Corrective Measures Study Work Plan

Former Chamberlain Manufacturing Corporation Site
Waterloo, Iowa

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ENVIRON

Contents

1 Purpose of the Corrective Measures Study ("CMS")

The former Chamberlain Manufacturing property (the "Subject Site") is located at 550 Esther Street in the City of Waterloo, Black Hawk County, Iowa. The Subject Site is an irregularly shaped parcel containing approximately 22.8 acres.

The Subject Site manufactured metal washer wringers and projectile metal parts from approximately 1919 until 1996 when it was sold to Atlas Warehouse L.C. for use as a storage facility. The Subject Site was subsequently abandoned and is currently vacant. The City of Waterloo acquired the Subject Site from Atlas Warehouse L.C. in 2005 in an effort to facilitate redevelopment and has demolished the remaining structures of the Subject Site.

The Subject Site is zoned Heavy Industrial (M-2) by the City. The Subject Site is adjoined by park land to the north and south, single family residential housing to the west, and Virden Creek followed by a gold course to the east. Virden Creek is within approximately 100 feet of the Subject Site at its closest point. Gates Park adjoins the Subject Site to the north across Louise Street, to the east across Virden Creek, and to the south across the railroad tracks. Single family residences are located across East 4th Street to the west of the Subject Site. Single family residences are also located along the east side of East 4th between Anita and Louise Streets

The redevelopment plan and future use of the Subject Site have not yet been determined, so residential, commercial/industrial, and recreational use will be considered as potential future property uses for the Subject Site.

1.1 Potential Sources of Contamination

The primary contaminant in groundwater is trichloroethylene (TCE), although other chlorinated solvents, volatile organic compounds and metals are present in groundwater and addressed in the risk assessment (See Section 1.3). There are currently two identified source areas of groundwater contamination; one located near Monitoring Well MW-1 and a second near OSMW-4. The contaminated groundwater plumes appear to originate from these two locations in the subsurface. Figure 1 shows recent groundwater data, including those concentrations observed in MW-1 and OSMW-4.

1.2 Site Geology and Hydrogeology

Groundwater is found in unconsolidated and consolidated aquifers in the area. Groundwater in both the unconsolidated deposits and the Silurian and Devonian rock units is likely to flow to the southwest toward the Cedar River. No continuous confining layer separates the sands, gravels and limestones of the water-bearing formations from the bedrock, so these units are believed to be hydraulically connected. Perched groundwater exists at the Subject Site, within fill material overlying native soils.

1.3 Risk Assessment

The April 2010 Risk Assessment performed by Tetra Tech on behalf of the Environmental Protection Agency (EPA) identified unacceptable risks at the Subject Site.[1] The risk assessment evaluated chemicals of potential concern ("COPCs") based on the site history for soil, groundwater, and indoor air screening. The COPCs identified as driving the risk in the risk assessment were:

- Soil –arsenic, cadmium, and mercury
- Groundwater – TCE, tetrachloroethene (PCE), 1,1,2-trichloroethane (1,1,2-TCA), 1,2-dichloropropane, benzene, chloroform, vinyl chloride, arsenic, and mercury
- Indoor air and soil gas – chloroform, PCE, and TCE

Tetra Tech calculated cumulative risks from exposure to soil and groundwater to various receptors including current and future residents (both on and off-site), commercial/industrial workers, construction workers, recreational users, and trespassers. Tetra Tech calculated unacceptable risks (lifetime excess cancer risks greater than EPA's risk range of 10^{-6} to 10^{-4} or a hazard index greater than one) for future industrial/commercial workers, future construction workers, and future adult child and residents. Most of the calculated risk is due to ingestion and direct contact with groundwater. This risk, however, is largely theoretical as the City of Waterloo provides drinking water to residents and the use of groundwater from private wells is currently restricted. Tetra Tech calculated acceptable cumulative risk levels for trespassers, and adult and child recreational visitors for all pathways. Inspection of the risk assessment calculations presented in Appendix D of the Risk Assessment Report indicates that TCE in groundwater, mercury in perched groundwater, and arsenic, cadmium and mercury in soil are the principal risk drivers at the Subject Site as they represent the majority of the risk and hazard quotients calculated.

Groundwater

Investigations by Chamberlain have identified groundwater contamination on and off site. Groundwater monitoring wells on the site have identified a TCE plume that underlays both the Subject Site and the area to the southwest of the Subject Site. The 2010 Risk Assessment Report concluded that based on the results of these investigations, ingestion of and direct contact with TCE in on-site groundwater for a hypothetical residential exposure scenario represents an excess lifetime cancer risk of approximately 10^{-3}, due primarily to ingestion and inhalation of TCE contaminated groundwater.

In the 2010 Risk Assessment, it was assumed that lower aquifer groundwater could be used as a potable water supply in the future, assuming residential exposure and absent the current institutional controls prohibiting groundwater use. If groundwater associated with the site was used as a potable water supply several exposure pathways to adult and child residents can

[1] The Health Consultation of the Former Chamberlain Manufacturing Site prepared by the Iowa Department of Public Health dated April 27, 2012 and Comments on the Tetra Tech Risk Assessment Report prepared by ENVIRON dated September 7, 2012 did not identify any risks at the Subject Site other than the vapor intrusion risk that is being addressed as an interim measure.

occur such as ingestion, direct contact, and inhalation of vapors from the water while it is in use. However, groundwater present in the upper (perched) and lower aquifer are not being used as a drinking water source. The proposed corrective measure(s) will address the EPA's goal of restoring groundwater resources, where reasonably practicable.

On-site Soils

The 2010 Risk Assessment Report found that the calculated risks to future adult residents from surface soil are within acceptable ranges. The excess lifetime cancer risks for the child resident from exposure to soil is also within the acceptable range, but the hazard index slightly exceeds one (1.6), due to the presence of cadmium in soil (individual hazard quotient was equal to 0.96). No individual hazard quotient exceeded one, but the summed hazard index was slightly greater than one. The exposure point concentrations calculated by Tetra Tech represented the upper 95th confidence limit of the mean for soil on the entire Subject Site. This confidence limit may need to be reviewed if specific plans for residential and recreational uses are actualized by the City and reflect smaller exposure areas, representing individual residential yards. This may require the corrective measure of isolated hot spot soil investigation and removal, or placement of engineered barriers consistent with a future development plan.

The Risk Assessment Report demonstrated that calculated risks to commercial/industrial workers from on-site soils were in acceptable risk ranges. On-site soils did additionally contain TCE, barium, mercury, and selenium. These constituents were found at levels exceeding medium-level screening values for residential land use at some locations, but were not specifically identified as unacceptable human health risks.

The major portion of the excess cancer risk due to exposures to soils estimated by Tetra Tech was due to the presence of naturally occurring arsenic. The 95th % upper confidence limit (95 UCL) concentrations for both surface soils and subsurface soils were 6.5 mg/kg and 5.6 mg/kg, respectively, which are lower than the 7.14 mg/kg identified as a background value for Blackhawk County, Iowa,[2] indicating that the risks associated with arsenic in the soils are not related to the Subject Site. Furthermore, the Subject Site soil data for arsenic do not exceed the Iowa generic statewide soil standard.[3] As noted in the Scope of Work of the Unilateral Administrative Order for the Subject Site, the media cleanup standards may take into account naturally occurring background concentrations for metals. For these reasons, no corrective measures will be necessary to address arsenic in Subject Site soils.

Recent demolition activities on the Subject Site have uncovered soils containing objectionable odors. Air and soil sampling were conducted on February 8, 2013. Soil samples were analyzed for total extractable hydrocarbons, volatile organic compounds (VOCs), and metals. Air samples were analyzed for VOCs. The observed concentrations of constituents in soil were below applicable statewide standards, and observed chemical concentrations in air were below exposure limits. Additional corrective measures, therefore, will be considered in order to

[2] United States Geological Survey, National Geochemical Survey Database, http://mrdata.usgs.gov/geochem/select.php

[3] https://programs.iowadnr.gov/riskcalc/pages/standards.aspx

address the objectionable odors. As the source of the odor appears to be petroleum compounds, these measures may be undertaken in the IDNR LUST program.

The City of Waterloo, through its consultant, HR Green, has also requested that certain anomalies noted in a 2004 geophysical survey, located in the northeast portion of the Site be investigated. Chamberlain will retain a qualified environmental professional to review the results of the metal detection and ground penetrating radar (GPR) survey, and will investigate anomalies to the extent that they may represent structures containing or which historically contained hazardous substances. This potential investigation would likely include completion of test pits or trenches.

Indoor Air

Indoor air quality risks have been evaluated, and TetraTech identified indoor air concentration risks and hazards driven by TCE. The most likely exposure of TCE to off-site residents is via intrusion of vapors from groundwater to indoor air. Chamberlain has already actively implemented the corrective measure of residential sub-slab and indoor air monitoring and mitigation to address risks to human health for this exposure pathway.

Tetra Tech did not evaluate the risk to potential future on-site residents or indoor commercial/industrial workers to vapors, but this pathway would need to be addressed in the corrective measures in the event of future residential or commercial/industrial use of the Subject Site.

Construction Workers

The risk assessment identified an on site unacceptable risk from exposure to TCE and mercury from groundwater and various metals in soil to construction workers in trenches. Construction workers exposed to groundwater while working in a trench may inhale vaporized TCE or mercury. The selected corrective measure will address the potential risks of construction workers in trenches.

2 Corrective Measure Objectives

2.1 Target Media Cleanup Standards

The corrective measure objectives are developed as site-specific objectives for the purpose of protecting human health and the environment. Once corrective measure objectives are designated, they serve as a basis for the development of corrective measure alternatives necessary to meet the remediation goals.

The proposed corrective measure objectives will include the following:

- Minimize future potential human health risks due to ingestion and direct contact with on- and off-site groundwater.
- Restore the groundwater beneath and downgradient of the site to drinking water standards, consistent with practicable remediation technologies.
- Prevent human exposure by inhalation of indoor air concentrations above applicable risk criteria identified by the EPA in the Vapor Intrusion Characterization Work Plan dated October 14, 2010 and subsequent updates dated November 14, 2011 and February 17, 2012.
- Protect the health and safety of future Site construction workers.

Federal Standards

Federal level standards for the site will include the EPA Maximum Contaminant Level (MCL) standards for groundwater. Any additional, applicable federal standards identified in the development of the Corrective Measures Study will also be included in the evaluation of the alternatives

State Standards

Iowa Administrative Code, Chapter 61: Water Quality Standards will be applied to the site for groundwater contamination. Any additional, applicable state standards identified in the development of the Corrective Measures Study will also be included in the evaluation of the alternatives.

Risk Derived Standards – Iowa Land Recycling Program

Risk derived standards for the site include those developed for the Iowa Land Recycling Program, also identified as Chapter 137 in the Iowa Administrative Code.

2.2 Points of Compliance

Points of compliance will be specific to each medium and corrective measure (for example, the point of compliance for the construction worker safety plan will be all locations with potentially unacceptable risk/exposure levels), and will be discussed in detail in the CMS report.

2.3 Risk Assessment Guidance

The Risk Assessment Report (2010) has already been completed by the EPA. However, USEPA and Iowa guidance documents and regulations are appropriate and applicable to the site.

3 Corrective Measure Technologies/Alternatives

3.1 Alternatives to be Considered

No Action Alternative

A no action alternative will be considered.

Site-Specific Institutional Controls Alternative

In this alternative, only site specific institutional controls will be implemented on the Subject Site which could include: erecting fences, utilizing security patrols and guard posts on the property, enacting deed restrictions on the property or posting notices or warnings at the Subject Site.

Restrict Groundwater Use Alternative

An alternative to develop unified regulatory restriction of groundwater in the area will be evaluated as part of the corrective measures study. Individual county regulations already restrict the use of, and drilling of new, ground water wells.

Future Construction Worker Protection Alternative

The preparation of a comprehensive health and safety plan will be considered. This will prevent construction worker exposure to site soil and groundwater that might create vapor exposure levels considered to be hazardous to human health.

Monitored Natural Attenuation (MNA) Alternative

Temporal monitoring data from the quarterly monitoring program for the TCE plume will be evaluated for stability and biodegradation. Additional analysis of data is required to confirm that the plume is stable and biodecay is occurring before an MNA plan can be prepared. Enhanced biodegradation may be considered as a component of this technology.

Enhanced biodegradation Alternative

The use of a soil and/or groundwater amendment to enhance and promote in-situ biodegradaion of TCE will be considered. Additional sampling and analysis is required to determine if appropriate biological activity occurs on the site to support in-situ biodegradation, and if so, what soil amendment will create the most effective treatment.

In-Situ Oxidation Alternative

The use of a soil and/or groundwater amendment to enhance and promote in-situ oxidation of TCE will be considered. Additional sampling and analysis is required to determine if appropriate biological activity occurs on the site to support in-situ oxidation, and if so, what soil amendment will create the most effective treatment.

Slurry Barrier or Reactive Wall Alternative

The use of a slurry barrier or reactive wall to prevent the movement of the TCE plume is not feasible due to the site location. There is no local aquitard that would provide a feasible tie in for a wall to confine the movement of the TCE. This alternative will not be further considered in the Corrective Measures Study.

Pump-and-Treat Alternative

Pump-and-treat, as a long-term method of treatment for in-situ contamination with chlorinated solvents, has proven generally unsuccessful. It may, however, prove useful when implemented on a limited scale to address relatively high concentrations of TCE in on-site areas as a means to minimize offsite impacts.

Air Sparging with Soil Vapor Extraction

Air sparging with soil vapor extraction is a technology that will be considered in the CMS and further evaluated in the CMS Report.

Soil Excavation Alternative

If the future use of the Subject Site is residential, then limited hot-spot soil investigation and excavation may be considered depending on the specific development plan.

Soil Engineered Barrier Alternative

If the future use of the Subject Site is residential, then limited hot-spot soil investigation, and possible use of engineered barriers to limit exposure may be considered depending on the specific development plan.

Odorous Soil Alternative

Recent demolition activities on-site have uncovered shallow soils containing residual petroleum hydrocarbons and objectionable odors. Various corrective measures including localized soil capping, in-situ treatment, and soil excavation will be considered in order to address the potential odor issue. In the event that odors are caused by petroleum compounds, these activities may be undertaken in the IDNR LUST program.

Vapor Intrusion Alternative

If the future use of the Subject Site is residential or commercial/industrial (if an occupied building may be constructed over the residual plume), then vapor barriers and/or subslab depressurization systems may be considered to limit exposure to vapors.

4 Investigating and Evaluating Potential Corrective Measures

Proposed corrective measures, which could be composed of a single alternative or a combination of alternatives identified above, will be initially evaluated with respect to the EPA performance standards. These performance standards ensure that human health and the environment are protected and further degradation is prevented. Four performance standards for evaluating corrective measures have been identified by the EPA:[4]

- **Protect Human Health and the Environment**. Corrective action remedies must be protective of human health and the environment. Remedies may include those measures that are needed to be protective, but are not directly related to media cleanup, source control, or management of wastes.
- **Attain Media Cleanup Standards.** Remedies will be required to attain media cleanup standards set by the implementing agency which may be derived from existing state or federal regulations (e.g. groundwater standards) or other standards. In some cases, certain technical aspects of the remedy, such as the practical capabilities of remedial technologies, may influence to some degree the media cleanup standards that are established.
- **Control the Source of Releases.** A critical objective of any remedy must be to stop further environmental degradation by controlling or eliminating further releases that may pose a threat to human health and the environment.
- **Compliance with Applicable Standards for Management of Waste.** The evaluation process of the alternatives will include a discussion of how the specific activities will be conducted in compliance with all applicable state or federal regulations

Proposed corrective measures that meet the performance standards (if more than one corrective measure meets the performances standards) will also be evaluated with respect to balancing criteria, or remedy decision selection factors. The EPA provided five key remedy selection decision factors for evaluating a corrective measure/technology:[5]

- **Long-term Reliability and Effectiveness.** Demonstrated and expected reliability are ways of assessing the risk and effect of failure. Evaluation of alternatives may consider whether the technology or a combination of technologies have been used effectively under analogous site conditions, whether failure of any one technology in the alternative would have an immediate impact on receptors, and whether the alternative would have the flexibility to deal with uncontrollable changes at the site (e.g., heavy rain storms, earthquakes, etc.). The EPA recognizes that most corrective measure technologies deteriorate with time. Often, deterioration can be slowed through proper system operation

[4] USEPA Unilateral Order on Consent for Chamberlain Manufacturing Corporation at Waterloo, April 20, 2010, Attachment A (Scope of Work), p. 9.
[5] USEPA Unilateral Order on Consent for Chamberlain Manufacturing Corporation at Waterloo, April 20, 2010, Attachment A (Scope of Work), pp. 10-11.

and maintenance, but the technology eventually may require replacement. Each corrective measure alternative should be evaluated in terms of the projected useful life of the overall alternative and of its component technologies. Useful life is defined as the length of time the level of effectiveness can be maintained.

- **Reduction in the Toxicity, Mobility, or Volume of Wastes.** As a general goal, the EPA prefers remedies that employ techniques, such as treatment technologies, that are capable of eliminating or substantially reducing the inherent potential for the wastes in or contaminated media at the facility to cause future environmental releases or other risks to human health and the environment. There may be some situations where achieving substantial reductions in toxicity, mobility or volume may not be practical or even desirable.
- **Short-term Effectiveness.** Short-term effectiveness may be particularly relevant when remedial activities will be conducted in densely populated areas, or where waste characteristics are such that risks to workers or to the environment are high and special protective measures are needed. Possible factors to consider include fire, explosion, exposure to hazardous substances and potential threats associated with treatment, excavation, transportation, and re-disposal, or containment of waste material.
- **Implementability.** Implementability will often be a determining variable in shaping remedies. Some technologies will require state or local approvals prior to construction, which may increase the time necessary to implement the remedy. Assessing the implementability of each alternative will take into account the time associated with the administrative activities (e.g., permits, off-site approvals, etc.); the constructability, implementation timeline, and time to achieve beneficial results; the availability of required technical resources and materials; and the availability of the prospective technologies for each alternative.
- **Cost.** The relative cost of a remedy may be an appropriate consideration, especially in those situations where several different technical alternatives to remediation will offer equivalent protection of human health and the environment, but may vary widely in cost. However, in those situations where only one remedy is being proposed, the issue of cost would not need to be considered. Cost estimates could include costs for: engineering, site preparation, construction, materials, labor, sampling/analysis, waste management/disposal, permitting, health and safety measures, training, operation and maintenance, etc.

5 Proposed Pilot-or Bench-Scale Studies

Bench- or pilot-scale studies may be conducted as part of the Corrective Measures Study. Depending on the most feasible alternative for the site, bench- or pilot-scale studies may be needed. This determination will be included in the Corrective Measures Study.

6 Outline for the CMS Report

The CMS Report Outline will generally follow the requirements in the RCRA Corrective Action Plan guidance set forth by the EPA's 1994 RCRA Corrective Action Plan (Final). The general sections to be included in the CMS report include the following:

- Introduction/Purpose
- Description of Current Conditions
- Corrective Action Objectives
- Identification, Screening, and Development of Corrective Measure Alternatives
- Detailed Evaluation of Selected Corrective Measure Alternative
- Recommended Corrective Measure Alternative and Rationale

7 Project Management

The Project Management team will be decided upon approval of the scope of work for development of the Corrective Measures Report. This information will be provided by Chamberlain.

Tentative Schedule[6]

Prepare Pilot/Bench Test Work Plan (PBTWP)	60 days from CMSWP approval
Complete Pilot/Bench-Scale Testing	160 days from PBTWP approval
Prepare Preliminary Screening Results	60 days after testing is complete
Prepare Draft CMS Report	60 days after EPA approves preliminary screening results

[6] The final schedule may need to be adjusted if, for example, additional data need to be collected.

8 References

ENVIRON International Corporation. 2012. Comments on the Tetra Tech Risk Assessment Report, Former Chamberlain Corporation Site, Waterloo, Iowa, September 7, 2012.

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HR Green, Memorandum Re: February 8, 2013 Air and Soil Sampling from Robin Husman to Noel Anderson and Chris Western of the City of Waterloo, March 20, 2013.

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Iowa Administrative Code. 2008. Chapter 133. Rules for Determining Cleanup Actions and Responsible Parties.

Iowa Administrative Code. 2008. Chapter 137: Iowa Land Recycling Program and Response Action Standards.

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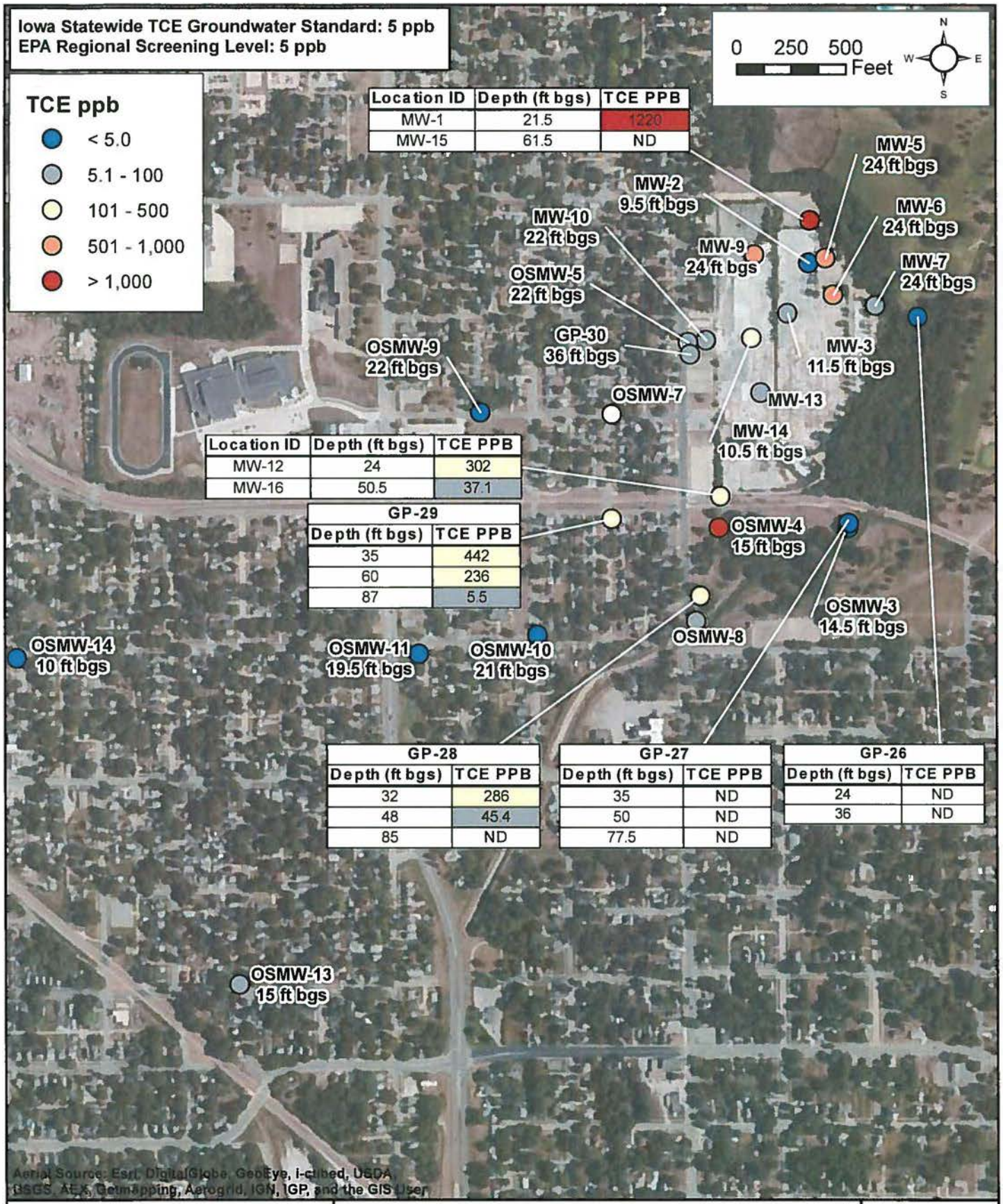
Figures



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2011 and 2012 Groundwater Sample Locations
TCE Concentrations
Former Chamberlain Manufacturing Site
Waterloo, Iowa

Figure 1

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