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2013 Annual Report

Madison-Kipp Corporation
201 Waubesa Street
Madison, Wisconsin

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ARCADIS

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2013 Annual Report

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1. Introduction

ARCADIS was retained by Madison-Kipp Corporation (MKC) to complete investigation and remedial activities at its facility located at 201 Waubesa Street, in Madison, Wisconsin (Site). Environmental investigation and remediation activities have been ongoing since 1994. Investigation activities focused on tetrachloroethene (PCE) and were expanded to evaluate polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs) and Resource Conservation and Recovery Act (RCRA) metals beginning in 2012.

This report presents a brief summary of the Site history, a description of investigation and remedial activities completed between February and December 2013, a summary of the observations and analytical results, and recommendations for future activities. Activities completed prior to February 2013 have been previously documented in the *Site Investigation Work Plan,* dated May 31, 2012, and the *Site Investigation and Interim Actions Report, February 2012 – January 2013*, dated March 15, 2013, and the addenda. A Natural Resources (NR) 712.09 submittal certification is included in Appendix A.

1.1 Site Background

The Site is located at 201 Waubesa Street in Madison, Wisconsin. The Site is located in the southwest quarter of Section 5, Township 7 North, Range 10 East in Dane County. The location of the Site is illustrated on a topographic quadrangle presented as Figure 1-1.

The Site is approximately 7.5 acres in size. A 130,000-square foot building occupies much of the Site. Asphalt parking lots are located in the northeastern, southwestern and southeastern portions of the Site. The building has a 25,000 square-foot second floor and a 25,000 square-foot basement. The Site is zoned M-1 (industrial/manufacturing). The Site is currently operated as a metal die casting facility.

The Site is located in the eastern portion of Madison, in a mixed use area of commercial, industrial and residential land use. The Site is bounded by the Capital City Bike Trail to the north, Atwood Avenue to the south and Waubesa Street to the west. Residences are located adjacent to the east and west sides of the Site, and further west (across Waubesa Street) and east (across Marquette Street). Commercial properties are located to the south (across Atwood Street) and further east. The Goodman Community Center is located to the north across the Capital City Bike Trail.

The Site is also located at the northeast end of the Madison Isthmus, which is a narrow strip of land separating Lake Mendota and Lake Monona. The Site is approximately 1,500 feet north of Lake Monona and approximately 6,800 feet east of Lake Mendota. This is important from a hydrogeological perspective because the lakes function as hydrologic boundaries for the Site. The topography of the Site is relatively flat, with an elevation ranging from approximately 870 to 880 feet above mean sea level. The Site and surrounding area is serviced by municipal water supply and sewer systems.

Investigation and remediation activities have been ongoing at the Site since 1994. This report presents the activities completed from February through December 2013. Activities completed prior to February 2013 have been previously documented in the *Site Investigation Work Plan,* dated May 31, 2012, and the *Site Investigation and Interim Actions Report, February 2012 – January 2013*, dated March 15, 2013, and the addenda.

2. Site Investigation

The following sections present an overview of Site investigation activities completed during the reporting period. The results of the investigation are presented in a subsequent section of the report. Figure 2-1 presents a summary of sample locations for work completed from February 2012 through this reporting period.

2.1 Regulatory Correspondence

All investigation and remediation activities were completed with approval from the Wisconsin Department of Natural Resources (WDNR). A complete list of work plans, summary reports, correspondence and copies of regulatory correspondence for the period of February 2013 to date is included in Appendix B.

2.2 Site Investigation Activities

Activities from January 26 through December 31, 2013 are documented in this report and include the following:

- Underground Storage Tank (UST) Investigation – Advanced 17 soil borings and installed Monitoring Well MW-24 to investigate the soil and groundwater in the vicinity of the former 1,000-gallon waste oil UST located in the southeast parking lot area.

- PCB Investigation, Western Property Boundary – Advanced and sampled 32 soil borings on Site along the western property boundary to determine the extent and degree of soil impacts. Two samples from each boring were collected and submitted for laboratory analysis of PCBs.

- PCB Investigation, Supplemental Building Interior – Advanced and sampled 27 soil borings to complete delineation of volatile organic compounds (VOCs) and PCBs beneath the manufacturing building on Site.

- PCB Investigation, 237 Waubesa Street – Advanced and sampled four hand auger borings off Site at 237 Waubesa Street to evaluate the extent and degree of soil impacts in the upper four feet of soil at this residence. A total of eight soil samples were collected and submitted for laboratory analysis of VOCs, PCBs and PAHs.

- PAH Background Study – Advanced and sampled 23 soil borings off Site to obtain background PAH data and determine if the detected off-Site PAHs in soil represented normal background conditions in an urban environment. A total of 23 soil samples were collected and submitted for laboratory analysis of PAHs.

- Monitoring Well Soil Investigation, Off Site – Advanced and sampled soil borings (MW-26S and MW-27D/D2) to determine the presence or absence of soil impacts off Site.

- Monitoring Well Installation – Installed six single-screened groundwater monitoring wells (MW-24, MW-25D, MW-25D2, MW-26S, MW-27D and MW-27D2) to investigate groundwater in the unconsolidated soils and bedrock.

- Extraction Well Installation – Installed one groundwater extraction well (GWE-1) to conduct a step test for use in designing a groundwater extraction treatment system.

- Groundwater Monitoring – Collected groundwater elevations and sampled 61 sample intervals for analysis of VOCs in April, July, and October 2013. Select wells were also sampled for total and dissolved PCBs and total and dissolved RCRA metals.

- Vapor Probe Installation and Sampling – Replaced three vapor probes along the northern property boundary and collected soil gas vapor samples from the vapor probes located around the perimeter of the Site.

- Office Indoor Air Sampling Activities – Completed a building survey and chemical inventory of the office area to determine and document if any indoor air sources of VOCs exist within the office space. Collected indoor air samples to determine if concentrations of VOCs are present in the office.

- Surveyed the locations of the newly completed soil borings and wells.

- Collected and disposed of non-hazardous and hazardous investigative-derived waste (IDW).

- Soil Vapor Extraction (SVE) System – Completed routine SVE system monitoring. Completed removal of the temporary SVE system and installation of a more permanent SVE system. Collected and disposed of non-hazardous and hazardous IDW.

- PCB Excavation – Completed excavation and backfill of off-Site soils containing PCBs at six residential properties located at 233, 241, 245, 249, 253, and 257 Waubesa Street.

- Performed annual sub-slab depressurization systems (SSDS) inspections and developed operation and maintenance Plans for five residences along South Marquette Street. A permanent sub-slab vapor point was installed at each residence as part of the annual inspections.

- Post-Injection Monitoring – Continued post-injection monitoring of the in-situ chemical oxidation pilot test study that was conducted in December 2012.

2.3 Site Preparation

Prior to any intrusive work, Site utilities were cleared in accordance with the ARCADIS Utility Locate Policy, where a minimum of three lines of evidence are required. ARCADIS contacted the Wisconsin One-Call, "Digger's Hotline," and a private locator. ARCADIS also contracted for a ground penetrating radar survey and consulted with MKC employees to confirm the locations of known utilities.

2.4 On-Site Soil Investigation

2.4.1 UST Investigation

An investigation associated with a former 1,000-gallon waste oil UST located in the southeast parking lot area was conducted beginning February 28, 2013. A total of 17 direct-push soil borings (UST-1 through UST-17) were advanced around the location of the former UST and on March 28, 2013, Monitoring Well MW-24 was installed. The investigation was completed by RJN in accordance with the work plan titled *Underground Storage Tank Site Investigation Work Plan*, dated January 14, 2013 and accepted by the WDNR on January 15, 2013. The details of the UST investigation were submitted to the WDNR by RJN in a report titled *Underground Storage Tank Investigation*, dated August 5, 2013. The WDNR granted closure of the waste oil UST in a letter dated March 6, 2014. Soil boring logs (WDNR Form 4400-112) and borehole abandonment forms (WDNR 3300-005) are included in Appendix C. Monitoring well construction forms (WDNR Form 4400-113A) and well development forms (WDNR Form 3300-114B) are included in Appendix D.

2.4.2 PCB Investigation Activities, Western Property Boundary

In August 2013, 32 soil borings were advanced on Site using direct push drilling methods at locations adjacent to the 233, 261, 265 and 269 Waubesa Street property lines to determine the extent and degree of potential soil impacts. Soil samples were collected from each soil boring at depths of 0 to 2 and 2 to 4 feet below land surface (bls) and submitted for laboratory analysis of PCBs. The investigation activities were completed in accordance with the WDNR-approved *Additional Polychlorinated Biphenyl Sampling Work Plan, Western Property Boundary*, dated July 2013. The details of the investigation were submitted to the WDNR in a document titled *Summary of Activities Related to Polychlorinated Biphenyls, May through August 2013*, dated October 11, 2013. Soil boring logs (WDNR Form 4400-112) and borehole abandonment forms (WDNR 3300-005) are included in Appendix C.

2.4.3 Supplemental Building Interior PCB Investigation

The WDNR requested a work plan to delineate the PCBs and VOCs beneath the manufacturing building on Site. Twenty seven soil borings were proposed to complete additional delineation beneath the building. Advancement of the borings began on December 30, 2013. This work was conducted in accordance with the *Supplemental Work Plan for Polychlorinated Biphenyl Building Subsurface Investigation*, dated August 1, 2013. Figure 2-2 presents the locations of the soil borings advanced within the building from 2012 to date. The details of the investigation will be submitted to the WDNR under separate cover.

2.5 Off-Site Soil Investigation

2.5.1 PCB Investigation Activities, 237 Waubesa Street

On November 12, 2013, four soil borings were advanced using hand-auger techniques on the 237 Waubesa Street property to evaluate the extent and degree of potential soil impacts in the upper four feet at this residence. Access to this property had previously been denied. The work was completed in accordance with the WDNR- and United States Environmental Protection Agency (U.S. EPA)-approved *Final Revised Work Plan for Polychlorinated Biphenyl Recommended* Activities, dated December 2012 and the *Proposal for Sampling Activities at 237 Waubesa Street* dated October 25, 2013. Soil samples were collected from each soil boring from depths of 0 to 2 and 2 to 4 feet bls. A total of eight soil samples were collected and submitted for laboratory analysis of PCBs, VOCs and PAHs. Details of the investigation activities were submitted to the

WDNR in a document titled *Summary of Activities Related to Polychlorinated Biphenyl Investigation, 237 Waubesa Street,* dated January 8, 2014. Soil boring logs (WDNR Form 4400-112) and borehole abandonment forms (WDNR 3300-005) are included in Appendix C.

2.5.2 PAH Background Study

On December 16 and 17, 2013, 23 soil borings were advanced off Site utilizing hand auger techniques to obtain background PAH data and confirm if the detected off-Site PAHs in soil on the properties adjacent to the Site were consistent with normal background conditions in an urban environment. A total of 23 soil samples were collected and analyzed for concentrations of PAHs. This work was completed in accordance with the work plan titled *Polynuclear Aromatic Hydrocarbon Work Plan* submitted to the WDNR on August 1, 2013. The details of the study were submitted to the WDNR in a document titled *Polynuclear Aromatic Hydrocarbons Background Study*, dated February 7, 2014. Soil boring logs (WDNR Form 4400-112) and borehole abandonment forms (WDNR 3300-005) are included in Appendix C. Figure 2-3 presents the locations where PAH samples were taken from 2012 through this reporting period.

2.5.3 Soil Sampling From Monitoring Well Installation

On August 21 and November 18, 2013, two soil borings (MW-26S and MW-27) were advanced off Site using hollow stem auger techniques. Two soil samples were collected from MW-26S and three soil samples were collected from MW-27 for laboratory analysis of VOCs and PAHs. This work was completed in accordance with the work plan titled *Northern Well Installations Work Plan,* submitted to the WDNR on August 1, 2013. Soil boring logs (WDNR Form 4400-112) are included in Appendix C.

2.6 Groundwater Investigation

Six monitoring wells were installed as part of the continued Site investigation and one groundwater extraction well was installed for groundwater remediation activities. Below is a summary of the wells including installation dates and purpose of each well.

- Monitoring Well MW-24 was installed on Site in the southeast parking lot on March 28, 2013. This well was installed to evaluate groundwater impacts near the former 1,000-gallon waste oil UST.

- Monitoring Wells MW-25D and MW-25D2 were installed between April 4 and May 3, 2013. These wells were installed to delineate groundwater impacts off Site to the southeast of the Site.

- Monitoring Well MW-26S was installed on August 21, 2013. This well was installed to delineate the horizontal extent of groundwater impacts in the unconsolidated soil.

- Monitoring Wells MW-27D and MW-27D2 were installed between November 18 and December 19, 2013. These wells were installed to delineate groundwater impacts off Site to the north of the Site.

- Groundwater Extraction Well GWE-1 was installed on January 9, 2014. This well was installed for groundwater extraction.

Monitoring well locations are presented on Figure 2-4. The above work was completed in accordance with the *Underground Storage Tank Site Investigation Work Plan* submitted to the WDNR on January 14, 2013 for MW-24; *Site Investigation and Interim Actions Report February 2012 – January 201*3 submitted to the WDNR on March 15, 2013 for MW-25D/25D2; *Northern Well Installations Work Plan* submitted to the WDNR on August 1, 2013 for MW-27D/27D2; and *Groundwater Remedial Strategy* submitted to WDNR on October 15, 2013 for GWE-1. Well construction details are summarized in Table 2-1. Monitoring well construction forms (WDNR Form 4400-113A) and well development forms (WDNR Form 3300-114B) are included in Appendix D. Below is a summary of activities completed as part of the groundwater investigation.

2.6.1 Boring Advancement

Hollow stem auger drilling was selected to install wells in the unconsolidated soils and mud rotary drilling was selected to install wells in the bedrock. One monitoring well (MW-26S) was screened across the water table in the unconsolidated soils off Site. Four bedrock wells (MW-25D, MW-25D2, MW-27, MW-27D2) were installed off Site. One bedrock monitoring well (MW-24) and one groundwater extraction well (installed into the bedrock) were installed on Site. Precautions to limit drag-down of contaminants were implemented when advancing boreholes into the bedrock. Monitoring Wells MW-25D/D2 and MW-27/27D2 and Groundwater Extraction Well GWE-1 were drilled into competent bedrock and temporary casing was installed before advancing to target end depths.

2.6.2 Vertical Aquifer Profiling

Groundwater samples were collected from the MW-25 and MW-27 boreholes in bedrock using a double packer for VOCs. The groundwater VOC samples were collected between April 8 and 19, 2013 from MW-25 and between November 19 and December 2, 2013 from MW-27. The groundwater VOC analytical results were used to determine the vertical extent of groundwater impacts and aid in selecting the target intervals for the wells. Vertical aquifer profiling was completed at each borehole location using a "top-down" sampling approach. Groundwater samples were collected from every other 10-foot interval from the base of the permanent casing (estimated 40 feet bls) to 180 feet, and then every 10-foot interval from 180 to 200 feet bls. After the drill casing was advanced to the desired sampling depth, the lead drill casing was retracted and the packer system was installed. The packer system limits the flow of groundwater from above and below the desired sampling interval, so a discrete interval of the borehole can be sampled. Prior to sampling, the interval was purged using a decontaminated submersible pump. Approximately 200 to 300 gallons were removed from each interval before sampling. The groundwater samples were collected and submitted to TestAmerica for laboratory analysis of VOCs using U.S. EPA Method 8260.

2.6.3 Down-Hole Geophysical Logging

Down-hole geophysical logging was conducted at MW-25 from April 22 through 25, 2013 to a depth of approximately 220 feet; at MW-27 on December 8 and 9, 2013 to a depth of approximately 216 feet; and at GWE-1 from December 17 through 19, 2013 to a depth of approximately 180 feet. Multiple geophysical logging tools were utilized including gamma, fluid temperature, fluid resistivity, caliper, heat-pulse flow meter, and high resolution acoustic and optical borehole televiewers. The primary purpose of geophysical logging was to determine the depths and orientations of open, flowing fractures that intersected the boreholes, and to identify transmissive groundwater–bearing zones. The geophysical report is presented under Appendix G.

2.6.4 Well Development

The goal of well development is to produce groundwater samples that are representative of the water quality in the target interval, and to minimize sediment, drill cuttings and drilling fluids in the samples. Monitoring wells screened in unconsolidated soils were developed by surging and pumping with a submersible pump. Wells screened in bedrock were developed before the wells were constructed by brushing the borehole and purging a minimum of 5,000 gallons. After the bedrock wells were installed the screen intervals were developed using air lifting techniques to remove additional sediment-laden water. Well development forms (WDNR Form 4400-113B) are included in Appendix D.

2.6.5 Monitoring Well Groundwater Elevation Measurements

Static groundwater measurements were collected at the Site monitoring network in April, July, and October 2013. The monitoring wells were opened and allowed to equilibrate prior to measuring depth to groundwater. Measurements were collected from the north side of the casing using an electronic water level meter capable of measuring to an accuracy of plus or minus 0.01 feet. Groundwater elevations are summarized in Table 2-2. The water level meter was decontaminated between well locations using non-phosphate laboratory grade detergent water and rinsed with distilled water.

2.6.6 Monitoring Well Sample Collection and Analysis

Groundwater samples were collected for VOCs in April, July, and October 2013. Groundwater samples were also collected and submitted from select wells for analysis of total and dissolved PCBs and total and dissolved metals. Groundwater samples were collected from monitoring wells using low-flow sampling techniques. Field parameters were recorded using a multi-parameter meter for pH, conductivity, dissolved oxygen, redox potential, and temperature. Groundwater samples were collected from the multiport wells using the Westbay-supplied sampling equipment. All non-dedicated field equipment was decontaminated between each well location using non-phosphate laboratory grade detergent water and rinsed with distilled water.

2.7 Vapor Monitoring

Vapor monitoring was completed at the Site soil vapor probes and the interior of the MKC office building. Monitoring details are provided below.

2.7.1 Vapor Probe Monitoring

As recommended in the SI Report, the four soil vapor probes located within the bike path north of the Site (VP-3 through VP-6) were to be sampled on a quarterly basis (April, July, and October 2013; January 2014). Semi-annual sampling of the on-Site network of soil vapor probes was planned for July 2013 and January 2014. 17 soil vapor probes are included in the on-Site network (probes either on Site or near the bike path): VP-1N, VP-1S, VP-2N, VP-2S, VP-3, VP-4, VP-5, VP-6, VP-102, VP-114, VP-126, VP-202, VP-210, VP-222, VP-237, VP-249 and VP-261 (Figure 2-5). A summary of the January 2014 monitoring will be presented under separate cover.

During the vapor monitoring events, soil vapor samples were collected from the vapor probes over an approximate 30-minute time period using 6-liter summa canisters. The vapor samples were submitted for analysis of five VOCs by U.S. EPA Method TO-15: PCE, TCE, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride to Eurofins Air Toxics, Inc. laboratory in Folsom, California. Due to elevated groundwater levels and/or saturated soil conditions along the northern portion of the Site in 2013, a limited number of vapor samples were collected from the five vapor probes located in this area (VP-3 through VP-6 and VP-102).

2.7.2 Office Indoor Air Monitoring

Indoor air sampling was conducted in the MKC office building in 2013. The office indoor air sampling activities were performed in accordance with the *Indoor Air Sampling Work Plan* dated August 1, 2013 and approved by the WDNR in a letter dated October 9, 2013.

On December 13, 2013, five indoor air samples were collected from locations within the first floor office area. Two samples were also collected from crawlspace entrances within the office area. One location was re-sampled on January 24, 2014 to confirm results.

The samples were collected over an approximate 8-hour period using 6 liter summa canisters. Each sample was submitted for laboratory analysis of five VOCs by U.S. EPA Method TO-15. The five VOCs include PCE, TCE, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride. The samples were submitted to Eurofins Air Toxics, Inc. laboratory using appropriate chain-of-custody procedures.

A summary of the office indoor air sampling activities was provided in the *Summary of Office Indoor Air Sampling Activities* letter dated February 24, 2014 and submitted to WDNR.

2.8 Sample Location Elevation Survey

Soil borings and well locations were surveyed by North Shore Engineering of Mequon, Wisconsin, a Wisconsin licensed surveyor. The survey included the northing, easting, ground elevations and top of casing elevations for the monitoring wells. Vertical elevation accuracy was established at plus or minus 0.01 foot and horizontal location accuracy was set at plus or minus 0.1 foot. Horizontal coordinates are referenced to the North American Datum of 1983 (NAD 83 [1991]) and elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88).

To minimize disruptions to the property owners, the locations of off-Site hand auger soil borings were measured in the field in relation to the property boundary/fence-line and approximated using an aerial photograph image by an ARCADIS Geographic Information System Specialist.

2.9 Investigative-Derived Waste

IDW was generated during the Site investigation activities including soil and rock cuttings, development water, purge water and decontamination water. Nonhazardous soil and rock cuttings were collected in rolloffs and/or 55-gallon steel drums and transported off Site for disposal at Veolia Glacier Ridge Landfill LLC in Horicon, Wisconsin. Hazardous soil and rock cuttings were collected in steel 55-gallon drums or loaded into trucks and disposed of off Site at Wayne Disposal, Inc., in Belleville, Michigan. Non-hazardous development, purge, and decontamination water was collected in aboveground polyethylene storage tanks or tankers and disposed of off Site at CWT Wisconsin in West Allis, Wisconsin or steel 55-gallon drums and disposed of with MKC facility wastewater. Disposal documentation is presented in Appendix I.

3. Site Geologic and Hydrogeologic Conditions

Below is a summary of the Site geologic and hydrogeologic conditions based on soil and bedrock boreholes advanced and monitoring wells installed on Site and off Site. A geologic cross section was prepared to illustrate subsurface conditions using the Site wells. The location of the geologic cross section is depicted on Figure 3-1. Geologic Cross Section A-A' is presented as Figure 3-2.

3.1 Site Geology

The Site's near-surface geology consists of two unconsolidated units consisting of fill material and glacially-derived deposits, which overlie weakly cemented sandstone bedrock. A brief description of each unit is presented below.

- ***Fill Material***

  Fill material consisting of debris and non-native sand, is located near the ground surface. The fill material classified as debris included slag, glass, brick, aluminum and steel pieces, wire, and rubber with an average thickness of approximately 0.5 feet. The fill material classified as non-native sand was described as very fine to medium grained sand. This fill material averaged from 2- to 4-feet thick.

Underlying the fill material are several glacially-derived deposits including an upper clay unit, several gravel lenses, and a lower sand unit. Below is a description of each unit.

- ***Clay Unit***

  The uppermost native soil at the Site is referred to as the clay unit. The clay unit consists of stiff to medium stiff clay with some to little silt and trace to some very fine to fine sand. The clay unit was encountered from the land surface to an average depth of 6 feet bls.

- ***Gravel Lenses***

  Several continuous gravel lenses were identified within the upper clay and lower sand units. Three distinct gravel lenses were identified and appear to be laterally continuous across the Site. The lenses were identified at average depths of approximately 6.8, feet, 15.4 feet bls, and 23.8 feet bls onsite.

- ***Sand Silt Unit***

  The sand unit located beneath the clay unit consists of very fine to coarse grained sand (mostly very fine to fine). The sand unit was encountered from an average of 6.0 feet bls to bedrock which was encountered at an average of 30 to 34 feet bls.

Underlying the unconsolidated soil, three bedrock formations were identified. Below is a description of each formation.

- ***Lone Rock Formation***

  The Lone Rock Formation is located immediately below the unconsolidated soils and was described as a friable to moderately hard, glauconitic, very fine to fine grained quartz sandstone. The Lone Rock Formation is intensely to highly jointed with predominantly horizontal fractures occurring along bedding planes. The base of the Lone Rock Formation was encountered at approximately 95 feet bls and averaged approximately 65-feet thick on Site. There is a topographic high in the bedrock located near the center of the Site. However, the top of the Lone Rock Formation is heavily eroded, and regionally slopes to the south (WGNHS, 1999).

- ***Wonewoc Formation***

  The Wonewoc Formation is located below the Lone Rock Formation and was subdivided into two Members including the Ironton and the Galesville Members. The Ironton Member was described as friable to moderately hard, very fine to fine grained sandstone. Bioturbation and very hard red and orange sandstone containing iron-rich cementation are key characteristics of this Member. The average thickness of the Member was approximately 32 feet. The Galesville Member was described as alternating beds of hard very fine to fine sandstone and friable, rounded, medium grained sandstone. Both the Ironton and Galesville Members are intensely to highly jointed with predominantly horizontal fractures. The average thickness of the Member was approximately 99 feet.

- ***Eau Claire Formation***

  The Eau Claire Formation was described as hard to moderately hard, very fine to fine grained sandstone interbedded with laminated, pale green siltstone and shale. A shale layer located within the Eau Claire Formation is known as the Eau Claire

Aquitard. The Eau Claire Aquitard is considered to be a leaky confining unit (WGNHS, 1999). The shale in the vicinity of the Site is estimated to range from 10- to 20-feet thick, although it has been eroded in portions of the central Yahara Lakes. Where present, the shale impedes groundwater flow from the Upper Paleozoic Aquifer (which includes the Lone Rock and Wonewoc Formations) and protects the Mount Simon Aquifer (located beneath the Eau Claire Formation) by limiting downward flow.

3.2 Geophysical Data

Down-hole geophysical data were collected at boreholes MW-25, MW-27, and GWE-1 for the purpose of characterizing the geology and hydrogeology and nature and extent of constituents in the fractured bedrock groundwater zone near the Site. Multiple geophysical logging tools were utilized including gamma, fluid temperature, fluid resistivity, caliper, heat-pulse flow meter, high-resolution acoustic borehole televiewer, and optical borehole televiewer. The geophysical data are illustrated with stratigraphic descriptions on logs included in Appendix G. Below is a summary of the findings by location.

MW-25

The geophysical tools were implemented between approximately 60 and 220 feet below ground at MW-25. Below is a summary of the findings.

- The Lone Rock Formation was encountered from approximately 42 to 114 feet bls. The Wonewoc Formation was present at approximately 114 feet bls and extended below the total depth drilled at 230 feet bls.

- Fractures were ranked by COLOG Geophysics Group on a scale from 0 to 5 to represent flow potential (the higher the ranking, the more potential for flow through the fractures). The highest ranking fractures at MW-25 were identified as Ranking 2 (clean, distinct continuous fracture) at 90.5 feet, 95 feet bls, 111 and 114 feet bls, and 125 feet bls; and Ranking 3 (distinct fracture with apparent aperture) at 126 feet bls. Fractures were also identified by the caliper tool at 66, 112 and 127 feet bls.

- Natural gamma readings varied between approximately 25 and 75 counts per second, with prominent peaks indicated at depths of approximately 68, 77, 95, 110, and 114 feet bls. Changes in natural gamma readings are due to changes in lithology. These data demonstrate the heterogeneous and horizontally-layered structure of the bedrock units. The natural gamma readings can be used to estimate formation breaks near the Site.

- Conductivity values varied between approximately 2,200 and 2,550 microSiemens per centimeter (µS/cm). Changes in conductivity along a borehole may indicate intervals where groundwater is entering the borehole from discrete fractures. There was a prominent conductivity change from approximately 66 to 84 feet bls and from approximately 91 to 110 feet bls, suggesting this interval may contain open flowing fractures that transmit groundwater.

- Fluid temperature varied between approximately 11 and 12 degrees Celsius (^{o}C), with a constant decrease in temperature occurring from approximately 44 to 220 feet bls.

- The heat pulse flow meter, under pumping conditions [(1.4 gallons per minute (gpm)], measured upward vertical flow rates in the borehole at approximately 0.053 to 0.662 gpm from approximately 65 to 120 feet bls and a downward vertical flow at approximately 0.048 to 0.253 gpm. From approximately 120 to 198 feet bls. This change in flow direction supports the conclusion that a discrete groundwater flow pathway exists above approximately 120 feet bls, since the minimal pumping at the surface was not able to be overcome.

MW-27

The geophysical tools were implemented between 1 and 211 feet bls at MW-27. Below is a summary of the findings.

- The Lone Rock Formation was encountered from approximately 28 to 101 feet bls. The Wonewoc Formation was present at approximately 101 feet and extended below the total depth logged at 211 feet bls.

- The highest ranking fractures at MW-27 were identified as Ranking 2 (clean, distinct continuous fracture) at 151, 154 , 163, 174, 178, 179 , 181, 184 , and 185 feet bls and Ranking 3 (distinct fracture with apparent aperture) at 153, 172, 181, 184, and 185 feet bls. Fractures were also identified at approximately 180, 184 to 186, and 190 to 194 feet bls by the caliper tool.

- Natural gamma readings varied between approximately 10 and 60 counts per second, with prominent peaks indicated at depths between 89 and 104 feet bls.

- Conductivity values varied between approximately 500 and 540 µS/cm. There was a prominent conductivity change from approximately 134 to 184 feet bls, when the conductivity gradually decreases to the depth logged at 215 feet bls. The interval with the prominent conductivity change suggests this interval may contain multiple open flowing fractures that transmit groundwater.

- Fluid temperature varied between approximately 15.2 and 16 ^{o}C and showed a gradual decrease with depth along the length of the borehole.

- The heat pulse flow meter measured upward vertical flow rates in the borehole at approximately 0.053 to 0.662 gallons per minute (gpm) from approximately 65 to 120 feet bls and a downward vertical flow at approximately 0.048 to 0.253 gpm. From approximately 120 to 198 feet bls. This change in flow direction supports the conclusion that a discrete groundwater flow pathway exists above approximately 120 feet bls.

- The heat pulse flow meter, under pumping conditions (2.5 gpm) measured upward vertical flow rates in the borehole at approximately 0.027 to 0.862 gpm from approximately 130 to 210 feet bls.

GWE-1

The geophysical tools were implemented between 1 and 180 feet bls at GWE-1. Below is a summary of the findings.

- The Lone Rock Formation was encountered from approximately 34 to 92 feet bls. The Wonewoc Formation was present at approximately 92 feet and extended below the total depth logged at 180 feet bls.

- The highest ranking fractures at GWE-1 were identified as Ranking 3 (distinct fracture with apparent aperture) at 84, 103, and 159 feet bls and Ranking 4 (wide fracture or multiple interconnected fractures) from 102 to 103 feet bls. Fractures were also identified at approximately 84, 102, 110, and 133 feet bls by the caliper tool.

- Natural gamma readings varied between approximately 10 and 40 counts per second, with prominent peaks indicated at depths of approximately 53, 59, 69, 74, and 85 feet bls.

- Conductivity values varied between approximately 875 and 985 µS/cm. There was a prominent conductivity change from approximately 52 to 90 feet bls. The interval with the prominent conductivity change suggests this interval may contain multiple open flowing fractures that transmit groundwater.

- Fluid temperature varied between approximately 15.5 and 16.8 ^{o}C, with a gradual decrease in temperature occurring with depth along the borehole.

- The heat pulse flow meter, under pumping conditions (1.5 gpm), measured upward vertical flow rates in the borehole measured at approximately 0.011 to 0.05 gpm from approximately 45 to 75 feet bls, downward vertical flow at approximately 0.043 to 0.074 gpm from approximately 90 to 104 feet bls, and no flow from approximately 75 to 90 feet bls and from 104 feet bls to total depth logged at 180 feet bls. The change to a downward flow direction from 90 to 104 feet supports the conclusion that a discrete groundwater flow pathway exists at this interval since the minimal pumping at the surface was not able to be overcome.

In summary, the geophysical data and other down-hole data indicate that bedrock beneath and near the Site is heterogeneous and horizontally layered, which is consistent with the depositional environments in which the sandstone layers were deposited. The data show that groundwater flow at these locations occurs in discrete fractures that intersect boreholes at different depths, and are most likely associated with horizontal bedding plane partings parallel to the horizontally layered sandstone units.

3.3 Hydrogeologic Conditions

The 2013 investigation included the installation of 6 wells (MW-24, MW-25D, MW-25D2, MW-26S, MW-27D, and MW-27D2). The current groundwater monitoring well network at the Site includes 61 sample intervals. Below is a summary of the Site's potentiometric surfaces, hydraulic gradient directions, and horizontal and vertical gradients using data from the current well network.

3.3.1 Potentiometric Surface, Hydraulic Gradient Direction, and Gradient

Site-wide groundwater elevations were collected quarterly in April, July, and October 2013. Groundwater elevations are summarized in Table 2-2. The quarterly data were evaluated to determine the hydraulic gradient direction and calculate horizontal gradients. Below is a summary of the findings.

- ***Water Table Surface Elevation***

  The water table surface elevation using April, July, and October 2013 data are presented on Figures 3-3 through 3-5. Wells screened across the water table are located approximately 3 to 35 feet bls. The hydraulic gradient direction across the water table was to the south to southeast in April and July and to the east in October. The water table is primarily influenced by the amount of precipitation and the lock and dam where the Yahara River drains from Lake Mendota south into Lake Monona. The horizontal gradient in the saturated unconsolidated soils was calculated as 0.002 foot per foot to 0.008 foot per foot.

- ***Lower Lone Rock Formation Potentiometric Surface***

  The potentiometric surface in the Lower Lone Rock Formation using April, July, and October 2013 data are presented on Figures 3-6 through 3-8. Wells screened in the Lower Lone Rock Formation are located approximately 60 to 96 feet bls. The hydraulic gradient direction in the Lower Lone Rock Formation is generally to the east and southeast in the southern half of the Site, and to the north in the northern half of the Site. The northerly gradient direction is based by the groundwater elevation high measured at the MW-3 well nest. The horizontal gradient in the Lower Lone Rock Formation was calculated as 0.001 to 0.005 foot/foot to the south and 0.002 to 0.005 foot/foot to the east and southeast.

- ***Upper Wonewoc Formation Potentiometric Surface***

  The potentiometric surface in the Upper Wonewoc Formation using April, July, and October 2013 data are presented on Figures 3-9 through 3-11. Wells screened in the Lower Wonewoc Formation are located between approximately 120 to 187 feet bls. The hydraulic gradient direction in the Lower Wonewoc Formation is uniformly to the east and southeast consistent with the regional hydraulic gradient. Hydraulic gradients in the Lower Wonewoc Formation do not appear to be influenced by pumping at the nearest water supply wells. The horizontal gradient in the Lower

Wonewoc Formation was calculated as 0.001 to 0.007 feet per feet across the Site.

3.3.2 Vertical Gradients

Vertical gradients were calculated for well pairs using the April, July, and October 2013 groundwater elevation data. Wells are screened or have sample intervals in four geologic units including the wells screened across the water table, Lone Rock Formation, Wonewoc Formation, and Eau Claire Formation. Vertical gradient data are summarized in Table 3-1.

The current well network includes 10 wells nests including MW-2 through MW-6, MW-9, MW-17, MW-22, MW-23, MW-25, and MW-27. There are currently four multiport wells (MP-13 through MP-16) with four to seven sample intervals at each well. Below is a summary of vertical gradients and key observations made from the monitoring wells and multiport wells.

- The average vertical gradients between the water table wells and Lone Rock Formation were calculated at 0.020 to 0.024 feet/feet and the hydraulic gradient direction is down. The exception is the Monitoring Well MW-22S and MW-22D nest where the magnitude of the average vertical gradient is 0.044 feet/feet and the hydraulic gradient direction is up.

- The average vertical gradients between the Lone Rock Formation and the Wonewoc Formation were calculated at 0.010 to 0.081 feet/feet and the hydraulic gradient direction is down. An order of magnitude lower vertical gradient (nearly flat) was calculated between Monitoring Wells MW-9D to MW-9D2 and MW-25D and MW-25D2 at 0.007 feet/feet at both sets of wells and the hydraulic gradient direction was down.

- Upward vertical gradients were calculated between MW-5D2 and MW-5D3 with an average of 0.001 feet/feet and between MW-27D to MW-27D2 at an average of 0.0002 feet/feet.

- The direction of the vertical gradients for the Site was nearly consistently downward and within the same order of magnitude from the unconsolidated to the bedrock, as well as within each bedrock formation and between bedrock formations. This finding is consistent with a mathematical groundwater flow model commissioned by Dane County (WGNHS, 1999).

4. Site Investigation Results

Below is a summary of the soil, groundwater and vapor analytical results from the investigation completed during the reporting period.

4.1 On-Site Soil Analytical Results

4.1.1 UST Investigation

The UST investigation indicated that the former UST is likely not a source of petroleum contamination at the Site. No further actions were recommended. The results of the UST investigation were submitted to the WDNR by RJN in a report titled *Underground Storage Tank Investigation*, dated August 5, 2013. A case closure request was submitted to the WDNR on September 16, 2013 and final closure was granted on March 6, 2014.

4.1.2 PCB Investigation Activities, Western Property Boundary

All of the soil sample results from the western property boundary investigation were below the U.S. EPA's self-implementing high occupancy cleanup level with no site restrictions of 1 milligrams per kilogram (mg/kg). The soil analytical results were provided to the WDNR on August 28, 2013 with the recommendation that no further actions are necessary in this area. WDNR concurred with this recommendation in electronic correspondence dated September 11, 2013. The results of the investigation were submitted to the WDNR in a document titled *Summary of Activities Related to Polychlorinated Biphenyls, May through August 2013*, dated October 11, 2013.

4.1.3 Supplemental Building Interior PCB Investigation

The additional borings advanced to delineate the extent of PCBs and VOCs beneath the building were completed between December 30, 2013 and February 27, 2014. The results of the supplemental building interior investigation will be submitted to the WDNR under separate cover.

4.2 Off-Site Soil Analytical Results

4.2.1 PCB Investigation Activities, 237 Waubesa Street

The PCB soil sample results from the investigation at 237 Waubesa Street were below the U.S. EPA's self-implementing high occupancy cleanup level with no site restrictions of 1 mg/kg and the WDNR's non-industrial direct contact RCL of 0.22 mg/kg in all samples. There were no detections of VOCs in any of the soil samples. Based on the results of the investigation, it was recommended that no further actions are necessary related to PCBs and VOCs. Results of the investigation activities were submitted to the WDNR in a document titled *Summary of Activities Related to Polychlorinated Biphenyl Investigation, 237 Waubesa Street*, dated January 8, 2014.

4.2.2 PAH Background Study

The PAH Background Study confirmed that residential PAH concentrations from samples collected from properties adjacent to the Site are background and typical of Madison, Wisconsin. Therefore, no additional investigation or remediation is necessary. The results of this study were submitted to the WDNR in a document titled *Polynuclear Aromatic Hydrocarbons Background Study*, dated February 7, 2014. The WDNR concurred with the conclusions and recommendations of this report in the *Polynuclear Aromatic Hydrocarbon Soil Contamination Determination* letter dated March 7, 2014.

4.2.3 Soil Sampling From Monitoring Well Installation

A total of five soil samples were collected from MW-26S and MW-27. A summary of soil VOC and PAH analytical results are presented on Table 4-1, and soil laboratory analytical reports are presented in Appendix E. The locations of off-Site wells are presented on Figure 2-4.

Soil VOC analytical results were reported below laboratory detection limits. Soil PAH analytical results were reported below laboratory detection limits and below residual contaminant levels, with the exception of benzo(a)pyrene which was detected above the non-industrial direct contact RCL at 0.08 mg/kg from 2 to 4 feet bls. The non-industrial direct contact RCL for benzo(a)pyrene is 0.0148 mg/kg.

4.3 Groundwater Analytical Results

Groundwater samples were collected from bedrock boreholes for vertical aquifer profiling, monitoring wells, and multiport wells. Groundwater analytical laboratory reports are included under Appendix F. The following subsections describe the samples collected, and the nature and distribution of groundwater impacts.

4.3.1 Vertical Aquifer Profiling VOC Analytical Results

A total of 21 groundwater samples were collected from bedrock boreholes MW-25 and MW-27 and submitted for laboratory analysis of VOCs between April 8 and December 2, 2013. A summary of the groundwater VOC analytical results is included in Table 4-2. The location of boreholes MW-25 and MW-27 (converted to wells) are presented on Figure 2-4. Groundwater laboratory analytical reports are presented in Appendix F. The groundwater VOC concentrations and down-hole geophysical data were used to select screen intervals for MW-25 and MW-27.

4.3.2 Monitoring Well Groundwater Analytical Results

The current groundwater monitoring well network at the Site includes 61 sample intervals. The sample intervals are designed to collect samples from four geologic units including from shallowest to deepest: the water table; Lone Rock Formation; Wonewoc Formation; and the Eau Claire Formation.

Groundwater samples were collected for laboratory analysis of VOCs in April, July and October 2013 from the well network. Additionally, groundwater samples were collected for total and dissolved metals from wells located in the north parking lot to evaluate post-treatment concentrations in February, March, April, and July from MW-3S, MW-3D, MW-3D2, MW-3D3, MW-5S, MW-5D, MW-5D2, MW-5D3, MP-13 (seven sampling intervals), and MW-18S. Groundwater samples were also collected for total and dissolved PCBs in April, July, and October from Monitoring Wells MW-22S, MW-22D, MW-23S, and MW-23D located under the Site building. Groundwater analytical results are presented in Table 4-3, and groundwater laboratory analytical reports are presented in Appendix F.

Groundwater PCE, trichloroethene, and cis-1,2-dichloroethene isoconcentration maps were prepared for each quarterly groundwater sampling event for each of the three geologic units (Water Table, Upper Lone Rock Formation, and Upper Wonewoc

Formation). Below is a summary of the VOC groundwater analytical results and estimated extent of impacts by geologic unit.

4.3.2.1 Groundwater Analytical Results for the Water Table

Monitoring wells with screens located across the water table include MW-1, MW-2S, MW-3S, MW-7, MW-8, MW-10S, MW-11S, MW-12S, MW-18S, MW-22S, MW-23S, and MW-26S. Monitoring wells MW-4S, MW-6S, and MW-24 are screened below the water table, but were used to prepare isoconcentration maps to understand the extent of impacts at and near the water table. Groundwater analytical results for the water table are presented in Table 4-3.

- VOC concentrations were reported above Enforcement Standards (ESs) for PCE, TCE, and cis-1,2-dichloroethene. PCE was the primary VOC reported above the ES in the groundwater samples collected at MW-1, MW-3S, MW-18S, MW-22S, and MW-23S. PCE was reported below the ES in the groundwater samples collected at MW-2S, MW-4S, MW-6S, MW-7, MW-8, MW-10S, MW-11S, MW-12S, MW-24, and MW-26S.

- One or more total PCB (Aroclors 1016, Aroclor 1232, and Aroclor 1242) concentrations were detected in groundwater samples collected at Monitoring Well MW-22S. Dissolved PCBs were reported below laboratory detection limits at Monitoring Well MW-23S.

- Dissolved metal concentrations were detected above the ESs in groundwater samples collected at MW-3S for chromium. Chromium is likely naturally occurring and not attributed to a release. Additionally, total and dissolved manganese concentrations were detected above the ESs in groundwater samples collected at MW-3S and MW-18S, respectively. The manganese concentrations are attributed to the in-situ chemical oxidation (ISCO) injection completed at the MW-3 well nest.

The estimated extent of PCE, TCE, and cis-1,2-dichloroethene in groundwater from the water table wells from April, July, and October are presented on Figures 4-1 through 4-9. PCE isoconcentration cross sections for A-A' and B-B' are presented as Figures 4-10 and 4-11. The locations of the cross sections are depicted on Figure 3-1. As shown, the highest PCE concentrations are centered near the MW-3 well nest and the MP-13 sampling location in the north parking lot. Groundwater PCE, TCE, and cis-1,2-dichloroethene impacts are delineated in by the water table wells to north by Monitoring

Well MW-12S and MW-26S, to the east by Monitoring Wells MW-7, MW-8, and MW-11S, to the south by MW-6S, and to the west by Monitoring Well MW-10S.

A groundwater monitoring program is proposed in Section 6. Groundwater samples will be collected and analyzed for concentrations of VOCs from wells screened across the water table where PCE was detected above the ES, and MW-22S for total and dissolved PCBs. Additional groundwater samples will not be collected for total or dissolved metals, since the metals detected above the ES are from naturally occurring metals or attributed to the ISCO injection.

4.3.2.2 Groundwater Analytical Results for the Lone Rock Formation

Monitoring wells screened in the Lone Rock Formation include MW-2D, MW-3D, MW-3D2, MW-4S, MW-4D, MW-4D2, MW-5S, MW-5D, MW-6S, MW-6D, MW-9D, MW-9D2, MP-13 (44 to 48 feet bls; 67 to 71 feet bls; 81 to 85 feet bls), MP-14 (70 to 75 feet bls), MP-16 (80 to 84 feet bls), MW-19D, MW-20D, MW-21D, MW-22D, MW-23D, and MW-24. However, groundwater data from Monitoring Wells MW-4S, MW-6S, and MW-24 were used to illustrate the water table PCE isoconcentration maps, and are thus not used in the Lone Rock Formation isoconcentration maps. Groundwater analytical results for the Lone Rock Formation are presented in Table 4-3.

- VOC concentrations were reported above the ESs for PCE, TCE, cis-1,2-dichloroethene, and benzene in one or more well. PCE was the primary VOC reported above the ES in the groundwater samples collected at MW-2D, MW-3D, MW-3D2, MW-5S, MW-5D, MW-6D, MW-9D2, MP-13 (44 to 48 feet), MP-13 (67 to 81 feet), MP-13 (81 to 85 feet), MP-14 (70 to 75 feet), MW-19D, MW-20D, MW-21D, MW-22D, and MW-23D. Benzene was reported above the ES in the groundwater sample collected at Monitoring Well MW-6D. PCE was reported below the ES in the groundwater samples collected at MW-4D, MW-4D2. MW-9D, MP-14 (70 to 75 feet), and MP-16 (80 to 84 feet).

- One or more total PCB (Aroclor 1232 and Aroclor 1242) concentrations were detected in groundwater samples collected at Monitoring Well MW-22D. Dissolved PCBs were reported below laboratory detection limits at Monitoring Well MW-23D.

- Total metal concentrations were detected above the ESs in groundwater samples collected at MP-13 from 44 to 48 feet for iron. Iron is naturally occurring in the bedrock formation. Dissolved manganese concentrations were detected above the ESs in groundwater samples collected at MW-3D and MW-3D2. The manganese concentrations are attributed to the ISCO injection completed at the MW-3 well nest.

The estimated extent of PCE, TCE, and cis-1,2-dichloroethene in groundwater from the Lone Rock Formation from April, July, and October are presented on Figures 4-12 through 4-20. PCE isoconcentration cross sections for A-A' and B-B' are presented as Figures 4-10 and 4-11. As shown, the highest PCE concentrations are centered near Multiport Well MP-13 in the north parking lot and extends south under the building. PCE is delineated in groundwater in the Lower Lone Rock Formation to the north by low concentrations at Monitoring Well MW-9D2, to the east by Multiport Well MP-16, and to the west by Multiport Well MP-14.

A groundwater monitoring program is proposed in Section 6. Groundwater samples will be collected and analyzed for concentrations of VOCs from wells screened in the Lone Rock Formation and MW-22D for total and dissolved PCBs. Additional groundwater samples will not be collected for total or dissolved metals, since the metals detected above the ES are from naturally occurring metals or attributed to the ISCO injection.

4.3.2.3 Groundwater Analytical Results for the Wonewoc Formation

Monitoring wells screened in the Wonewoc Formation include Monitoring Wells MW-5D2, MP-13 (102 to 106; 121 to 125; 135 to 139; 163 to 167 feet bls), MP-14 (100 to 105; 135 to 140; 170 to 178 feet bls), MP-15 (88 to 92; 100 to 105; 120 to 125; 142 to 146; 177 to 187 feet bls), MP-16 (106 to 116; 140 to 144; 175 to 179 feet bls), MW-17, MW-19D2, MW-20D2, MW-21D2, MW-25D, MW-25D2, MW-27D, and MW-27D2. However, groundwater data from Monitoring Well MW-25D were used to illustrate the Lone Rock Formation isoconcentration maps, and are thus not used in the Wonewoc Formation isoconcentration maps. Groundwater analytical results for the Wonewoc Formation are presented in Table 4-3.

- PCE was the primary VOC reported above the ES at Monitoring Wells MW-5D2, Multiport Wells MP-13 (102 to 106 feet, 121 to 125 feet, 135 to 139 feet, and (163 to 167 feet), MP-15 (88 to 92 feet, 100 to 105 feet, 120 to 125 feet, 142 to 146 feet, 183 to 187 feet), MP-14 (135 to 140 feet, 170 to 178 feet), MP-15 (88 to 92 feet, 100 to 105 feet, 120 to 125 feet, 142 to 146 feet, 177 to 178 feet), MP-16 (106 to 116 feet, 140 to 144 feet, 175 to 179 feet), and Monitoring Wells MW-17, MW-19D2, MW-20D2, MW-21D2, and MW-27D2). PCE concentrations were below the

ES at Monitoring Wells MW-25D2, MW-27D, and at Multiport Well MP-14 (100 to 105 feet).

- Dissolved manganese metal concentrations were detected above the ESs in groundwater samples collected at MW-19D2 and MW-20D2. The manganese concentrations are attributed to the ISCO injection completed at the MW-3 well nest.

The estimated extent of PCE, TCE, and cis-1,2-dichloroethene in groundwater from the Wonewoc Formation from April, July, and October 2013 are presented on Figures 4-21 through 4-29. PCE isoconcentration cross sections for A-A' and B-B' are presented as Figures 4-10 and 4-11. As shown, the highest PCE concentrations are centered on Multiport Well MP-13 in the north parking lot and extend south and north. PCE is delineated in the Upper Wonewoc Formation to the east by Multiport Well MP-16 and to the west by Multiport Well MP-14.

A groundwater monitoring program is proposed in Section 6. Groundwater samples will be collected and analyzed for concentrations of VOCs from wells screened in the Wonewoc Formation. Additional groundwater samples will not be collected for total or dissolved metals, since the metals detected above the ES are from naturally occurring metals or attributed to the ISCO injection.

4.3.2.4 Groundwater Analytical Results for the Eau Claire Formation

Monitoring wells screened in the Eau Claire Formation include Monitoring Wells MW-3D3 and MW-5D3. Monitoring wells MW-3D3 and MW-5D3 serve as vertical delineation wells on Site. Groundwater analytical results for the Eau Claire Formation are presented in Table 4-3. The VOC analytical results were below ESs. Total iron and manganese metal concentrations were detected above the ESs in groundwater samples collected at MW-3D3 and MW-5D3. Dissolved iron and manganese metal concentrations were detected above the ESs in groundwater samples collected at MW-3D3 and MW-5D3. Iron is a naturally occurring metal in the bedrock formation. The manganese concentrations are attributed to the ISCO injection completed at the MW-3 well nest.

A groundwater monitoring program is proposed in Section 6. Groundwater samples will be collected and analyzed for concentrations of VOCs from wells screened in the Eau Claire Formation. Additional groundwater samples will not be collected for total or dissolved metals, since the metals detected above the ES are from naturally occurring metals or attributed to the ISCO injection.

4.4 Vapor Analytical Results

Below is summary of on-Site vapor and office indoor air analytical results.

4.4.1 On-Site Vapor Analytical Results

The four soil vapor probes located within the bike path north of the Site (VP-3 through VP-6) were to be sampled on a quarterly basis in 2013 (April, July, and October 2013). However, due to elevated groundwater levels and/or saturated soil conditions along the northern portion of the Site, only one vapor sample was collected during the quarterly events (VP-6 during the April 2013 event).

Vapor samples were collected as part of the semi-annual monitoring from 12 of the 17 on-Site vapor probes during the July 2013 event: VP-1N, VP-1S, VP-2N, VP-2S, VP-114, VP-126, VP-202, VP-210, VP-222, VP-237, VP-249, and VP-261 (Figure 2-5). As mentioned above, vapor probes located along the northern portion of the Site (VP-3 through VP-6, and VP-102) were unable to be sampled due to elevated groundwater levels.

A summary of the vapor probe analytical data is presented in Table 4-4, and vapor laboratory analytical reports are presented in Appendix H. The analytical data were compared to the calculated screening levels for deep soil gas to indoor air. Vapor probes adjacent to residences were compared to the residential screening levels, and the bike path vapor probe (VP-6) was compared to the non-residential screening levels. In general, the 2013 data are consistent with previous vapor probe data. None of the soil vapor samples collected from vapor probes adjacent to residences contained VOC concentrations above residential screening levels. Vapor Probe VP-6 did not contain concentrations of VOCs in exceedance of the non-residential screening levels. Vapor Probes VP-1N, VP-1S, VP-2N, VP-2S, VP-102, VP-114, and VP-126 are located within the influence of the SVE system.

4.4.2 Office Indoor Air Analytical Results

The analytical results of the office indoor air samples were compared to Wisconsin's non-residential indoor air action levels. The results of the crawlspace samples were compared to Wisconsin's sub-slab vapor action levels for large commercial/industrial buildings. Results of the indoor air samples were below the non-residential indoor air action levels in all five samples for the five VOCs, with the exception of indoor air Sample IA-5. Sample IA-5 contained a non-residential indoor air exceedance for TCE. This location was re-sampled on January 24, 2014 to confirm the results. The analytical results from Sample IA-5 collected on January 24, 2014 were below the non-residential indoor air action levels for the five VOCs. Results of both crawlspace samples were below the sub-slab vapor action levels for large commercial/industrial building for the five VOCs. A summary of the indoor air and crawlspace analytical results was presented in the *Summary of Office Indoor Air Sampling Activities* report dated February 24, 2014 and submitted to WDNR. Copies of the vapor laboratory analytical reports are presented in Appendix H.

5. Interim Remedial Actions

ARCADIS completed the following interim remedial actions during the reporting period:

- A SVE system was installed to replace the temporary Phase I SVE system.
- Existing SSDSs at five adjacent residences along South Marquette Street were inspected.
- Soil excavations related to PCBs were completed at six off-Site residential properties.
- Continued groundwater monitoring was conducted as related to an ISCO injection pilot study.

The following subsections provide details regarding these remediation activities.

5.1 SVE System

A SVE system was installed in May 2013 to replace the temporary Phase I SVE system. The SVE system is located in the same area as the Phase I SVE and utilizes SVE Wells SVE-1 through SVE-9 to provide capture and treatment of soil vapors.

Performance monitoring, outlined in the *Monitoring and Sampling Plan for the Phase I SVE System*, submitted to the WDNR on March 8, 2012, is conducted on a monthly basis and consists of monitoring the nine SVE extraction wells, the existing on-Site soil vapor probes within the radius of influence of the SVE system, SVE system influent and effluent sample collection, and SVE system operations.

The SVE system was operated at a total vacuum of approximately 5 inches of water and at a total extraction rate of approximately 225 standard cubic feet per minute with the make-up air closed. Influent and effluent system air samples are collected on a monthly basis. The SVE effluent data are used to calculate the total mass of each VOC constituent discharged from the system per hour and per year. The calculated values are compared to the discharge limits listed in Table A of Wis. Admin. Code NR 445 (based on stack height between 25 and 40 feet) to confirm that the discharge is in compliance with the State of Wisconsin discharge requirements.

Vacuum measurements are collected at Soil Vapor Probes VP-1N, VP-2N, VP-1S, VP-2S, VP-102, VP-114, and VP-126, which are located on the Site and are within the radius of influence of the SVE system. The purpose of the monitoring is to evaluate the effectiveness of the SVE system in preventing the potential off-Site migration of soil vapors within the vadose zone. Vacuum monitoring completed to date indicates the SVE system is effectively controlling sub-surface vapors within the vadose zone in the radius of influence.

Summaries of the SVE system operational data along with tables of routine monitoring data, influent and effluent vapor sample analytical data, and discharge compliance calculations are provided in the routine Bi-Monthly Reports and SVE Progress Reports submitted to WDNR in 2013 (refer to Appendix B). The SVE system is effectively controlling sub-surface vapors within the vadose zone and treatment of soil vapors on Site.

5.2 Vapor Mitigation

SSDSs were installed at 146, 150, 154, 162, and 166 South Marquette Street in 2011. Information regarding the SSDSs was previously presented in the SI Report dated March 2013.

ARCADIS completed inspections of the SSDSs at each of the five residences in December 2013. In addition, a maintenance plan was developed for each of these five residential homes, as required by Appendix 5 of the Wisconsin Vapor Intrusion Mitigation Guidance. The inspection documentation and maintenance plans were provided to the resident, WDNR, and the Wisconsin Department of Health Services in the *Results of Sub-Slab Depressurization System Inspection* letters dated January 24, 2014 (150, 162, and 166 South Marquette Street) and February 13, 2014 (146 and 154 South Marquette Street).

5.3 Off-Site PCB Excavation Areas

Off-Site soil excavation activities were completed in accordance with the *Addendum to the Final Revised Work Plan for Polychlorinated Biphenyl Recommended Activities* (Final Work Plan Addendum) dated December 2012. The Final Work Plan Addendum was approved by the WDNR, in conjunction with the U.S. EPA, in a letter dated March 12, 2013.

In accordance with the Final Work Plan Addendum, off-Site soils containing PCBs at concentrations above the WDNR's non-industrial direct contact residual contaminant level of 0.22 mg/kg were excavated and disposed of at Glacier Ridge Landfill in Horicon, Wisconsin. Excavation and backfill activities took place from May 20 through June 27, 2013 at six residential properties located at 233, 241, 245, 249, 253, and 257 Waubesa Street. A thin strip of landscaping (approximately 2 feet wide) where soils contained PCB concentrations above 1 mg/kg, was also excavated on Site immediately east of the fence-line adjacent to the residences.

Confirmation soil samples were collected at approximately every 5 feet along the side walls and base of the excavation areas to confirm PCB soil concentrations did not exceed applicable criteria prior to backfilling.

A summary of the excavation, confirmation, and backfill activities was presented in the *Summary of Activities Related to Polychlorinated Biphenyls, May through August 2013* report dated October 11, 2013 and submitted to WDNR and U.S. EPA.

5.4 ISCO Pilot Test

ISCO pilot test activities were completed in December 2012 per the approved *In-Situ Chemical Oxidation Groundwater Pilot Test Work Plan* (Work Plan) dated October 17, 2012.

Pilot activities were conducted to support evaluation of potential full-scale deployment of the ISCO technology to treat chlorinated VOCs in groundwater at the Site. The objectives of the pilot study were to gain information sufficient to define the conditions noted above and to support a more thorough evaluation of the injectability (e.g., achievable flow rates and necessary injection pressures) and permanence of VOC treatment using the ISCO remedial approach to enable remedial design. Supplemental post injection monitoring was completed on a monthly basis from February to April 2013. Monitoring results from the April supplemental monitoring event indicated that VOC concentration trends had stabilized and sodium permanganate solution was depleted providing limited reduction value moving forward. Final ISCO results were included in the *Discharge Monitoring Report – In-Situ Chemical Oxidation Groundwater Pilot Test* dated May 15, 2013.

5.5 Additional Activities

MKC is also completing additional Site-related activities. SSDSs will be installed in 48 homes located near the Site. This work was initiated in December 2013. The SSDSs are being installed by Acura, on behalf of MKC. Once the systems are installed, MKC will coordinate annual inspections for the next five years.

In addition, MKC will be coordinating with 25 property owners immediately adjacent to the Site for excavation of the top 1 foot of soil materials from the backyards. MKC anticipates work starting in June 2014, weather permitting.

6. Recommendations

Below is a summary of the recommendations based on the investigation and interim remedial action activities.

6.1 Soil

- On-Site
  - No additional soil investigation or remedial activities will be completed.
  - Soil exceedances will be managed through maintenance of the Site building and paved areas as an engineered barrier (cap). A Cap Maintenance Plan and Materials Handling Plan will be submitted to the WDNR under separate cover.
- Off-Site
  - No additional soil investigation activities will be completed.
  - Residual PCB-impacted soil above the industrial RCL within the rain garden will be excavated to the extent practicable to a depth of 4 feet bls and disposed at an approved landfill. This work will be conducted in accordance with the *Rain Garden Soil Removal Work Plan*, dated December 18, 2013 that was submitted to the WDNR.

6.2 Groundwater Monitoring

- No additional groundwater monitoring wells will be installed.
- The 2014 groundwater monitoring program will consist of the following:
  - Collection of quarterly groundwater elevations in April, July, and October from the entire well network consisting of 61 sample intervals.
  - Collection of quarterly groundwater samples (April, July, and October) for VOCs from Monitoring Wells MW-25D, MW-25D2, MW-27D, and MW-27D2 to evaluate groundwater quality trends from these newly installed wells.

- Collection of semi-annual (April and October) groundwater samples for VOCs from the well network (56 sampling intervals) with the exception of the following:

  - Groundwater samples will not be collected from Monitoring Wells MW-7, MW-8, MW-10S, MW-11S, or MW-12S since groundwater VOC concentrations have consistently been reported below laboratory detection limits or NR 140 ESs.

- Collection of semi-annual (April and October) groundwater samples for total and dissolved PCBs from Monitoring Wells MW-22S and MW-22D.

- Groundwater sampling will be conducted using low-flow sampling techniques. The groundwater samples will be submitted for laboratory analysis of VOCs by Method 8260B and/or PCBs by Method 8082.

6.3 Groundwater Remediation

As summarized in the October 15, 2013 *Groundwater Remedial Strategy* letter approved by WDNR in electronic correspondence dated October 16, 2013, MKC will incorporate groundwater extraction to minimize off-Site VOC migration, facilitate the removal of VOC mass and provide hydraulic influence. The basis of design will be provided to the WDNR in April 2014. With concurrence from WDNR, the design of the groundwater extraction treatment system would be completed this spring with subsequent permitting, installation and startup of the system anticipated in summer 2014.

A focused ISCO injection event will be completed in the existing shallow injection well (IW-1S) screened in the unconsolidated zone in March 2014. This task is above and beyond what was requested of the WDNR for groundwater remediation. The intent of the ISCO injection is to promote additional treatment of VOCs within the unconsolidated zone in addition to targeting the deeper bedrock groundwater through extraction as presented above.

6.4 Vapor Monitoring

The 2014 vapor monitoring program will consist of the following:

- On-Site

- Annual monitoring of the on-Site network of soil vapor probes (July 2014). Soil vapor samples will be collected from 17 Vapor Probes: VP-1N, VP-1S, VP-2N, VP-2S, VP-3, VP-4, VP-5, VP-6, VP-102, VP-114, VP-126, VP-202, VP-210, VP-222, VP-237, VP-249 and VP-261.

- Soil vapor samples will be collected from these vapor probes over an approximate 30-minute time period using 6-liter summa canisters. The vapor samples will be submitted for analysis of five VOCs by U.S. EPA Method TO-15: PCE, TCE, cis-1,2-dichloroethene, trans-1,2-dichloroethene and vinyl chloride.

• Off-Site

  - No off-Site residential vapor sampling will be completed.

6.5 SVE System

In 2014, SVE performance monitoring will continue to be conducted on a monthly basis. The SVE performance monitoring will consist of:

• Vacuum monitoring at the nine SVE Extraction Wells SVE-1 through SVE-9;

• Vacuum monitoring at the existing on-Site Soil Vapor Probes VP-1N, VP-2N, VP-1S, VP-2S, VP-102, VP-114 and VP-126, located on the Site and within the radius of influence of the SVE system;

• SVE system operation documentation including: instantaneous flow rate for each vapor extraction well, vacuum/pressure at various locations throughout the system, air temperature and the combined flow rate for the system; and

• Influent and effluent SVE system sample collection for analysis of VOCs using U.S. EPA Method TO-15.

The data will be used to optimize system operation, demonstrate capture of soil vapors via the extraction system, and calculate the total pounds of each constituent discharged from the system per hour and per year. The calculated values will be compared to the discharge limits listed in Table A of Wis. Adm. Code NR 445 to confirm that the discharge is in compliance with the State of Wisconsin discharge requirements and to determine whether continued treatment of the soil vapor stream is required.

6.6 Reporting

The following reporting will be completed and submitted to the WDNR for the Site:

- Summary of the interior building investigation activities;
- Basis of design document for the groundwater extraction system;
- Semi-annual reporting to document the SVE performance monitoring and any recommendations. (This is a modification to the current frequency of every other month.); and
- 2014 annual report will be prepared and submitted to WDNR.

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