

Executive Summary

This is the third five-year review (FYR) for the Shaw Avenue Dump Site (Site) and is required due to contamination remaining above levels that allow for unlimited use and unrestricted exposure. The Site is located on the southeastern edge of Charles City, Iowa, approximately 600 feet from the Cedar River, near the intersection of Shaw Avenue and Clark Street. The Site is owned by the city of Charles City, occupies approximately 24 acres of the Cedar River 100-year floodplain, and had been operated as a municipal disposal site from prior to 1949 to 1964.

Salsbury Laboratories, Inc., a producer of veterinary pharmaceuticals, disposed of waste sludges directly at the Site from 1949 to 1953. Salsbury Laboratories also discharged waste to the municipal wastewater treatment plant which subsequently disposed of its sludge at the Site through 1964. Salsbury Laboratory waste contained high concentrations of arsenic and organic compounds including nitrophenol, 2-nitroaniline, nitrobenzene, and 1,1,2-TCA. The Site was identified as a potential hazardous waste site by the Iowa Department of Environmental Quality (IDEQ) in 1977 and was placed on the National Priorities List (NPL) in July 1987.

The U.S. Environmental Protection Agency, in consultation with the Iowa Department of Natural Resources (IDNR [formerly IDEQ]), issued an Operable Unit 1 (OU1) Record of Decision (ROD) in September 1991 that presented the remedy of in situ fixation/stabilization of soil and chemical fill containing greater than 50 parts per million (ppm) arsenic or 20 ppm cadmium, installation of a low permeability cap, groundwater monitoring, and institutional controls as the remedy. The EPA issued an Explanation of Significant Differences (ESD) in March 1992 which modified the remedy to excavation and off-site disposal of the chemical fill and contaminated soil. In 1992, the EPA entered into a Consent Decree with the city of Charles City, Iowa, and Solvay Animal Health, Inc. (the successor to Salsbury Laboratories, Inc.) which required the remedy be implemented. Remedial action field work was physically completed on May 15, 1992. An estimated total 2,220 cubic yards of chemical fill and contaminated soil was excavated and disposed off site.

The EPA issued an OU2 ROD in September 2000 which selected no further action for groundwater, but stipulated that groundwater monitoring and institutional controls required by the 1992 Consent Decree be continued. The intent of the groundwater monitoring was to allow for an evaluation of the effectiveness of the contaminated soil and chemical fill remedial action (RA) in preventing or reducing the leaching of contaminants to groundwater, as well as to assess the need for additional RAs at the Site. Groundwater monitoring and site maintenance are the remaining actions being conducted at the Site.

The OU1 RA has been completed and chemical fill areas have been excavated. These activities have either eliminated or reduced risks posed by exposure to contaminated soil and chemical fill in these areas. Newly available toxicity values for the polycyclic aromatic hydrocarbons (PAHs) since completion of the ROD call into question whether current concentrations of these contaminants in the on-site soil warrant additional remedial action(s).

Contaminants remain in groundwater at concentrations which exceed federal primary drinking water maximum contaminant levels (MCLs) and Iowa health-based standards. Although contaminants remain above drinking water standards, general decreasing arsenic concentrations in groundwater indicate that the OU1 RA has reduced contaminant migration into groundwater. However, MW-2 arsenic concentrations continue to increase, and certain wells previously exhibiting decreasing arsenic concentration trends now exhibit either no discernible trend or one which is stable. In addition, the current groundwater monitoring plan includes limited chemical constituents. For example, the plan was revised in 2002 and no longer includes site-related contaminants of potential concern (COPCs) such as benzene, xylene, toluene, and 2-nitroaniline. Current levels are unknown and changes in toxicity warrant additional investigation. It is recommended that additional sampling be performed and the results evaluated to determine if additional remedial actions are warranted.

Ecological risks were not comprehensively evaluated as part of the OU1 and OU2 risk assessment and remedy selection process. Currently, the campground adjacent to the Site has a recreationally used pond, and environmental data has not been collected from the pond since a 2000/2001 risk assessment. Due to the increasing arsenic concentrations in MW-2, adjacent to the campground pond, it is recommended that environmental samples (i.e., surface water and sediment samples) be collected from the pond and the adjacent Cedar River to evaluate whether there are unacceptable risks to human health and the environment.

Site institutional controls are in place and no groundwater production wells have been completed on site. No private wells are located downgradient of any site monitoring well where arsenic and/or vinyl chloride exceeds its MCL.

A protectiveness determination of the OU1 remedy cannot be made at this time until further information is obtained. Further information will be obtained by collecting soil samples and evaluating them for PAHs in on-site soil. Once results are evaluated, these levels will be used to evaluate risk and determine if additional remedial action is warranted. It is anticipated that information will be collected and evaluated by September 2016, at which time a protectiveness determination will be made.

A protectiveness determination of the OU2 limited action remedy cannot be made at this time until further information is obtained. Further information will be obtained by completing the following activities:

- Collect environmental data from the recreational pond and Cedar River to determine if unacceptable risks to human health or the environment exist and could warrant additional remedial actions; and
- Based on changes in toxicity values for benzene, xylene, toluene, and 2-orthonitroaniline, collect groundwater samples and evaluate risks to human health to determine if additional remedial actions are warranted.

It is anticipated that information will be collected and evaluated by September 2016, at which time a protectiveness determination will be made.

Table of Contents

Executive Summary	ES-1
List of Acronyms and Abbreviations	iv
Five-Year Review Summary Form	vii
1.0 Introduction	1
2.0 Site Chronology	3
3.0 Background	5
3.1 Site Location	5
3.2 Physical Characteristics	5
3.2.1 Topography	5
3.2.2 Surface Hydrology and Drainage	5
3.2.3 Geology and Hydrogeology	6
3.3 Land and Resource Use	6
3.4 History of Contamination	7
3.5 Initial Response	7
3.6 Basis for Taking Action	8
4.0 Remedial Actions	10
4.1 Remedy Selection	10
4.1.1 Operable Unit 1	10
4.1.2 Operable Unit 2	11
4.1.3 Consent Decree	12
4.2 Remedy Implementation	12
4.2.1 Operable Unit 1	12
4.2.2 Operable Unit 2	14
4.3 System Operation/Maintenance Activities	14
5.0 Progress Since Last Review	16
6.0 Five-Year Review Process	19
6.1 Administrative Components	19
6.2 Community Involvement	19
6.3 Document Review	19
6.4 Data Review	19
6.5 Evaluation of Historical COC Concentration Trends	20
6.6 Site Inspection	22
6.7 Interviews	23
7.0 Technical Assessment	25
7.1 Question A: <i>Is the remedy functioning as intended by the decision documents?</i>	25
7.1.1 Remedial Action Performance	25
7.1.2 System Operations and Maintenance	26
7.1.3 Opportunities for Optimization	26
7.1.4 Early Indicators of Potential Issues	26
7.1.5 Implementation of Institutional Controls and Other Measures	27
7.2 Question B: <i>Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?</i>	28

7.2.1	Changes in Standards and To-Be-Considered Criteria	28
7.2.2	Changes in Exposure Pathways	29
7.2.3	Changes in Toxicity and Other Contaminant Characteristics.....	30
7.2.4	Changes in Risk Assessment Methods	32
7.2.5	<i>Are the remedial action objectives (RAOs) used at the time of the remedy selection still valid?</i>	34
7.3	<i>Question C: Has any other information come to light that could call into question the protectiveness of the remedy?</i>	34
7.3.1	Ecological Risks.....	34
7.3.2	Natural Disaster Impacts.....	34
7.3.3	Any Other Information That Could Call Into Question the Protectiveness of the Remedy	34
7.4	Technical Assessment Summary	34
8.0	Issues.....	38
9.0	Recommendations and Follow-up Actions.....	40
10.0	Protectiveness Statements.....	41
11.0	Next Review.....	44

Tables

Table 1:	Chronology of Site Events
Table 2:	Summary of Well Construction Details
Table 3:	Groundwater Monitoring Frequency and Analysis
Table 4:	Quarterly Groundwater Elevations
Table 5:	Groundwater Quality Data Summary
Table 6:	Changes in Federal Maximum Contaminant Levels
Table 7:	Changes in Oral Reference Dose
Table 8:	Changes in Inhalation Reference Concentrations
Table 9:	Changes in Oral Cancer Slope Factors
Table 10:	Changes in Cancer Inhalation Unit Risks
Table 11:	Changes in Standard Default Exposure Factors
Table 12:	Vapor Intrusion Risks from Chemicals of Concern in Groundwater

Figures

Figure 1:	Location Map
Figure 2:	Site Map
Figure 3:	Groundwater Flow – May 2014
Figure 4:	Arsenic Concentrations MW-2
Figure 5:	Arsenic Concentrations MW-6
Figure 6:	Arsenic Concentrations MW-7
Figure 7:	Arsenic Concentrations MW-8

Attachments

- Attachment A: Contaminants of Potential Concern
- Attachment B: Operable Unit 1 As-Built Drawings
- Attachment C: Semiannual Inspection Reports
- Attachment D: List of Documents Reviewed
- Attachment E: Photographs Documenting Site Conditions
- Attachment F: Iowa Groundwater Well Data Base Results
- Attachment G: Five-Year Review Site Inspection Checklist

List of Acronyms and Abbreviations

§	section
1,1-DCE	1,1-dichloroethene
1,1,2-TCA	1,1,2-trichloroethane
ALM	Adult Lead Methodology
AMSL	above mean sea level
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BLRA	baseline risk assessment
CENWK	U.S. Army Corps of Engineers, Kansas City District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
DCE	1,2-dichloroethane
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-year Review
HAL	Health Advisory Level
IAC	Iowa Administrative Code
IC	institutional control
IDEQ	Iowa Department of Environmental Quality
IDNR	Iowa Department of Natural Resources
LDL	Laboratory Lowest Detection Limit
MCL	Maximum Contaminant Level
NA	not applicable
NCP	National Contingency Plan
NPL	National Priorities List
NRL	Negligible Risk Level
NS	not sampled
O&M	operations and maintenance
OU	Operable Unit
PAHs	polycyclic aromatic hydrocarbons
PCOR	Preliminary Close Out Report
ppm	part per million
PQL	Practical Quantitation Limit
PRP	Potentially Responsible Party
PVC	polyvinyl chloride
RA	Remedial Action

RAO	Remedial Action Objective
RfC	reference concentration
RfD	reference dose
RI	Remedial Investigation
ROD	Record of Decision
RSLs	Regional Screening Levels
SARA	Superfund Amendments and Reauthorization Act
SOW	statement of work
SVOC	semi-volatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
UCVA	Upper Cedar Valley Aquifer
USGS	U.S. Geological Survey
µg/L	microgram per liter
VOC	volatile organic compound

[Intentionally Blank]

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Shaw Avenue Dump Site		
EPA ID: IAD980630560		
Region: 7	State: IA	City/County: Charles City/Floyd County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	Has the site achieved construction completion? Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Elizabeth Hagenmaier		
Author affiliation: U.S. EPA Region 7		
Review period: 07/28/2013 – 8/5/2015		
Date of site inspection: 9/10/2014		
Type of review: Statutory		
Review number: 3		
Triggering action date: 08/31/2010		
Due date (five years after triggering action date): 08/31/2015		

Issues/Recommendations				
Issues and Recommendations Identified in the Five-Year Review:				
OU2	Issue Category: Remedy Performance			
	Issue: Arsenic concentrations in MW-2, adjacent to the campground pond, have been increasing. However, environmental samples have not been collected or analyzed in the pond or the Cedar River adjacent to the Site since the 2000/2001 Risk Assessment.			
	Recommendation: Collect environmental data from the recreational pond and Cedar River to determine if unacceptable risks to human health or the environment exist and could warrant additional remedial actions.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	June 2016
OU1	Issue Category: Remedy Performance			
	Issue: Newly available toxicity values for the polycyclic aromatic hydrocarbons since completion of the ROD.			
	Recommendation: Collect soil samples and evaluate them for PAHs in on-site soil. Once results are evaluated, these levels will be used to evaluate risk and determine if additional remedial action is warranted.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	June 2016
OU2	Issue Category: Remedy Performance			
	Issue: The current groundwater monitoring plan does not include all site-related COPCs, and toxicity values have changed for some COPCs including benzene, xylene, toluene, and 2-nitroaniline, all of which were identified as site-related COPCs in groundwater. Current levels of these COPCs are unknown and changes in toxicity warrant additional investigation.			
	Recommendation: Based on changes in toxicity values for benzene, xylene, toluene, and 2-nitroaniline, collect groundwater samples to evaluate risks to human health and determine if additional remedial actions are warranted.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	PRP	EPA/State	June 2016

OU1	Issue Category: Institutional Controls			
	Issue: Institutional controls have been implemented through deed restrictions that restrict land and groundwater use at the site. However, the deed restrictions may present enforceability issues.			
	Recommendation: An environmental covenant pursuant to the Iowa Uniform Environmental Covenants Act should be considered to ensure that institutional controls continue to run with the land.			
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	No	PRP	EPA	June 2017

Protectiveness Statement(s)		
Operable Unit: OU1	Protectiveness Determination: Protectiveness Deferred	Addendum Due Date (if applicable): September 30, 2016
<p>Protectiveness Statement: A protectiveness determination of the OU1 remedy cannot be made at this time until further information is obtained. Further information will be obtained by collecting soil samples and evaluating them for PAHs in on-site soil. Once results are evaluated, these levels will be used to evaluate risk and determine if additional remedial action is warranted. It is anticipated that information will be collected and evaluated by September 2016, at which time a protectiveness determination will be made.</p>		
Operable Unit: OU2	Protectiveness Determination: Protectiveness Deferred	Addendum Due Date (if applicable): September 30, 2016
<p>Protectiveness Statement: A protectiveness determination of the OU2 limited action remedy cannot be made at this time until further information is obtained. Further information will be obtained by completing the following activities:</p> <ul style="list-style-type: none"> • Collect environmental data from the recreational pond and Cedar River to determine if unacceptable risks to human health or the environment exist and could warrant additional remedial actions; and • Based on changes in toxicity values for benzene, xylene, toluene, and 2-nitroaniline, evaluate risks to human health and determine if additional remedial actions are warranted. <p>It is anticipated that information will be collected and evaluated by September 2016, at which time a protectiveness determination will be made.</p>		

Sitewide Protectiveness Statement (if applicable)

Protectiveness Determination:

Protectiveness Deferred

Protectiveness Statement:

A protectiveness determination of the remedies cannot be made at this time until further information is obtained. Further information will be obtained by completing the following activities:

- Collect soil samples and evaluate them for PAHs in on-site soil. Once results are evaluated, these levels will be used to evaluate risk and determine if additional remedial action is warranted;
- Collect environmental data from the recreational pond and Cedar River to determine if unacceptable risks to human health or the environment exist and could warrant additional remedial actions; and
- Based on changes in toxicity values for benzene, xylene, toluene, and 2-nitroaniline, evaluate risks to human health and determine if additional remedial actions are warranted.

It is anticipated that information will be collected and evaluated by September 2016, at which time a protectiveness determination will be made.

[Intentionally Blank]

1.0 Introduction

The purpose of the five-year review (FYR) is to evaluate the performance of the remedy and determine if the remedy is, and will continue to be, protective of human health and the environment. The FYR report identifies issues found during the review, if any, and makes recommendations to address them.

The U.S. Environmental Protection Agency has prepared this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c) and the National 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.

The EPA interpreted this requirement further in the NCP; 40 CFR § 300.430(f)(4)(ii) 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.

The EPA Region 7 has conducted a third FYR of the remedial actions implemented at the Shaw Avenue Dump Site (Site) in Charles City, Floyd County, Iowa. This review was conducted from August 2014 through August 2015 and is documented in this report. The triggering action for this review is the signature date of the second FYR, August 31, 2010. This FYR review is required due to contamination remaining on site above levels that allow for unlimited use and unrestricted exposure.

The Site was addressed under two operable units (OUs). OU1 addresses sources of chemical waste in soils. That remedy has been implemented and institutional controls limiting property use are in place. OU2 addresses residual groundwater contamination. Groundwater monitoring continues and institutional controls limiting groundwater uses are in place. This FYR addresses both OUs.

[Intentionally Blank]

2.0 Site Chronology

A chronology of significant site events and dates is provided in **Table 1**.

[Intentionally Blank]

3.0 Background

3.1 Site Location

The Site is located in Charles City, Floyd County, Iowa, situated in the northwest quarter of the southwest quarter of Section 7, Township 35 North, Range 15 West, in the northeastern portion of the state (**Figure 1**). The Site occupies approximately 24 acres within the southeastern part of Charles City near the intersection of Shaw and Clark Avenues, adjacent to the Cedar River. The Site has an approximate length of 2,000 feet, an average width of approximately 525 feet, and is bounded on the west by the Iowa Terminal Railroad easement (now a public walking trail) and to the south by the Cedar River. The area where hazardous substances had been disposed is generally located in the northwest portion of the Site, as depicted in **Figure 2**.

3.2 Physical Characteristics

3.2.1 Topography

The Site and adjacent land generally slope from the northeast to the south/southwest. The Site's topographic high is located in its northeastern area and is approximately 1,020 feet above mean sea level (AMSL). The Site's topographic low is located in its south/southwestern area and is approximately 980 feet AMSL. The ground surface elevation in the vicinity of Operable Unit 1 (OU1) ranges between approximately 1,006 feet AMSL and 1,010 feet AMSL (Conestoga-Rovers & Associates, 1993).

3.2.2 Surface Hydrology and Drainage

Regional

The drainage basin of the Cedar River at Charles City is approximately 1,054 square miles with an average discharge of 650 cubic feet per second, based on measurements obtained at the U.S. Geological Survey (USGS) gauging stations at Charles City. The Cedar River flows southeast to a point where it meets the Iowa River, and the Iowa River continues southeast to ultimately drain into the Mississippi River (EPA, 2010).

Surface water features directly related to the Cedar River in the vicinity of Charles City include oxbow lakes and marshy areas. These features, for the most part, are confined to an area north of Charles City and are not prominent at Charles City or just downstream of Charles City. This, along with the presence of rapids in the Cedar River within the city limits, may indicate that the Cedar River, south of the meander features, is flowing through a bedrock-controlled valley. Surface water features partially related to the Cedar River are the water-filled depressions found sporadically within the floodplain of the river. The Cedar River is the likely source of recharge to these features (EPA, 2010).

Site Specific

The south/southwestern portion of the Site and most of the area west of the Iowa Terminal Railroad tracks (off site) are situated within the Cedar River 100-year floodplain. The northeastern portion of the Site, in the vicinity of OU1, is located above the 100-year floodplain.

The 100-year flood boundary at the Site varies from an elevation of approximately 995 feet AMSL at the northern end of the Site to approximately 994 feet AMSL at the southern end of the Site. Surface drainage generally flows toward the river (Conestoga-Rovers & Associates, 1993).

3.2.3 Geology and Hydrogeology

The Site is located over the Cedar Valley limestone formation, and the Upper Cedar Valley aquifer underlies the entire site. Surface soil is an alluvial deposit in which the waste materials were placed. The Cedar Valley formation's surface, at the Site, has been found to be extremely fractured and weathered (EPA, 1991).

Site borings conducted during the Remedial Investigation (RI) identified several hydraulically separate water-bearing units. These include a local perched aquifer at the northern end of the Site, an unconfined alluvium aquifer in the southern portion of the Site, an unconfined upper bedrock aquifer (the Upper Cedar Valley), and a lower bedrock aquifer (the Lower Cedar Valley). The Upper and Lower Cedar Valley limestone formations are separated by the Chickasaw Shale which acts as a semi-confining unit, preventing flow from the upper unit to the lower unit. An upward hydraulic head also prevents flow from the upper to the lower bedrock aquifer (EPA, 1991).

Groundwater flow direction in the Upper Cedar Valley Aquifer (UCVA) aquifer is typically west to southwest along the northern and southwestern portions of the Site and to the south along the southeastern portion of the Site to the Cedar River. During periods of heavy snow melt or heavy precipitation, a temporary groundwater flow divide is created in the northern portion of the Site and flow direction is both west/southwest and east/northeast. Groundwater flow in the unconfined alluvial aquifer is generally towards the Cedar River. However, during periods of high river flow, the flow direction in the northern portion of the Site will reverse and the alluvial aquifer will be recharged by the Cedar River. The Cedar River is the discharge point for the unconfined alluvial aquifer and the UCVA (EPA, 1991).

The general groundwater flow direction in the UCVA is depicted in **Figure 3**. This interpretation is based on water levels collected from all Site wells during May 2014 and is consistent with historical groundwater flow maps. No wells are screened in the Lower Cedar Valley Aquifer.

3.3 Land and Resource Use

Charles City, Iowa, has a recorded population of 7,652 (2010 census data), of which an estimated 1,000 to 5,000 people reside within one mile of the Site (EPA Superfund Information System, 2014). The Site is owned by Charles City and is used for the storage of mulch (along the southeastern perimeter), which is available to the public. The Iowa Terminal Railroad tracks, oriented parallel to and along the northwestern border of the Site, have been converted into a public walking path.

Land use near the Site consists of a high school (1,500 feet north of the Site); high school stadium (within 500 feet of northern disposal cells); campground (west of the Site); municipal

wastewater treatment plant (southeast of the Site); several residences; and a pond (southwest of the Site). **Figure 2** depicts local land use adjacent to the Site. The major land uses in the general vicinity of Charles City are farmland, including crops and orchard operations; livestock grazing; industry; urban; and sand pit and quarrying operations.

Charles City municipal water supply wells are located approximately two miles north of the Site and serve the population of Charles City. The Cedar River also serves as a source of potable water for municipalities both upstream and downstream of Charles City.

Ecological resources in the Charles City area are located around the Cedar River. The river serves as a source of replenishment for the water-bearing zones in its vicinity. The Cedar River downstream of the Site is used as a source of contact and non-contact recreation.

3.4 History of Contamination

The city of Charles City purchased the northern area of the Site in 1899 and continued to acquire adjoining property until 1964. The Site had been used for an unknown amount of time prior to 1949 as a landfill/dump and continued to be used as such through 1964 (EPA, 1991).

Two areas in the northern half of the Site were used from 1949 to 1953 to dispose of an estimated 14,000 to 28,000 cubic feet of arsenic-contaminated solid waste generated by Salsbury Laboratories, Inc. (later Solvay Animal Health, Inc.) from the chemical batch processing of arsenic compounds used in the production of animal pharmaceuticals. Salsbury Laboratories, Inc., also generated liquid waste during the period between 1949 and 1964 which was discharged to the municipal wastewater treatment plant, which then disposed of its generated sludges in the Site's northern waste cells and also in an undefined area on the southern portion of the Site (EPA, 2010). An estimated 10,000 tons of this sludge was disposed between 1949 and 1964. RI characterization of the disposal cells containing Salsbury wastes indicate the presence of significant concentrations of arsenic, cadmium, chromium, lead and volatile and semi-volatile organic compounds (VOCs and SVOCs) (EPA, 1991).

The Site was identified as a potential hazardous waste site by the Iowa Department of Environmental Quality (IDEQ) in 1977. IDEQ studied the Site and documented arsenic contamination in surface water in an abandoned gravel pit near the Site, issuing several reports between 1977 and 1981 (EPA, 1991).

3.5 Initial Response

No removal actions have been implemented at the Site. A preliminary assessment was conducted in 1984. The Site was proposed for the National Priorities List (NPL) in 1985 and was listed in 1987. An RI addressing soil contamination was initiated in 1988 and completed in 1990. Also in 1990, the Site was listed on the Iowa registry of confirmed abandoned or uncontrolled disposal sites as a category "b" site (significant threat to the environment – action required). A second RI addressing groundwater was initiated in 1992 and completed in 1999. In 1997, separate from Record of Decision (ROD) or consent order requirements, Charles City closed/abandoned two private residential wells located near the Site and provided these residences with connections to municipal water (EPA, 1991; 2000).

3.6 Basis for Taking Action

Forty individual compounds, in addition to a group of similar PAHs, were identified as potential chemicals of concern in the soil, surface water, groundwater, and chemical fill at the Shaw Avenue Dump Site. Several waste disposal cells located in the northern portion of the Site were identified by the RI as containing Salsbury Laboratories, Inc., waste. This disposal cell waste material, referred to as the “chemical fill,” was characterized as containing high concentrations of arsenic, cadmium, chromium, lead, VOCs and SVOCs including methylene chloride, 1,1,2-trichloroethane, and 2-nitroaniline. An underground storage tank, located near the chemical fill, was considered a possible source of benzene, toluene, xylene, and manganese. PAHs (e.g., arsenic, beryllium, cadmium, and lead) were identified in the area of the Site where municipal wastes were burned and asphaltic materials were disposed. The chemical fill and the adjacent contaminated soil are considered the source of contamination for the groundwater. Using the characterization data collected during the 1990 RI, a human health baseline risk assessment (BLRA) was completed in 1991.

The human health BLRA found that vinyl chloride, benzene, 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethane (DCE), 1,1,2-trichloroethane (1,1,2-TCA), arsenic, beryllium, cadmium, manganese, nickel, toluene, and xylene were associated with significant non-cancer health risks. The hazard indices for the future residential use scenarios, based on combined exposures by one of three age groups to surface soils, surface water, fish, irrigated homegrown produce, and groundwater from one of twelve specific water-bearing zones, ranged from less than 1 to 186, most of which exceeded the target hazard index of 1. The target hazard index was also exceeded for future on-site workers (HI = 1.21), based on exposures to the chemical fill.

The human health baseline risk assessment also calculated excess cancer risks for reasonable maximum exposure scenarios and determined that the future residential use and on-site worker scenarios exceeded a level of concern, based on the EPA’s target cancer risk range of 10^{-4} to 10^{-6} . As described above, twelve residential use scenarios were evaluated using groundwater data from various units (e.g., Bedrock A – G and Alluvium B – F), along with data for surface soils, surface water, fish, and irrigated vegetables. The excess cancer risk estimates for the future residential use scenarios ranged from 1×10^{-3} to 6×10^{-2} (Table 5-1, 1991 HHRA). The excess cancer risk estimate for the future on-site worker scenario was 1×10^{-3} , based on exposure to the chemical fill (Table 5-2, 1991 HHRA).

A short environmental effects evaluation was completed as part of the risk assessment (BVWST, 1991). The environmental effects evaluation found that information necessary to more completely evaluate possible environmental effects caused by contaminants found at the Shaw Avenue Dump Site had not been collected. No further ecological assessment of the Site has been completed.

[Intentionally Blank]

4.0 Remedial Actions

The Site consists of two OUs, each having a separate ROD. OU1 addresses the chemical fill and contaminated soil, and OU2 addresses groundwater contamination.

4.1 Remedy Selection

4.1.1 Operable Unit 1

The OU1 ROD was signed on September 26, 1991. Remedy selection was based on the following OU1 ROD Remedial Action Objectives (RAOs):

- Eliminate or reduce to an acceptable level the risks posed by exposure to the contaminated soil and chemical fill.
- Eliminate or reduce the potential migration of contaminants into groundwater.

Major components of the selected remedy, as described by the ROD, are:

- Fixation/stabilization of chemical fill and contaminated soil;
- Installation of a low-permeability cap to protect the fixated/stabilized material, consisting of either a two-foot clay layer covered by a two-foot fill and vegetated layers, or an eight-inch thick reinforced concrete slab placed over the stabilized waste;
- Implementation of deed restrictions placed upon the landfill property, which would prohibit the construction, installation, maintenance, or use of any wells on the Site for the purposes of extracting water for human drinking, bathing, or swimming purposes, or for the irrigation of food or feed crops, as well as any construction or intrusive activities at the Site;
- Installation of a fence and markers around the capped fill;
- Removal of an underground gasoline tank associated with the Charles City maintenance facility;
- Groundwater monitoring during and after implementation of the fixation/stabilization remedy to determine the effectiveness of the remedy in preventing leaching of contaminants to groundwater.

The ROD recognized that the full effectiveness of the fixation/stabilization technology employed by the selected remedy would not be known until treatability studies were conducted, and that the possibility existed that the selected technology might not achieve remediation objectives. For this possibility, the ROD selected excavation and off-site removal as the contingency remedy. If needed, the decision to change the remedy from fixation/stabilization to excavation/removal would be explained in an Explanation of Significant Differences (ESD).

Treatability studies yielded unacceptable results, and therefore, an ESD was signed on March 24, 1992, which notified the public of the decision to implement the contingency remedy of excavation and off-site disposal. The ESD identified that “the only difference from the

contingency remedy described in the ROD is that prior to disposal of the chemical fill and contaminated soil at the offsite landfill, the contaminated material will be stabilized/fixated to the best practicable level if the contaminated material were to fail the TCLP test (EPA, 1992).”

The major components of the contingency remedy, as described by the ESD, are:

- Excavation of chemical fill and waste materials exceeding the following levels (performance standards): arsenic at 50 parts per million (ppm) and cadmium at 20 ppm;
- Horizontal excavation to extend a minimum of two feet beyond the limit of the chemical fill, subject to modification based upon results of soil sampling conducted in February 1992;
- Confirmation sampling conducted at 14-foot intervals along the perimeter of the excavation;
- Verification testing to assure that the performance standard is met;
- Excavation backfilled with clean fill placed in 12-inch lifts, compacted to a minimum of 90% standard Proctor density, and the upper six inches to be backfilled with clean topsoil over which a vegetated cover will be placed;
- Excavation and removal of an underground gasoline tank pursuant to Underground Storage Tank regulations.

Requirements for establishing institutional controls (ICs) as described in the OU1 ROD remained. The ESD identifies contaminants of potential concern (COPCs) for the chemical fill, surface soil, and subsurface soil (**Attachment A**). The 1992 Consent Decree also provides a Statement of Work (SOW) prescribing how the Remedial Action (RA) was to be performed.

4.1.2 Operable Unit 2

The OU2 ROD, signed on September 28, 2000, selected no further CERCLA RA. This remedy was based upon the following: contaminant source removal (soil RA); lack of exposure to hazardous contaminants; ICs prohibiting the location of a residence or installation of groundwater wells on or near the Site; no unacceptable risk to human health from exposure to contaminated groundwater existing at the Site; and contaminated drinking water exceeding standards being confined to the landfill area (EPA, 2000). The OU2 ROD requires the continuation of groundwater monitoring and ICs specified by the 1992 Consent Decree. The objective of the monitoring is to “...evaluate the effectiveness of the excavation and removal of the chemical fill and surrounding contaminated soil in preventing or reducing the leaching of contaminants to the groundwater and the need for additional remedial actions at the Site” (EPA, 1992). For purposes of this FYR, the groundwater monitoring and ICs will be evaluated as OU2.

OU2 COPCs and their corresponding Maximum Contaminant Levels (MCLs) and Iowa health-based standards are provided in **Attachment A**. At the time of the OU2 ROD, only arsenic, 1,1,2-TCA, and vinyl chloride exceeded health-based drinking water standards at the Site (EPA, 2000). The Consent Decree requires sampling and analysis for vinyl chloride, 1,1-DCE, DCE, 1,1,2-TCA, benzene, toluene, xylene, 2-nitroaniline, arsenic, and manganese. Iowa action levels

are based either upon the Negligible Risk Level (NRL), which is the 1×10^{-6} excess cancer risk, or the lifetime Health Advisory Level (HAL). Quarterly groundwater elevation measurements are also required by the Consent Decree.

4.1.3 Consent Decree

The EPA entered into a consent decree on May 26, 1992, with Solvay Animal Health, Inc., and the city of Charles City, Iowa. The stated objective of the Consent Decree was protecting public health or welfare or the environment at the Site by designing and implementing response actions and reimbursing response costs to the U.S. Government. The referenced response action is established by a SOW attached to the Consent Decree, which defines how the objectives of the OU1 ROD, for both soil and groundwater, are to be accomplished.

The SOW describes the purpose of the RA as preventing direct contact by on-site workers, trespassers or other users of the Site with contaminated materials and removing the chemical fill and surrounding contaminated soils that exceed the performance standard. The SOW also states the objectives of the groundwater monitoring program are to evaluate the effectiveness of the excavation and removal of the chemical fill and surrounding contaminated soil in preventing or reducing contaminants leaching to the groundwater, and the need for additional RAs at the Site.

4.2 Remedy Implementation

The EPA Preliminary Close Out Report (PCOR), documenting construction completion for the Site, was signed on March 30, 2001. The PCOR states that all physical construction associated with the remedy has been completed in accordance with the RODs dated September 28, 2000, and September 26, 1991; the ESD dated March 20, 1992; and the Consent Decree dated May 26, 1992. Additionally, in 2001 IDNR reclassified the Site on its registry of confirmed abandoned or uncontrolled disposal sites as a class “d” site, which is a site that has been properly closed but requires continued management.

4.2.1 Operable Unit 1

The OU1 remedial design was approved by the EPA in March 1992 (EPA, 2010), and RA fieldwork activities were completed on May 15, 1992, when demobilization from the Site occurred (Shaw, 1993). The remedial design and construction of the RA were conducted in accordance with the SOW provided by the Consent Decree. Implementation of the RA is reported by the Conestoga-Rovers & Associates-authored Remedial Action Report dated October 1993.

Excavation is reported to have extended vertically from the ground surface to the top of bedrock (Conestoga-Rovers, 1993). Excavation depths depicted by construction as-built drawings provided in **Attachment B** range from approximately 14 feet below ground surface (bgs) at the excavation’s northern extent (location of chemical fill) to about 6 feet bgs at its southern extent. A significant portion of the excavation is depicted as being approximately 6 to 8 feet bgs. Field determinations of the extent of chemical fill are reported to have been made based upon its distinctive visual characteristics. Stockpiled topsoil was later characterized as contaminated soil and managed as such, due to having produced a yellowish leachate after precipitation events,

which yielded a result of 142 ppm arsenic. The estimated total volume of excavated chemical fill and contaminated soil, based upon excavation cross-section surveys, is 2,220 cubic yards. (Conestoga-Rovers & Associates, 1993)

Confirmation and verification sampling was conducted at approximate 14-foot intervals along the perimeter of the excavation, as specified in the RA Work Plan, except that discrete samples were used for confirmation analysis as opposed to composite samples. Three discrete samples were collected along the sidewall of the excavation from depths of one-third and two-thirds of the sidewall's height, and at the excavation's base. Each discrete sample was split, and if the analysis confirmed that the performance standard was met, the remains of the split sample were prepared and sent to a different lab for confirmation analysis. Additional excavation was conducted when verification samples did not meet the performance standard. The location and results of verification samples are depicted on the as-built drawing provided in **Attachment B**. There was no requirement to conduct verification/confirmation sampling across the excavation floor.

The RA performance objective of 50 ppm arsenic and 20 ppm cadmium are reported as having been met at all but one verification sample location where arsenic failed to meet the performance objective (location 009A, 59.2 ppm arsenic, wet weight basis). All confirmation/verification samples were reported on a wet weight basis for the purpose of verifying compliance with the soil remediation objectives.

To implement the ICs required by the OU1 ROD, the Environmental Protection Declaration of Restrictive Covenants and Easements was completed on February 21, 2001, by and between the city of Charles City, Iowa, and Fort Dodge Animal Health, a division of American Home Products, a successor to Solvay Animal Health, Inc. In addition to the restrictive covenant, the 2000 OU2 ROD identifies the following ICs as also being in place:

- The Charles City Flood Plains Management Ordinance forbids construction of residential buildings in the area of a floodplain; this ordinance also requires that any residential construction in the fringe of a floodplain be elevated a minimum of one foot above the 100-year floodplain level. In general, any development in the fringe area would be cost prohibitive considering the cost associated with filling in the area to reach the required elevation before construction could commence.
- The Site and property within the vicinity of the Site (with the exception of a portion of the area to the southeast) are located within the city limits of Charles City and are subject to building restrictions prescribed by Charles City ordinance. Under the ordinance, the city prohibits the construction of wells for any purposes at residential establishments, including for irrigation.
- The city of Charles City requires any development in a new subdivision to be connected to the city water supply pursuant to its subdivision regulation.
- The Site is included in the registry of "hazardous waste or hazardous substance disposal sites" under the Iowa Environmental Act. The Act requires the owner or operator of a property on the registry to obtain written approval from the state before "substantially

changing the manner in which the site is used”. In this case, changing use of the Site from a landfill to residential would require such an approval. IDNR has stated that it would not grant approval for such a change in use of the Site.

- The restrictive covenant, required by the 1992 Consent Decree, prohibits the construction, installation or use of wells, or use of groundwater at the Site; and the maintenance or use of any wells on the property for the purposes of extracting water for human drinking, bathing or swimming purposes, or for the irrigation of food or feed crops. Any construction or intrusive activities on this property is also prohibited.

4.2.2 Operable Unit 2

Quarterly groundwater monitoring was initiated in 1992 after completion of the RA field work, and continued until the EPA and IDNR approved a “Proposed Groundwater Monitoring Program” submitted by the Potentially Responsible Party (PRP) in 2002. The revised groundwater monitoring program specifies semiannual sampling of certain wells that historically had high arsenic concentrations and biennially for other wells. The list of analytes for the approved revised monitoring program includes total arsenic, vinyl chloride, 1,1-DCE, DCE, and 1,1,2-TCA.

The approved groundwater monitoring program was again revised as the result of a recommendation made in the 2010 FYR Report. The sampling frequency for arsenic at MW-2 was revised from biennial (every other year) to semiannual. The current requirements of the groundwater monitoring program are summarized in **Table 3**. Groundwater monitoring reports summarizing results and maintenance activities are submitted annually by the PRPs to both the EPA and IDNR.

4.3 System Operation/ Maintenance Activities

Inspection of the monitoring well network, and the Site in general, is conducted on a semiannual basis. Inspection reports generated since April 2010 are provided in **Attachment C**. The inspections address monitoring well access, external/internal conditions of the ground cover at the former chemical fill area, and flood damage, if any. Maintenance recommendations are also identified, as needed. No significant maintenance issues have been identified during this FYR period.

[Intentionally Blank]

5.0 Progress Since Last Review

The protectiveness statement provided in the second FYR report is:

“The remedy, inclusive of all OUs at the Shaw Avenue Dump Site, is protective of human health and the environment. All threats at the site have been addressed through excavation and offsite disposal of the chemical fill and surrounding contaminated soil, ICs that prohibit use of groundwater or intrusive activities, and long-term groundwater monitoring.”

Nine maintenance-related recommendations and two monitoring issues were identified in the second FYR report. None of these issues were considered to have an impact on the current or future protectiveness of the remedy. All issues have been reported as resolved.

The maintenance issues and the manner in which each was resolved are as follows (Conestoga-Rovers & Associates, 2011):

Issue 1: Although securely locked, the well cap for MW-8A could be opened without removing the lock.

Status: Well cap and welded locking clips have been lowered on the riser pipe; accomplished May 3, 2010.

Issue 2: MW-4 was missing a mechanical well plug/cap.

Status: Lock and torqueable plug installed on April 22, 2010.

Issue 3: At MW-4B the concrete well pad lacked sufficient slope to discourage entry of surface water runoff and was cracked around the edges.

Status: Replacement cement collar installed on May 5, 2010.

Issue 4: MW-2 did not have a mechanical well plug/cap to discourage entry of surface water runoff.

Status: Lock and torqueable plug installed on April 22, 2010.

Issue 5: At flush-mounted well MW-18, one of the bolts securing the well cap was missing and the second remaining bolt was loose allowing the lid to be potentially pried off.

Status: Cap's two bolt receivers in surface casing have been re-threaded and the cap is secured; accomplished on May 3, 2010.

Issue 6: Based on biennial sampling, arsenic concentrations have increased in MW-2 since 2003.

Status: Included in semiannual sampling event to be performed in April; sampling occurred on April 16, 2010. Semiannual sampling at this well was also conducted June and November 2011.

Issue 7: MW-14 is obstructed and cannot be sampled without repair or re-drilling.

Status: Obstruction identified as a metal split spoon remnant. Well hole was over drilled and replaced with a 2" PVC well; accomplished on May 5, 2010. Re-survey to obtain a new reference elevation has been accomplished.

Issue 8: MW-18 is an open-borehole completion. Collapse of the borehole wall prevents water-level collection.

Status: Limestone obstruction removed by drill rig. Core hole opened to original bottom at 42.5 feet bgs; accomplished on May 4, 2010.

Issue 9: Six wells – MW-2, MW-2A, MW-4, MW-4A, MW-4B, and MW-14 – were recently converted from above-ground well completions to flush-mount well completions. These wells had not been resurveyed at the time of the site inspection. Therefore, water levels collected from these wells cannot be used to determine the groundwater flow direction until the reference elevations have been established.

Status: Survey of new reference elevation accomplished on September 22, 2010.

The two monitoring issues were addressed as follows:

Issue 1: Increase monitoring frequency for MW-2 from biennial to semiannual to more closely monitor increasing arsenic concentrations.

Status: Semiannual sampling at MW-2 for arsenic was initiated in April 2010 and was conducted June and November 2011.

Issue 2: Obtain sediment and surface water samples in the Cedar River adjacent to MW-2.

Status: Upon further consideration, the EPA withdrew this issue via email correspondence dated April 1, 2011, authored by Ms. Shelley Brodie, EPA, to Mr. Neil Leipzig, Conestoga-Rovers & Associates (Conestoga-Rovers & Associates, 2011). During this FYR period, this issue was carried forward due to the increasing arsenic concentration trend in MW-2.

[Intentionally Blank]

6.0 Five-Year Review Process

6.1 Administrative Components

The FYR was conducted by Elizabeth Hagenmaier, the EPA Region 7 Remedial Project Manager for the Site, supported by Daniel Mroz, Andrew Gosnell, and David Daniel, of the U.S. Army Corps of Engineers, Kansas City District (CENWK).

6.2 Community Involvement

A public notice regarding the initiation of the FYR was placed in the Charles City Press on January 9, 2015, notifying the public of the start of the FYR process. The completed FYR report will be available at the Site information repository, the Charles City Public Library, 106 Milwaukee Mall, Charles City, Iowa 50616; and the EPA Superfund Division Records Center, 11201 Renner Boulevard, Lenexa, Kansas 66219.

6.3 Document Review

This FYR included a review of relevant information contained in a variety of site-related documents, including an assessment of the condition of the administrative record located at the Charles City Public Library. The information review primarily focused on documents produced after September 2010 (start of the FYR time frame), but also included information presented in the Feasibility Study Addendum, ESD, OU2 ROD, PCOR, the First and Second FYR Reports, boring logs, well construction details, and quarterly inspection and monitoring reports. A list of site-related documents, reviewed in total or in part during preparation of this FYR, is provided in **Attachment D**.

6.4 Data Review

The Site monitoring well network consists of 12 alluvial and 18 bedrock wells with each alluvial well paired with a bedrock well. Sixteen of the 30 wells are currently in use for monitoring. Sampling is conducted primarily for arsenic; however, four wells are sampled for select VOCs. **Figure 2** depicts the location of all wells; **Table 2** provides boring log and well construction information; and **Table 3** summarizes the current monitoring program with respect to sampling frequency and analytes reported. During this FYR period, the PRPs submitted annual reports which summarized groundwater monitoring results and maintenance activities. This groundwater monitoring data has been consolidated from the annual PRP reports and is presented as **Tables 4** and **5**. **Table 4** is a compilation of groundwater elevations and **Table 5** presents groundwater sample analytical results. Groundwater data is also graphically presented in **Figures 4** through **7** for those wells that are sampled on a biennial basis and have consistently contained higher arsenic concentrations.

During the first FYR period, quarterly groundwater monitoring was performed in accordance with the Consent Decree. In 2002, the EPA and IDNR approved the PRP's "Proposed Groundwater Monitoring Program" in which the frequency of groundwater monitoring for total arsenic was revised to a semiannual schedule for bedrock monitoring wells MW-6, MW-7, and MW-8 and a biennial schedule for all other bedrock wells except for MW-1, MW-3, MW-13, MW-16, and MW-18, which were not to be sampled. The revised schedule for VOC sampling

requires the biennial sampling of MW-1, MW-1A, MW-1B, MW-2, and MW-2A. During the second FYR period, groundwater monitoring continued according to this revised schedule. The second FYR report, however, recommended increasing the sampling frequency at MW-2 to semiannual because of an increasing arsenic concentration trend. This recommendation was implemented at the start of the third FYR period. In response to an EPA request, two additional rounds of samples were collected at MW-2 during June and November 2011, at which time the EPA target analyte metals were also sampled and analyzed.

For purposes of this FYR evaluation, groundwater data has been compared to both the MCL and Iowa action levels, which are based upon a 10^{-6} risk level (negligible risk).

Arsenic

As shown in **Tables 4 and 5** and **Figures 4 through 7**, MW-2, MW-6, MW-7, and MW-8 consistently contained the highest arsenic concentrations, ranging from 95 micrograms per liter ($\mu\text{g/L}$) (MW-7) to 2,500 $\mu\text{g/L}$ (MW-2). MW-14 may also be considered a high arsenic well; but its sampling lapsed between 1993 and 2010, resulting in a more limited data set for this well. At MW-14, three sampling events occurred during this FYR period which yielded results of 400, 426, and 381 $\mu\text{g/L}$. In addition to these elevated arsenic concentration wells, the following wells also yielded groundwater samples with arsenic concentrations that included exceedances of the MCL (10 $\mu\text{g/L}$) and no concentration greater than 123 $\mu\text{g/L}$: MW-11 (80 to 123 $\mu\text{g/L}$); MW-12 (8 to 16 $\mu\text{g/L}$); and, MW-19 (4 to 45 $\mu\text{g/L}$). The following wells exceeded the Iowa arsenic action level of 0.02 $\mu\text{g/L}$ during at least one sampling round, but did not exceed the MCL: MW-4, MW-9, MW-15, and MW-17.

Volatile Organic Compounds

Vinyl chloride slightly exceeded its 2.0 $\mu\text{g/L}$ MCL at MW-2 for all biennially collected samples during this FYR period: 3.14 $\mu\text{g/L}$ (2010 sample); 2.47 $\mu\text{g/L}$ (2012 sample); and 2.89 $\mu\text{g/L}$ (2014 sample). Samples collected during the previous FYR period yielded vinyl chloride results of 1.8 $\mu\text{g/L}$, 1.52 $\mu\text{g/L}$ and 1.62 $\mu\text{g/L}$. Samples collected for vinyl chloride at other wells were all reported as non-detect.

The VOCs 1,1-DCE, DCE and 1,1,2-TCA exceeded Iowa action levels but did not exceed their respective MCLs. **Table 7** identifies the corresponding Iowa action levels for these contaminants. Wells at which these contaminants exceeded Iowa action levels are MW-1A, MW-1B, MW-2, and MW-2A. Concentrations for these constituents ranged between 1.13 $\mu\text{g/L}$ and 2.26 $\mu\text{g/L}$.

6.5 Evaluation of Historical COC Concentration Trends

Arsenic data trend plots for wells MW-2, MW-6, MW-7, and MW-8 were constructed using simple linear regressions and are provided as **Figures 4 through 7**. No trend plot is provided for MW-14 as it lacks a sufficient number of data points for conducting a statistical analysis. These wells, as previously stated, contain the highest concentrations of arsenic. MW-6 and MW-8 are located adjacent to or directly downgradient of the former chemical fill area, MW-7 is located

down and side-gradient to the former chemical fill area, and MW-2 is furthest downgradient from the former fill area (**Figure 3**).

MW-2

An upward arsenic concentration trend exists in MW-2 (**Figure 4**) based upon samples collected during this FYR period. Arsenic concentrations increased from approximately 1,500 µg/L to 2,500 µg/L. As previously stated, the sampling frequency was increased from biennial to semiannual in 2010.

No trend is evident for MW-2 vinyl chloride concentrations for the biennial samples collected from 2006 through 2012. All three samples exceeded the vinyl chloride MCL of 2.0 µg/L (3.14 µg/L, 2.47 µg/L, and 2.89 µg/L). Comparatively, samples collected from this well during the previous FYR period yielded vinyl chloride concentrations which were less than the MCL (1.8 µg/L, 1.52 µg/L and 1.62 µg/L).

MW-2 is located in the downgradient direction from the MW-6/MW-6A well cluster. MW-6, which is screened in bedrock, is currently impacted with arsenic. Historical concentrations in the associated alluvial well (MW-6A) were generally below action levels. This situation is mirrored in the MW-2/MW-2A cluster. The alluvial well (MW-2A) at this location has not shown arsenic concentrations in excess of the MCL since 1997, and was last sampled in 2002. The presence of arsenic in MW-2 suggests bedrock plume migration in the downgradient direction.

MW-6

Arsenic concentrations in MW-6 do not depict a strong trend (**Figure 5**) and fluctuate around a concentration of 200 µg/L. This is a change from the decreasing arsenic concentration trend previously exhibited during the 2010 FYR period. Arsenic concentrations spiked during the spring of 2013 and 2014, with respective concentrations of 377 µg/L and 271 µg/L. Remaining sample concentrations ranged from 103 µg/L to 162 µg/L.

MW-7

Arsenic concentrations in MW-7 remain relatively stable and exhibited no discernible trend (**Figure 6**). Arsenic concentrations in this well varied and yielded a mean of 170 µg/L. Another side-gradient well, MW-11, showed similar concentrations over time, with no discernible trend. It is theorized by Conestoga-Rovers & Associates (PRP contractor) that the concentration fluctuations in these two wells are due to short-lived groundwater gradient changes caused by isolated precipitation events. This could account for the arsenic concentration spikes and drops since source removal.

MW-8

MW-8 arsenic concentrations exhibited no statistical trend during this review period. This is a change from the previous FYR period, as 2005 through 2010 data depict a decreasing arsenic concentration trend. Since 2003, arsenic had decreased steadily from 9,500 µg/L to approximately 1,000 µg/L. Magnitude of order concentration changes occurred during this FYR period. High concentrations ranged from 1,200 µg/L to 1,810 µg/L, and the low concentrations

ranged from 106 µg/L to 347 µg/L. Five results are considered high, three results are considered low, and one result of 847 µg/L is considered mid-level. High results occurred during both spring and fall seasons while low concentrations occurred during three spring sampling events. Sample results obtained during the previous FYR period also exhibited similar fluctuating concentrations.

6.6 Site Inspection

A September 10, 2014, site inspection was conducted by Elizabeth Hagenmaier and Karim Dawani, EPA, supported by Andy Gosnell and Jean Schumacher, CENWK; John Falls and Steve Diers, city of Charles City; Briana Marvuglio and Jeff Field, Zoetis (PRP); Neil Leipzig, Conestoga-Rovers & Associates (consultant to Zoetis); and, Greg Fuhrmann, Alex Moon and Cal Lundberg, IDNR. Photographs representative of site inspection observations are provided in **Attachment E**.

The purpose of the site inspection was to assess the condition of the remedy and identify any issues that could negatively affect its protectiveness. The site inspection assessed the overall maintenance of the Site, the surface integrity of the groundwater monitoring wells (including well pads, protective covers, stickup, name plates, and locks), perimeter fencing, and ICs which prohibit the construction of wells for any purpose at residences.

Prior to the site inspection, the inspection team met for introductions and to discuss the itinerary. The meeting was conducted in a conference room at the Sleep Inn & Suites, 1416 South Grand Avenue, in Charles City. Because the Shaw Avenue site inspection was conducted concurrently with another site (LaBounty Superfund Site), interviews were conducted the following morning and are discussed in Section 6.7 below.

The site inspection began by driving to the intersection of Clark Street and Shaw Avenue, which is the entrance to the fenced area of the Shaw Avenue Site. Throughout the inspection, Mr. Neil Leipzig (PRP contractor project manager) escorted the inspection team during the inspection.

MW-8, MW-8A, and MW-19 were observed on the north side of the entrance road to the Site. The remediated waste excavation area included a grass-covered area between MW-8 and MW-8A and the road. It was noted that the locking cover on MW-8A had been repaired since the 2010 FYR site inspection (**Photo No. 1**). The inspection team then proceeded south toward the city wastewater treatment plant on the southern edge of the property (**Photo No. 2**), observing a new “grit pad” constructed in the fall of 2013 to drain material removed from sewers during cleaning prior to landfilling (**Photo No. 3**). Mr. Leipzig indicated that the grit pad was the only change on the Site since the 2010 FYR. From there, the team observed MW-15 and MW-15A, located adjacent to a large pile of concrete rubble (**Photo No. 4**), then observed MW-3 and MW-3A.

At the adjacent campground property, the party inspected MW-2 and 2A. It was noted that MW-2 had been fitted with a locking well cap in accordance with a recommendation from the 2010 FYR (**Photo No. 5**). The party then inspected well clusters MW-4, -6, -8, and -12, then

departed the campground for the LaBounty Site Inspection. A smaller party consisting of Ms. Hagenmaier, Mr. Dawani, Mr. Leipzig, Mr. Gosnell, Ms. Marvuglio, and Ms. Schumacher returned to the Site to inspect the remaining monitoring wells. All wells appeared secure and serviceable, and all maintenance issues noted from the 2010 FYR appeared to have been addressed.

Mr. Leipzig pointed out that MW-13 had a different style lock on it to discourage vandalism. He noted instances where the previous locks had been cut off and the well purportedly used by parties investigating contamination associated with petroleum storage tanks at the gas station formerly located near the intersection of Shaw Avenue and Clark Street. When the well cap was removed, a bailer, not used for sampling by the PRP's contractor, was found inside the well. This same observation was made during the 2010 FYR site inspection.

Since implementation of the ROD, a campground opened in May 2000 adjacent to the Site. This campground is used for recreational and limited seasonal camping and includes a three-acre pond intended for wading, swimming, and recreational fishing, which may be hydraulically connected to the Site's groundwater discharge and the Cedar River. The Site is bounded by residential areas across Clark Street to the north, east, and northwest, and by the Cedar River to the west and southwest. The city wastewater treatment plant is located southeast of the former chemical fill area.

6.7 Interviews

Interviews were conducted at the Sleep Inn & Suites at 1416 South Grand Avenue in Charles City. The following individuals were interviewed on March 10, 2010: Elizabeth Hagenmaier, EPA; Steve Diers and John Fallis, city of Charles City; Neil Leipzig, Conestoga-Rovers & Associates; and, Cal Lundberg and Greg Fuhrmann, IDNR. Interview summaries are included as **Attachment G**.

All interviewees stated that they had been informed about the Site's activities and progress, or in the case of Mr. Diers, were in the process of being informed as a new stakeholder. No one interviewed expressed concerns regarding the protectiveness of the Site. Neil Leipzig indicated that the remedy was functioning as expected and, based on historical trends from MW-6 and MW-8, contaminant levels were decreasing near the former source. Mr. Leipzig also indicated that there were opportunities to optimize operations and maintenance (O&M), including reducing sampling frequencies, and inquired about removing the Site from the NPL. Cal Lundberg, IDNR, also indicated that the state of Iowa would like to see the Site removed from the State Registry of Hazardous Substances or Hazardous Waste Disposal Sites (State Registry).

[Intentionally Blank]

7.0 Technical Assessment

The FYR must determine whether the remedy at a site is and will continue to be protective of human health and the environment. EPA guidance describes three questions used to provide a framework for organizing and evaluating data and information, and to ensure all relevant issues are considered when determining the protectiveness of a remedy. This section presents a technical assessment and is formulated based on the answers to Questions A, B, and C, presented below. As answers were formulated, consideration was given to the status of the RA. For consistency with FYR guidance, each question is summarily answered yes or no. Supporting information is provided in the previous sections and referenced documents with additional analysis provided, as needed. Section 7.4 presents a summary of the technical assessment.

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

Groundwater at the Site continues to demonstrate elevated levels of arsenic.

7.1.1 Remedial Action Performance

Contaminant source removal was completed in 1992 and achieved the RAO of eliminating or reducing risks posed by human exposure to contaminated soil and chemical fill. Verification and confirmation samples collected along the wall only (not the bedrock floor) of the chemical fill and contaminated soils excavation area confirmed attainment of the performance standards of 50 ppm arsenic and 20 ppm cadmium. This signifies a reduction in human health risks associated with direct exposures to these two compounds to within or below the EPA's target cancer risk range and below an acceptable hazard index of 1.

The second RAO of eliminating or reducing potential migration of contaminants into groundwater was partially achieved. The soil RA removed contaminant source material and thereby reduced the potential migration of contaminants into groundwater from both the chemical fill and contaminated soil. Residual waste may remain in the fractured bedrock and continue to back-diffuse into the groundwater. The expected response of monitored groundwater subsequent to contaminant source removal is that COC concentrations would gradually decrease over time. This has generally occurred except at MW-2 where an increasing arsenic concentration trend has been exhibited over the previous ten years. MW-2 arsenic concentrations are now an order of magnitude greater than 15 years ago. The increased concentrations detected in MW-2 call into question the level of arsenic exposures and associated risks now potentially occurring at the campground recreational use pond and in the Cedar River located near MW-2. The significant increase in arsenic concentrations at MW-2 is inconsistent with the sitewide arsenic response as observed in site monitoring wells. It is also noted that arsenic concentration trends at wells MW-6, -7 and -8 changed from decreasing to either stable or non-discernible, although the latest concentrations detected are all well above the arsenic MCL. Based on results for these and other wells, site groundwater remains impacted by site contaminants at concentrations exceeding MCLs.

Sampling of MW-14, located off site and within the adjacent campground, was resumed this review period after having been last sampled in 1993. Arsenic concentrations during this FYR

period were 400 µg/L, 381 µg/L and 426 µg/L, which is an increase from the 124 µg/L to 239 µg/L recorded for the period from September 1992 to September 1993.

Vinyl chloride concentrations detected in samples collected from MW-2 during this FYR period exceeded the MCL of 2.0 µg/L and were also greater than concentrations reported for the previous FYR period. Vinyl chloride concentrations this FYR period were 3.14 µg/L, 2.47 µg/L, and 2.89 µg/L as compared to the 1.90 µg/L, 1.52 µg/L, and 1.62 µg/L reported for the previous FYR period. Application of the Mann-Kendall trend analysis yielded no discernible concentration trend across the ten-year period of November 2004 through October 2014.

In 2002, the PRP, with concurrence from the EPA and IDNR, reduced the number of analytes, particularly VOCs, that were being collected and analyzed. Based on changes to toxicity values (as discussed in Question B), this FYR recommends collecting additional groundwater data and analyzing it for a more robust suite of VOCs identified as COPCs in the ROD.

The OU2 ROD includes a statement in Section H that, "...the contamination exceeding drinking water standards is confined to the landfill area. Therefore, there is no significant threat to human health or the environment from the groundwater at the site; and no further Remedial Action is necessary...." Current monitoring results identify off-site contamination at MW-2 and MW-14 at concentrations exceeding MCLs, and as previously stated, groundwater may be contributing arsenic to the campground recreational use pond and the nearby Cedar River. This FYR identifies issues and recommendations that will evaluate the potential need for additional remedial actions.

7.1.2 System Operations and Maintenance

Operation and maintenance of the implemented remedies is occurring as intended. The FYR site inspection did not identify any maintenance issues pertaining to the OU1 RA. Groundwater monitoring during this FYR period has been conducted in accordance with requirements of the approved 2002 Revised Groundwater Monitoring and Maintenance Plan. Maintenance issues identified during the 2010 FYR and presented in Section 5.0 of this report have been corrected.

7.1.3 Opportunities for Optimization

Opportunities to optimize the groundwater monitoring program may exist. A reduced sampling frequency for certain monitoring wells could be considered. Possible candidate wells include those which have consistently provided samples having no MCL exceedances. Additionally, alternate sampling methodologies, such as passive diffusion bags for VOCs, the use of "Snap Samplers™" for metals, or the exclusive use of the "Hydrasleeve™" system can be considered. The use of these methods should reduce the time necessary to conduct sampling events.

7.1.4 Early Indicators of Potential Issues

The continued increase in arsenic concentrations at MW-2 is inconsistent with the arsenic responses observed at site monitoring wells and is substantially higher than the next highest arsenic concentration observed at any other monitoring well. Also noted are the increased

arsenic concentrations observed at off-site MW-14 as compared to when this well was last sampled in 1993.

7.1.5 Implementation of Institutional Controls and Other Measures

Institutional controls as described in the following paragraphs are implemented for the Site. However, site institutional controls do not extend off site, and a campground that includes an approximately three-acre recreational use pond opened in May 2000 on property adjacent to the Site. Recreational use of the pond, including swimming, wading, fishing, and/or boating, may result in human exposures to site COCs as the pond is located near MW-2, the monitoring well containing the highest arsenic concentrations.

The ROD requires implementation of institutional controls (IC), in the form of deed restrictions, to be placed upon the landfill property. A restrictive covenant was recorded on February 21, 2001, with the Floyd County Recorder of Deeds that satisfies the IC provision of the ROD and Consent Decree. The restrictive covenant runs with the property comprising the Site. It prohibits the construction, installation, maintenance, or use of any wells on the Site for purposes of extracting water for human consumption, bathing, or swimming, or for the irrigation of food or feed crops, as well as any construction or intrusive activities at the Site.

Charles City maintains ownership of the property which comprises the Site, and there are no current or planned changes in land use. The Site is listed on the State Registry pursuant to Iowa Code 455B.426. The State Registry listing, which is filed with the county recorder, prohibits the sale or significant change in use of the property without the written approval of the Director of IDNR. In 2001, IDNR reclassified the Site on its registry as a class “d” site, which is a site that has been properly closed, but requires continued management.

Charles City also submitted, for recording with the Recorder of Deeds, access easements which run with the property comprising the Site reserving access necessary for the PRPs to implement any future RA and to conduct O&M activities. The Environmental Protection Declaration of Restrictive Covenants and Easements was completed on February 21, 2001, by and between the city of Charles City and Fort Dodge Animal Health. An Environmental Covenant pursuant to the Iowa Uniform Environmental Covenants Act should be considered to further enhance the land use restrictions placed on the Site.

The Iowa groundwater well data base (Iowa GEOSAM) was accessed during this FYR, and areas near the Site were searched for registered groundwater wells. A single well, registered as a “test hole”, is located across from the campground and is approximately 800 feet north/northwest of MW-14 (**Attachment F**). This well was drilled on April 30, 1996. It is cased to 185 feet bgs and was completed as an open borehole to 283 feet bgs; it has a yield of 200 gallons per minute. The current status of this well is unknown. Based upon its upgradient location with respect to the former chemical fill area, it is not expected to be adversely impacted by site contaminants.

7.2 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?*

As discussed in Section 7.2.1, the risk-based cleanup levels for arsenic and cadmium in soil remain protective, and the MCLs (ARARs) and state screening levels used for monitoring purposes are current. The RAOs (Section 7.2.5) are still valid. However, as discussed in Sections 7.2.2-7.2.4, the impacts of changes in exposure assumptions, toxicity values, and risk assessment methodology on the protectiveness of the remedy are currently unknown. In particular, arsenic levels in MW-2 have significantly increased. It is unknown whether the arsenic levels in the adjacent campground pond and nearby Cedar River have increased concurrently, but if so, current levels may pose unacceptable risks to recreational human and ecological receptors. Ecological risks to aquatic receptors in the pond and Cedar River were not adequately characterized at the time of the ROD. Although risks to recreational campground users were found acceptable in 2001, contaminant migration over the last 14 years may have led to increased exposures to site COPCs in the current pond and river sediment, surface water, and/or fish, resulting in unacceptable risks of cancer and non-cancer health effects. A secondary issue is changes in toxicity values for benzene, toluene, xylene, and 2-nitroaniline (groundwater COPCs), as well as new toxicity values for the PAHs (soil COPCs), where previously there were none. It is unknown whether the current concentrations of these COPCs in site soil, groundwater, or other media are above acceptable risk-based levels derived using today's toxicity values.

7.2.1 Changes in Standards and To-Be-Considered Criteria

- *Have there been changes to risk-based cleanup levels or standards identified as ARARs in the ROD that call into question the protectiveness of the remedy?*

No. Soil cleanup levels in the OU1 ROD were 50 ppm arsenic and 20 ppm cadmium. At the time of the ROD, the risk assessment evaluated potential future residential, industrial, and/or recreational use of the Site, but ICs are now in place to restrict residential construction. Thus, it is appropriate to compare the cleanup levels to the EPA's current industrial soil Regional Screening Levels (RSLs). As of May 2015, the current industrial soil RSLs for arsenic are 3 ppm to 300 ppm, based on the target risk range of 10^{-6} to 10^{-4} , respectively, and 480 ppm, based on a non-cancer hazard quotient of 1. The cleanup goal of 50 ppm arsenic falls within the acceptable cancer risk range for industrial soil and is less than the target HQ of 1. For cadmium, the current industrial soil RSLs are 9,300 ppm to 930,000 ppm, based on the cancer risk range of 10^{-6} to 10^{-4} , respectively, and 980 ppm, based on a non-cancer hazard quotient of 1. The cleanup level of 20 ppm cadmium is below both the cancer and non-cancer RSLs.

No risk-based cleanup levels or ARARs are presented in the OU2 ROD. The ROD states that for the selected groundwater alternative, identified in the ROD as a "no action" alternative, "Federal and/or state applicable or relevant and appropriate regulations will not be applicable to the no action alternative since no exposure to contaminated groundwater will occur." For monitoring purposes, current MCLs are used.

7.2.2 Changes in Exposure Pathways

- *Have any human health or ecological routes of exposure or receptors changed or been newly identified (e.g., dermal contact where none previously existed, new populations or species identified on site or near the site) that could affect the protectiveness of the remedy?*

Yes, potential new human health and ecological routes of exposure may exist and receptors have changed. These were not identified in previous FYRs and may call into question the protectiveness of the remedy.

From a human health perspective, a campground opened adjacent to the Site in May 2000 after the initial baseline risk assessment was completed and ROD was finalized. This campground is intended for recreational and limited seasonal camping and includes a three-acre pond intended for wading, swimming, and recreational fishing. The pond is likely to be hydraulically connected to the site's groundwater discharge and the Cedar River. This pond was characterized during the year 2000 through sampling and analysis of its water, sediment and fish. A risk assessment was completed in 2001 that evaluated human health risks associated with potential exposures to site contaminants while wading, swimming, or fishing in the campground pond and while wading and swimming in the Cedar River (Conestoga-Rovers & Associates, 2001). Although the risk assessment found that potential risks associated with use of the campground were acceptable, incidental ingestion of sediment from the banks of the pond or river was not evaluated. Based on arsenic levels detected in sediment at the time, this additional route of exposure would not appear to result in significant human health risks, but as discussed below, the concentrations in the sediment and surface water may have since increased, potentially resulting in unacceptable health risks.

Ecological exposures to aquatic receptors in the Cedar River were not adequately characterized in the baseline risk assessment. Surface water samples from the river are not likely to be reflective of potential arsenic contamination from groundwater sources. It is recommended that the groundwater transition zone in the river near MW-2 be characterized to determine potential ecological impacts. Also, potential impacts on aquatic receptors in the campground pond should be evaluated.

- *Are there newly identified contaminants or contaminant sources?*

No new contaminants or contaminant sources were identified during the FYR period.

- *Are there unanticipated toxic byproducts of the remedy not previously addressed by the decision documents (e.g., byproducts not evaluated at the time of remedy selection)?*

No unanticipated toxic byproducts of the remedy have been identified.

- *Have physical site conditions (e.g., changes in anticipated direction or rate of groundwater flow) or the understanding of these conditions changed in a way that could affect the protectiveness of the remedy?*

Yes, groundwater monitoring at MW-2 indicates that groundwater in the vicinity of the pond on the adjacent campground has experienced significant arsenic concentration, compared to when the pond was characterized for the 2001 risk assessment (2,590 µg/L in 2014 vs. 126 to 236 µg/L in 2000). It is possible, but not presently known, whether the arsenic concentrations in the campground pond and Cedar River have concurrently risen with the increased levels in MW-2. If arsenic levels have risen, exposures to site contaminants in the campground pond and Cedar River may pose unacceptable health risks to human recreational receptors, as well as to ecological receptors in the pond and river. Thus, it is unknown whether the remedy remains protective.

7.2.3 Changes in Toxicity and Other Contaminant Characteristics

- *Have toxicity factors for contaminants of concern at the site changed in a way that could affect the protectiveness of the remedy?*

Tables 7, 8, 9, and 10 contain the human health reference doses, reference concentrations, cancer slope factors, and inhalation unit risks, respectively, that were used in the risk assessment completed prior to the 1991 OU1 ROD, as well as the current values for all COPCs in surface soil, subsurface soil, and groundwater. Note, the toxicity values for COPCs only that were identified in the chemical fill area are not included in these tables since that area was excavated.

Oral Non-Cancer Toxicity Values. As shown in **Table 7**, the oral reference doses (RfDs) for arsenic, benzene, beryllium, cobalt, DCE, 2-nitroaniline, toluene, 1,1,2-TCA, vinyl chloride, and the xylenes decreased, meaning that we would consider the same level of exposure today to pose *greater* non-cancer risks, compared to when risks were evaluated in 1991. Cadmium, cobalt, 1,1-DCE, manganese, and zinc pose *less* risk for non-cancer health effects (i.e., the oral RfDs have increased), since 1991 BLRA. The oral RfDs for the remaining soil and groundwater COPCs have not changed. The implementation of institutional and land use controls has eliminated drinking water or shower exposures to groundwater; therefore these changes do not affect the protectiveness of the remedy.

Inhalation Non-Cancer Toxicity Values. As shown in **Table 8**, the inhalation reference concentrations (RfCs) for arsenic, benzene, beryllium, cadmium, cobalt, DCE, 1,1-DCE, manganese, nickel, 2-nitroaniline, 1,1,2-TCA, and vinyl chloride have decreased since 1991, meaning inhalation exposures to these compounds pose *greater* risk of non-cancer health effects. The RfCs for toluene and xylene have increased, meaning they pose *less* risk. The remaining RfCs have not changed.

Oral Cancer Toxicity Values. As shown in **Table 9**, oral cancer slope factors are now available for many of the polycyclic aromatic hydrocarbons (i.e., benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluroanthene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene). At the time of the BLRA, no CSFs were available for the PAHs, so the potential cancer risk from oral ingestion of these COPCs could not be evaluated. The CSF for benzene has increased since 1991, meaning it poses greater cancer risks from oral exposures. Conversely,

the CSFs for arsenic, beryllium, 1,1-DCE, and vinyl chloride have decreased, meaning less cancer risk from oral exposures to these COPCs.

Inhalation Cancer Toxicity Values. As shown in **Table 10**, inhalation unit risks are now available for many of the PAHs. IURs were not available in 1991 to evaluate potential cancer risks from inhalation exposure to the PAHs. An IUR has also been published for cobalt since the 1991 BLRA. Conversely, the IURs for arsenic, benzene, beryllium, cadmium, DCE, 1,1-DCE, nickel, 1,1,2-TCA, and vinyl chloride have decreased since 1991, meaning there is thought to be less risk of cancer from inhalation exposure to these COPCs.

Impact of Human Health Toxicity Value Changes on Remedy Protectiveness. When evaluating the cumulative impact of the increases and decreases in toxicity values, it is helpful to examine exposures to soil and groundwater separately.

Groundwater is currently monitored for arsenic, DCE, 1,1-DCE, 1,1,2-TCA, and vinyl chloride. The changes in toxicity values for these COPCs would not impact the protectiveness of the remedy, since current MCLs are used for reporting, which are protective of human health. Of the remaining compounds designated as groundwater COPCs in the 1991 BLRA, toxicity values have increased for benzene, toluene, and xylene, as well as for 2-nitroaniline. Had risks been evaluated in 1991 using today's toxicity values, it is possible that these compounds would be included in the monitoring program. The ROD called for the removal of an underground storage tank, which may have been the source of the benzene, toluene, and xylene. The ROD noted that 2-nitroaniline was one of the liquid waste products disposed at the Site by Salsbury Laboratories during the 1949-1964 time period. Since the concentrations of benzene, toluene, xylene, and 2-nitroaniline in site groundwater are unknown, we recommend including these analytes in the groundwater monitoring program, at least on a temporary basis until current levels are known. The current groundwater remedy (i.e., ICs restricting site groundwater use) is expected to be protective of human health, unless sufficiently high levels in groundwater have resulted in high pond water concentrations. (See the arsenic discussion in Section 7.2.2.)

Although a number of COPCs were identified in chemical fill, surface soil, and subsurface soil, only arsenic and cadmium were used to confirm sufficient removal of the chemical fill area. Of the remaining soil COPCs, the toxicity values for four naturally-occurring metals (i.e., beryllium, cobalt, manganese, and nickel) have changed slightly. However, the extent of change in these toxicity values is unlikely to pose unacceptable health risks. Of greater concern is the addition of cancer slope factors and inhalation unit risks for the PAHs, when previously there were none. Since toxicity values were not available for the PAHs in 1991, no cleanup goals could be based on this class of compounds at the time. However, the 1991 BLRA reports levels of PAHs above industrial soil RSLs, outside of the excavated chemical fill area. For example, 82 ppm benzo(a)pyrene was detected in bore hole 5A, located near MW-6 and the campground; the industrial soil RSL based on a 1×10^{-4} excess cancer risk is 29 ppm. The current remedy, via ICs that prevent excavation, should be protective by eliminating subsurface soil exposures. However, since only four composite surface soil samples were collected for the 1991 BLRA, since current surface soil concentrations are unknown, and since new toxicity values for the PAHs mean they

pose increased health risks, we recommend surface soil sampling, particularly near MW-6, for the carcinogenic PAH compounds.

Ecological Toxicity Values. The Iowa WQC for arsenic is 150 µg/L; the value used in the risk assessment was 190 µg/L. The Iowa WQC for cadmium is 0.45 µg/L; the value used in the risk assessment was 1 µg/L.

- *Have other contaminant characteristics changed in a way that could affect protectiveness of the remedy?*

An oral relative bioavailability of 60 percent has been recommended for arsenic in soils and sediments (USEPA, 2012). This value is a 40 percent reduction of the prior 100 percent gastric absorption estimate. This change in bioavailability is not applicable to the dermal absorption or inhalation exposure routes. No other contaminant characteristics have changed in a way that would affect protectiveness of the remedy (EPA, 2012).

7.2.4 Changes in Risk Assessment Methods

- *Have standardized risk assessment methodologies changed in a way that could affect the protectiveness of the remedy?*

The 1991 BLRA evaluated residential, commercial/industrial, recreational, and trespassing scenarios. However, the residential and construction worker scenarios are no longer expected because institutional controls now restrict use of site groundwater, residential use, and construction/excavation of the Site. Of the remaining scenarios, the commercial/industrial worker scenario is the most conservative (i.e., expected to result in the highest exposures). Based on the ICs, workers are only expected to be exposed to surface soil. Changes in many of the standard default exposure factors (values used to calculate daily intakes of chemicals for human receptors in BLRAs) occurred in May 2014. Default exposure factors are not available for the trespassing or recreational scenarios, which are site-specific and vary with time and land use. **Table 11** summarizes the changes in exposure parameters for surface soil exposures by an outdoor commercial/industrial worker.

Workers are exposed to surface soil via incidental ingestion, inhalation, and dermal exposure. There have been slight to no changes in most of the parameters used to evaluate these routes of exposure, except for a significant increase in the default exposure frequency. Although we would calculate much greater risk for the default outdoor worker today, the true exposure frequency at the Site may be much closer to the 90 days/year used in the 1991 calculations. Specific to the dermal route, the 1991 calculations used a matrix factor (0.15) multiplied by a soil adherence factor (1.45 mg/cm²), which appears equivalent to today's soil adherence factor for workers (now = 0.12 mg/cm²; prior to 2014 = 0.2 mg/cm²). Inhalation exposures are now calculated using RAGS Part F methodology, but these changes are not likely to significantly impact risks at this Site since this route is minor for most of the site soil COPCs. (See below for a discussion on inhalation exposures from groundwater.) Overall, we do not expect changes in the standard default exposure parameters for workers to affect the protectiveness of the remedy.

Vapor Intrusion. Volatile organic compounds of sufficient toxicity and volatility have been detected in groundwater samples collected from the Site since the last FYR that may present potential vapor intrusion risks. However, at present there are no overlying occupied structures present on site. The Vapor Intrusion Screening Level (VISL) Calculator, a spreadsheet tool that allows calculation of potential risks from soil gas and groundwater concentrations (USEPA, 2014), was used to evaluate the potential for vapor intrusion (VI). A conservative residential exposure scenario was used to evaluate potential VI risks; however, ICs at the Site prohibit any construction or intrusive activities on the property. The mean annual temperature assumed for the groundwater was 9°C. The groundwater concentrations used were:

- 2.1 µg/L DCE – MW-2, 10/09/2010
- 2.2 µg/L 1,1-DCE – MW-1A, 10/09/2010
- 2.3 µg/L 1,1,2-TCA – MW-1A, 10/09/2010
- 3.1 µg/L vinyl chloride – MW-2, 10/09/2010

Lower concentrations were detected in some wells in the 2012 sampling while none were detected in the 2013 and 2014 sampling rounds.

The VISL results, presented in **Table 12**, show 1.3×10^{-5} for vinyl chloride as the highest cancer risk with 1,1,2-TCA and DCE showing cancer risks of 1.8×10^{-7} and 4.1×10^{-7} , respectively. **Table 12** also shows that all of these chemicals have hazard quotients (HQs) less than 1.

All cancer risks are within the EPA's target cancer risk range from 10^{-6} to 10^{-4} while the HQs indicate that adverse non-cancer health effects are unlikely to occur even if exposure continued over a lifetime. Thus, possible vapor intrusion risks do not affect the protectiveness of the remedy.

Arsenic Bioavailability In Soil. The EPA recommended in 2012 that the relative bioavailability of arsenic in soil should be considered to be 60 percent rather than the 100 percent default previously used. This results in a substantial decrease in cancer risk estimates for arsenic by soil ingestion.

Ecological Risk. Ecological risk assessment guidance has changed significantly since the 1991 baseline risk assessment. Ecological risk assessments should be done according to the Ecological Risk Assessment Guidance for Superfund (EPA, 1997). Several ecological updates are available for further reference; the document can be found at <http://www.epa.gov/oswer/riskassessment/ecoup/>.

Other. Other than the changes discussed above, risk assessment methodologies have not changed in a way that would affect the protectiveness of the remedy.

7.2.5 *Are the remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

Yes. The RAOs of eliminating or reducing to an acceptable level the risks posed by exposure to contaminated soil and chemical fill; eliminating or reducing the potential migration of contaminants into groundwater; and, evaluating the effectiveness of the excavation and removal of the chemical fill and surrounding contaminated soil in preventing or reducing the leaching of contaminants to groundwater, all remain valid.

The ESD RA performance standards of 50 ppm arsenic and 20 ppm cadmium yield risk levels within or below the EPA's target cancer risk range and less than the target non-cancer hazard quotient of 1 for a commercial/industrial land use scenario.

Based on sampling results for PAHs in on-site soils and results of environmental monitoring in the campground pond and Cedar River, these RAOs may need to be revisited or modified.

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

Information has been identified that potentially affects the protectiveness of the remedy.

7.3.1 Ecological Risks

The environmental effects evaluation (B&V Waste Science and Technology Corp., 1991) determined that information necessary to more completely evaluate possible adverse environmental effects caused by contaminants found at the Shaw Avenue Site had not been collected. Ecological risks at the Site have never been fully characterized according to EPA guidance. This FYR recommends evaluating ecological risks at the campground pond and in the Cedar River.

7.3.2 Natural Disaster Impacts

No natural disaster impacts are known to have occurred at the Site during this FYR period.

7.3.3 Any Other Information That Could Call Into Question the Protectiveness of the Remedy

No additional information is provided that could call into question the protectiveness of the remedy.

7.4 Technical Assessment Summary

The objective of the remedy's ICs is to prevent the use of site groundwater; however, a recreational use pond opened in May 2000 in an area where groundwater arsenic concentrations are indicated to be increasing, and which now contains the highest arsenic concentrations of monitored groundwater (MW-2 data). The pond is believed to be hydraulically connected to site groundwater and the Cedar River. Due to the significant increase of groundwater arsenic concentrations near the pond, it is called into question whether recreational use of the pond and

the nearby Cedar River and effects on ecological receptors present an unacceptable risk to human health and the environment.

An early indicator of the potential effectiveness of the RA source removal was the reduction in groundwater COC concentrations. The RA effectiveness may have been partially compromised by the inability to remove impacted solid waste/sludge from the highly fractured bedrock present at/near the surface of the Cedar Valley formation. Verification sampling was not performed on the floor of the excavation following removal. Matrix diffusion and groundwater flow reversals/rising water table in this setting could release/mobilize residual COCs that may account for the arsenic concentrations detected in MW-2, -6, -7, and -8 during this FYR period. Prior to this FYR, site monitoring wells have generally exhibited decreasing arsenic concentrations, except for MW-2, which has resulted in an overall decrease in groundwater arsenic concentrations. However, beginning this review period, MW-6, -7, and -8 did not exhibit decreasing concentration trends, but instead exhibited either no discernible trend or one which was stable. It is unknown whether decreasing concentration trends will resume at these wells. MW-2 has consistently exhibited a trend of increasing arsenic concentrations that has increased by an order magnitude. In addition, during this FYR period MW-2 exhibited vinyl chloride concentrations greater than the MCL whereas prior to this FYR, concentrations were either non-detect or less than the MCL.

The OU1 RA achieved the RAO of either eliminating or reducing risks posed by exposure to contaminated soil and chemical fill. The RA performance standards of 50 ppm arsenic and 20 ppm cadmium are within or below the EPA's target cancer risk range and less than the target non-cancer hazard quotient of 1 for a commercial/industrial land use scenario. Actual site risks are expected to be lower as residual arsenic soil concentrations, demonstrated by all but one RA verification sample result, are less than 50 ppm.

Levels of PAHs were consistently detected in surface and subsurface soil, particularly south of the chemical fill area, during the remedial investigation. However, because no non-cancer or cancer toxicity values were available at the time, potential risks could not be evaluated and cleanup levels could not be derived. Based on the EPA's current industrial soil RSLs, the levels of PAHs detected at the time exceed a 1×10^{-4} excess lifetime cancer risk. The area where highest levels were detected was near MW-6, which is adjacent to the campground. Current PAH concentrations and resulting exposures and health risks are unknown. Although ICs prohibiting excavation of the Site prevent contact with PAHs in the subsurface soil, there are no controls in place to prevent surface soil contact.

Site ICs are in place and no groundwater wells have been completed on site. However, a recreationally used pond, believed to be hydraulically connected to site groundwater, is located off site in an area where groundwater has high arsenic concentrations. This is inconsistent with the IC objective of preventing the use of site-contaminated groundwater.

The OU2 ROD statement that "...contamination exceeding drinking water standards is confined to the landfill area" is not valid and was not valid at the time the ROD was signed. Groundwater containing arsenic and vinyl chloride at concentrations exceeding MCLs is present off site, as

demonstrated by sample results for MW-2 and MW-14. In addition, the current groundwater monitoring plan includes limited chemical constituents. For example, the plan was revised in 2002 and no longer includes site-related COPCs such as benzene, xylene, toluene, and 2-nitroaniline. Current levels are unknown and changes in toxicity warrant additional investigation.

[Intentionally Blank]

8.0 Issues

Four issues are identified that could impact protectiveness.

Issue No. 1: Arsenic concentrations have shown an increasing trend in MW-2, adjacent to the campground pond. However, environmental samples have not been collected or analyzed in the pond or the Cedar River adjacent to the Site since the 2000/2001 Risk Assessment.

Issue No. 2: Newly available toxicity values for the polycyclic aromatic hydrocarbons since completion of the ROD.

Issue No. 3: The current groundwater monitoring plan does not include all site-related COPCs, and toxicity values have changed for some COPCs including benzene, xylene, toluene, and 2-nitroaniline, all of which were identified as site-related COPCs in groundwater. Current levels of these COPCs are unknown and changes in toxicity warrant additional investigation.

Issue No. 4: Institutional controls have been implemented through deed restrictions that restrict land and groundwater use at the site. However, the deed restrictions may present enforceability issues.

[Intentionally Blank]

9.0 Recommendations and Follow-up Actions

Recommended actions to address the issues identified in Section 8.0 are provided below.

Recommendation for Issue No. 1: Collect environmental data from the recreational pond and Cedar River to determine if unacceptable risks to human health or the environment exist and could warrant additional remedial actions.

Recommendation for Issue No. 2: Collect soil samples and evaluate them for PAHs in on-site soil. Once results are evaluated, these levels will be used to evaluate risk and determine if additional remedial action is warranted.

Recommendation for Issue No. 3: Based on changes in toxicity values for benzene, xylene, toluene, and 2-nitroaniline, collect groundwater samples and evaluate risks to human health to determine if additional remedial actions are warranted.

Recommendation for Issue No. 4: An environmental covenant pursuant to the Iowa Uniform Environmental Covenants Act should be considered to ensure that institutional controls continue to run with the land.

[Intentionally Blank]

10.0 Protectiveness Statements

OU1

A protectiveness determination of the OU1 remedy cannot be made at this time until further information is obtained. Further information will be obtained by collecting soil samples and evaluating them for PAHs in on-site soil. Once results are evaluated, these levels will be used to evaluate risk and determine if additional remedial action is warranted. It is anticipated that information will be collected and evaluated by September 2016, at which time a protectiveness determination will be made.

OU2

A protectiveness determination of the OU2 limited action remedy cannot be made at this time until further information is obtained. Further information will be obtained by completing the following activities:

- Collect environmental data from the recreational pond and Cedar River to determine whether unacceptable risks to human health or the environment exist and could warrant additional remedial actions; and
- Based on changes in toxicity values for benzene, xylene, toluene, and 2-nitroaniline, evaluate risks to human health and determine if additional remedial actions are warranted.

It is anticipated that information will be collected and evaluated by September 2016, at which time a protectiveness determination will be made.

Sitewide

A protectiveness determination of the remedies cannot be made at this time until further information is obtained. Further information will be obtained by completing the following activities:

- Collect soil samples and evaluate them for PAHs in on-site soil. Once results are evaluated, these levels will be used to evaluate risk and determine if additional remedial action is warranted;
- Collect environmental data from the recreational pond and Cedar River to determine whether unacceptable risks to human health or the environment exist and could warrant additional remedial actions; and
- Based on changes in toxicity values for benzene, xylene, toluene, and 2-nitroaniline, evaluate risks to human health and determine if additional remedial actions are warranted.

It is anticipated that information will be collected and evaluated by September 2016, at which time a protectiveness determination will be made.

[Intentionally Blank]

11.0 Next Review

The next FYR for the Site is due no later than five years from the date of the EPA's signed approval of this FYR. The next FYR is expected to be completed in 2020.

FIGURES



Figure 1 Location Map

Shaw Avenue Dump Site

DRAWN BY: ASG
DATE: March 2010

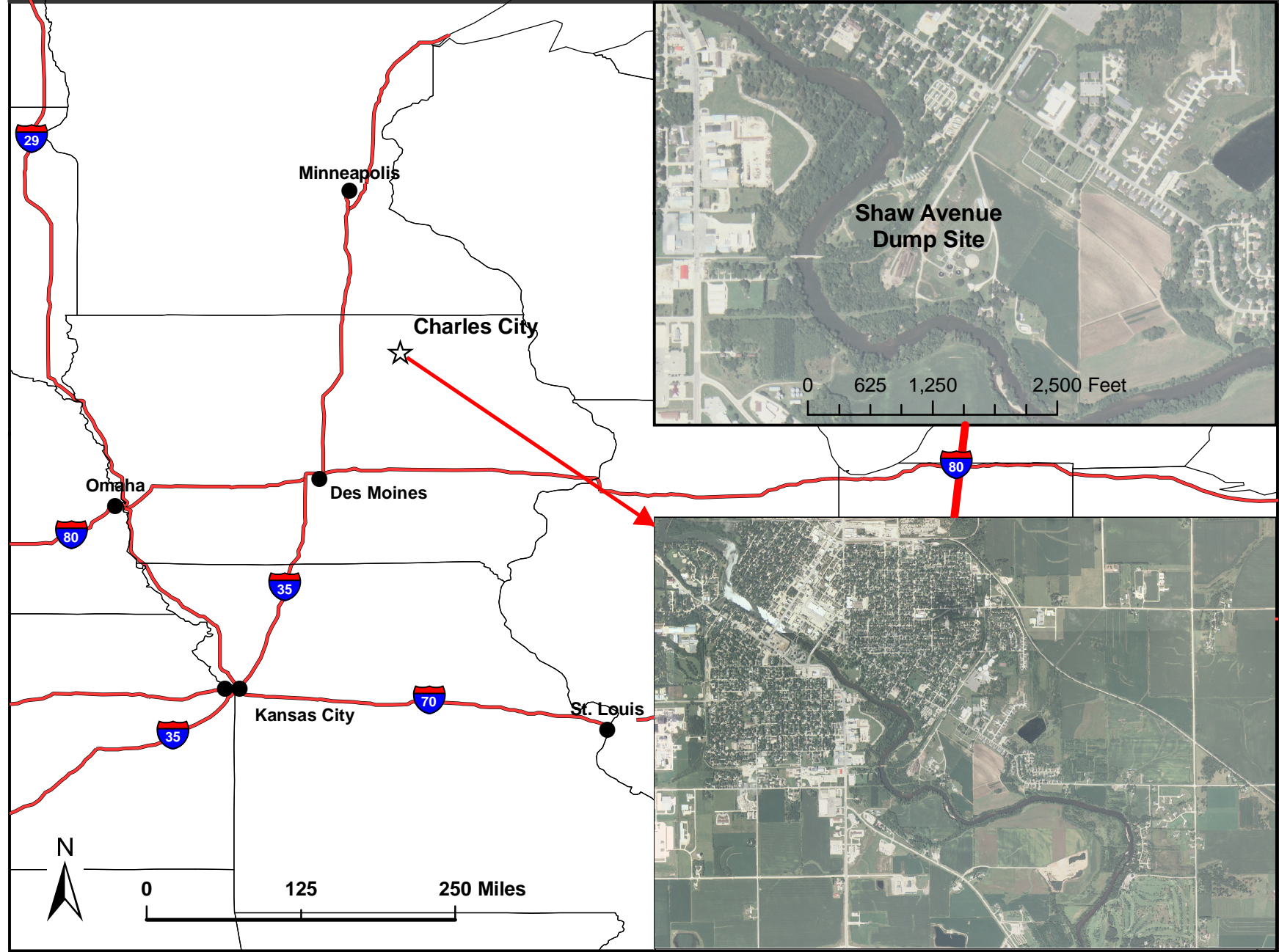




Figure 2 Site Map Shaw Avenue Dump Site

DATE: March 2010

DRAWN BY: ASG

CHECKED BY: FWM



US Army Corps
of Engineers

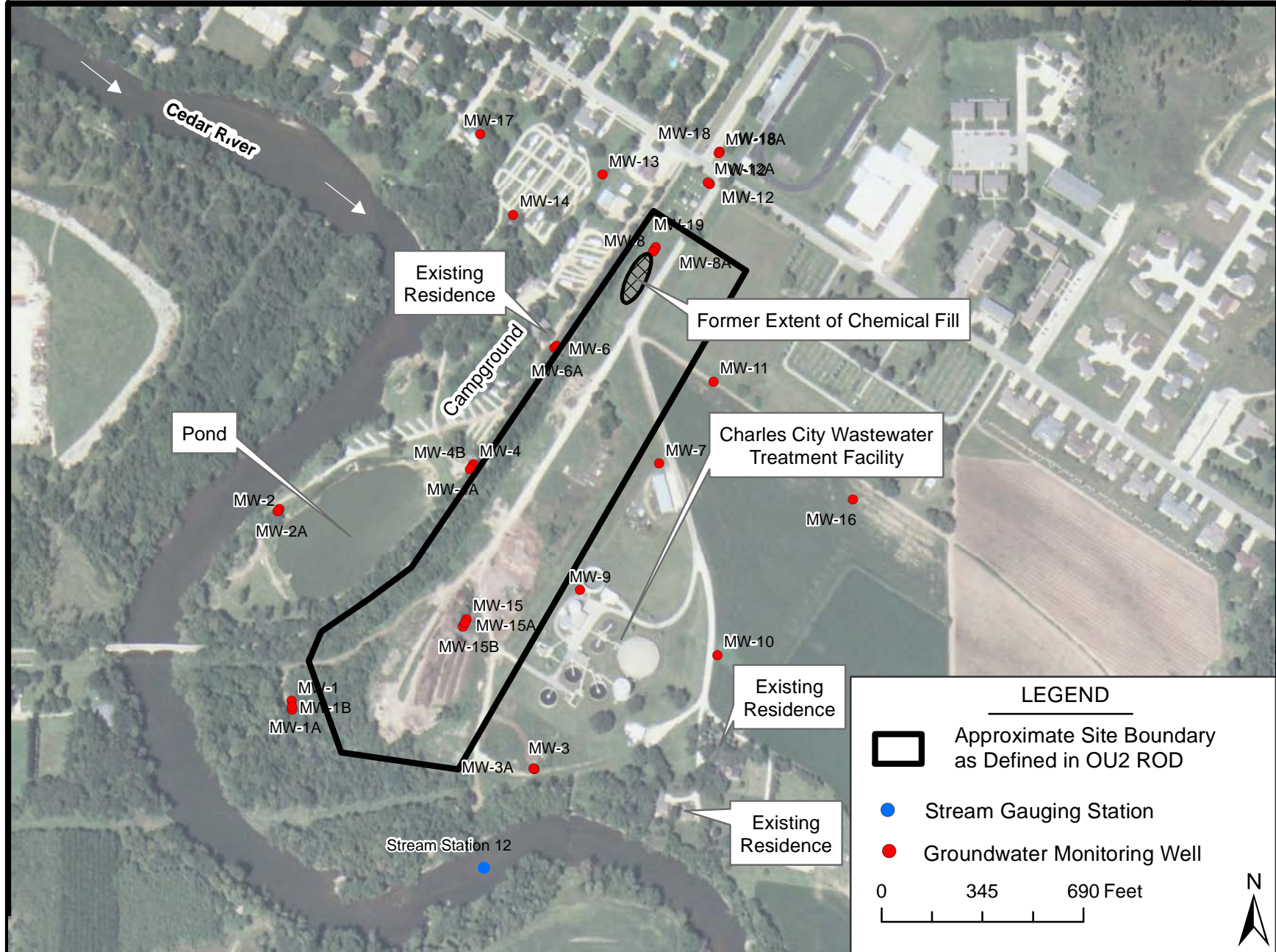


Figure 3 Groundwater Flow - May 2014

Shaw Avenue Dump Site

DATE: November 2014

DRAWN BY: ASG
CHECKED BY: DLM

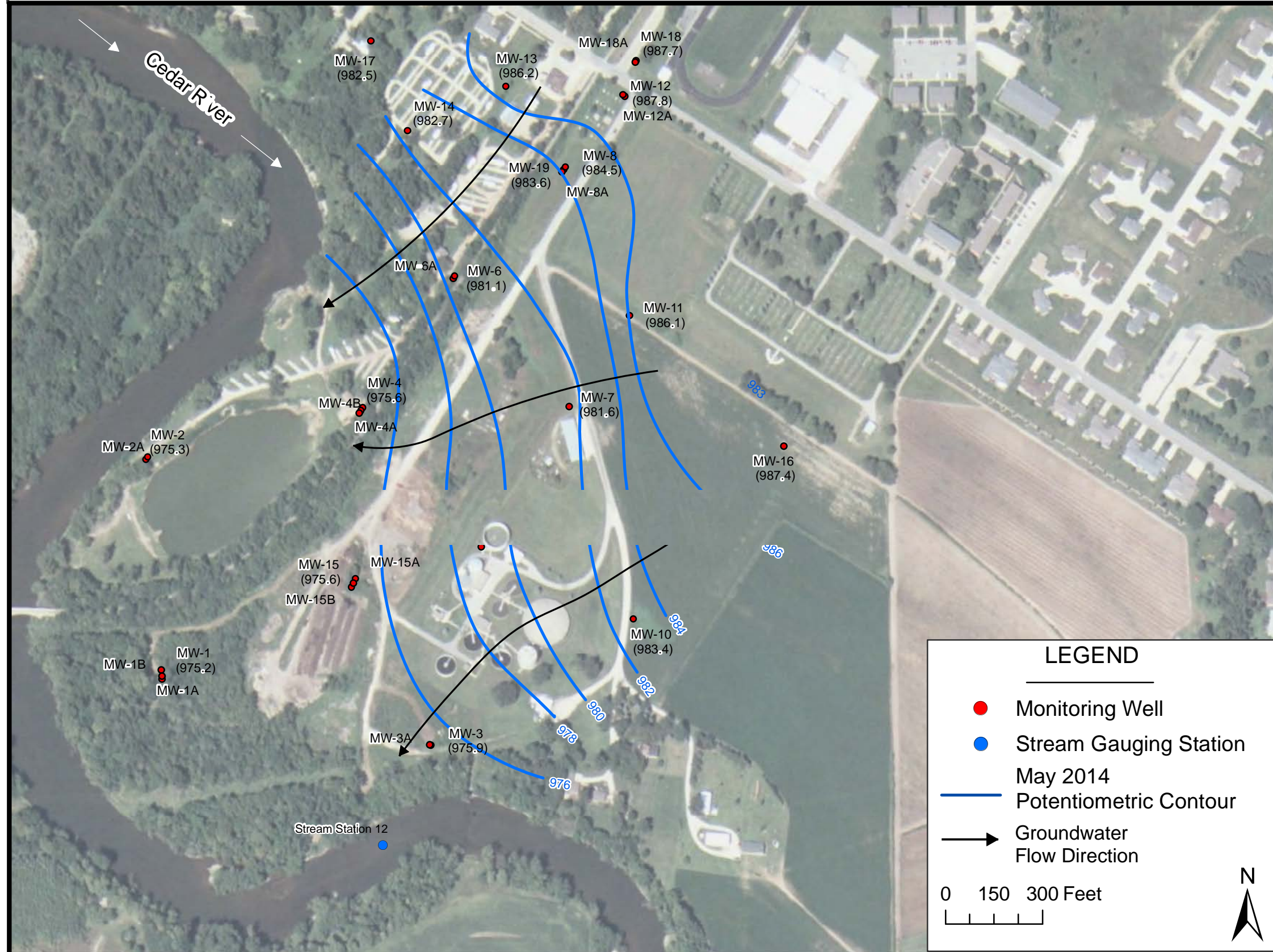


FIGURE 4
Arsenic Concentrations MW-2
Shaw Avenue Dump Site

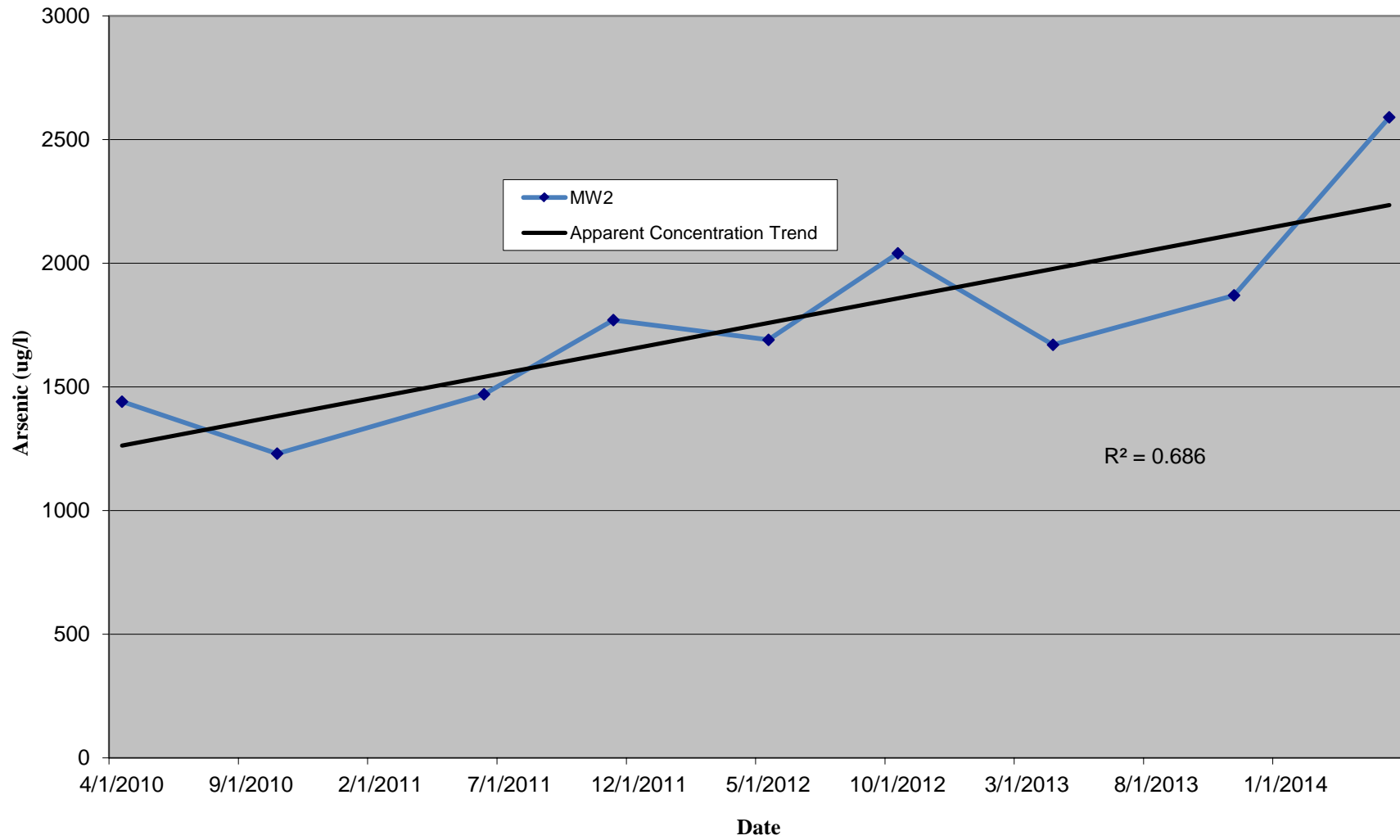


FIGURE 5
Arsenic Concentrations MW-6
Shaw Avenue Dump Site

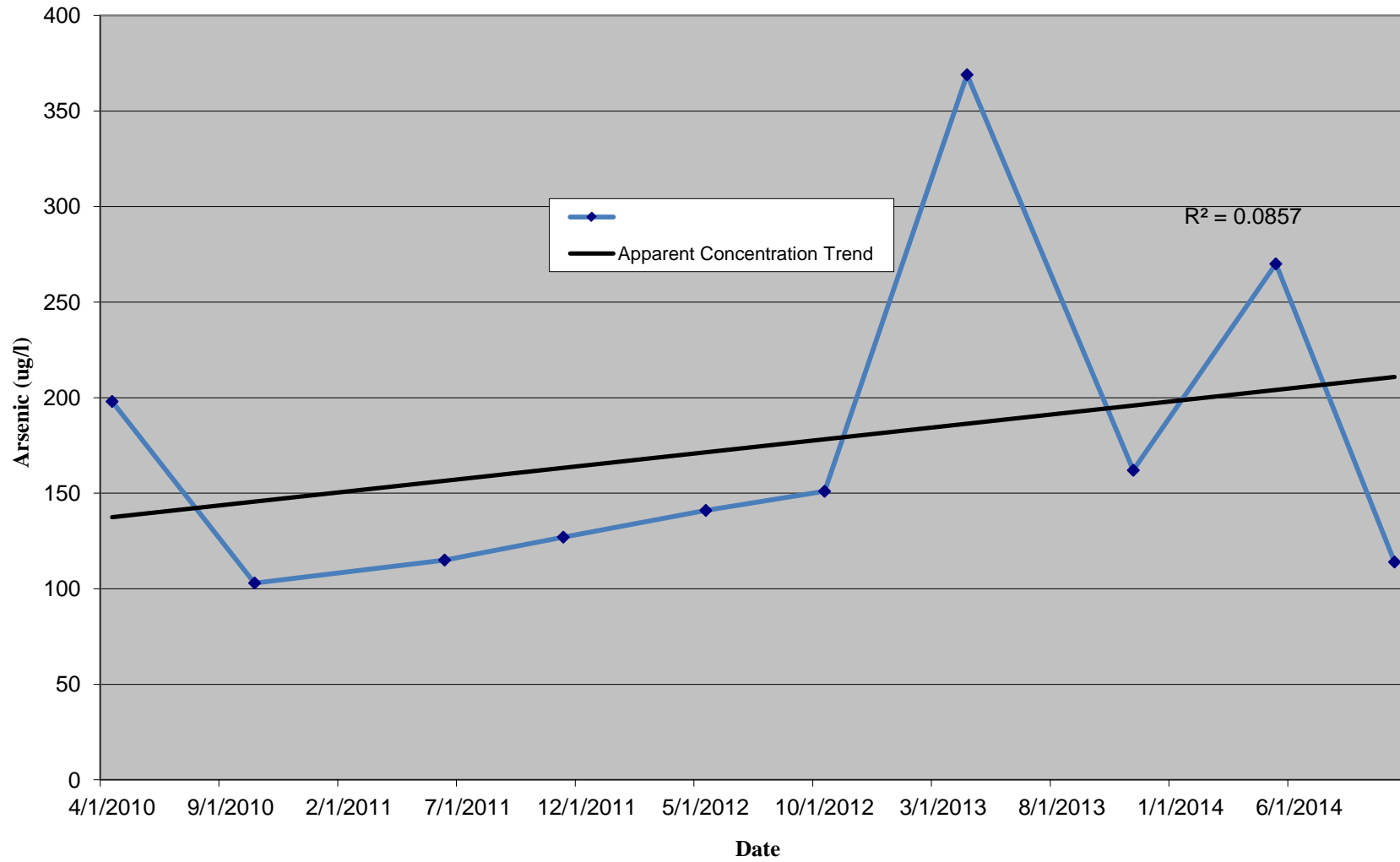


FIGURE 6
Arsenic Concentrations MW-7
Shaw Avenue Dump Site

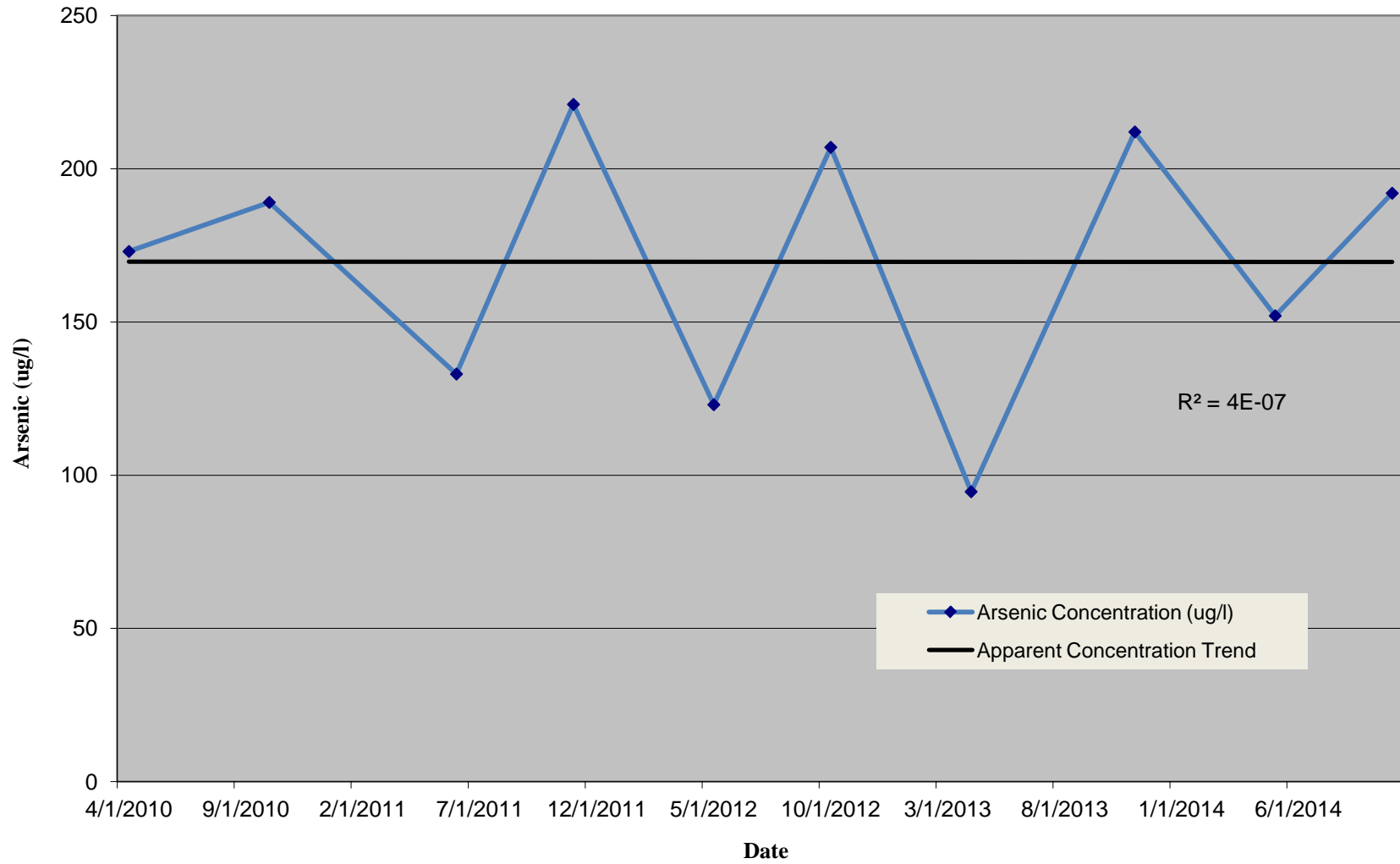
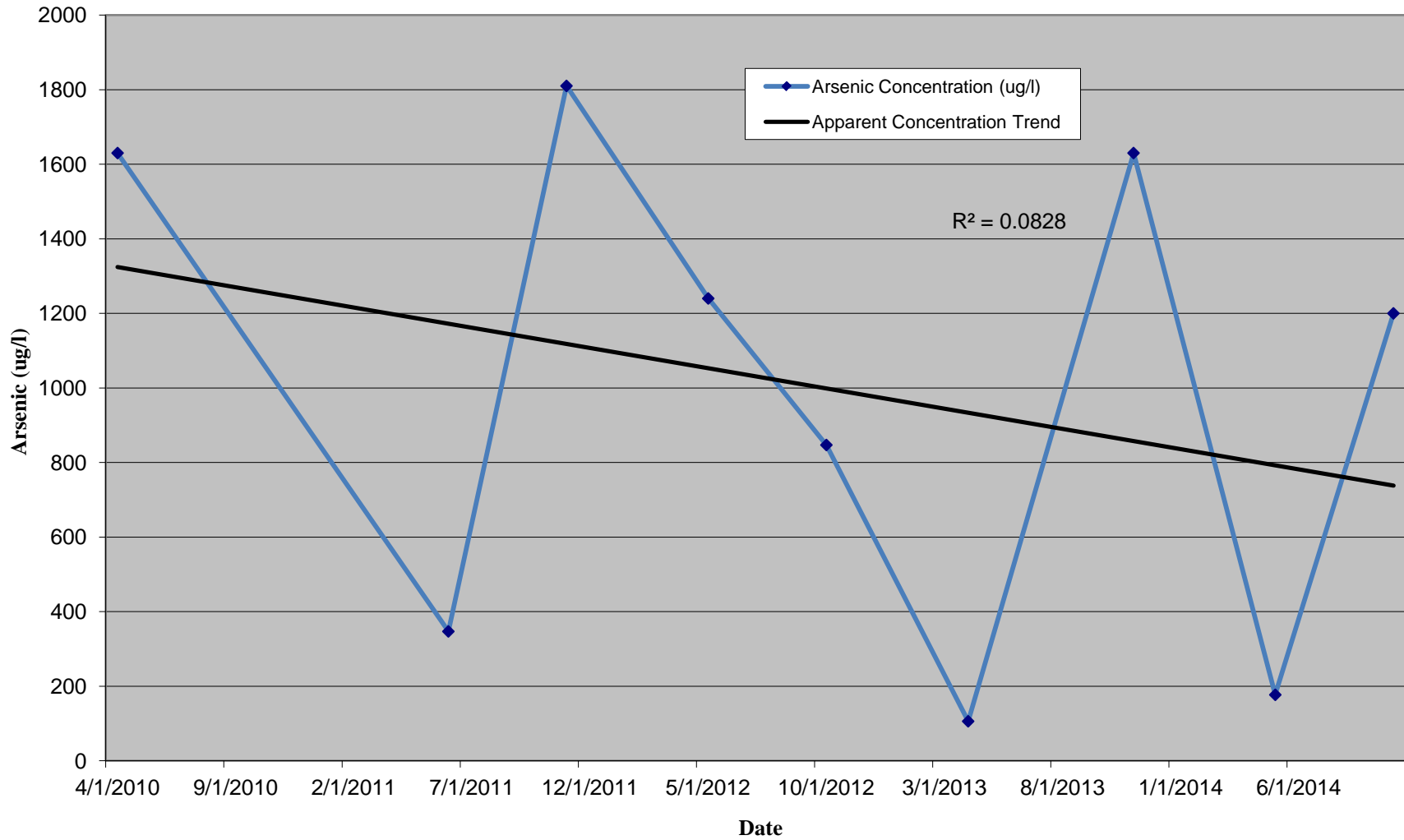


FIGURE 7
Arsenic Concentrations MW-8
Shaw Avenue Dump Site



TABLES

Table 1
Chronology of Site Events
Shaw Avenue Dump Site
Charles City, Iowa

Event	Date
Preliminary Assessment	1984
Proposed for the National Priorities List (NPL)	1985
Final listing on the NPL	1987
Consent Decree	1988
Removal Assessments	1990, 1991, 1993
Remedial Investigation/Feasibility Study (RI/FS)	1990
Baseline Risk Assessment	1991
OU1 Record of Decision (ROD)	1991
Explanation of Significant Differences	1992
Consent Decree	1992
Remedial Design	1992
Remedial Action Implementation (OU1)	1992
OU2 RI	1999
OU2 FS	2000
OU2 ROD	2000
EPA Declaration of Restrictive Covenants and Easements	2001
Preliminary Close Out Report (PCOR)	2001
2002 Revised Site Monitoring and Maintenance Plan	2002
First Five-year Review	2005
Second Five-year Review	2010

TABLE 2
Summary of Well Construction Details
Shaw Avenue Dump Site
Charles City, Iowa

<i>Well No.</i>	<i>Stratigraphic Location</i>	<i>Original Ground Elevation (ft. AMSL)</i>	<i>Reference Elevation (ft. AMSL)</i>	<i>Open Hole/ Screened Interval Depth (ft. BGS)</i>	<i>Open Hole/ Screened Interval Elevation (ft. AMSL)</i>	<i>Groundwater Elevation Range (ft. AMSL)</i>	<i>Date Completed (mm/dd/yy)</i>	<i>Construction Details (ft. BGS)</i>
MW-1	Bedrock	990.4	992.55	48.0 - 62.8	942.4 - 927.6	979 - 973	12/29/1989	4"Ø PVC casing to 48.0', 3"Ø open hole to 62.8' well bottom.
MW-1A	Alluvium	990.5	993.44	31.6 - 46.6	958.9 - 943.9	980 - 973	8/24/1988	15.0' long 2"Ø #10 slot stainless steel screen, from 31.6' to 46.6' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-1B	Alluvium	990.7	993.49	15.0 - 32.0	975.7 - 958.7	980 - 973	8/25/1988	17.0' long 2"Ø #10 slot stainless steel screen, from 15.0' to 32.0' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-2	Bedrock	983.5	983.88	36.2 - 51.2	947.3 - 932.3	980 - 968	9/20/1988; converted to a flush-mount on 8/10/2009	4"Ø PVC casing to 36.2', 3"Ø open hole to 51.2' well bottom.
MW-2A	Alluvium	983.5	983.91	9.5 - 29.5	974.0 - 954.0	979 - 973	9/9/1988; converted to a flush-mount on 8/10/2009	20.0' long 2"Ø #10 slot stainless steel screen, from 9.5' to 29.5' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-3	Bedrock	988.3	990.78	24.9 - 40.1	963.4 - 948.2	980 - 973	8/25/1988	4"Ø PVC casing to 24.9', 3"Ø open hole to 40.1' well bottom.
MW-3A	Alluvium	988.5	991.14	12.3 - 22.3	976.2 - 966.2	980 - 973	8/19/1988	10.0' long 2"Ø #10 slot stainless steel screen, from 12.3' to 22.3' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-4	Bedrock	989.5	989.30	51.8 - 67.5	937.7 - 922.0	981 - 973	9/20/1988; converted to a flush-mount on 8/10/2009	4"Ø PVC casing to 51.8', 3"Ø open hole to 67.5' well bottom.
MW-4A	Alluvium	989.5	989.21	33.5 - 50.5	956.0 - 939.0	981 - 973	9/15/1988; converted to a flush-mount on 8/10/2009	17.0' long 2"Ø #10 slot stainless steel screen, from 33.5' to 50.5' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-4B	Alluvium	989.2	989.17	16.5 - 33.5	972.7 - 955.7	981 - 973	9/16/1988; converted to a flush-mount on 8/10/2009	17.0' long 2"Ø #10 slot stainless steel screen, from 16.5' to 33.5' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-6	Bedrock	1001.7	1004.62	40.1 - 63.2	961.6 - 938.5	987 - 975	9/22/1988	4"Ø PVC casing to 40.1', 3"Ø open hole to 63.2' well bottom.
MW-6A	Alluvium	1001.6	1004.59	24.5 - 39.5	977.1 - 962.1	981 - 973	9/22/1988	15.0' long 2"Ø #10 slot stainless steel screen, from 24.5' to 39.5' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-7	Bedrock	1002.9	1006.43	6.5 - 34.1	996.4 - 968.8	989 - 975	1/9/1990	4"Ø PVC casing to 6.5', 3"Ø open hole to 34.1' well bottom.
MW-8	Bedrock	1010.5	1013.64	17.5 - 32.7	993.0 - 977.8	996 - 982	8/20/1988	4"Ø PVC casing to 17.5', 3"Ø open hole to 32.7' well bottom.
MW-8A	Alluvium	1010.6	1013.89	11.8 - 16.8	998.8 - 993.8	996 - 994	8/31/1988	5.0' long 2"Ø #10 slot stainless steel screen, from 11.8' to 16.8' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-9	Bedrock	995.8	998.01	7.9 - 29.8	987.9 - 966.0	981 - 974	1/10/1990	4"Ø PVC casing to 7.9', 3"Ø open hole to 29.8' well bottom.
MW-10	Bedrock	993.0	995.53	13.2 - 28.5	979.8 - 964.5	989 - 975	12/27/1989	4"Ø PVC casing to 13.2', 3"Ø open hole to 28.5' well bottom.
MW-11	Bedrock	1003.6	1006.50	6.8 - 42.4	996.8 - 961.2	994 - 977	1/4/1990	4"Ø PVC casing to 6.8', 3"Ø open hole to 42.4' well bottom.

TABLE 2
Summary of Well Construction Details
Shaw Avenue Dump Site
Charles City, Iowa

<i>Well No.</i>	<i>Stratigraphic Location</i>	<i>Original Ground Elevation (ft. AMSL)</i>	<i>Reference Elevation (ft. AMSL)</i>	<i>Open Hole/ Screened Interval Depth (ft. BGS)</i>	<i>Open Hole/ Screened Interval Elevation (ft. AMSL)</i>	<i>Groundwater Elevation Range (ft. AMSL)</i>	<i>Date Completed (mm/dd/yy)</i>	<i>Construction Details (ft. BGS)</i>
MW-12	Bedrock	1017.3	1019.22	21.2 - 69.6	996.1 - 947.7	1006 - 979	1/3/1990	4"Ø PVC casing to 21.2', 3"Ø open hole to 69.6' well bottom.
MW-12A	Alluvium	1017.1	1019.24	10.0 - 15.0	1007.1 - 1002.1	1013 - 1009	1/9/1990	5.0' long 2"Ø #10 slot stainless steel screen, from 10.0' to 15.0' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-13	Bedrock	1004.8	1007.86	11.6 - 45.4	993.2 - 959.4	990 - 979	1/12/1990	4"Ø PVC casing to 11.6', 3"Ø open hole to 45.4' well bottom.
MW-14	Bedrock	1002.3	1002.67	11.9 - 34.9	990.4 - 967.4	985 - 979	1/8/1990; converted to a flush-mount on 8/11/2009	4"Ø PVC casing to 11.9', 3"Ø open hole to 34.9' well bottom.
MW-15	Bedrock	1001.3	1003.06	67.0 - 82.5	934.3 - 918.8	980 - 973	1/2/1990	4"Ø PVC casing to 67.0', 3"Ø open hole to 82.5' well bottom.
MW-15A	Alluvium	1000.7	1003.34	41.0 - 61.0	959.7 - 939.7	981 - 973	1/5/1990	20.0' long 2"Ø #10 slot stainless steel screen, from 41.0' to 61.0' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-15B	Alluvium	1000.9	1003.29	27.6 - 47.6	973.3 - 953.3	981 - 973	12/12/1989	20.0' long 2"Ø #10 slot stainless steel screen, from 27.6' to 47.6' (well bottom), with 2"Ø PVC riser pipe to surface.
MW-16	Bedrock	1002.9	1005.51	12.6 - 28.3	991.7 - 974.6	992 - 978	8/16/1990	4"Ø PVC casing to 12.6', 3"Ø open hole to 28.3' well bottom.
MW-17	Bedrock	~ 1005	1007.40	47.0 - 63.0	~ 958 - 942	988 - 977	8/20/1990	4"Ø PVC casing to 47.0', 3"Ø open hole to 63.0' well bottom.
MW-18	Bedrock	~ 1018	1017.74	22.1 - 42.6	~ 996 - 975	994 - 980	8/17/1990	4"Ø PVC casing to 22.1', 3"Ø open hole to 42.6' well bottom.
MW-18A	Alluvium	~ 1018	1017.87	10.0 - 15.0	~ 1008 - 1003	1014 - 1011	8/21/1990	5.0' long 2"Ø #10 slot stainless steel screen, from 10.0' to 15.0' (well bottom), with 2"Ø stainless steel riser pipe to surface.
MW-19	Bedrock	~ 1010	1012.95	36.3 - 53.0	~ 974 - 957	993 - 978	7/14/1992	4"Ø PVC casing to 36.3', 3"Ø open hole to 53.0' well bottom.

ft. AMSL - feet above mean sea level

ft. BGS - Feet below ground surface as per date of well installation

MW Nests 2, 4, 18 and MW-14 were resurveyed in September 2010

MW-8 was resurveyed in July 2011

TABLE 3
Groundwater Monitoring Frequency and Analysis
Shaw Avenue Dump Site
Charles City, Iowa

Item	Identification	Frequency	Analysis
Alluvial Wells	MW-1A	Biennial	VOCs*
	MW-1B	Biennial	VOCs*
	MW-2A	Biennial	VOCs*
	MW-3A	NA	NA
	MW-4A	NA	NA
	MW-4B	NA	NA
	MW-6A	NA	NA
	MW-8A	NA	NA
	MW-12A	NA	NA
	MW-15A	NA	NA
	MW-15B	NA	NA
	MW-18A	NA	NA
Bedrock Wells (UCVA)	MW-1	Biennial	VOCs*
	MW-2	Biennial	VOCs*
		Semi-Annual	Arsenic
	MW-3	NA	NA
	MW-4	Biennial	Arsenic
	MW-6	Semi-Annual	Arsenic
	MW-7	Semi-Annual	Arsenic
	MW-8	Semi-Annual	Arsenic
	MW-9	Biennial	Arsenic
	MW-10	Biennial	Arsenic
	MW-11	Biennial	Arsenic
	MW-12	Biennial	Arsenic
	MW-13	NA	NA
	MW-14	Biennial	Arsenic
	MW-15	Biennial	Arsenic
	MW-16	NA	NA
	MW-17	Biennial	Arsenic
	MW-18	NA	NA
	MW-19	Biennial	Arsenic

Notes:

UCVA: Upper Cedar Valley Aquifer

* Reported VOCs include Vinyl Chloride, 1,1-Dichloroethene, 1,2-Dichloroethene and 1,1,2 Trichloroethane

NA = Not Sampled

Water levels collected from all site well on a semi annual basis

TABLE 4
QUARTERLY GROUNDWATER ELEVATIONS
POST OU1 REMEDIATION GROUNDWATER MONITORING
2010-2014
SHAW AVENUE SITE
CHARLES CITY, IOWA

<i>Monitoring Well ID</i>	<i>Top of Casing Elevation (ft. AMSL)</i>	<i>Groundwater Elevation (ft. AMSL)</i>		
		<i>Apr 15 2010</i>	<i>Oct 9 2010</i>	<i>Jun 14 2011</i>
MW-1	992.55	974.88	975.28	974.83
MW-1A	993.44	974.83	975.29	974.84
MW-1B	993.49	974.83	975.27	974.84
MW-2	983.88	975.23	975.48	975.13
MW-2A	983.91	975.00	975.09	974.91
MW-3	990.78	975.04	975.24	974.98
MW-3A	991.14	974.77	975.32	974.81
MW-4	989.30	975.32	975.76	980.3
MW-4A	989.21	975.34	975.79	975.32
MW-4B	989.17	975.44	975.90	975.4
MW-6	1004.62	980.52	977.65	978.57
MW-6A	1004.59	975.84	976.04	983.57
MW-7	1006.43	980.27	977.02	978.45
MW-8	1013.64	983.65	982.35	982.57
MW-8A	1013.89	994.78	994.67	994.85
MW-9	998.01	977.00	976.17	976.91
MW-10	995.53	997.95	977.16	979.23
MW-11	1006.50	982.42	980.24	982.98
MW-12	1019.22	984.85	981.53	984.62
MW-12A	1019.24	986.40	1010.11	1011.24
MW-13	1007.86	1011.91	979.60	982.14
MW-14	1002.67	984.23	978.95	980.66
MW-15	1003.06	NA	975.69	975.22
MW-15A	1003.34	975.21	975.72	975.18
MW-15B	1003.29	975.16	975.69	975.17
MW-16	1005.51	975.14	980.96	983.6
MW-17	1007.40	984.09	979.02	982.18
MW-18	1017.74	NA	981.35	981.4
MW-18A	1017.87	1013.32	1012.25	1013.59
MW-19	1012.95	985.49	980.91	983.73

MW Nests 2, 4, 18 and MW-14 were resurveyed in September 2010

Note:

NA - Not Available

ft. AMSL - feet above mean sea level

TABLE 4
QUARTERLY GROUNDWATER ELEVATIONS
POST OU1 REMEDIATION GROUNDWATER MONITORING
2010-2014
SHAW AVENUE SITE
CHARLES CITY, IOWA

<i>Monitoring Well ID</i>	<i>Top of Casing Elevation (ft. AMSL)</i>	<i>Groundwater Elevation (ft. AMSL)</i>					
		<i>Nov 28 2011</i>	<i>May 19 2012</i>	<i>Oct 23 2012</i>	<i>Apr 19 2013</i>	<i>Nov 19 2013</i>	<i>May 24 2014</i>
MW-1	992.55	973.38	974.53	973.23	976.42	973.69	975.19
MW-1A	993.44	973.44	974.47	974.47	976.38	973.66	975.16
MW-1B	993.49	973.45	974.46	973.19	976.37	973.65	975.15
MW-2	983.88	976.38	974.78	973.47	976.82	973.97	975.30
MW-2A	983.91	973.54	974.51	973.28	976.54	973.78	974.96
MW-3	990.78	973.46	974.28	973.20	976.91	973.69	975.87
MW-3A	991.14	973.35	974.53	973.11	976.80	973.58	975.54
MW-4	989.30	973.69	975.05	973.45	977.03	973.96	975.60
MW-4A	989.21	973.73	975.07	973.46	977.05	973.97	975.62
MW-4B	989.17	973.82	975.14	973.56	977.13	974.07	975.73
MW-6	1004.62	975.49	979.45	975.11	984.92	984.22	981.07
MW-6A	1004.59	973.9	975.38	973.64	978.48	974.21	976.35
MW-7	1006.43	975.47	979.25	975.28	987.20	976.06	981.62
MW-8	1013.44	981.49	982.36	982.44	996.60	981.93	984.49
MW-8A	1013.89	994.77	994.39	994.82	996.76	994.82	994.81
MW-9	998.01	974.16	977.23	973.98	981.07	974.49	978.59
MW-10	995.53	975.34	980.95	975.06	988.55	976.24	983.44
MW-11	1006.50	978.24	983.85	978.08	990.64	979.40	986.11
MW-12	1019.22	979.13	985.46	978.85	992.10	980.12	987.75
MW-12A	1019.24	1009.84	1011.52	1009.96	1013.18	1010.19	1011.94
MW-13	1007.86	DRY	NA	DRY	989.77	978.56	986.24
MW-14	1002.67	977.08	981.17	976.57	987.37	977.60	982.68
MW-15	1003.06	973.63	974.96	973.34	976.82	973.76	975.56
MW-15A	1003.34	973.62	974.92	973.34	976.78	973.83	975.56
MW-15B	1003.29	973.59	974.90	973.32	976.75	973.83	975.55
MW-16	1005.51	978.36	984.98	978.00	989.57	981.61	987.41
MW-17	1007.40	976.89	981.27	976.40	987.37	977.60	982.47
MW-18	1017.59	979.31	985.19	979.01	991.87	980.25	987.66
MW-18A	1017.60	1012.26	1012.65	1012.15	1013.95	1012.55	1012.91
MW-19	1012.95	978.65	984.36	978.41	991.82	979.23	983.63

MW-8 was resurveyed in July 2011

Note:

NA - Not Available

ft. AMSL - feet above mean sea level

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW1		
	10/9/2010	10/23/2012	10/22/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	ND1	ND1	ND1
1,1-Dichloroethene	ND2	ND2	ND2
1,2-Dichloroethane	ND1	ND1	ND1
1,1,2-Trichloroethane	ND1	ND1	ND1
<i>Metals (µg/L)</i>			
Arsenic (Total)	--	--	--

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

M1 - The MS and/or MSD were outside control limits.

NDxx - The compound was not detected at the detection limit XX

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

MW1-A

	10/9/2010	10/23/2012	10/22/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	ND1	ND1	ND1
1,1-Dichloroethene	2.24	ND2	ND2
1,2-Dichloroethane	ND1	ND1	ND1
1,1,2-Trichloroethane	2.26	1.82	2.02
<i>Metals (µg/L)</i>			
Arsenic (Total)	--	--	--

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

J - Analyte detected at a level less than the Reporting Limit and greater than or equal to the Method Detection Limit. Concentrations within this range are estimated.

NDxx - The compound was not detected at the detection limit XX

**TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA**

MW1-B

	10/9/2010	10/23/2012	10/21/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	ND1	ND1	ND1
1,1-Dichloroethene	ND2	ND2	ND2
1,2-Dichloroethane	ND1	ND1	ND1
1,1,2-Trichloroethane	ND1	1.45	ND1
 <i>Metals (µg/L)</i>			
Arsenic (Total)	--	--	--

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

J - Analyte detected at a level less than the Reporting Limit and greater than or equal to the Method Detection Limit. Concentrations within this range are estimated.

NDxx - The compound was not detected at the detection limit XX

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW2			
	4/16/2010	10/9/2010	6/15/2011	11/28/2011
Volatile Organic Compounds (µg/L)				
Vinyl Chloride	--	3.14	--	--
1,1-Dichloroethene	--	ND2	--	--
1,2-Dichloroethane	--	2.05	--	--
1,1,2-Trichloroethane	--	ND1	--	--
Metals, Total [Dissolved] (µg/L)				
Arsenic	1440 MHA (1400)	1230	1470 (1100) [1170 (1190)]	1770 (1770) [1840 (1800)]
Aluminum	--	--	ND100 (ND100) [ND100 (ND100)]	ND100 (ND100) [ND100 (ND100)]
Antimony	--	--	ND37.3 (ND37.3) [ND37.3 (ND37.3)]	ND37.3 (ND37.3) [ND37.3 (ND37.3)]
Barium	--	--	258 (254) [221 (236)]	273 (262) [272 (263)]
Beryllium	--	--	ND0.580 (ND0.580) [0.678 J (0.976 J)]	0.739J (1.15J) [ND10 (ND10)]
Cadmium	--	--	ND0.92 (ND0.92) [ND0.92 (ND0.92)]	ND0.92 (ND0.92) [ND0.92 (ND0.92)]
Calcium	--	--	75500 (74200) [64400 (69400)]	78900 (78900) [82700 (80000)]
Chromium	--	--	ND1.81 (ND1.81) [ND1.81 (ND1.81)]	9.32 (ND1.81) [ND1.81 (3.28)]
Cobalt	--	--	ND20 (ND20) [ND20 (ND20)]	ND20 (ND20) [ND20 (ND20)]
Copper	--	--	ND20 (ND20) [ND20 (ND20)]	ND20 (ND20) [ND20 (ND20)]
Iron	--	--	2000 (1960) [1710 (1850)]	2700J (2120J) [2170 (2140)]
Lead	--	--	ND4 (ND4) [ND4 (ND4)]	ND4 (ND4) [ND4 (ND4)]
Magnesium	--	--	23900 (23700) [21100 (22800)]	24800 (24800) [25700 (25100)]
Manganese	--	--	12.8 (12.3) [12.5 (13.9)]	23.2 (15.6) [27.5 (38.4)]
Mercury	--	--	ND0.2 (ND0.2) [ND0.2 (ND0.2)]	ND0.2 (ND0.2) [ND0.2 (ND0.2)]
Nickel	--	--	ND2.58 (ND2.58) [ND2.58 (ND2.58)]	5.61 (ND2.58) [ND2.58 (ND3.58)]
Potassium	--	--	2020 (2040) [1930 (2030)]	2120 (2080) [2140 (2120)]
Selenium	--	--	ND5 UJ (ND5 UJ) [ND5 UJ (ND5 UJ)]	ND5R(ND5R) [ND5 (ND5)]
Silver	--	--	ND2.58 (ND2.49) [ND1.7 (ND1.7)]	ND1.7 (ND1.7) [ND1.7 (ND1.7)]
Sodium	--	--	154000 (155000) [150000 (163000)]	153000 (155000) [157000 (156000)]
Thallium	--	--	ND2 UJ (ND2 UJ) [ND2 UJ (ND2 UJ)]	ND2 UJ(ND2UJ) [ND2 (ND10)]
Vanadium	--	--	ND50 (ND50) [ND50 (ND50)]	ND50(ND50) [ND50 (ND50)]
Zinc	--	--	ND20 (ND20) [ND20 (ND20)]	315J(ND20 UJ) [ND20 (ND20)]

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

J - Analyte detected at a level less than the Reporting Limit and greater than or equal to the Method Detection Limit. Concentrations within this range are estimated.

MHA- Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information.

UJ - Non-detect at the associated limit, estimated due to possible low bias.

NDxx - The compound was not detected at the detection limit XX

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW2					
	5/21/2012	10/25/2012	4/19/2013	11/20/2013	5/24/2014	10/22/2014
<i>Volatile Organic Compounds (µg/L)</i>						
Vinyl Chloride	--	2.47	--	--	--	2.89(2.87)
1,1-Dichloroethene	--	ND2	--	--	--	ND2(ND2)
1,2-Dichloroethane	--	ND1	--	--	--	1.47(1.66)
1,1,2-Trichloroethane	--	ND1	--	--	--	ND1(ND1)
<i>Metals, Total [Dissolved] (µg/L)</i>						
Arsenic	1690 (1690)	2040(1830)	1670(1790)	1870(2310)	2590(2550)	2330(2290)
Aluminum	--	--	--	--	--	--
Antimony	--	--	--	--	--	--
Barium	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--
Calcium	--	--	--	--	--	--
Chromium	--	--	--	--	--	--
Cobalt	--	--	--	--	--	--
Copper	--	--	--	--	--	--
Iron	--	--	--	--	--	--
Lead	--	--	--	--	--	--
Magnesium	--	--	--	--	--	--
Manganese	--	--	--	--	--	--
Mercury	--	--	--	--	--	--
Nickel	--	--	--	--	--	--
Potassium	--	--	--	--	--	--
Selenium	--	--	--	--	--	--
Silver	--	--	--	--	--	--
Sodium	--	--	--	--	--	--
Thallium	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--
Zinc	--	--	--	--	--	--

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 1,1-dichloroethene, 1,2-dichloroethane, 1,1,2-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

J - Analyte detected at a level less than the Reporting Limit and greater than or equal to the Method Detection Limit. Concentrations within this range are estimated.

MHA- Due to high levels of analyte in the sample, the MS/MSD calculation does not provide useful spike recovery information.

UJ - Non-detect at the associated limit, estimated due to possible low bias.

NDxx - The compound was not detected at the detection limit XX

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

MW-2A

	10/9/2010	10/25/2012	10/23/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	ND1	ND1	ND1
1,1-Dichloroethene	ND2	2.04	ND2
1,2-Dichloroethane	ND1	1.13	ND1
1,1,2-Trichloroethane	ND1	ND2	ND1
<i>Metals (µg/L)</i>			
Arsenic (Total)	--	--	--

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

J - Analyte detected at a level less than the Reporting Limit and greater than or equal to the Method Detection Limit. Concentrations within this range are estimated.

NDxx - The compound was not detected at the detection limit XX

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW-4		
	10/9/2010	10/25/2012	10/22/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
<i>Metals (µg/L)</i>			
Arsenic (Total)	ND1	1.84	ND1

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 1,1-dichloroethene, 1,2-dichloroethane, 1,1,2-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

NDxx - The compound was not detected at the detection limit XX

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW6									
	4/16/2010	10/9/2010	6/15/2011	11/29/2011	5/21/2012	10/25/2012	4/19/2013	11/20/2013	5/24/2014	10/22/2014
<i>Volatile Organic Compounds (µg/L)</i>										
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--	--	--
<i>Metals (µg/L)</i>										
Arsenic (Total)	198	103	115	127	141	151	369(377)	162	270(271)	114

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW7									
	4/16/2010	10/9/2010	6/15/2011	11/29/2011	5/21/2012	10/24/2012	4/19/2013	11/20/2013	5/24/2014	10/21/2014
<i>Volatile Organic Compounds (µg/L)</i>										
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--	--	--
<i>Metals (µg/L)</i>										
Arsenic (Total)	173	189	133 (110)	221	123	207	94.6	212	152	192

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

MW8

	4/17/2010	10/12/2010	6/15/2011	11/30/2011	5/21/2012	10/23/2012	4/19/2013	11/20/2013	5/24/2014	10/23/2014
<i>Volatile Organic Compounds (µg/L)</i>										
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--	--	--
<i>Metals (µg/L)</i>										
Arsenic (Total)	1630	NA	347	1810	1240	847	106	1630	177(169)	1200

Notes:

- All Concentrations reported as ug/l
- Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.
- Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.
- Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.
- () - Analysis of duplicate sample.
- - Analysis was not conducted for this parameter.
- NA - Not Available

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW-9		
	10/12/2010	10/24/2012	10/22/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
<i>Metals (µg/L)</i>			
Arsenic (Total)	3.49	4.34	5.32

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW-10		
	10/9/2010	10/24/2012	10/21/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
<i>Metals (µg/L)</i>			
Arsenic (Total)	ND1	ND1	ND1

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

ND1 = Non detect at 1 ug/L detection limit.

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW-11		
	10/12/2010	10/24/2012	10/21/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
<i>Metals (µg/L)</i>			
Arsenic (Total)	123	100	79.8

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

M1 - The MS and or MSD were outside control limits

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW-12		
	10/12/2010	10/24/2012	10/21/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
<i>Metals (µg/L)</i>			
Arsenic (Total)	8.06	10	16.3

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW-14		
	10/9/2010	10/24/2012	10/22/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
<i>Metals (µg/L)</i>			
Arsenic (Total)	400 M1	426	381

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

M1 - The MS and or MSD were outside control limits

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW-15		
	10/11/2010	10/24/2012	10/22/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
<i>Metals (µg/L)</i>			
Arsenic (Total)	3.76 (3.66)	4.83	4.94

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW-17		
	10/12/2010	10/24/2012	10/23/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
<i>Metals (µg/L)</i>			
Arsenic (Total)	4.6	4.17	4.20

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

TABLE 5
GROUNDWATER QUALITY DATA SUMMARY
2010-2014
OU2 GROUNDWATER MONITORING
SHAW AVENUE SITE
CHARLES CITY, IOWA

	MW-19		
	10/12/2010	10/24/2012	10/23/2014
<i>Volatile Organic Compounds (µg/L)</i>			
Vinyl Chloride	--	--	--
1,1-Dichloroethene	--	--	--
1,2-Dichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
<i>Metals (µg/L)</i>			
Arsenic (Total)	45.4	9.89	4.20

Notes:

All Concentrations reported as ug/l

Monitoring well to be sampled biennially for vinyl chloride, 11-dichloroethene, 12-dichloroethane, 112-trichloroethane, per 2002 revised Site M&M Plan.

Monitoring well to be sampled semi-annually for total arsenic concentrations, per 2002 revised Site M&M Plan.

Monitoring well to be sampled biennially for total arsenic concentrations, per 2002 revised Site M&M Plan.

() - Analysis of duplicate sample.

-- - Analysis was not conducted for this parameter.

NA - Not Available

TABLE 6
Changes in Federal Maximum Contaminant Levels
Shaw Avenue Dump Site
Charles City, Iowa

Potential Chemical of Concern	2000 ROD	Last FYR	Current FYR	Source
Arsenic	50	10	10	USEPA, 2014
Benzene	5	5	5	USEPA, 2014
Cadmium	5	5	5	USEPA, 2014
Dichloroethane, 1,2-	5	5	5	USEPA, 2014
Dichloroethene, 1,1-	7	7	7	USEPA, 2014
Manganese	NA	NA	NA	USEPA, 2014
Nitroaniline, 2-	NA	NA	NA	USEPA, 2014
Toluene	1000	1000	1000	USEPA, 2014
Trichlorethane, 1,1,2	NA	5	5	USEPA, 2014
Vinyl chloride	2	2	2	USEPA, 2014
Xylenes	10000	10000	10000	USEPA, 2014

All Maximum Contaminant Levels reported in micrograms per liter.

ROD = Record of Decision

FYR = Five Year Review

NA = Not applicable

USEPA, 2014 at <http://water.epa.gov/drink/contaminants/#List>

TABLE 7
Changes in Oral Reference Doses
Shaw Avenue Dump Site
Charles City, Iowa

Chemical of Potential Concern	Media	1991 BLRA	Current	Source	Effect on Risk
Anthracene	Subsurface Soil	3.0E-01	3.0E-01	IRIS	No change
Arsenic	Surface Soil, Subsurface Soil, Groundwater	1.0E-03	3.0E-04	IRIS	Increased
Benz[a]anthracene	Surface Soil, Subsurface Soil	NA	NA	-	No change
Benzene	Groundwater	NA	4.0E-03	IRIS	Increased
Benzo[a]pyrene	Subsurface Soil	NA	NA	-	No change
Benzo[b]fluoranthene	Subsurface Soil	NA	NA	-	No change
Benzo[g,h,i]perylene	Subsurface Soil	NA	NA	-	No change
Benzo[k]fluoranthene	Subsurface Soil	NA	NA	-	No change
Beryllium	Surface Soil	5.0E-03	2.0E-03	IRIS	Increased
Bis(2-ethylhexyl)phthalate	Subsurface Soil	2.0E-02	2.0E-02	IRIS	No change
Cadmium	Surface Soil, Subsurface Soil, Groundwater	5.0E-04	5.0E-04 (water) 1.0E-3 (soil)	IRIS	No change (water); Decreased
Chrysene	Surface Soil, Subsurface Soil	NA	NA	-	No change
Cobalt	Surface Soil	NA	3.0E-04	PPRTV	Increased
Copper	Subsurface Soil	3.7E-02	4.0E-02	HEAST	Decreased
Dibenz[a,h]anthracene	Subsurface Soil	NA	NA	-	No change
1,2-Dichloroethane	Groundwater	NA	6.0E-03	PPRTVX	Increased
1,1-Dichloroethene	Groundwater	9.0E-03	5.0E-02	IRIS	Decreased
Fluoranthene	Surface Soil, Subsurface Soil	4.0E-02	4.0E-02	IRIS	No change
Fluorene	Subsurface Soil	4.0E-02	4.0E-02	IRIS	No change
Indeno[1,2,3-cd]pyrene	Subsurface Soil	NA	NA	-	No change
Manganese	Surface Soil, Subsurface Soil, Groundwater	1.0E-01	1.4E-01	IRIS	Decreased
Nickel	Surface Soil	2.0E-02	2.0E-02	IRIS	No change
2-Nitroaniline	Groundwater	NA	1.0E-02	PPRTVX	Increased
Phenanthrene	Surface Soil, Subsurface Soil	NA	NA	-	No change
Pyrene	Surface Soil, Subsurface Soil	3.0E-02	3.0E-02	IRIS	No change
Toluene	Groundwater	2.0E-01	8.0E-02	IRIS	Increased
1,1,2-Trichloroethane	Groundwater	5.7E-02	4.0E-03	IRIS	Increased
Vinyl Chloride	Groundwater	NA	3.0E-03	IRIS	Increased
Xylenes	Groundwater	2.0E+00	2.0E-01	IRIS	Increased
Zinc	Subsurface Soil	2.0E-01	3.0E-01	IRIS	Decreased

All oral Reference Doses reported in milligrams per kilogram per day.

BLRA = Baseline Risk Assessment

NA = Not available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Tables

PPRTV = Provisional Peer-Reviewed Toxicity Value

PPRTVX = Provisional Peer-Reviewed Toxicity Appendix Screening Value

TABLE 8
Changes in Inhalation Reference Concentrations
Shaw Avenue Dump Site
Charles City, Iowa

Chemical of Potential Concern	Media	1991	Current	Source	Effect on Risk
Anthracene	Subsurface Soil	NA	NA	NA	No change
Arsenic	Surface Soil, Subsurface Soil, Groundwater	NA	1.5E-05	CalEPA	Increased
Benz[a]anthracene	Surface Soil, Subsurface Soil	NA	NA	-	No change
Benzene	Groundwater	NA	3.0E-02	IRIS	Increased
Benzo[a]pyrene	Subsurface Soil	NA	NA	-	No change
Benzo[b]fluoranthene	Subsurface Soil	NA	NA	-	No change
Benzo[g,h,i]perylene	Subsurface Soil	NA	NA	-	No change
Benzo[k]fluoranthene	Subsurface Soil	NA	NA	-	No change
Beryllium	Surface Soil	NA	2.0E-05	IRIS	Increased
Bis(2-ethylhexyl)phthalate	Subsurface Soil	NA	NA	-	No change
Cadmium	Surface Soil, Subsurface Soil, Groundwater	NA	1.0E-05	ATSDR	Increased
Chrysene	Surface Soil, Subsurface Soil	NA	NA	-	No change
Cobalt	Surface Soil	NA	6.0E-06	PPRTV	Increased
Copper	Subsurface Soil	NA	NA	-	No change
Dibenz[a,h]anthracene	Subsurface Soil	NA	NA	-	No change
1,2-Dichloroethane	Groundwater	NA	7.0E-03	PPRTV	Increased
1,1-Dichloroethene	Groundwater	NA	2.0E-01	IRIS	Increased
Fluoranthene	Surface Soil, Subsurface Soil	NA	NA	-	No change
Fluorene	Subsurface Soil	NA	NA	-	No change
Indeno[1,2,3-cd]pyrene	Subsurface Soil	NA	NA	-	No change
Manganese	Surface Soil, Subsurface Soil, Groundwater	3.0E-04	5.0E-05	IRIS	Increased
Nickel	Surface Soil	NA	9.0E-05	ATSDR	Increased
2-Nitroaniline	Groundwater	NA	5.0E-05	PPRTVX	Increased
Phenanthrene	Surface Soil, Subsurface Soil	NA	NA	-	No change
Pyrene	Surface Soil, Subsurface Soil	NA	NA	-	No change
Toluene	Groundwater	5.7E-01	5.0E+00	IRIS	Decreased
1,1,2-Trichloroethane	Groundwater	NA	2.0E-04	PPRTVX	Increased
Vinyl Chloride	Groundwater	NA	1.0E-01	IRIS	Increased
Xylenes	Groundwater	8.6E-02	1.0E-01	IRIS	Decreased
Zinc	Subsurface Soil	NA	NA	-	No change

All inhalation Reference Concentrations given in milligrams per cubic meter

BLRA = Baseline Risk Assessment

NA = Not available

ATSDR = Agency for Toxic Substance and Disease Registry

CalEPA = California Environmental Protection Agency

IRIS = Integrated Risk Information System

PPRTV = Provisional Peer-Reviewed Toxicity Value

PPRTVX = Provisional Peer-Reviewed Toxicity Appendix Screening Value

TABLE 9
Changes in Oral Cancer Slope Factors
Shaw Avenue Dump Site
Charles City, Iowa

Chemical of Potential Concern	Media	1991 BLRA	Current	Source
Anthracene	Subsurface Soil	NA	NA	NA
Arsenic	Surface Soil, Subsurface Soil, Groundwater	1.8E+00	1.5E+00	IRIS
Benz[a]anthracene	Surface Soil, Subsurface Soil	NA	7.3E-01	IRIS
Benzene	Groundwater	2.9E-02	5.5E-02	IRIS
Benzo[a]pyrene	Subsurface Soil	NA	7.3E+00	IRIS
Benzo[b]fluoranthene	Subsurface Soil	NA	7.3E-01	IRIS
Benzo[g,h,i]perylene	Subsurface Soil	NA	NA	-
Benzo[k]fluoranthene	Subsurface Soil	NA	7.3E-02	IRIS
Beryllium	Surface Soil	4.3E+00	NA	-
Bis(2-ethylhexyl)phthalate	Subsurface Soil	1.4E-02	1.4E-02	IRIS
Cadmium	Surface Soil, Subsurface Soil, Groundwater	NA	NA	-
Chrysene	Surface Soil, Subsurface Soil	NA	7.3E-03	IRIS
Cobalt	Surface Soil	NA	NA	-
Copper	Subsurface Soil	NA	NA	-
Dibenz[a,h]anthracene	Subsurface Soil	NA	7.3E+00	IRIS
1,2-Dichloroethane	Groundwater	9.1E-02	9.1E-02	IRIS
1,1-Dichloroethene	Groundwater	6.0E-01	NA	-
Fluoranthene	Surface Soil, Subsurface Soil	NA	NA	-
Fluorene	Subsurface Soil	NA	NA	-
Indeno[1,2,3-cd]pyrene	Subsurface Soil	NA	7.3E-01	IRIS
Manganese	Surface Soil, Subsurface Soil, Groundwater	NA	NA	-
Nickel	Surface Soil	NA	NA	-
2-Nitroaniline	Groundwater	NA	NA	-
Phenanthrene	Surface Soil, Subsurface Soil	NA	NA	-
Pyrene	Surface Soil, Subsurface Soil	NA	NA	-
Toluene	Groundwater	NA	NA	-
1,1,2-Trichloroethane	Groundwater	5.7E-02	5.7E-02	IRIS
Vinyl Chloride	Groundwater	2.3E+00	7.2E-01	IRIS
Xylenes	Groundwater	NA	NA	-
Zinc	Subsurface Soil	NA	NA	-

All oral Cancer Slope Factors reported in (mg/kg-day)⁻¹

BLRA = Baseline Risk Assessment

NA = Not available

IRIS = Integrated Risk Information System

TABLE 10
Changes in Cancer Inhalation Unit Risks
Shaw Avenue Dump Site
Charles City, Iowa

Chemical of Potential Concern	Media	1991 BLRA	Current	Source
Anthracene	Subsurface Soil	NA	NA	NA
Arsenic	Surface Soil, Subsurface Soil, Groundwater	5.0E+01	4.3E-03	IRIS
Benz[a]anthracene	Surface Soil, Subsurface Soil	NA	1.1E-04	CalEPA
Benzene	Groundwater	2.9E-02	7.8E-06	IRIS
Benzo[a]pyrene	Subsurface Soil	NA	1.1E-03	CalEPA
Benzo[b]fluoranthene	Subsurface Soil	NA	1.1E-04	CalEPA
Benzo[g,h,i]perylene	Subsurface Soil	NA	NA	-
Benzo[k]fluoranthene	Subsurface Soil	NA	1.1E-04	CalEPA
Beryllium	Surface Soil	8.4E+00	2.4E-03	IRIS
Bis(2-ethylhexyl)phthalate	Subsurface Soil	NA	2.4E-06	CalEPA
Cadmium	Surface Soil, Subsurface Soil, Groundwater	6.1E+00	1.8E-03	IRIS
Chrysene	Surface Soil, Subsurface Soil	NA	1.1E-05	CalEPA
Cobalt	Surface Soil	NA	9.0E-03	PPRTV
Copper	Subsurface Soil	NA	NA	-
Dibenz[a,h]anthracene	Subsurface Soil	NA	1.2E-03	CalEPA
1,2-Dichloroethane	Groundwater	9.1E-02	2.6E-05	IRIS
1,1-Dichloroethene	Groundwater	1.2E+00	NA	-
Fluoranthene	Surface Soil, Subsurface Soil	NA	NA	-
Fluorene	Subsurface Soil	NA	NA	-
Indeno[1,2,3-cd]pyrene	Subsurface Soil	NA	1.1E-04	CalEPA
Manganese	Surface Soil, Subsurface Soil, Groundwater	NA	NA	-
Nickel	Surface Soil	8.4E-01	2.6E-04	CalEPA
2-Nitroaniline	Groundwater	NA	NA	-
Phenanthrene	Surface Soil, Subsurface Soil	NA	NA	-
Pyrene	Surface Soil, Subsurface Soil	NA	NA	-
Toluene	Groundwater	NA	NA	-
1,1,2-Trichloroethane	Groundwater	5.7E-02	1.6E-05	IRIS
Vinyl Chloride	Groundwater	2.9E-01	4.4E-06	IRIS
Xylenes	Groundwater	NA	NA	-
Zinc	Subsurface Soil	NA	NA	-

All Inhalation Unit Risks given in ($\mu\text{g}/\text{m}^3$)-1

BLRA = Baseline Risk Assessment

NA = not available

CalEPA = California Environmental Protection Agency

IRIS = Integrated Risk Information System

PPRTV = Provisional Peer-Reviewed Toxicity Value

TABLE 11
Changes in Standard Default Exposure Factors
Shaw Avenue Dump Site
Charles City, Iowa

Exposure Factor	Units	1991 Value	2015 Value
Averaging Time - cancer	days	25,550	25,550
Averaging Time - non-carcinogenic	days	10,950	9,125
Body Weight	kg	70	80
Dermal Absorption Factor	-	0.04	Chemical-specific (As = 0.03, Cd = 0.001, PAHs = 0.13)
Exposure Duration	years	30	25
Exposure Frequency	days/year	90	225
Fraction Exposure (inhalation only) ^a	-	0.33	NA
Inhalation Rate ^a	m ³ /day	30	NA
Matrix Factor (dermal only) ^b	-	0.15	1
Skin Surface Area	cm ²	3,120	3,470
Soil Adherence Factor ^b	mg/cm ²	1.45	0.12
Soil Ingestion Rate	mg/day	100	100

^a Inhalation exposures are now evaluated following RAGS Part F methodology, which does not include this parameter.

^b Current methodology does not include use of a "matrix factor"; however, today's soil adherence factor appear to include the old soil adherence factor multiplied by the matrix factor.

mg/day = milligrams per day

mg/cm² = milligrams per square centimeter

cm² = square centimeter

m³/day = cubic meters per day

kg = kilogram

TABLE 12
Vapor Intrusion Risks from Chemicals of Concern in Groundwater
Shaw Avenue Dump Site
Charles City, Iowa

OSWER VAPOR INTRUSION ASSESSMENT

Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.3.1, May 2014 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature	T _{gw}	9	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard
		C _{gw}	C _{ia}	CR	HQ
		(ug/L)	(ug/m ³)		
107-06-2	Dichloroethane, 1,2-	2.10E+00	4.47E-02	4.1E-07	6.1E-03
75-35-4	Dichloroethylene, 1,1-	2.20E+00	1.27E+00	No IUR	6.1E-03
79-00-5	Trichloroethane, 1,1,2-	2.30E+00	3.09E-02	1.8E-07	1.5E-01
75-01-4	Vinyl Chloride	3.10E+00	2.18E+00	1.3E-05	2.1E-02

Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
IUR		RfC		i
(ug/m ³) ⁻¹		(mg/m ³)		
2.60E-05	I	7.00E-03	P	
		2.00E-01	I	
1.60E-05	I	2.00E-04	X	
4.40E-06	I	1.00E-01	I	VC

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: <http://www.epa.gov/iris/subst/index.html>

P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: <http://hhpprtv.ornl.gov/pprtv.shtml>

A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: <http://www.atsdr.cdc.gov/mrls/index.html>

CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: <http://www.oehha.ca.gov/risk/ChemicalDB/index.asp>

H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: <http://epa-heast.ornl.gov/heast.shtml>

S = See RSL User Guide, Section 5

X = PPRTV Appendix

Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply

VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).

TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply

Yellow highlighting indicates site-specific parameters that may be edited by the user.

Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

ATTACHMENTS

Attachment A

Contaminants of Potential Concern

Operable Unit 1
Contaminants of Potential Concern

TABLE 1
Potential Chemicals of Concern - Chemical Fill
Shaw Avenue Dump Site

	BH89 (mg/kg)	BH90 (mg/kg)	BH91 (mg/kg)	BH91 (Dup) (mg/kg)	BH93 (mg/kg)	BH93 (Dup) (mg/kg)	BH95 (mg/kg)	BH95 (Dup) (mg/kg)	Frequency	Range (mg/kg)	Arithmetic Mean (1,2) (mg/kg)	Maximum (mg/kg)	95th Upper Confidence (mg/kg)
Aluminum	740	179	693		381		813	1220	5/5	179 - 1220	635	1220	972
Antimony	4070	16200	438		13500		7780	6130	5/5	438 - 16200	8398	16200	13947
Arsenic	264000	31500 J	48200		241000		90300	88800 J	5/5	31500 - 264000	135000	264000	228538
Barium	21.3	24	23.7		83.6		31.5	37.4	5/5	21.3 - 83.6	38	83.6	60
Cadmium	1300	91.7	225		1260		390	360 J	5/5	91.7 - 1300	653	1300	1150
Calcium	270000 J	20500 J	13900 J		215000 J		80400 J	91800 J	5/5	13900 - 270000	122240	270000	220823
Chromium	2.6	12	45.6		6.7		17.2	14.4	5/5	2.6 - 45.6	17	45.6	31
Cobalt	0.97 ND	1.3 ND	1.3 ND		0.92 ND		5.5	4.9	1/5	0.92 - 5.5	2	5.5	4
Copper	18.8 J	202 J	45.9 J		63 J		691 J	557 J	5/5	18.8 - 691	204	691	444
Iron	1410	4720	2120		1860		4200 J	14500 J	5/5	1410 - 14500	492	14500	9619
Lead	30.7	711	47.9		318		391	234 J	5/5	30.7 - 711	300	711	539
Magnesium	1570	382	314		667		845	1140	5/5	314 - 1570	815	1570	1269
Manganese	507	27.7	73.4		141		240	235 J	5/5	27.7 - 507	198	507	360
Mercury	0.18 ND	2.7	0.28 ND		0.2 ND		2	1.3	2/5	0.18 - 2.7	1	2.7	2
Nickel	6.4	9.6	30.1		35.8		188	173	5/5	6.4 - 188	54	188	119
Potassium	199	402	178		241		245	360	5/5	178 - 402	276	402	361
Silver	9.1	2.2 ND	1.6 ND		7.6		3 ND	2.7 J	5/5	1.6 - 9.1	5	9.1	8
Sodium	815	1320	867		2090		1290	1140	5/5	815 - 2090	1276	2090	1712
Thallium	3.7	11.3	1.1 ND		2.3		12.8	9.6	4/5	1.1 - 12.8	6	12.8	11
Vanadium	2 U	1.8	6.2		1.3 ND		11.2	8.8	3/5	1.3 - 11.2	5	11.2	8
Zinc	149	30.9 ND	95.6		304		857	882 J	5/5	30.9 - 882	292	882	586
Cyanide	--	10.2	4		1.9		1.3 ND	1.6	3/4	1.3 - 10.2	4	10.2	8
	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Nitrobenzene	31000 ND	5500000 ND	1900000 J		460000 ND R		610000 ND	5100000 ND R	1/4	31000 - 5500000	3132750	5500000	5803591
2-Nitrophenol	31000 ND	5500000 ND	2000000 ND R		1300000 J		610000 ND	5100000 ND	1/4	31000 - 5500000	2707750	5500000	5762876
2-Nitroaniline	350000 J	53000000 J	2000000 ND J		3900000 J		5900000 J	95000000 J	4/5	200000 - 95000000	30490000	95000000	66674184
4,4'-DDT	99 ND J	1300 ND J	6100 J		270 ND J		680 ND J	540 ND J	1/5	99 - 6100	1689.8	6100	30422

Notes:

- (1) Non-detect values were assumed equal to the detection limit when calculating the mean concentration.
- (2) For duplicate samples, the higher concentration of the two samples was used to calculate the mean concentration.
- J - The associated numerical value is an estimated quantity.
- ND - The data is unusable (compound may or may not be present).
- NR - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.
- U - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.

TABLE 1
Potential Chemicals of Concern - Chemical Fill
Shaw Avenue Dump Site

	BH89 (ug/kg)	BH90 (ug/kg)	BH91 (ug/kg)	BH91 (Dup) (ug/kg)	BH93 (ug/kg)	BH93 (Dup) (ug/kg)	BH95 (ug/kg)	BH95 (Dup) (ug/kg)	Frequency	Range (ug/kg)	Arithmetic Mean (1, 2) (ug/kg)	Maximum (ug/kg)	95th Upper Confidence (ug/kg)
Methylene Chloride	19 ND	140 ND J	23	12 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 140	41.1	140	89
Acetone	32 J	140 ND R	28 ND	160 R	18 ND	18 ND R	31 ND J	26 ND J	1/4	18 - 32	27.25	32	34
1,1-Dichloroethene	10 ND J	91 J	210	78 J	27 J	9 ND J	16 ND	13 ND	3/5	10 - 210	70.8	210	143
Chloroform	10 ND	69 ND J	17	11 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 69	24.3	69	46
1,2-Dichloroethane	10 ND	69 ND J	25	9 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 69	25.8	69	47
1,1,2-Trichloroethane	10 ND	170 J	510	210 J	81	170 J	42	21	4/5	10 - 510	162.6	510	336
Benzene	10 ND	69 ND J	150	62 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 150	50.8	150	103
Tetrachloroethane	10 ND	69 ND J	26	14 J	9 ND	9 ND J	16 ND	13 ND	1/5	9 - 69	26	69	47
Toluene	10 ND	69 ND J	79	48 J	9 ND	46 J	16 ND	13 ND	2/5	10 - 79	36.6	79	66
Chlorobenzene	10 ND	69 ND J	240	88 J	9	9 J	16 ND	13 ND	2/5	9 - 240	68.8	240	153
Ethylbenzene	10 ND	69 ND J	380	270 J	18	23 J	16 ND	13 ND	2/5	10 - 380	98.6	380	234
Xylene (total)	10 ND	480 J	680	530 J	110	140 J	22	13 ND	4/5	10 - 680	262.4	680	522

Notes:

- (1) Non-detect values were assumed equal to the detection limit when calculating the mean concentration.
 - (2) For duplicate samples, the higher concentration of the two samples was used to calculate the mean concentration.
- J - The associated numerical value is an estimated quantity.
R - The data is unusable (compound may or may not be present).
ND - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.
U - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.

Table 2
Potential Chemicals of Concern - Surface Soil
Shaw Avenue Dump Site

	Area 1 (mg/kg)	Area 2 (mg/kg)	Area 2 (Dup) (ug/kg)	Area 3 (mg/kg)	Area 4 (mg/kg)	Frequency	Range (mg/kg)	Arithmetic Mean (1,2) (mg/kg)	Maximum (mg/kg)	95th Upper Confidence (mg/kg)
Arsenic	12	5.9	6.2	1.7	4.4	4/4	1.7 - 12	6.1	12	11
Beryllium *	2.1 ND	2 ND	4.4 J	2 ND	2 ND	1/4	2 - 39.6	11.4	39.6	31
Cadmium *	2.1 ND	2 ND	4.2 J	2 ND	2 ND	1/4	2 - 37.8	11	37.8	29
Cobalt *	5.7	5 ND	42 J	5 ND	5 ND	2/4	5 - 378	110	378	293
Nickel	12	7.1	54 J	7.3	10	4/4	7.3 - 54	21	54	43
	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Phenanthrene	65 ND	120	71	65 ND	10	2/4	10 - 120	65	120	111
Fluoranthene	130 ND	140	130 ND	130 ND	210	2/4	130 - 210	153	210	193
Pyrene	130 ND	180	130	130 ND	210	2/4	130 - 210	163	210	203
Benzo(a)anthracene	65 ND	83	65 ND	65 ND	130	2/4	65 - 130	86	130	117
Chrysene	65 ND	67	65 ND	65 ND	140	2/4	65 - 140	84	140	122

Notes:

- (1) Non-detect values were assumed equal to the detection limit when calculating the mean concentration.
- (2) For duplicate samples, the higher concentration of the two samples was used to calculate the mean concentration.
- J - The associated numerical value is an estimated quantity.
- ND - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.
- * - The surface soil results reflect the results of a composite of nine samples for each area. EPA Region VII has taken the position that the results of any of the surface soil samples in that area may be at a value of nine times the reported value. Therefore, for this evaluation, the maximum concentration is the measured concentration for beryllium, cadmium, and cobalt multiplied by nine.

Table 3
Potential Chemicals of Concern - Subsurface Soil
Shaw Avenue Dump Site

	BIISA (mg/kg)	BIISB (ug/kg)	BIISC (ug/kg)	BIISC (Dup) (ug/kg)	MW1 (ug/kg)	MWISA (mg/kg)	Frequency	Range (mg/kg)	Arithmetic Mean (1,2) (mg/kg)	Maximum (mg/kg)	95th Upper Confidence (ug/kg)
Arsenic	15	21	350	120	135 J	14.2	5/5	14.2 - 350	107	350	231
Cadmium	2 ND	2 ND	39 J	6.5 J	1.1	2.2 ND	2/5	1.1 - 39	9.3	39	23
Copper	31	4.5	4.9	4.4	164 J	41 J	5/5	4.5 - 164	49	164	106
Lead	130	29	20	22	323	131 J	5/5	22 - 323	127	323	231
Manganese	280 J	460 J	290 J	370 J	186 J	407 J	5/5	186 - 460	341	460	433
Zinc	410 J	26 J	68 J	37 J	302 J	299 J	5/5	26 - 410	221	410	362

	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Fluorene	20000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 20000	4446	20000	11863
Phenanthrene	160000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 160000	32446	160000	93255
Anthracene	88000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 88000	18046	88000	51396
Fluoranthene	190000	370 ND	340 ND	370 ND	930	1000 ND J	3/5	340 - 190000	38534	190000	110743
Pyrene	200000	370 ND	340 ND	370 ND	870	730 ND	2/5	340 - 200000	40468	200000	116522
Benzo(a)anthracene	94000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 94000	19246	94000	54884
Chrysene	10000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 100000	20446	100000	58372
Bis(2-ethylhexyl)phthalate	19000 ND J	370 ND J	340 ND J	800 J	760 ND	730 ND	1/5	340 - 19000	4332	19000	11326
Benzo(b)fluoranthene	94000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 94000	19246	94000	54884
Benzo(k)fluoranthene	85000	370 ND	340 ND	370 ND	950	730 ND	2/5	340 - 85000	17484	85000	49672
Benzo(a)pyrene	82000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 82000	16846	82000	47907
Indeno(1,2,3-cd)pyrene	47000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 47000	9646	47000	27559
Dibenzo(a,h)anthracene	21000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 21000	4648	21000	12444
Benzo(g,h,i)perylene	51000	370 ND	340 ND	370 ND	760 ND	730 ND	1/5	340 - 51000	10646	51000	29885

Notes:

- (1) Non-detect values were assumed equal to the detection limit when calculating the mean concentration.
 - (2) For duplicate samples, the higher concentration of the two samples was used to calculate the mean concentration.
- J - The associated numerical value is an estimated quantity.
ND - A non-detect value; the associated numerical value represents the detection limit of the laboratory apparatus.

Operable Unit 2

Contaminants of Potential Concern

Table 1
Potential Chemicals of Concern - Ground Water
Shaw Avenue Dump Site

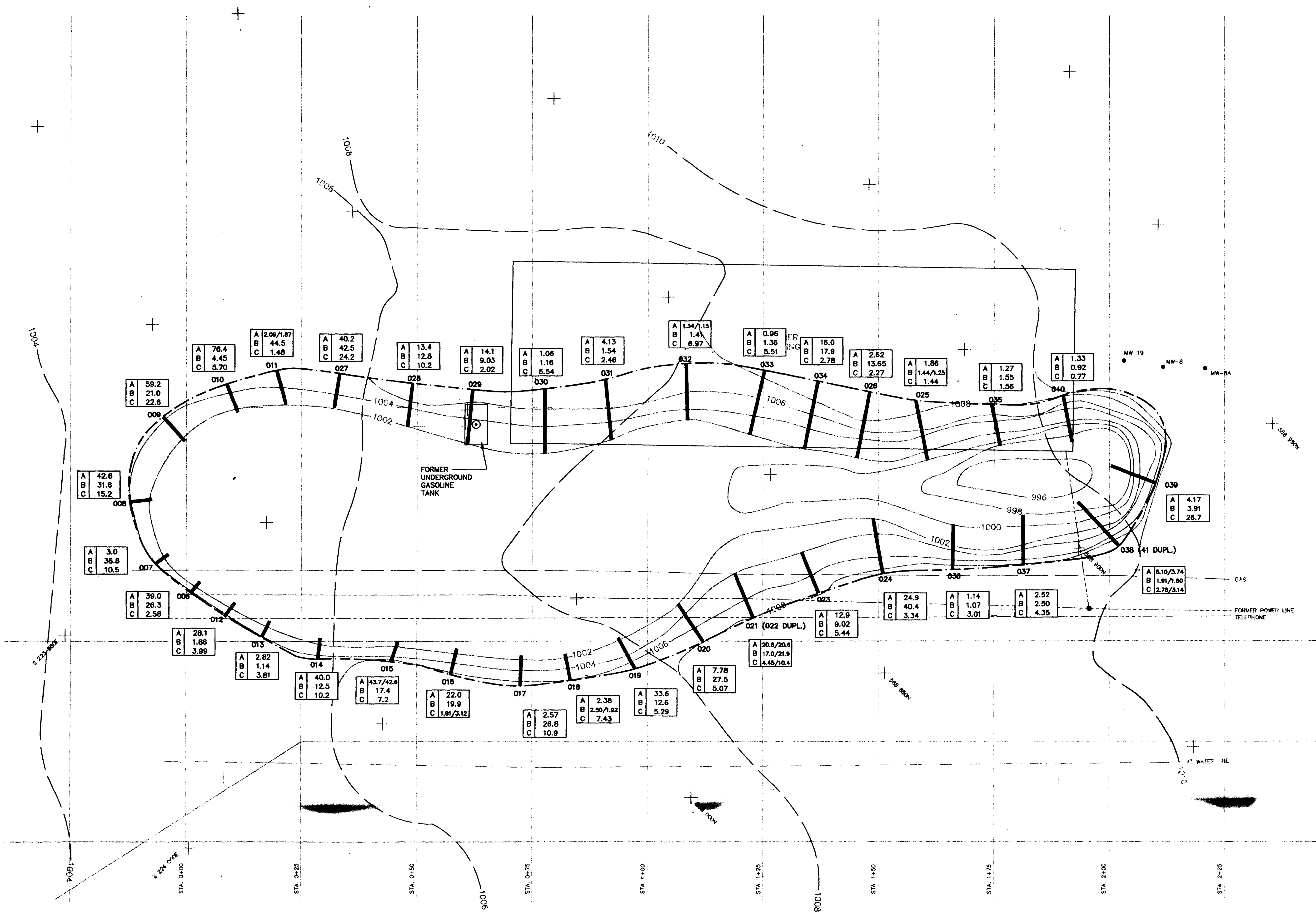
	Frequency	Range (µg/l)	Arithmetic Mean (1,2) (µg/l)	Maximum (µg/l)	MCL ^(E) (µg/l)	MCLG ^(E) (µg/l)	Iowa Action Level (µg/l)
Vinyl Chloride	8/115	5 - 408	12.5	408	2	0	0.015 ⁽³⁾
1,1-Dichloroethene	17/115	2.5 - 166	6.2	166	7	7	7 ⁽⁴⁾
1,2-Dichloroethane	7/115	2.5 - 44.7	3.2	44.7	5	0	0.4 ⁽³⁾
1,1,2-Trichloroethane	12/115	2.5 - 64.5	4.1	64.5	—	—	3 ⁽⁴⁾
Benzene	6/101	2.5 - 3180	139.2	3180	5	0	1 ⁽³⁾
Toluene	6/101	2.5 - 2600	110	2600	1000	1000	1000 ⁽⁴⁾
Xylene	6/101	2.5 - 1610	81	1610	10000	10000	10000 ⁽⁴⁾
2-Nitroaniline	7/120	25 - 1600	47.1	1600	—	—	—
Arsenic	33/118	2.5 - 23000	585.6	23000	50	50	0.03 ⁽³⁾
Cadmium	7/118	2.5 - 64.8	3.7	64.8	5	5	5 ⁽⁴⁾
Maganese	88/118	7.5 - 3120	353.2	3120	--	--	—

Notes:

- (1) Non-detects were assumed to equal the detection limit when calculating mean concentrations for wells which also exhibited positive detections.
- (2) Non-detect-were assumed to equal half the detection limit when calculating mean concentrations for wells which also exhibited positive detections.
- (3) Iowa action level is based on the Negligible Risk Level (NRL) which is the one in a million cancer risk level.
- (4) Iowa action level is based on the Lifetime Health Advisory Level (HAL).
- (5) Federal maximum contaminant level (MCL) and maximum contaminant level goal (MCLG).
- (6) ug/l = micrograms per liter

Attachment B

Operable Unit 1 As-Built Drawings



LEGEND:

- MW-8 MONITORING WELL
- OVERHEAD POWER LINE
- UNDERGROUND WATER LINE
- UNDERGROUND TELEPHONE LINE
- UNDERGROUND GAS LINE
- PRE EXCAVATION CONTOUR
- POST EXCAVATION CONTOUR
- LIMIT OF EXCAVATED FILL/SOILS
- SOIL SAMPLED UNDER THE UNDERGROUND STORAGE TANK
- 020 SOIL SAMPLE LOCATION

— SAMPLE LEVEL	
A	22.0
B	19.9
C	1.91/3.12

— CONCENTRATION OF ARSENIC (WET SAMPLES IN PPW)

NO	Revision	Date	Initial

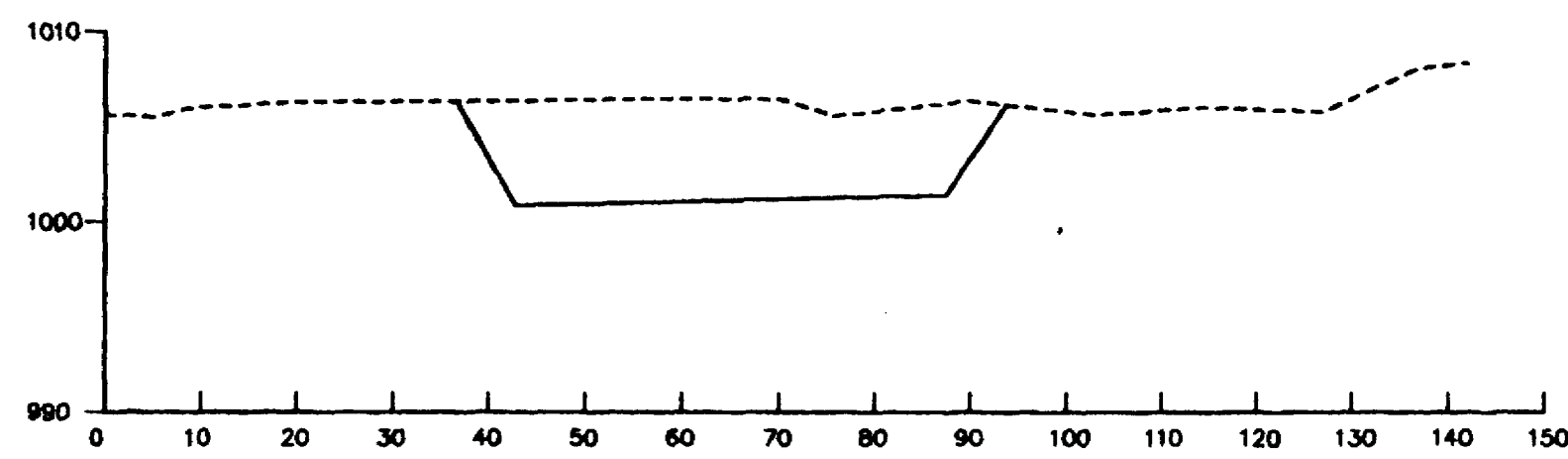
Approved

CITY OF CHARLES CITY / SOLVAY
ANIMAL HEALTH INC.
SHAW AVENUE SITE RA REPORT
SOIL SAMPLE VERIFICATION RESULTS
FOR ARSENIC

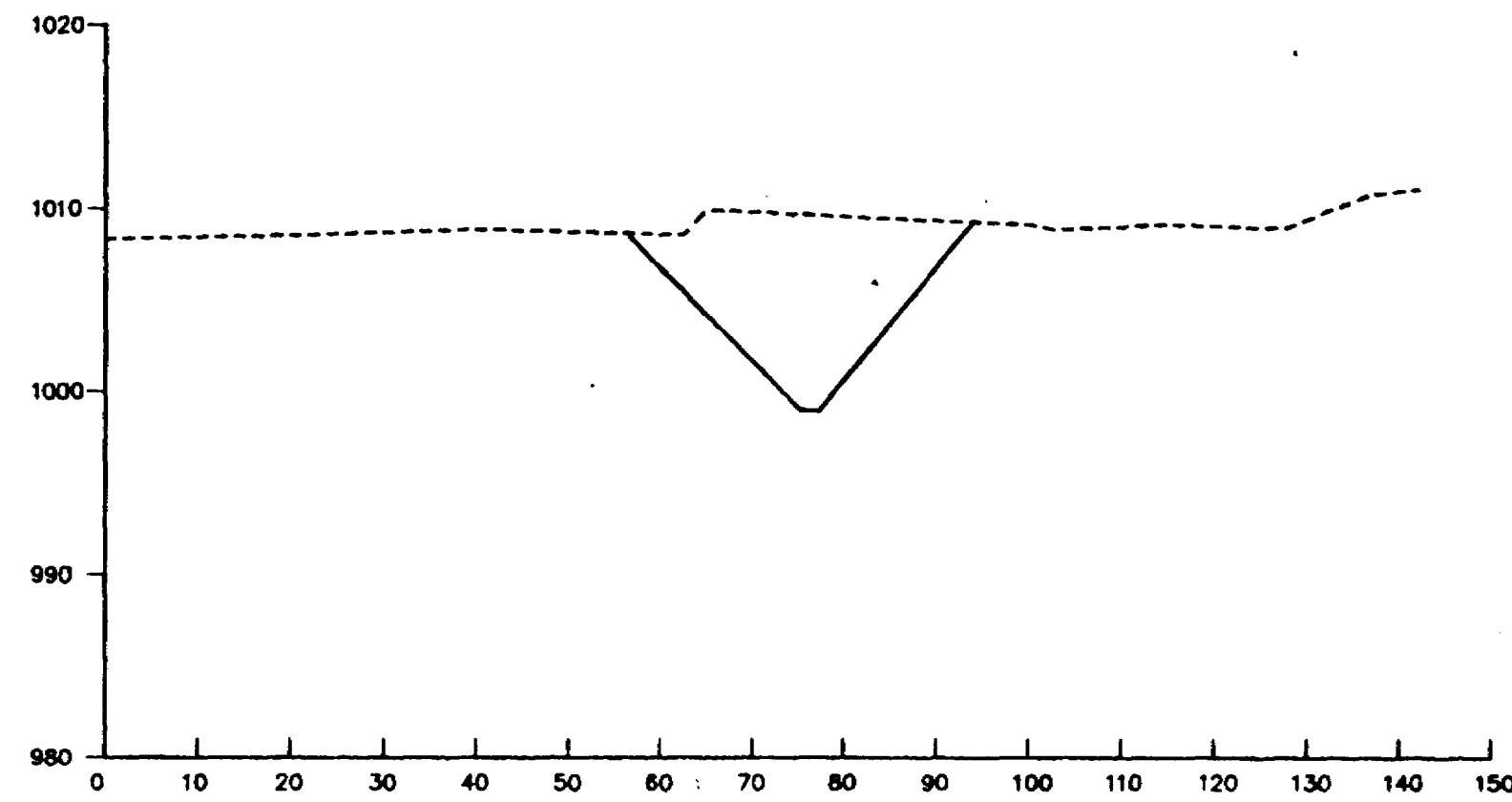
CRA
CONESTOGA-ROVERS & ASSOCIATES

Drawn by: K.E.M.	Scale: 1"=10'	Date: OCTOBER 1992	File No: P-02	Rev. No: 0
Designed by: P.J.D.	Field book:	Project No: 2227	Drawing No: PLAN 2	
Checked by: E.S.R.				

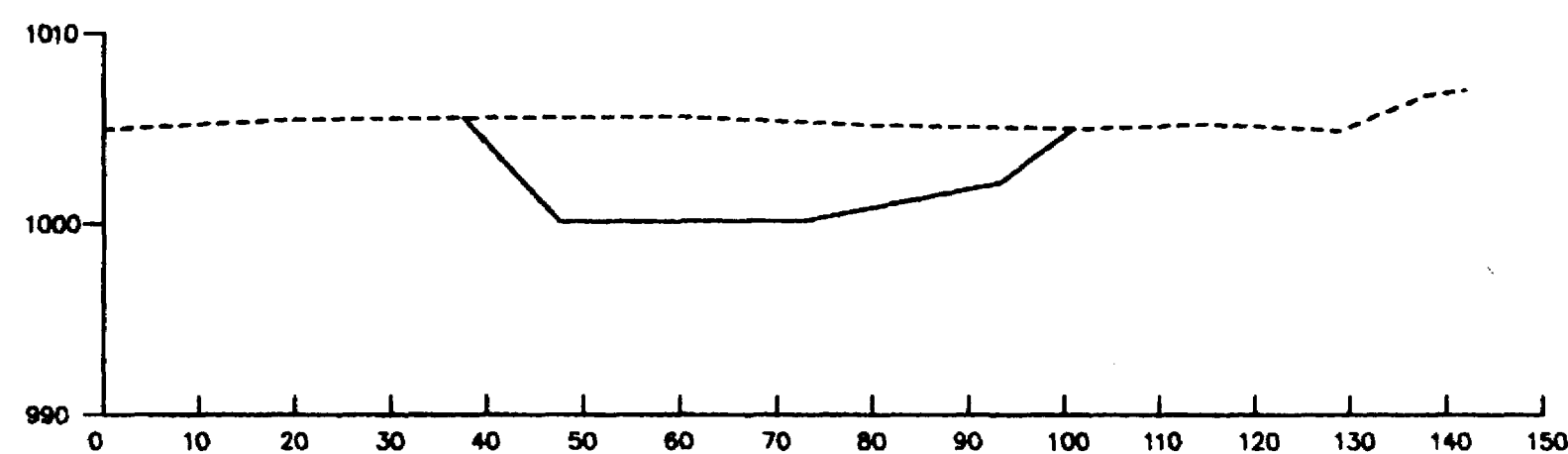
CON 12-15
Doc #29046



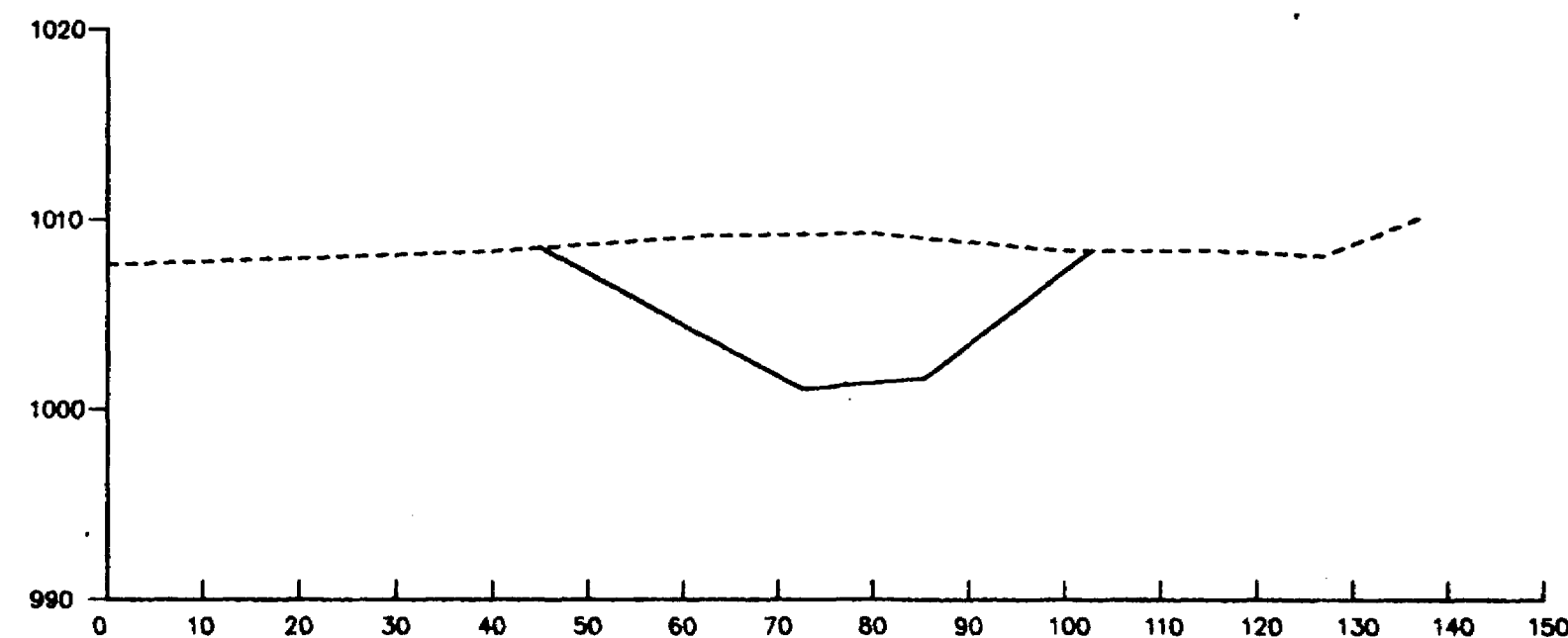
STATION 0 + 50



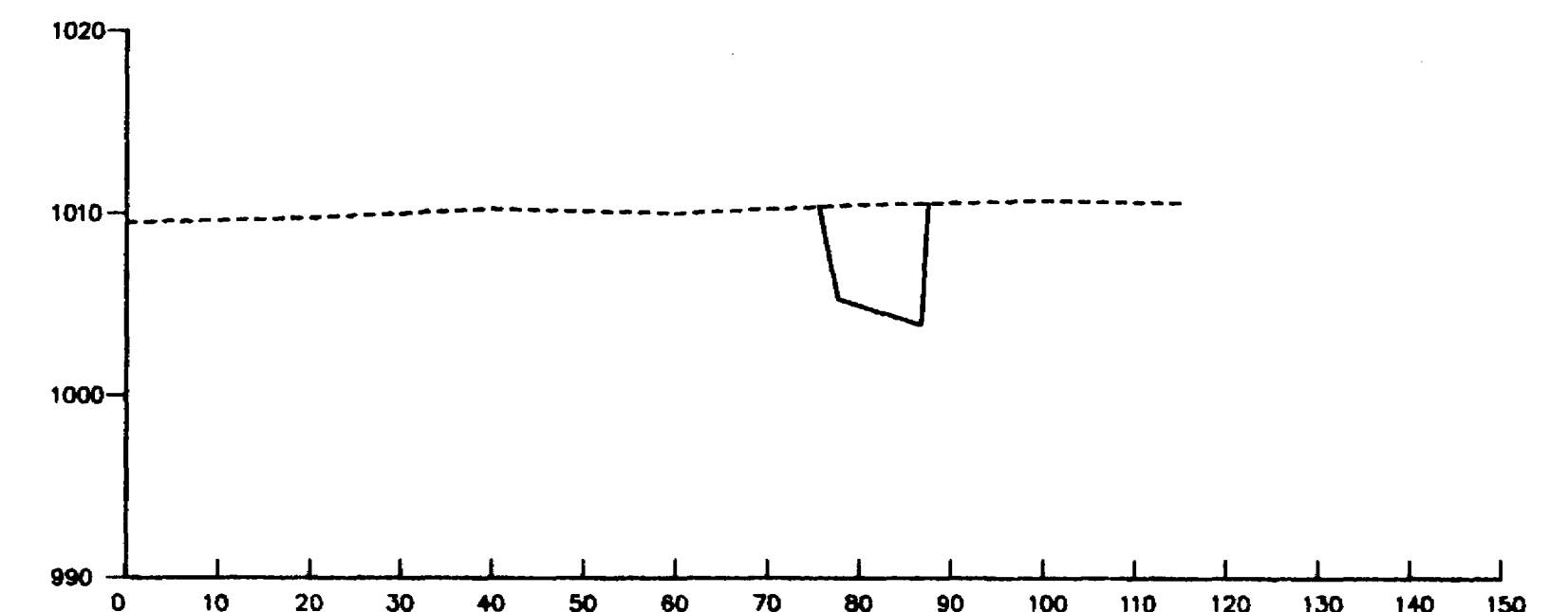
STATION 1 + 50



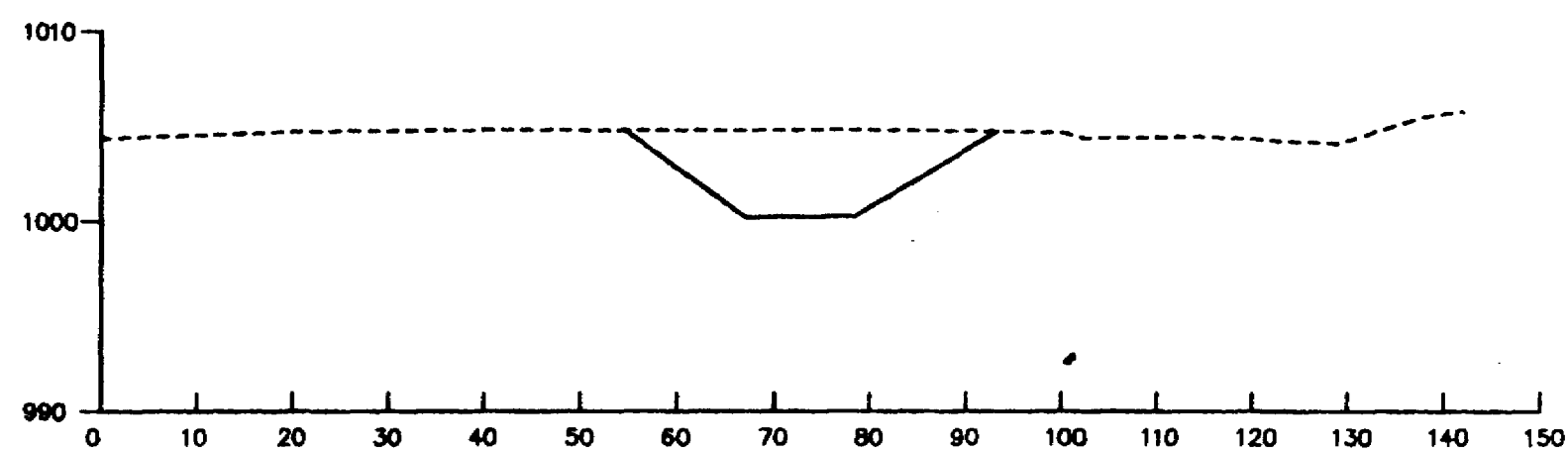
STATION 0 + 25



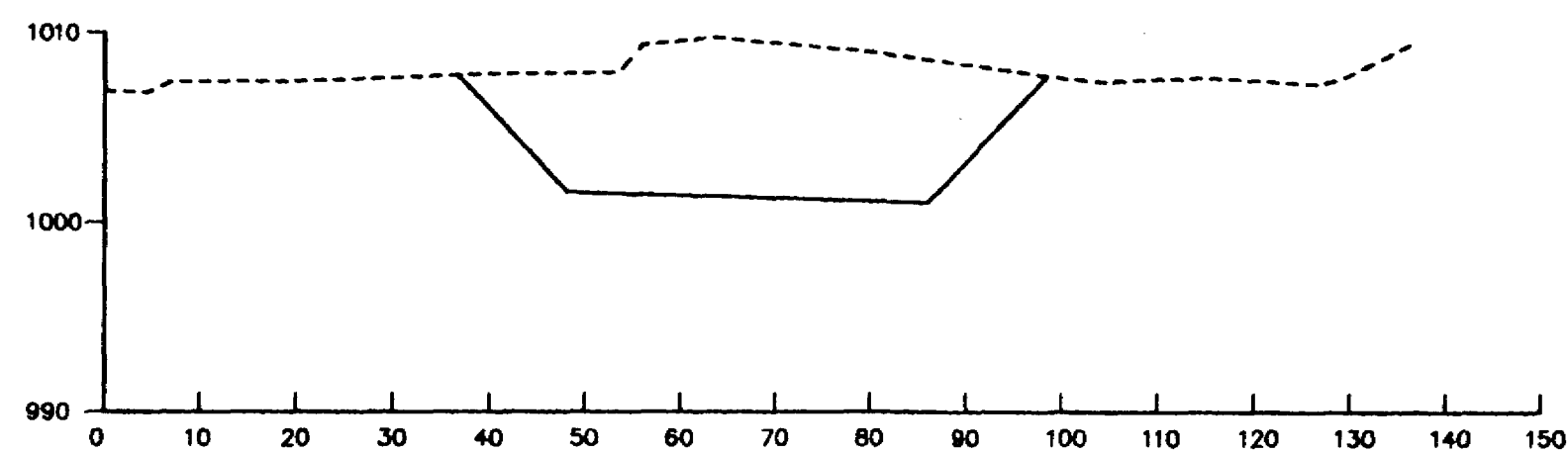
STATION 1 + 25



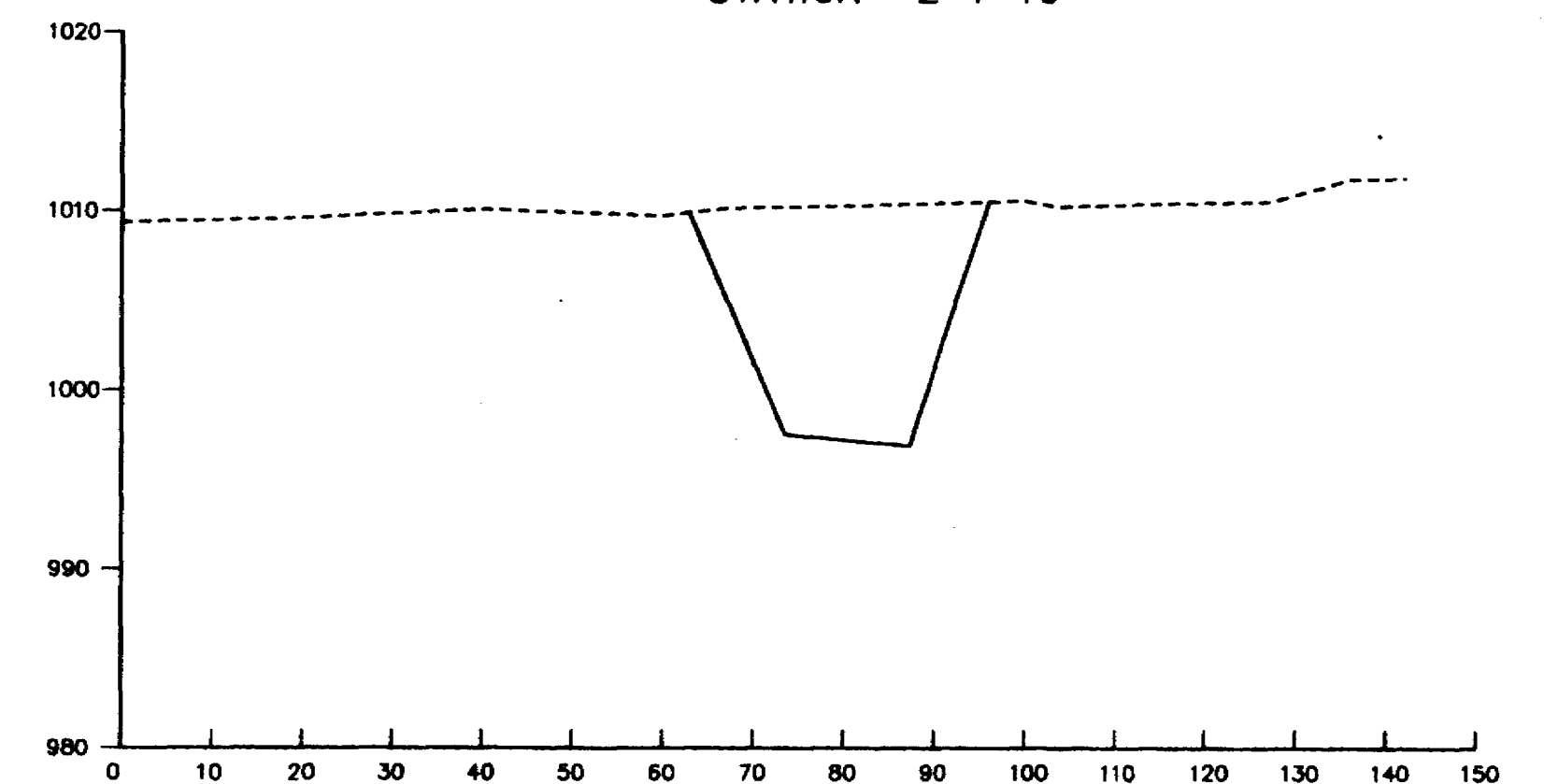
STATION 2 + 10



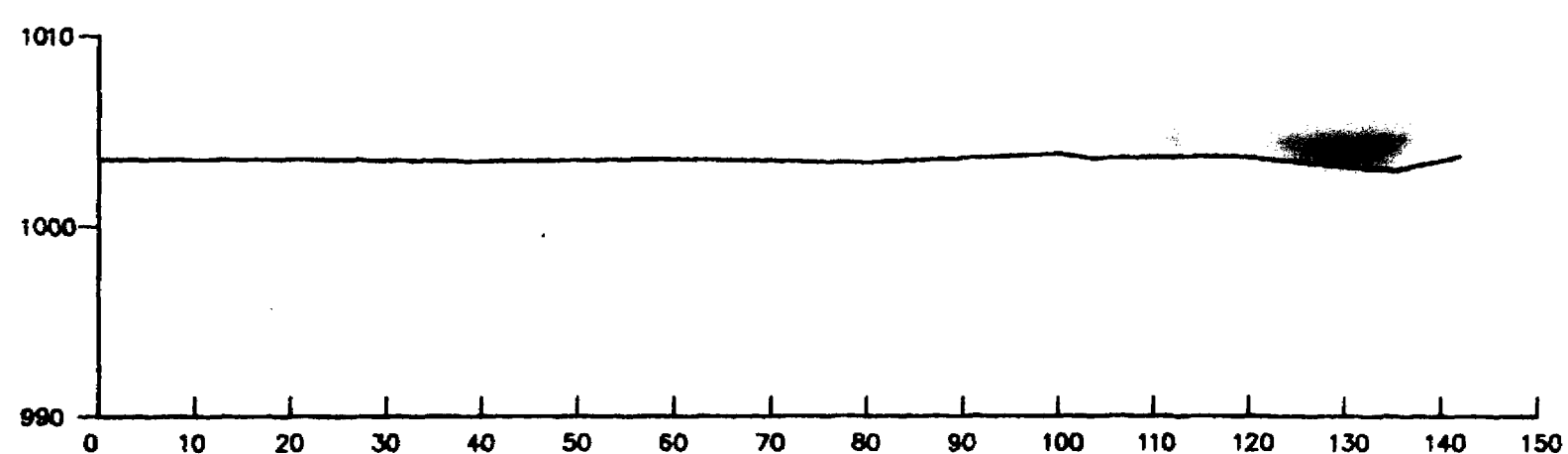
STATION 0 + 00



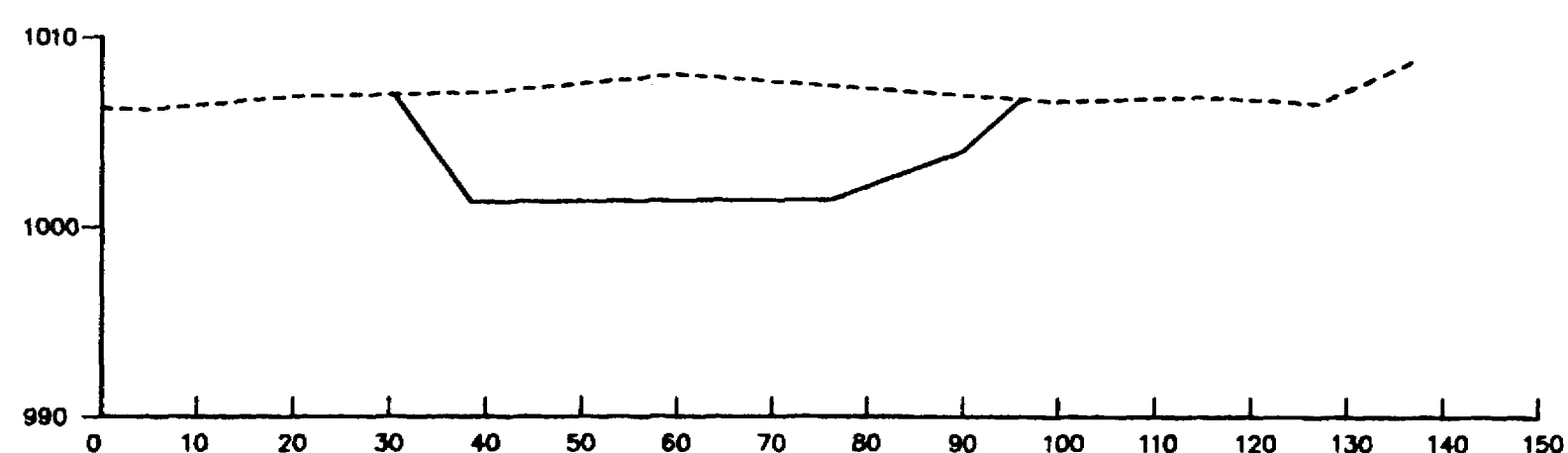
STATION 1 + 00



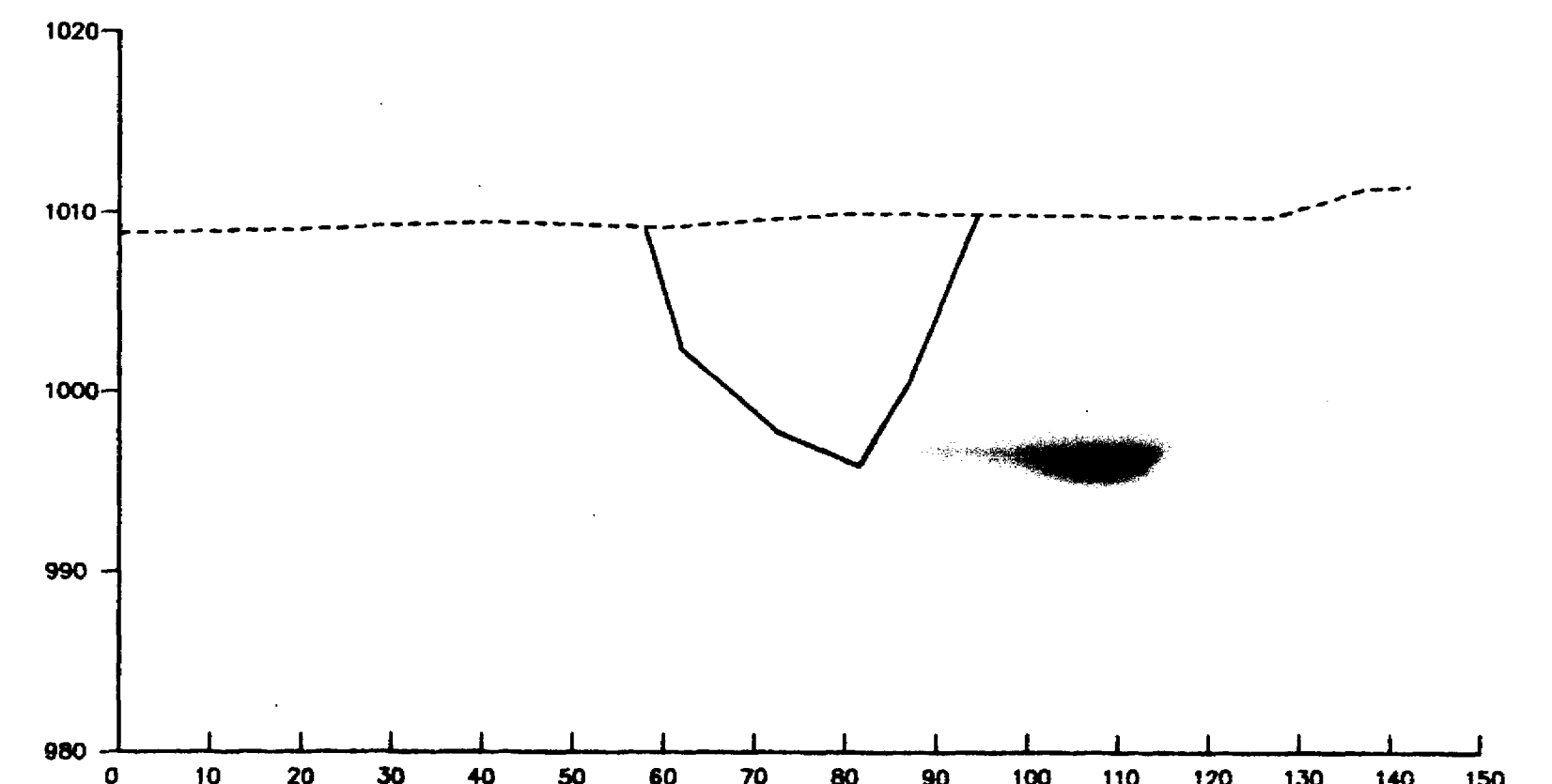
STATION 2 + 00



STATION 0 - 40



STATION 0 + 75



STATION 1 + 75

LEGEND

- PRE-EXCAVATION GRADE
- EXCAVATED GRADE AS OF MAY 1992

NO	Revision	Date	Initial

Approved

CITY OF CHARLES CITY/SOLVAY
ANIMAL HEALTH INC.
SHAW AVENUE SITE RA REPORT
FINAL EXCAVATION
CROSS SECTIONS

CRA
CONESTOGA-ROVERS & ASSOCIATES

Drawn by: I.W.R.	Scale: 1"=20' H 1"=10' V	Date: OCTOBER 1992	File No./Rev.No: X-01 / -
Designed by: D.K.	Field book:	Project No: 2227	Drawing No: PLAN 3
Checked by: E.R.			

CON 12-15
Doc #29047

Attachment C

Semiannual Inspection Reports

Semi-Annual Inspection Reports Since 2nd 5-Year Review

SEMI-ANNUAL INSPECTION REPORT
SHAW AVENUE DUMP SITE
CHARLES CITY, IOWA

DATE: April 15, 2010 TIME: 1740

WEATHER CONDITIONS: Overcast/Intermittent rain/75°F

(X) Denotes condition as acceptable. Use Comments to identify observed deviation and corrective measure completed to correct.

COMMENTS

MONITORING WELLS

- a) External condition
- 1. Cement collar _____
 - 2. Standpipe _____
 - 3. Cap and Lock PM to address as part of EPA/USCOE March 10 site visit
 - 4. Identification _____
- b) Internal condition PM to address as part of EPA/USCOE March 10 site visit

(Note: Well productivity and depth are checked in conjunction with the well's` sampling event. Document these measurements. A significant increase or decrease in evacuation rate, adjusted for seasonal variation or a decrease in well depth, may indicate an internal defect in the well.)

- c) Access to Well Locations _____

FINAL GROUND COVER (FORMER CHEMICAL FILL AREA)

- a) Erosion, settlement, cover growth Wells 8/19 - Ground cover disturbed by City when plowed to gain access
- b) Growth of trees or brush _____
- c) Debris _____

FLOOD DAMAGE (Note: Inspect after each significant event)

- a) Monitoring wells in flood plain _____

MAINTENANCE RECOMMENDATIONS

GENERAL COMMENTS (Describe observed general condition and activities)

Inspection carried out by: *Nail Ferguson, P.E.*
Signature
Dana Sherman

SEMI-ANNUAL INSPECTION REPORT
SHAW AVENUE DUMP SITE
CHARLES CITY, IOWA

DATE: October 9, 2010 TIME: 1030

WEATHER CONDITIONS: Sunny/76°F

(X) Denotes condition as acceptable. Use Comments to identify observed deviation and corrective measure completed to correct.

COMMENTS

MONITORING WELLS

- a) External condition
- 1. Cement collar MW-2 cement collar damaged
 - 2. Standpipe _____
 - 3. Cap and Lock _____
 - 4. Identification _____
- b) Internal condition _____

(Note: Well productivity and depth are checked in conjunction with the well's` sampling event. Document these measurements. A significant increase or decrease in evacuation rate, adjusted for seasonal variation or a decrease in well depth, may indicate an internal defect in the well.)

- c) Access to Well Locations _____

FINAL GROUND COVER (FORMER CHEMICAL FILL AREA)

- a) Erosion, settlement, cover growth _____
- b) Growth of trees or brush _____
- c) Debris _____

FLOOD DAMAGE (Note: Inspect after each significant event)

- a) Monitoring wells in flood plain _____

MAINTENANCE RECOMMENDATIONS

GENERAL COMMENTS (Describe observed general condition and activities)

Inspection carried out by: *Nail Ferguson, P.E.*
Signature

Dana Sherman
Printed

SEMI-ANNUAL INSPECTION REPORT
SHAW AVENUE DUMP SITE
CHARLES CITY, IOWA

DATE: June 14, 2011 TIME: 1030

WEATHER CONDITIONS: Overcast, drizzle, 78°F

(X) Denotes condition as acceptable. Use Comments to identify observed deviation and corrective measure completed to correct.

COMMENTS

MONITORING WELLS

a) External condition

- 1. Cement collar MW-2 cement collar damaged
- 2. Standpipe _____
- 3. Cap and Lock _____
- 4. Identification _____

b) Internal condition

- MW-6 possible silted in

(Note: Well productivity and depth are checked in conjunction with the well's` sampling event. Document these measurements. A significant increase or decrease in evacuation rate, adjusted for seasonal variation or a decrease in well depth, may indicate an internal defect in the well.)

- c) Access to Well Locations _____

FINAL GROUND COVER (FORMER CHEMICAL FILL AREA)

- a) Erosion, settlement, cover growth _____
- b) Growth of trees or brush _____
- c) Debris _____

FLOOD DAMAGE (Note: Inspect after each significant event)

- a) Monitoring wells in flood plain _____

MAINTENANCE RECOMMENDATIONS

GENERAL COMMENTS (Describe observed general condition and activities)

Inspection carried out by: Nail Fejzovic, P.E.

Signature

Dana Sherman

Printed

SEMI-ANNUAL INSPECTION REPORT
SHAW AVENUE DUMP SITE
CHARLES CITY, IOWA

DATE: November 7, 2011 TIME: 1505

WEATHER CONDITIONS: Sunny, cool, dry

(X) Denotes condition as acceptable. Use Comments to identify observed deviation and corrective measure completed to correct.

COMMENTS

MONITORING WELLS

- a) External condition
- 1. Cement collar OK
 - 2. Standpipe OK
 - 3. Cap and Lock OK
 - 4. Identification OK
- b) Internal condition Not performed at this inspection

(Note: Well productivity and depth are checked in conjunction with the well's` sampling event. Document these measurements. A significant increase or decrease in evacuation rate, adjusted for seasonal variation or a decrease in well depth, may indicate an internal defect in the well.)

- c) Access to Well Locations OK

FINAL GROUND COVER (FORMER CHEMICAL FILL AREA)

- a) Erosion, settlement, cover growth OK, 6-8" vegetation, uniform growth
- b) Growth of trees or brush None
- c) Debris None

FLOOD DAMAGE (Note: Inspect after each significant event)

- a) Monitoring wells in flood plain OK

MAINTENANCE RECOMMENDATIONS

None

GENERAL COMMENTS (Describe observed general condition and activities)

Wells condition and dump site appearance acceptable

Inspection carried out by: Neil Leipzig
Signature

Neil Leipzig
Printed

SEMI-ANNUAL INSPECTION REPORT
SHAW AVENUE DUMP SITE
CHARLES CITY, IOWA

DATE: May 19, 2012 TIME: 1146

WEATHER CONDITIONS: Overcast/76°F

(X) Denotes condition as acceptable. Use Comments to identify observed deviation and corrective measure completed to correct.

COMMENTS

MONITORING WELLS

- a) External condition
- 1. Cement collar _____
 - 2. Standpipe _____
 - 3. Cap and Lock _____
 - 4. Identification _____
- b) Internal condition _____

(Note: Well productivity and depth are checked in conjunction with the well's` sampling event. Document these measurements. A significant increase or decrease in evacuation rate, adjusted for seasonal variation or a decrease in well depth, may indicate an internal defect in the well.)

- c) Access to Well Locations _____

FINAL GROUND COVER (FORMER CHEMICAL FILL AREA)

- a) Erosion, settlement, cover growth _____
- b) Growth of trees or brush _____
- c) Debris _____

FLOOD DAMAGE (Note: Inspect after each significant event)

- a) Monitoring wells in flood plain _____

MAINTENANCE RECOMMENDATIONS

GENERAL COMMENTS (Describe observed general condition and activities)

Inspection carried out by: Jeff Sherman
Signature

Jeff Sherman
Printed

SEMI-ANNUAL INSPECTION REPORT
SHAW AVENUE DUMP SITE
CHARLES CITY, IOWA

DATE: October 23, 2012 TIME: 13:20 – 15:00

WEATHER CONDITIONS: Overcast/60°F

(X) Denotes condition as acceptable. Use Comments to identify observed deviation and corrective measure completed to correct.

COMMENTS

MONITORING WELLS

- a) External condition
- 1. Cement collar _____
 - 2. Standpipe _____
 - 3. Cap and Lock _____
 - 4. Identification _____
- b) Internal condition _____

(Note: Well productivity and depth are checked in conjunction with the well's' sampling event. Document these measurements. A significant increase or decrease in evacuation rate, adjusted for seasonal variation or a decrease in well depth, may indicate an internal defect in the well.)

- c) Access to Well Locations _____

FINAL GROUND COVER (FORMER CHEMICAL FILL AREA)


- a) Erosion, settlement, cover growth _____
- b) Growth of trees or brush _____
- c) Debris _____

FLOOD DAMAGE (Note: Inspect after each significant event)

- a) Monitoring wells in flood plain _____

MAINTENANCE RECOMMENDATIONS

GENERAL COMMENTS (Describe observed general condition and activities)

Inspection carried out by: 
Signature

Ken Duwal
Printed

SEMI-ANNUAL INSPECTION REPORT
SHAW AVENUE DUMP SITE
CHARLES CITY, IOWA

DATE: June 30 TIME: 1530

WEATHER CONDITIONS: Sunny/76°F

(X) Denotes condition as acceptable. Use Comments to identify observed deviation and corrective measure completed to correct.

COMMENTS

MONITORING WELLS

- a) External condition
- 1. Cement collar _____
 - 2. Standpipe _____
 - 3. Cap and Lock _____
 - 4. Identification _____
- b) Internal condition _____

(Note: Well productivity and depth are checked in conjunction with the well's` sampling event. Document these measurements. A significant increase or decrease in evacuation rate, adjusted for seasonal variation or a decrease in well depth, may indicate an internal defect in the well.)

- c) Access to Well Locations _____

FINAL GROUND COVER (FORMER CHEMICAL FILL AREA)

- a) Erosion, settlement, cover growth tall grass around well in the old dump site
- b) Growth of trees or brush _____
- c) Debris _____

FLOOD DAMAGE (Note: Inspect after each significant event)

- a) Monitoring wells in flood plain _____

MAINTENANCE RECOMMENDATIONS

GENERAL COMMENTS (Describe observed general condition and activities)

Grass

Inspection carried out by: Jeff Sherman
Signature

Jeff Sherman
Printed

SEMI-ANNUAL INSPECTION REPORT
SHAW AVENUE DUMP SITE
CHARLES CITY, IOWA

DATE: November 20, 2013 TIME: 1100

WEATHER CONDITIONS: Cloudy/40°F

(X) Denotes condition as acceptable. Use Comments to identify observed deviation and corrective measure completed to correct.

COMMENTS

MONITORING WELLS

- a) External condition
- 1. Cement collar _____
 - 2. Standpipe _____
 - 3. Cap and Lock _____
 - 4. Identification _____
- b) Internal condition wells 2, 7, 8 & 6 checked

(Note: Well productivity and depth are checked in conjunction with the well's` sampling event. Document these measurements. A significant increase or decrease in evacuation rate, adjusted for seasonal variation or a decrease in well depth, may indicate an internal defect in the well.)

- c) Access to Well Locations _____

FINAL GROUND COVER (FORMER CHEMICAL FILL AREA)

- a) Erosion, settlement, cover growth _____
- b) Growth of trees or brush _____
- c) Debris _____

FLOOD DAMAGE (Note: Inspect after each significant event)

- a) Monitoring wells in flood plain _____

MAINTENANCE RECOMMENDATIONS

GENERAL COMMENTS (Describe observed general condition and activities)

WW Treatment plant has constructed a dump station west of plant's fence (ie NE -15 location) .

Inspection carried out by: Jeff Sherman
Signature
Jeff Sherman
Printed

SEMI-ANNUAL INSPECTION REPORT
SHAW AVENUE DUMP SITE
CHARLES CITY, IOWA

DATE: 05-24-14 TIME: 0800

WEATHER CONDITIONS: Cloudy/71°F

(X) Denotes condition as acceptable. Use Comments to identify observed deviation and corrective measure completed to correct.

COMMENTS

MONITORING WELLS

- a) External condition
- 1. Cement collar _____
 - 2. Standpipe _____
 - 3. Cap and Lock _____
 - 4. Identification _____
- b) Internal condition _____

(Note: Well productivity and depth are checked in conjunction with the well's sampling event. Document these measurements. A significant increase or decrease in evacuation rate, adjusted for seasonal variation or a decrease in well depth, may indicate an internal defect in the well.)

- c) Access to Well Locations _____

FINAL GROUND COVER (FORMER CHEMICAL FILL AREA)

- a) Erosion, settlement, cover growth _____
- b) Growth of trees or brush _____
- c) Debris _____

FLOOD DAMAGE (Note: Inspect after each significant event)

- a) Monitoring wells in flood plain _____

MAINTENANCE RECOMMENDATIONS

GENERAL COMMENTS (Describe observed general condition and activities)

Inspection carried out by:


Signature

Jeff Sherman

Printed

Attachment D

List of Documents Reviewed

List of Documents Reviewed

Agency for Toxic Substances and Disease Registry. Minimal Risk Levels (MRLs) for Hazardous Substances. Available on the Web at <http://www.atsdr.cdc.gov/mrls/>.

B&V Waste Science and Technology Corporation (BVWST), 1998. Risk Assessment Addendum Report to Baseline Risk Assessment. Shaw Avenue Site, Charles City, Iowa. October.

California Office of Environmental Health Hazard Assessment. Toxicity Criteria Database. Available on the Web at <http://www.oeha.ca.gov/risk/chemicalDB//index.asp>.

Conestoga-Rovers & Associates, 1993. Remedial Action Report, Shaw Avenue Site, Charles City, Iowa. October.

Conestoga-Rovers & Associates, 2002. Revised Site Monitoring and Maintenance Plan. Shaw Avenue Site, Charles City, Iowa. May.

Conestoga-Rovers & Associates, 2004. Summary of Groundwater Monitoring Results 1992-2004, Shaw Avenue Dump Site, Charles City, Iowa. May.

Conestoga-Rovers & Associates, 2014. Response to Request for Information to Support the USEPA 3rd Five Year Review of the Shaw Ave. Dump Site. August.

Conestoga-Rovers & Associates, 2014. Email - Data Summary Tables for the October 2014 groundwater sampling event; supporting documentation for the October 2014 event. November.

Iowa Administrative Bulletin, 2007. Environmental Protection Commission Amendment to Chapter 61 "Water Quality Standards." October.

Iowa Administrative Code, 2010. Chapter 61 Water Quality Standards. January.

Iowa Administrative Code, 2010. Chapter 133 Rules for Determining Cleanup Actions and Responsible Parties. January.

Iowa Department of Natural Resources Contaminated Sites. Available on the Web at <http://www.iowadnr.gov/land/consites/hwregistry/hwsitesalpha.html>.

- U.S. Environmental Protection Agency, 1991. Record of Decision, Shaw Avenue Dump, Charles City, Iowa. September.
- U.S. Environmental Protection Agency, 1992. Explanation of Significant Differences, Shaw Avenue Dump, Charles City, Iowa. March.
- U.S. Environmental Protection Agency, 1992. Consent Decree, U.S. v. Solvay Animal Health, Inc., and the City of Charles City, Iowa. May.
- U.S. Environmental Protection Agency, 2000. EPA Superfund: Record of Decision, Shaw Avenue Site, Charles City, Iowa, OU 02, EPA ID: IAD980630560. EPA/ROD/R07-00/031. September.
- U.S. Environmental Protection Agency, 2001. Preliminary Closeout Report, Shaw Avenue Dump Site, Charles City, Iowa. January.
- U.S. Environmental Protection Agency, 2001. Comprehensive Five-Year Review Guidance, EPA/540-R-01-007. Office of Emergency and Remedial Response. June.
- U.S. Environmental Protection Agency, 2004. Region 9 PRG Table. On the Web at www.epa.gov/region9/superfund/prg/files/04prgtable.pdf.
- U.S. Environmental Protection Agency, 2005. Five-Year Review Report for Shaw Avenue Superfund Site, Charles City, Iowa. September.
- U.S. Environmental Protection Agency, 2009. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment). Final. EPA-540-R-070-002. Office of Superfund Remediation and Technology Innovation. January.
- U.S. Environmental Protection Agency, 2009. 2009 Edition of the Drinking Water Standards and Health Advisories. EPA-540-R-09-011. Office of Water. October.
- U.S. Environmental Protection Agency, 2009. Regional Screening Level (RSL) Master Table. December. On the Web at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm.
- U.S. Environmental Protection Agency, 2010. National Recommended Water Quality Criteria. Available on the Web at <http://www.epa.gov/waterscience/criteria/wqctable/>.

U.S. Environmental Protection Agency, 2010. Drinking Water Contaminants. Available on the Web at <http://www.epa.gov/safewater/contaminants/index.html>.

U.S. Environmental Protection Agency, 2012. Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil. OSWER 9200.1-113. December.

U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS). Available on the Web at <http://www.epa.gov/iris>

Attachment E

Photographs Documenting Site Conditions



Photo 1: MW-8A adjacent to former contaminant source.



Photo 2: Grit pad used for draining materials derived from sewer cleanout.



Photo 3: Wastewater treatment plant.



Photo 4: Concrete rubble.

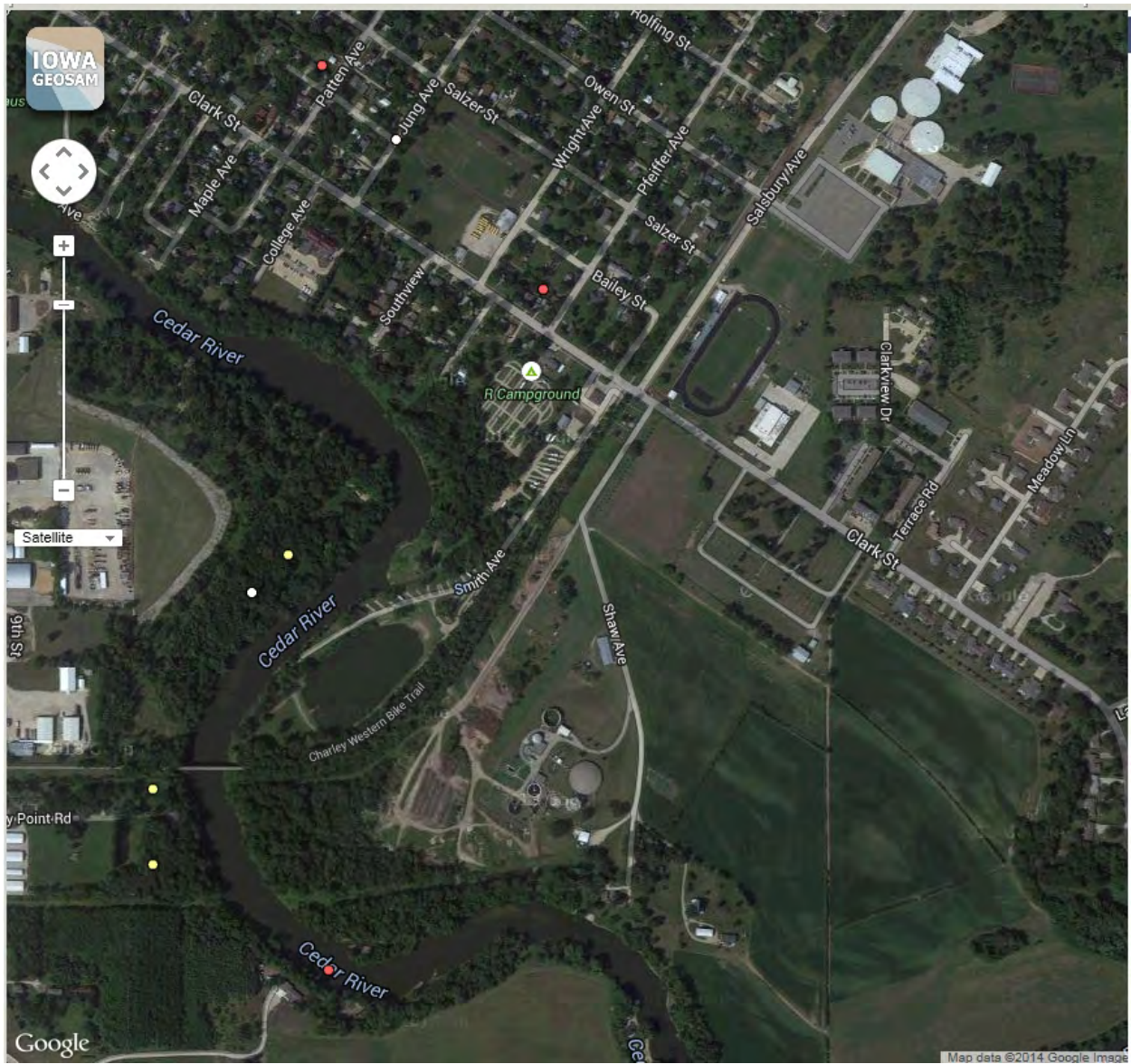


Photo 5: MW-2A showing locking well cap.

Attachment F

Iowa Groundwater Well Data Base Results

Iowa Geosam Data Base Results



Notes: The red dot located across Clark Street, across from the Campground, is identified as a commercial “test” well.

Iowa Geosam Data Base Results

General	Construction	Logs	Water	Storage
Identification		Location		
Date Received	1996-05-23	State	Iowa	
Owner Name	Sherman Nursery	County	Floyd	
Alt Name	FUCHS, DAVE	Quadrangle	Charles City, Iowa	
WNumber	28612	Township	T95N	
PWTS ID		Range	R15W	
Storet ID		Section	7	
SDWIS ID		Quarter		
USGS ID		Latitude	43.0601360000	
Project	Unknown	Longitude	-92.6629460000	
Operator	Unknown	Accuracy	Calc. +/- 3730 ft.	
		UTM X	527446	
		UTM Y	4767548	
Site		Drilling		
Site Type	Drilled hole	Drilling Company	Shawver Well Co.	
Well Status	Unknown	Drilling Date	1996-04-30	
Field Located		Drill Method	Rotary	
Elevation	1015 ft	Bedrock Depth	31 ft	
Elevation Accuracy	Digital Elevation Model Accurate to 50 ft	Well Depth	283 ft	
Landscape Position	Unknown	Total Depth	283 ft	
		Well Types	Test (water only)	
		Aquifers		

Attachment G

Five Year Review Site Inspection Checklist

Site Inspection Checklist

I. SITE INFORMATION			
Site name: Shaw Avenue Dump Site	Date of inspection: September 09, 2014		
Location and Region: Charles City, Iowa/Region 7	EPA ID: IAD980630560		
Agency, office, or company leading the five-year review: U.S. EPA Region 7	Weather/temperature: Overcast, ~65 degrees F, calm – slight breeze.		
Remedy Includes: (Check all that apply) <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> Landfill cover/containment <input type="checkbox"/> Access controls <input checked="" type="checkbox"/> Institutional controls <input type="checkbox"/> Groundwater pump and treatment <input type="checkbox"/> Surface water collection and treatment <input checked="" type="checkbox"/> Other: Groundwater Monitoring </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> Monitored natural attenuation <input type="checkbox"/> Groundwater containment <input type="checkbox"/> Vertical barrier walls </td> </tr> </table>		<input type="checkbox"/> Landfill cover/containment <input type="checkbox"/> Access controls <input checked="" type="checkbox"/> Institutional controls <input type="checkbox"/> Groundwater pump and treatment <input type="checkbox"/> Surface water collection and treatment <input checked="" type="checkbox"/> Other: Groundwater Monitoring	<input type="checkbox"/> Monitored natural attenuation <input type="checkbox"/> Groundwater containment <input type="checkbox"/> Vertical barrier walls
<input type="checkbox"/> Landfill cover/containment <input type="checkbox"/> Access controls <input checked="" type="checkbox"/> Institutional controls <input type="checkbox"/> Groundwater pump and treatment <input type="checkbox"/> Surface water collection and treatment <input checked="" type="checkbox"/> Other: Groundwater Monitoring	<input type="checkbox"/> Monitored natural attenuation <input type="checkbox"/> Groundwater containment <input type="checkbox"/> Vertical barrier walls		
Attachments: <input checked="" type="checkbox"/> Inspection team roster attached <input type="checkbox"/> Site map attached			
II. INTERVIEWS (Check all that apply)			
1. O&M Site Manager <div style="text-align: right; margin-right: 100px;"> Name: Neil Leipzig Title: Project Engineer Date: September 09, 2014 </div> <p>Interviewed: <input checked="" type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. 262-945-0626</p> <p>Problems, suggestions; <input type="checkbox"/> Report attached: No problems were noted. Mr. Leipzig indicated that the remedy was functioning as expected and, based on data obtained from MW-6 and MW-8, contaminant levels were decreasing overall. Indicated interest in reducing sampling frequency, and removal from NPL.</p>			
2. EPA Remedial Project Manager <div style="text-align: right; margin-right: 100px;"> Name: Elizabeth Hagenmaier Title: EPA RPM Date: September 09, 2014 </div> <p>Interviewed: <input checked="" type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. 913-551-7939</p> <p>Problems, suggestions; <input type="checkbox"/> Report attached: No problems or suggestions were provided. Ms. Hagenmaier stated that she had recently taken over the Shaw site. She indicated that she did not see any issues with the project moving forward</p>			

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: City of Charles City, Iowa
 Contact: Steve Dices City Administrator September 09, 2014
 Name Title Date
 Interviewed: at site at office by phone Phone no. 641-257-6300
 Problems; suggestions; Report attached: No problems were identified, and Mr. Dices indicated that he had not received public feedback of any type.

Agency: City of Charles City, Iowa
 Contact: John Fallis City Engineer September 09, 2014
 Name Title Date
 Interviewed: at site at office by phone Phone no. 641-257-6309
 Problems; suggestions; Report attached: No problems were identified.

Agency: Iowa Department of Natural Resources
 Contact: Greg Fuhrman Environmental Engineer September 09, 2014
 Name Title Date
 Interviewed: at site at office by phone Phone no. 515-281-5241
 Problems; suggestions; Report attached: No problems were identified, although Mr. Fuhrman indicated sampling frequency could be increased. Mr. Fuhrman felt adequately informed of site activities. The state indicated interest in removing the Shaw sites from the state contaminated sites registry.

4. **Other interviews** (optional) Report attached.

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

1. **O&M Documents**

<input checked="" type="checkbox"/> O&M manual	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
<input type="checkbox"/> As-built drawings	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
<input type="checkbox"/> Maintenance logs	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A

Remarks _____

2.	Site-Specific Health and Safety Plan <input type="checkbox"/> Contingency plan/emergency response plan Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	x N/A x N/A
3.	O&M and OSHA Training Records Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	x N/A
4.	Permits and Service Agreements <input type="checkbox"/> Air discharge permit <input type="checkbox"/> Effluent discharge <input type="checkbox"/> Waste disposal, POTW <input type="checkbox"/> Other permits _____ Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	x N/A x N/A x N/A x N/A
5.	Gas Generation Records Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	x N/A
6.	Settlement Monument Records Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	x N/A
7.	Groundwater Monitoring Records Remarks _____	x Readily available	x Up to date	<input type="checkbox"/> N/A
8.	Leachate Extraction Records Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	x N/A
9.	Discharge Compliance Records <input type="checkbox"/> Air <input type="checkbox"/> Water (effluent) Remarks _____	<input type="checkbox"/> Readily available <input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date <input type="checkbox"/> Up to date	x N/A x N/A
10.	Daily Access/Security Logs Remarks _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	x N/A

C. Institutional Controls (ICs)			
1.	Implementation and enforcement		
	Site conditions imply ICs not properly implemented	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
	Site conditions imply ICs not being fully enforced	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
	Type of monitoring (<i>e.g.</i> , self-reporting, drive by): <u>Self-reporting (site inspection reports)</u>		
	Frequency: <u>Quarterly</u>		
	Responsible party/agency: <u>Conestoga-Rovers & Associates (PRP contractor)</u>		
	Contact: <u>Neil Leipzig</u>	<u>Project Manager</u>	<u>Quarterly</u> <u>262-945-0626</u>
	Name	Title	Date Phone no.
	Reporting is up-to-date	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
	Reports are verified by the lead agency	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
	Specific requirements in deed or decision documents have been met	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> N/A
	Violations have been reported	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
	Other problems or suggestions: <input type="checkbox"/> Report attached		
<hr/> <hr/> <hr/>			
2.	Adequacy	<input checked="" type="checkbox"/> ICs are adequate	<input type="checkbox"/> ICs are inadequate <input type="checkbox"/> N/A
	Remarks _____		
D. General			
1.	Vandalism/trespassing	<input checked="" type="checkbox"/> Location shown on site map (MW-13)	<input type="checkbox"/> No vandalism evident
	Remarks: The lock on MW-13 had been cut off purportedly by parties investigating contamination associated with petroleum storage tanks at the gas station formerly located near the intersection of Shaw Avenue and Clark Street. A tamper-resistant lock was placed on the well by the PRP contractor.		
2.	Land use changes on site	<input checked="" type="checkbox"/> N/A	
	Remarks _____		
3.	Land use changes off site	<input checked="" type="checkbox"/> N/A	
	Remarks _____		
VI. GENERAL SITE CONDITIONS			
A. Roads	<input checked="" type="checkbox"/> Applicable	<input type="checkbox"/> N/A	
1.	Roads damaged	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> Roads adequate <input type="checkbox"/> N/A
	Remarks _____		
<hr/> <hr/> <hr/>			

B. Other Site Conditions		
Remarks _____ _____ _____ _____		
VII. LANDFILL COVERS <input type="checkbox"/> Applicable x N/A		
A. Landfill Surface		
1.	Settlement (Low spots) <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Settlement not evident Areal extent _____ Depth _____ Remarks _____ _____	
2.	Cracks <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Cracking not evident Lengths _____ Widths _____ Depths _____ Remarks _____ _____	
3.	Erosion <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Erosion not evident Areal extent _____ Depth _____ Remarks _____ _____	
4.	Holes <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Holes not evident Areal extent _____ Depth _____ Remarks _____ _____	
5.	Vegetative Cover <input type="checkbox"/> Grass <input type="checkbox"/> Cover properly established <input type="checkbox"/> No signs of stress G Trees/Shrubs (indicate size and locations on a diagram) Remarks _____ _____	
6.	Alternative Cover (armored rock, concrete, etc.) <input type="checkbox"/> N/A Remarks _____ _____	
7.	Bulges <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Bulges not evident Areal extent _____ Height _____ Remarks _____ _____	
8.	Wet Areas/Water Damage <input type="checkbox"/> Wet areas/water damage not evident <input type="checkbox"/> Wet areas <input type="checkbox"/> Location shown on site map Areal extent _____ <input type="checkbox"/> Ponding <input type="checkbox"/> Location shown on site map Areal extent _____ <input type="checkbox"/> Seeps <input type="checkbox"/> Location shown on site map Areal extent _____ <input type="checkbox"/> Soft subgrade <input type="checkbox"/> Location shown on site map Areal extent _____ Remarks _____ _____	

9.	Slope Instability	<input type="checkbox"/> Slides	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of slope instability
	Areal extent _____			
	Remarks _____			
B. Benches				
	<input type="checkbox"/> Applicable x 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.)			
1.	Flows Bypass Bench	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay	
	Remarks _____			
2.	Bench Breached	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay	
	Remarks _____			
3.	Bench Overtopped	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A or okay	
	Remarks _____			
C. Letdown Channels				
	<input type="checkbox"/> Applicable x N/A			
	(Channel lined with erosion control mats, rip-rap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)			
1.	Settlement	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of settlement	
	Areal extent _____	Depth _____		
	Remarks _____			
2.	Material Degradation	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of degradation	
	Material type _____	Areal extent _____		
	Remarks _____			
3.	Erosion	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of erosion	
	Areal extent _____	Depth _____		
	Remarks _____			

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

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

H. Retaining Walls		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Deformations	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Deformation not evident
	Horizontal displacement _____	Vertical displacement _____	
	Rotational displacement _____		
	Remarks _____		

2.	Degradation	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Degradation not evident
	Remarks _____		

I. Perimeter Ditches/Off-Site Discharge		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Siltation	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Siltation not evident
	Areal extent _____	Depth _____	
	Remarks _____		

2.	Vegetative Growth	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> N/A
	<input type="checkbox"/> Vegetation does not impede flow		
	Areal extent _____	Type _____	
	Remarks _____		

3.	Erosion	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Erosion not evident
	Areal extent _____	Depth _____	
	Remarks _____		

4.	Discharge Structure	<input type="checkbox"/> Functioning	<input type="checkbox"/> N/A
	Remarks _____		

VIII. VERTICAL BARRIER WALLS		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Settlement	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Settlement not evident
	Areal extent _____	Depth _____	
	Remarks _____		

2.	Performance Monitoring	Type of monitoring: _____	
	<input type="checkbox"/> Performance not monitored		
	Frequency _____	<input type="checkbox"/> Evidence of breaching	
	Head differential _____		
	Remarks _____		

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

1.	Treatment Train (Check components that apply) <input type="checkbox"/> Metals removal <input type="checkbox"/> Oil/water separation <input type="checkbox"/> Bioremediation <input type="checkbox"/> Air stripping <input type="checkbox"/> Carbon adsorbers <input type="checkbox"/> Filters _____ <input type="checkbox"/> Additive (e.g., chelation agent, flocculent) _____ <input type="checkbox"/> Others _____ <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> Sampling ports properly marked and functional <input type="checkbox"/> Sampling/maintenance log displayed and up to date <input type="checkbox"/> Equipment properly identified <input type="checkbox"/> Quantity of groundwater treated annually _____ <input type="checkbox"/> Quantity of surface water treated annually _____ Remarks _____ _____
2.	Electrical Enclosures and Panels (properly rated and functional) <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks _____ _____
3.	Tanks, Vaults, Storage Vessels <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Proper secondary containment <input type="checkbox"/> Needs Maintenance Remarks _____ _____
4.	Discharge Structure and Appurtenances <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks _____ _____
5.	Treatment Building(s) <input type="checkbox"/> N/A <input type="checkbox"/> Good condition (esp. roof and doorways) <input type="checkbox"/> Needs repair <input type="checkbox"/> Chemicals and equipment properly stored Remarks _____ _____
6.	Monitoring Wells (pump and treatment remedy) <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____ _____
D. Monitoring Data	
1.	Monitoring Data x Is routinely submitted on time x Is of acceptable quality
2.	Monitoring data suggests: <input type="checkbox"/> Groundwater plume is effectively contained x Contaminant concentrations are declining
E. Monitored Natural Attenuation	
1.	Monitoring Wells (natural attenuation remedy) <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance x 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
	<p>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.).</p> <p>The remedy consists of excavation, treatment, and disposal of contaminated soils at an offsite RCRA-permitted landfill, as well as groundwater monitoring and monitoring of the Cedar River. The remedy has been shown to be effective. Groundwater monitoring and monitoring in the Cedar River has continued and impacted source area wells show decreasing trends.</p>
B.	Adequacy of O&M
	<p>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.</p> <p>O&M consists of quarterly inspections and reporting on site conditions, and monitoring and evaluation of groundwater and surface water data. O&M procedures have been properly implemented and are being sufficiently maintained to ensure current and long-term protectiveness of the remedy.</p>
C.	Early Indicators of Potential Remedy Problems
	<p>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.</p> <p>The March 10, 2010, site inspection and a review of site documentation did not reveal any issues that would indicate there are potential problems with the remedy. A number of issues were identified involving monitoring wells (installing additional well clasp, installing new concrete pad, and installing mechanical well plug/cap), they are considered a part of routine operations and maintenance activities at the site. The frequency of repairs of this nature has not been high nor are they expected to be high in the future.</p>
D.	Opportunities for Optimization
	<p>Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.</p> <p>A reduced sampling frequency for groundwater monitoring wells and surface-water monitoring should be explored. Requests for optimization (revised sampling and analysis schedule, among others) should include the basis for the request and sufficient documentation to support the request and ensure the protectiveness of the remedy.</p>

Site Inspection Team Roster		
Personnel	Representing	Phone Number
Elizabeth Hagenmaier	EPA Region 7	913-551-7939
Karim Dawani	EPA Region 7	913-551-7289
Greg Fuhrmann	State of Iowa	515-281-5241
Alex Moon	State of Iowa	515-281-8927
Cal Lunberg	State of Iowa	515-281-7040
Andy Gosnell	U.S. Army Corps of Engineers, Kansas City District	816-389-3891
Jean Schumacher	U.S. Army Corps of Engineers, Kansas City District	816-389-3499
Neil Leipzig	Conestoga-Rovers & Associates	262-945-0626
Briana Sye Marvuglio	Zoetis	973-443-2806
Jeff Field	Zoetis	641-257-3352
John Fallis	city of Charles City, Iowa	641-257-6309
Steve Dices	city of Charles City, Iowa	641-257-6300

Appendix H

Vapor Intrusion Screening Level Calculator

ATTACHMENT H - VISL Analysis of VOC Risks

OSWER VAPOR INTRUSION ASSESSMENT

Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.0, November 2012 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (°C)	Tgw	9	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard
		Cgw	Cia	CR	HQ
		(ug/L)	(ug/m ³)		
107-06-2	Dichloroethane, 1,2-	2.1E+00	4.37E-02	4.7E-07	6.0E-03
x 75-35-4	Dichloroethylene, 1,1-	2.2E+00	1.29E+00	No IUR	6.2E-03
x 79-00-5	Trichloroethane, 1,1,2-	2.3E+00	3.03E-02	2.0E-07	1.5E-01
x 75-01-4	Vinyl Chloride	3.1E+00	2.21E+00	1.4E-05	2.1E-02

Inhalation Unit Risk	IUR Source*	Reference Concentration	RfC Source*	Mutagenic Indicator
(ug/m ³) ⁻¹		RfC		i
(mg/m ³)				
2.60E-05	I	7.00E-03	P	
		2.00E-01	I	
1.60E-05	I	2.00E-04	X	
4.40E-06	I	1.00E-01	I	VC

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario

Parameter	Units
Averaging time for carcinogens	(yrs)
Averaging time for non-carcinogens	(yrs)
Exposure duration	(yrs)
Exposure frequency	(days/yr)
Exposure time	(hr/day)

Residential		Commercial		Selected (based on scenario)	
Symbol	Value	Symbol	Value	Symbol	Value
ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
ATnc_R_GW	30	ATnc_C_GW	25	Atnc_GW	30
ED_R_GW	30	ED_C_GW	25	ED_GW	30
EF_R_GW	350	EF_C_GW	250	EF_GW	350
ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors

Source Medium	Units
Groundwater	(-)
Sub-Slab and Exterior Soil Gas	(-)

Residential		Commercial		Selected (based on scenario)	
Symbol	Value	Symbol	Value	Symbol	Value
AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
AFss_R_GW	0.1	AFss_C_GW	0.1	AFss_GW	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
 Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
 Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Trichloroethylene

Residential		Commercial		Selected (based on scenario)	
Symbol	Value	Symbol	Value	Symbol	Value
mIURTCE_R_GW	1.00E-06	mIURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
IURTCE_R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

Mutagenic Chemicals

The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.	Age Cohort	Exposure Duration	Age-dependent adjustment factor
	0 - 2 years	2	10
	2 - 6 years	4	3
	6 - 16 years	10	3
	16 - 30 years	14	1

Mutagenic-mode-of-action (MMOA) adjustment factor

76

This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride

See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: <http://www.epa.gov/iris/subst/index.html>
 P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: <http://hhpprtv.ornl.gov/pprtv.shtml>
 A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: <http://www.atsdr.cdc.gov/mrls/index.html>
 CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: <http://www.oehha.ca.gov/risk/ChemicalDB/index.asp>
 H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: <http://epa-heast.ornl.gov/heast.shtml>
 S = See RSL User Guide, Section 5
 X = PPRTV Appendix

Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).

VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).

TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).

Yellow highlighting indicates site-specific parameters that may be edited by the user.

Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).