



May 3, 2007

Mr. Alan T. Nass, P.G.
Wisconsin Department of Natural Resources
P.O. Box 10448
Green Bay WI 54307-0448



Dear Mr. Nass:

RE: Submittal of Final Report
Remedial Investigation of City of Chilton Municipal Well #5
Green Bay, Wisconsin
Contract #YIME0000011

Enclosed are two copies of the above referenced report on the investigation of the city of Chilton Municipal Well #5. This report was prepared by Foth Infrastructure & Environment, LLC, on behalf of the Wisconsin Department of Natural Resources in accordance with Contract No. YIME0000011.

Please contact the undersigned if you have any questions regarding the enclosed report.

Sincerely,

Foth Infrastructure & Environment, LLC

Philip R. Brochocki, P.G.
Lead Hydrogeologist

Janis S. Keszy, P.G.
Technical Director

Remedial Investigation of City of Chilton Municipal Well #5

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Wisconsin Department of Natural Resources
P.O. Box 10448
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Remedial Investigation of City of Chilton Municipal Well #5

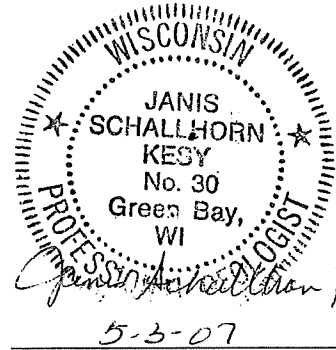
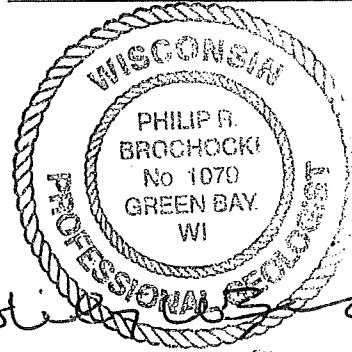
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Prepared for
Wisconsin Department of Natural Resources

Green Bay Service Center
Green Bay, Wisconsin

Prepared by
Foth Infrastructure & Environment, LLC

May 2007



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Remedial Investigation of City of Chilton Municipal Well #5

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Remedial Investigation of City of Chilton Municipal Well #5

Executive Summary

CMW-5, a high capacity drinking water well, was a part of the city of Chilton's municipal water supply system. CMW-5 was contaminated with trichloroethylene (TCE) and other contaminants of concern. The Wisconsin Department of Natural Resources (WDNR) requested Foth Infrastructure & Environment, LLC (Foth) to investigate the occurrences of these contaminants. Investigation work began in 1998 and consisted of groundwater and soil sampling at nearby locations. Locations of interest were identified by review of existing WDNR files and included the Chilton Plating Company, the adjacent Gordon Schneider property, Larsen's Cleaners, Mirro Plant #20 (Former), Chilton Coop Service Oil Co., and Western Industries Inc. (Chilton Metal Products) which are all upgradient of CMW-5.

Groundwater samples were collected from existing groundwater monitoring wells installed at Chilton Plating Company, new wells installed on the Gordon Schneider property, and at other properties surrounding CMW-5. Additional groundwater sampling included packer test screening of deep bedrock borings installed around CMW-5, including upgradient of Chilton Plating Company. Groundwater sampling indicated that elevated levels of TCE were present at Chilton Plating Company and the Gordon Schneider property. WDNR records indicated that elevated levels of TCE were also present at Larsen's Cleaners (which have yet to be defined) and at the Western Industries Inc., site (groundwater investigation is progressing).

Soil sampling was conducted by the WDNR at the Gordon Schneider property in 1995. These results along with soil sampling conducted at the Gordon Schneider property and Chilton Plating Company by Foth indicated elevated levels of TCE in the surficial soils at these sites. The presence of elevated levels of soil contamination at these locations indicate that a release of TCE had occurred.

Recommendations include additional investigation of the groundwater to define the extent of contamination.

List of Abbreviations, Acronyms, and Symbols

| | |
|---------|---|
| µg/l | micrograms per liter |
| ASTM | American Society of Testing Materials |
| CAD | computer aided drafting |
| CERCLIS | Comprehensive Environmental Response and Liability Information System |
| CPC | Chilton Plating Company |
| DCA | dichloroethane |
| DCB | dichlorobenzene |
| DCE | dichloroethylene |
| EPA | Environmental Protection Agency |
| Foth | Foth Infrastructure & Environment, LLC |
| GC | Gas chromatograph |
| gpm | gallons per minute |
| HSA | Hollow Stem Auger |
| ID | Inner diameter |
| MCL | Maximum concentration level |
| mg/L | milligrams per liter |
| MTBE | Methyl tertiary butylether |
| NGVD | National Geodetic Vertical Datum |
| NPL | National Priorities List |
| PCE | Tetrachloroethylene |
| PID | photo-ionization detector |
| SPILLS | Wisconsin Department of Natural Resources Spills List |
| SWL | Wisconsin Registry of Waste Disposal Sites |
| TCA | Trichloroethane |
| TCE | Trichloroethylene |
| VOCs | Volatile organic compounds |
| WDNR | Wisconsin Department of Natural Resources |
| WIF | Well information form |
| WLUST | Wisconsin Leaking Underground Storage Tank Site |

1 Introduction

The Wisconsin Department of Natural Resources (WDNR) retained the services of Foth Infrastructure & Environment, LLC (Foth) to conduct a site investigation of the environmental contamination in the area surrounding the city of Chilton's former municipal well number 5 (CMW-5). A site location map is provided as Figure 1-1. The investigation study area includes the area within a ¼-mile radius of former CMW-5. The location of former CMW-5 is shown on Figure 1-2.

Prior to this investigation the WDNR identified two properties within the study area that may be potential sources of groundwater contamination to CMW-5. These sites are the Chilton Plating Company (CPC) and Gordon Schneider properties. Both properties have documented groundwater contamination similar to the contamination found in former CMW-5.

CPC is located at 420 E. Main Street, and is approximately 500 feet west of former CMW-5. The Gordon Schneider property is located at 476 E. Main Street and is approximately 300 feet west of former CMW-5. These sites are adjacent to each other.

CMW-5 was permanently abandoned in April 2005.

1.1 Authorization

This investigation report has been prepared and is being submitted pursuant to the general requirements of Wisconsin Statute 292.11 which pertains to the discharge of hazardous substances. This statute is the primary basis for the assessment and remediation of releases of hazardous substances into the environment of the State of Wisconsin.

1.2 Purpose

The purpose of this report is to describe the investigation of the potential source(s) of environmental contamination of former CMW-5.

1.3 Scope

The scope of the investigation was based upon communications with the WDNR, project files on CPC and Gordon Schneider properties, historical review and site reconnaissance of the study area. As the investigation progressed the scope of the investigation was modified due to the findings of previous phases. The site investigation activities consisted of the following:

- ◆ Historical/Responsible Party Search
- ◆ Sewer Lateral Evaluation
- ◆ Phase I Hydrogeological Investigation - installation of monitoring wells
- ◆ Phase II Hydrogeological Investigation - drilling of bedrock boreholes and packer testing
- ◆ Soil Investigation

These events are discussed in detail in the following sections.

2 Project Background

2.1 Location of CMW-5

Former CMW-5 was located on East Main Street in Chilton, Wisconsin. The well was within Calumet County in the SE ¼ of the NW ¼ of the NE ¼ of Section 18, T18N, R20E. This location is shown on Figure 1-1 which is a portion of a 7.5-minute United States Geological Survey Topographic map. The study area is depicted on Figure 1-2. The study area includes a ¼-mile radius of former CMW-5.

2.2 Project Contacts

The former municipal well was owned by the city of Chilton. The owner representative is:

Mr. Todd Schwarz
City of Chilton Public Works Department
42 School Street
Chilton, WI 53014
(920) 849-2451

The responsible party for the investigation is the WDNR. The WDNR project manager is:

Mr. Alan T. Nass
Wisconsin Department of Natural Resources
P.O. Box 10448
Green Bay, WI 54307-0448
(920) 662-5161

2.3 CMW-5 Sampling Results

Historical results of groundwater samples indicated that volatile organic compounds (VOCs) were detected in CMW-5 since the early 1990's. The VOCs detected included the chlorinated compounds cis-1,2-dichloroethylene (DCE) and trichloroethylene (TCE). Subsequent monitoring indicated that 1,2-dichloroethane (DCA), dichloromethane and vinyl chloride were also present. Vinyl chloride concentrations were greater than the maximum contaminant levels (MCL) allowed in community water systems. An MCL is the highest level of a contaminant that WDNR allows in drinking water. MCLs ensure that drinking water does not pose either a short-term or long-term health risk. The MCL for vinyl chloride is 0.0002 mg/L.

2.4 Chilton Plating Company (CPC) Historical Investigation Results

In August 1991, unrelated to the findings at the municipal well, the WDNR required CPC to conduct a thorough environmental investigation at their property. CPC is approximately 500 feet west of former CMW-5. The investigation was required in response to reported spills on the property and because of results from samples collected by the WDNR during inspections in 1985 and 1987, showed that the on-site soils were contaminated with nickel, chromium and cyanide. CPC operates as a nickel, chrome, copper, zinc and tin electroplating facility. They were also a known user of TCE. Currently, and in the past they were a large quantity generator of hazardous waste (EPA ID WID006424857). Prior to April 1994, CPC generated F001 and F006 waste

types. These wastes included spent halogenated solvents (F001-TCE) used in degreasing, still bottoms from the recovery of spent solvent mixtures, and electroplating wastewater treatment sludge (F006). Since April 1994, CPC has only generated F006 wastes.

The results of CPC's investigations indicated that groundwater on the site is contaminated with TCE, chromium, and nickel. The groundwater contaminated with nickel and chromium was attributed to a source on CPC's property, however, the source of the TCE contamination was not identified. Based on CPC's investigation, the source of the TCE contaminated groundwater appeared to be coming from a neighboring property east of CPC and owned by Gordon Schneider.

2.5 Gordon Schneider Historical Investigation Summary

The Schneider property is located approximately 300 feet west of former CMW-5 and is bordered on the west by the CPC property. It is currently a vacant lot and is approximately 3/5 of an acre. In 1994, Mr. Schneider refused to allow CPC access to his property to continue the investigation of the TCE contaminated groundwater. Therefore, in June 1995, the WDNR conducted a limited investigation at the Schneider property. Both soil and groundwater samples were collected and analyzed in the field with a portable GC. The majority of the soil samples were collected at the water table interface (between 8 and 11 feet below grade). The majority of the soil at the water table interface was medium to coarse grained sand. Only five soil samples were collected from surficial soils. A sample collected at a depth of 13 inches near the northwest corner of the property along the river bank detected the targeted compounds as 1,2-DCE (99 µg/kg), TCE (48.1 µg/kg) and 1,2-DCA (1.5 µg/kg). The remaining four surficial samples did not contain the targeted VOCs.

Results of the WDNR's investigation indicated that TCE contamination was located in the groundwater and the soils at the water table interface within the south and central portion of the Schneider property indicating that the groundwater contamination extends beneath Main Street. The presence of concentrations of TCE in groundwater was documented as high as 9,700 ppb at the south edge of the site. The WDNR noted that the western perimeter of the property also contained substantial groundwater concentrations of cis-1,2-DCE and trans-1,2-DCE and vinyl chloride. Vinyl chloride, PCE, cis-1,2-DCE, and trans-1,2-DCE were also found in concentrations greater than the Wis. Admin. Code NR 140 groundwater quality standards. Soil and groundwater samples were not analyzed for metals.

Further investigations of the CPC and Schneider properties were conducted as part of this investigation of former CMW-5.

3 Regional Geology and Hydrogeology

Information on the geologic and hydrogeologic resources of Calumet County was obtained from published resources, the Calumet and Manitowoc Counties Soil Survey and well logs from the Wisconsin Geologic and Natural History Survey. A list of references is located in Section 9.

3.1 Regional Geology

The eastern two-thirds of Calumet County, including Chilton, is located in the Eastern Ridges and Lowlands physiographic province (Paull and Paull, 1977). Calumet County is underlain by Precambrian crystalline rocks, Paleozoic sedimentary rocks ranging in age from Cambrian to Silurian, Pleistocene glacial deposits and recent alluvial sediments. The Paleozoic rocks overlying Precambrian rocks slope to the east about 30 to 40 feet per mile.

Cambrian age sedimentary rocks consist of Mount Simon Sandstone, Eau Claire Sandstone, Galesville Sandstone, Franconian Sandstone and Trempealeau Formation. These formations are collectively described as Cambrian sandstones which contain varying amounts of shale, glauconite and dolomite.

The Ordovician system consists of the Prairie du Chien, St. Peter Sandstone, Platteville Formation, Decorah Formation, Galena Dolomite and Maquoketa Shale. The Prairie du Chien is a dolomite with minor limestone and oolitic chert which ranges in thickness from 0 to 140 feet due to post deposition erosion. The St. Peter Sandstone is poorly cemented sandstone with sandy shale and chert layers. The St. Peter Sandstone was deposited on an erosional surface; therefore, the thickness varies from zero to 360 feet. The Platteville Formation and Galena Dolomite are dolomites with chert, fossil fragments and shale layers which are separated by the Decorah Formation, which is a dolomitic shale. The upper unit of the Ordovician system is the Maquoketa Shale, which is a dolomitic shale.

The Silurian system consists of undifferentiated dolomites of the Cayugan, Niagaran and Alexandrian series. These dolomites contain varying amounts of fossil fragments, calcite, gypsum and limestone.

The overlying unconsolidated Pleistocene surficial deposits include morainal till deposits, stratified and unstratified clay, silt, sand, gravel and boulders, and glacio-lacustrine deposits of fine sands, silts and clays. Pleistocene deposits range in thickness from zero to 150 feet.

The majority of soils in Calumet County formed on glacial till sediments. The subsoil is generally loamy or clayey and is well to poorly drained with moderate to slow permeability.

3.2 Local Geology

The surficial soil over the majority of the investigation area was mapped as the Manawa silt loam (MbA). Generally, the soil surface layer is very dark silt loam about seven inches thick. The subsoil is about 15 inches thick. The upper part of the subsoil is brown, mottled, friable silty clay loam, and the lower part is reddish brown, mottled, firm clay. The substratum to a depth of 60 inches is reddish brown, mottled, firm silty clay.

The glacial overburden across the investigation area generally consists of sequences of fine to course grained sands interbedded with clay till. Based upon boring logs the overburden ranges in thickness between approximately 15 feet near MW-102 and approximately 45 feet near MW-104. The till has been described as the Chilton Member of the Kewaunee Formation. The Chilton Member is the surface unit in eastern Calumet County and is reddish-brown (5YR 4/4) and averages 17 percent sand, 49 percent silt, and 33 percent clay. The till is generally between three and 10 feet thick and was deposited by glacial ice of the Green Bay Lobe.

A review of the log of MW-103P on the Schneider Property indicated a layer of fill material consisting of clays and gravel about eight feet thick overlying sand, silt and gravels to a depth of approximately 24 feet where dolomite was encountered (822 National Geodetic Vertical Datum (NGVD)). A layer of clayey fill has been encountered across the site and varied in thickness between a few feet to as much as eight feet. This variation in fill materials may be a result of site development/riverbank improvement over the years. At nearby B-108, dolomite is about 158 feet thick and extends to a depth of approximately 182 feet where shale was encountered. Unconsolidated materials are similar at MW-105P near the property line shared with CPC, but extend to a depth of approximately 37 feet (811 NGVD). B-110, approximately 320 west of MW-105P, exhibits similar lithology. However, the unconsolidated materials extend to a depth of approximately 41 feet where dolomite was encountered (809 NGVD).

B-106, located approximately 580 feet east of the Schneider property, exhibits approximately four to six feet of fill material on top of about 14 feet of sand and silt covering dolomite (847 NGVD). Ground elevation at B-106 is approximately 20 feet higher than the Schneider property.

B-109, located approximately 360 feet northeast of the Schneider property, exhibited approximately seven feet of clay underlain by approximately nine feet of sand and silt. Dolomite was encountered at a depth of approximately 16 feet (830 NGVD). B-107, located approximately 470 feet southeast of the Schneider site exhibited five feet of clayey fill covering silt and sands to a depth of approximately 17 feet where dolomite bedrock was encountered (825 NGVD).

The bedrock contour maps presented in Appendix A shows that the bedrock surface primarily follows the ground contours and dips towards the southwest. The dolomite is the thickest at B-107 (172 feet) and the thinnest at B-106 (146 feet). Similarly the shale surface also dips towards the southwest. Figure 3-1 presents a geologic cross-section through the study area.

3.3 Regional Hydrogeology

Calumet County is part of the Lake Michigan Basin as defined by Skinner (1973). Within the Lake Michigan Basin three aquifers have been defined; the sand and gravel aquifer, the Niagara Aquifer and the Sandstone Aquifer.

The lower confining boundary of the Sandstone Aquifer is the Precambrian crystalline rock. The Sandstone Aquifer consists of the Cambrian Sandstones, Prairie du Chien, St. Peter Sandstone, Platteville Formation, Decorah Formation and the Galena Dolomite. The Cambrian Sandstones are the most productive unit producing up to 3,500 gal per minute (gpm) at municipal wells. No

wells are known to draw water exclusively from the Prairie du Chien which produces less than 50 gpm. The St. Peter Sandstone produces 600 gpm on average. The Platteville Formation, Decorah Formation and Galena Dolomite do not produce sufficient quantities of water for use, but are used in conjunction with the lower units of the Sandstone Aquifer when the units are deeply buried. However, they are an important portion of the aquifer where they are exposed or overlain by glacial deposits.

In areas where the Maquoketa Shale overlies the Sandstone Aquifer, it acts as the upper confining unit for the Sandstone Aquifer and the lower confining unit for the Niagara Aquifer. A few domestic wells obtain small quantities from the upper units of the Maquoketa Shale.

The Niagara Aquifer consists of the undifferentiated Silurian dolomites. This aquifer produces as much as 1,200 gpm. This is an important aquifer in areas where the Pleistocene deposits are thin and along Lake Michigan and Lake Winnebago where the Sandstone Aquifer may be saline.

The sand and gravel aquifer consists of the unconsolidated Pleistocene deposits. This aquifer is a significant source of groundwater in the basin where the Pleistocene deposits are of sufficient thickness.

Shallow groundwater moves toward nearby lakes and streams along shallow flow paths. Deeper, confined groundwater systems have a regional flow movement from the west towards Lake Michigan or to major pumping centers along long flow paths. Groundwater in the area is typically very hard.

3.4 Local Hydrogeology

Water table flow direction was predominantly east-northeast prior to the end of 2004. The December 2004 and October 2005 water level measurements indicate a more northerly flow component. This more northerly flow direction in the latter sampling rounds may be a result of diminished pumping and abandonment of CMW-5. A correlation of CMW-5 pumpage to water table contours has not been made. However, when water table gradients are compared the pre-abandonment gradients are stronger (0.013 - 0.018) than post-abandonment gradients (0.006 - 0.008). Water table maps are presented in Appendix B.

Potentiometric surface contours exhibited a northeast flow direction similar to the water table contours and during the March 2004 sampling event exhibited an easterly flow direction. Potentiometric surface gradients also decrease from between 0.02 and 0.03 pre-abandonment to 0.004 post-abandonment. Potentiometric surface contour maps are presented in Appendix B.

Vertical gradients between well nests were calculated. Persistent downward vertical gradients were observed at well nests MW-102 (0.149 - 0.004) and MW-104 (0.015 - 0.001). The weakest vertical gradients at these locations were observed after abandonment of CMW-5.

Well nest MW-103 exhibited a fairly strong downward vertical gradient (0.085) during the October 1999 round of water level measurements. The remaining rounds indicated weak upward gradients ranging between -0.007 and -0.004.

Vertical gradients were calculated between well pairs MW-4A/MW-4 and MW-4/MW-105P located near the southeast corner of the CPC site. Weak upward gradients between -0.008 and -0.004 were observed between MW-4A/MW-4 during three out of the four sampling rounds. Only the March 2004 round exhibited a downward gradient (0.010). Downward gradients ranging between 0.097 and 0.010 were observed between the deeper wells MW-4/MW-105P during three out of the four sampling rounds. Only the March 2004 round exhibited an upward gradient (-0.041).

Well nest MW-101 exhibited downward gradients (0.169 and 0.014) during the October 1999 and December 2004 sampling rounds. Upward gradients (-0.004 and -0.005) were observed during the March 2004 and October 2005 sampling rounds.

4 Elements of Investigation

4.1 Historical/Responsible Party Search

A data base search was conducted at the beginning of the project in December 1998. Federal and state data bases such as CERCLIS, NPL, SWL and SPILLS were searched for listings in the study area. CPC and Schneider properties files were also reviewed as part of the historical search. Due to the time elapse from initiation of the first phase of field work to preparation of this investigation report a second data base search was conducted in March 2006.

The following sources were reviewed to obtain information about properties that potentially may have released contaminants to the environment which may have impacted former CMW-5:

- ◆ National Priorities List (NPL) dated January 13, 2006
- ◆ Comprehensive Environmental Response and Liability Information System (CERCLIS) Superfund Listing dated January 13, 2006
- ◆ Wisconsin Hazard Ranking List (State Sites) dated September 20, 2000
- ◆ Wisconsin List of Active Leaking Underground Storage Tank Sites (WLUST) dated January 30, 2006
- ◆ Wisconsin Registry of Waste Disposal Sites (SWL) dated July 22, 2002
- ◆ Wisconsin Department of Natural Resources Spills List (SPILLS) June 30, 2006 and March 31, 2003
- ◆ Wisconsin Department of Natural Resources Other List (Other) dated January 30, 2006

The National Priority List (NPL) is EPA's list of known and confirmed Superfund sites. According to the information reviewed, there are no NPL sites within a 1-mile radius of the CMW-5.

The CERCLIS maintains information on sites nationally identified as hazardous or potentially hazardous which may require action. These sites are currently being investigated or an investigation has been completed regarding the release of hazardous substances. According to information reviewed, there are no CERCLIS sites within a 1-mile radius of CMW-5.

The Wisconsin List of Other Sites (Other) contains information pertaining to the non-LUST cleanup sites in the WDNR Emergency Repair Program sites as maintained by the Remediation

and Redevelopment Program Division. According to the information reviewed, there are six other sites listed within ½ mile of CMW-5. These sites are:

- ♦ Mirro Plant #20 (former) 44 Walnut Street,
- ♦ Schneider property 476 E. Main St,
- ♦ Chilton Plating Co Inc, 420 E Main St,
- ♦ Chilton Coop Service Oil Co, 428 Clay St,
- ♦ Larsens Cleaners 317 E. Main St,
- ♦ Mauna Products Corp South of East Main.

The WDNR spills (SPILLS) database is a listing of all spills as maintained by the Remediation and Redevelopment Program Division. According to the information reviewed there are nine SPILLS sites listed within ½-mile of CMW-5. These SPILLS sites are:

- ♦ NW CNR of Blding 44 Walnut, open
- ♦ Mirro Corp Plt20 44 Walnut, closed
- ♦ Quality Painters Inc 442 Clay St, open
- ♦ Thermal Clean Inc 476 Clay St, closed
- ♦ Miron Const 476 clay St, closed
- ♦ 208 E. Grand (historic spill), 428 Clay St, open
- ♦ Chilton Coop Service Oil Co 428 Clay St, open
- ♦ Chilton Plating Co Inc 420 E. Main St, closed
- ♦ CTH Y@ Irish Rd(Historic Spill) CTH Y at Irish Rd, open
- ♦ Manitowoc River - 220 E. Grand St, open
- ♦ Chilton Metal Products 300 E. Breed St, closed
- ♦ John Whitcomb 300 E. Breed St, closed
- ♦ Lunda Const 300 E. Breed St, closed
- ♦ Swift Trucking/Donald J Watts 300 E. Breed St, closed
- ♦ Superior Special Services 42 School St, closed
- ♦ 1126 E. Chestnut (historic spill), open
- ♦ 45 E. Chestnut (historic spill), open
- ♦ Kwik Trip 45 E. Chestnut, closed

There were 21 Spill sites listed as unmappable.

The Wisconsin Hazardous Ranking List (State Sites) contains information pertaining to facilities which are deemed potentially hazardous to public health and welfare by the WDNR. According to the information reviewed there are no State Sites listed within ½- mile of CMW-5.

The Wisconsin Registry of Waste Disposal (SWL) Sites is a comprehensive listing of all solid waste disposal sites located within the state of Wisconsin. According to the information reviewed there are no SWL sites within ½ mile of CMW-5. However, there were eight sites listed as unmappable. Among the unmappable sites were Chilton Metal Products, Chilton Canning Co., and city of Chilton.

Search information is presented in Appendix C.

4.2 Sewer Lateral Evaluation

Based on previous studies of the area, sewer lines in the vicinity of CPC and Gordon Schneider property were considered potential sources of contamination. This task included identifying the locations of the sewer lines in that vicinity, obtaining access agreements to perform the televising from the city of Chilton and retaining a televising contractor to conduct the sewer televising. Great Lakes TV & Seal conducted the sewer televising on May 19, 1999.

Great Lakes TV & Seal televised the 21-inch sanitary sewer from MH#56B, upstream to MH#56C. A civil technician from Foth and a WDNR representative were on site to observe the televising.

The lateral to the Schneider property did not have any flow (the city indicated the lateral was abandoned in 1988) and did not appear to have any indication that there was any flow out of it recently. The lateral to CPC had substantial flow entering the main and it was decided not to televise it since it would have to be plugged at the sample manhole outside of the plant to provide access for televising. Observations were discussed with the WDNR representative who indicated it was not necessary to televise any of the laterals off the 21-inch line. The televising observation report and a map of the sewer lines in the area are contained in Appendix D.

The pipe joints were observed to be in good condition and pipes were not found to have any defects or cracks.

4.3 Phase I Hydrogeological Investigation

4.3.1 Installation of Monitoring Wells

Nine monitoring wells (four water table observation wells and five piezometers) were installed in September 1999 as part of the Phase I Hydrogeological Investigation. These wells were installed to assess the vertical and horizontal extent of groundwater contamination around CMW-5 and assess the properties of the localized bedrock aquifer. The location of the monitoring wells is shown on Figure 1-2.

The drilling method used for the water table observation wells MW-102, MW-103, and MW-104 was 4.25-in inner diameter (ID) hollow stem augers (HSA). A combination of drilling methods (6.25-in ID HSA and air rotary method with a 5/8-in tricone bit) was used to drill MW-101. These methods were necessary due to rather shallow depth to bedrock at MW-101 (18 feet) and deeper depth to groundwater (approximately 39 feet).

All piezometers (MW-101P, MW-102P, MW-103P, MW-104P and MW-105P) were installed to intercept the upper one third of CMW-5 open interval at an elevation of about 657 NGVD. Piezometers MW-101P, MW-102P, and MW-104P were installed using 6.25-in ID HSA and air rotary methods.

Based on the nature of the lithology of the unconsolidated layer of the study area and the potential to transmit groundwater contamination to bedrock at locations that have or are suspected of having groundwater contamination MW-103P and MW-105P were drilled using a combination of mud and air rotary methods. MW-103P and MW-105P were installed to

intercept the upper one third of CMW-5 open interval. A 6.25-in diameter bentonite mud rotary method was used to drill these boreholes to the top of bedrock. A 6-in diameter steel casing with a bottom plug was extended through the borehole to the top of bedrock. A tremie pipe was used to deliver cement grout to fill the space between the casing and borehole from the bottom of the borehole to a distance above the top of the water column. The grout was allowed to set for at least 12 hours prior to continuing the borehole through the casing to the planned depth using air rotary method with a 5 $\frac{7}{8}$ -in tricone bit.

All soil cuttings and drilling fluids were placed into 55-gal drums and temporarily stored at a city of Chilton facility until disposal arrangements were made. Disposal of these materials is discussed in Section 6.

All wells were surveyed for horizontal control and elevation tied into a USGS benchmark.

Corresponding well construction forms and a well information form (WIF) are presented in Appendix E.

Table 1 presents monitoring well construction information.

4.3.2 Soil Sampling

A split-spoon sampler was driven ahead of the hollow stem augers to collect a minimally disturbed soil sample. The split spoon sampler was driven with a 140-pound hammer on a 30-inch free fall. This method of sample collection provides standard penetration resistance measurements (ASTM 1586) which gives an estimation of soil strength and compaction. Soil samples were collected continuously from the ground surface to the planned total depth. This frequency of sample collection permits review of subsurface lithology and vertical correlation of soil horizons.

Soils were screened for the presence of petroleum-related (VOCs) with a photo-ionization detector (PID). The soil samples were screened following the field jar headspace method described in Attachment 2 of Wisconsin Administrative Code, ILHR 10. All readings were recorded on the corresponding soil boring logs. Boring logs were prepared which describe the soils according to the Unified Soil Classification System. Corresponding soil boring logs are presented in Appendix E.

Up to two soil samples per boring were submitted for laboratory analysis. The intent of this data was the evaluation of the vertical extent of soil contaminated with VOCs within the boring. If soils exhibit obvious contamination, one sample from the interval which has the highest PID instrument reading was submitted for analysis as was a sample from an interval believed to be free of contamination. If soil contamination extended to the water table, the soil sample interval with the highest PID instrument reading of all sections sampled from an individual borehole was selected for analysis. The second sample for laboratory analysis was collected at the soil-groundwater interface. If soil contamination was not believed to be present, based on field observations, only one sample collected, from the soil-groundwater interface, was submitted for analysis. Analytical protocols and analytical results are presented in Section 5.

4.3.3 Monitoring Well Development

The wells were developed in accordance with Wis. Admin. Code NR141.21 and the water containerized and sampled for disposal. The wells were developed a minimum of 12 hours after completion. The wells were surged and purged for a minimum of 30 minutes. The surge and purge cycle consisted of several minutes of surging followed by several minutes of purging with a purge pump to remove material collected at the bottom of the well. Water was pumped from the well until ten well volumes have been removed or clear water was produced. Well development information is presented in Appendix E.

Information on disposal of well development water is presented in Section 6.

4.3.4 Groundwater Sample Collection and Analysis

Four rounds of groundwater samples were collected from the monitoring wells installed within the study area. Additional wells previously installed at the CPC site were also sampled. Concurrent "raw water" samples were collected from CMW-5 for comparison purposes. Groundwater sample collection procedures followed WDNR's *Groundwater Sampling Field Manual* PUBL-DG-038 96. All VOC samples and samples collected from CMW-5 were not filtered.

The monitoring wells that were included in this investigation are listed in Table 2. Monitoring well locations are shown on Figure 1-2. Vertical distribution of corresponding well screen openings are contained in Appendix F.

The laboratory parameters analyzed as part of the investigation were:

- ◆ VOC
- ◆ Chromium
- ◆ Nickel
- ◆ Zinc

The results of groundwater sampling are summarized on the groundwater data summary table, Table 3.

4.4 Phase II Hydrogeological Investigation

4.4.1 Round 1 Packer Testing - Drilling

In April 2000, three six-inch diameter borings (B-107, B-108, and B-109) were drilled into the Niagara dolomite in order to collect discrete groundwater samples from given intervals in an attempt to identify zones of groundwater contamination. Bedrock borings B-107, B-108, and B-109 are shown on Figure 1-2. B-108, located on the Schneider Property, was drilled to a depth of 183 feet where it encountered the top of the Maquoketa Shale (664 NGVD). B-107 and B-109 were drilled to depths of 76 feet and 82 feet, respectively. Steel casing was installed in each borehole and terminated near the top of competent bedrock prior to advancing the borehole to the planned depth. Cement grout was applied to the exterior of the casing by tremie pipe (beginning at the bottom of the borehole) and allowed to set a minimum of 12 hours in order to seal the

casing. Drilling continued through the casing to the planned depth using air rotary method with a 5 $\frac{7}{8}$ -in tricone bit.

All soil cuttings were placed into 55-gal drums and temporarily stored at a city of Chilton facility until disposal arrangements were made. All purge water was containerized and disposed of at the city of Chilton Wastewater Treatment Plant. Disposal of these materials is discussed in Section 6.

Each drill site was pre-surveyed for surface elevation so that groundwater samples could be collected at corresponding elevations. The corresponding boring logs are presented in Appendix E.

4.4.2 Round 1 Packer Testing - Groundwater Sampling

In June 2000, water quality sampling was completed with dual packers that were placed down the borehole and inflated to isolate the targeted bearing zones. (Packer information is presented in Appendix G.) Groundwater samples were collected a minimum of four hours after completion of the borehole.

Sampling began at the bottom of the borehole and worked up towards the surface. Three samples were collected from B-107 and B-109. These intervals ranged between 776 NGVD and 832 NGVD. Six samples were collected from B-108. These intervals ranged between 664 NGVD and 804 NGVD. Samples were collected at vertical intervals of approximately 20 to 30 feet apart. Only two intervals corresponded to all three borings. These intervals were 776 NGVD and 804 NGVD. Packer test sample intervals are presented in Appendix H. Variation on the number and elevation sampled was dependant on borehole depth and elevation of shale.

Samples were collected after purging a minimum of 50 gallons from the packer opening. Unfiltered samples were obtained from the end of the hose connected to the purge pump and analyzed for VOCs.

The boreholes were fitted with locking caps at the completion of sampling.

4.4.3 Round 2 Packer Testing - Drilling

In December 2004, B-107 and B-109 were deepened to the top of Maquoketa Shale. Two additional borings, B-106 and B-110, were also drilled to the top of the Maquoketa Shale. Table 4 shows the depth to shale and corresponding elevation.

B-106 was located on Kaytee Products property east of well nest MW-101. B-110 was located on a different Kaytee Products property west and upgradient of CPC. These boring locations are shown on Figure 1-2.

All soil cuttings were placed into roll-off dumpsters and temporarily stored at a city of Chilton facility until disposal arrangements were made. All purge water was disposed of at the city of Chilton Wastewater Treatment Plant. Disposal of these materials is discussed in Section 6.

The corresponding boring logs are presented in Appendix E.

4.4.4 Round 2 Packer Testing - Groundwater Sampling

In January 2005, water quality sampling was completed at B-110 and B-106 with dual packers that were placed down the borehole and inflated to isolate the targeted water bearing zones.

Sampling began at the bottom of the borehole and worked up towards the surface. Six samples were collected from both B-110 and B-106 at vertical intervals of approximately 20 to 40 feet apart. Sample intervals ranged between 660 NGVD and 832 NGVD. Three sample intervals corresponded to the two borings. These intervals were 720 NGVD, 748 NGVD, and 776 NGVD. Packer Test sample intervals are presented in Appendix H.

Samples were collected after purging a minimum of 50 gallons from the packer opening. Unfiltered samples were obtained from the end of the hose connected to the purge pump and analyzed for VOCs.

4.4.5 Round 3 Packer Testing - Groundwater Sampling

In October 2005, water quality sampling was completed at all five test borings with dual packers that were placed down the borehole and inflated to isolate the targeted water bearing zones.

Sampling began at the bottom of the borehole and worked up towards the surface. Five to six discrete samples were collected from each of the five boreholes depending upon depth. Sample intervals ranged between 654.5 NGVD and 832 NGVD. Three intervals overlapped at 702 NGVD, 748 NGVD, and 776 NGVD. Packer Test sample intervals are presented in Appendix H.

Samples were collected after purging a minimum of 50 gallons from the packer opening. Unfiltered samples were obtained from the end of the sample hose connected to the purge pump and analyzed for VOCs.

Sample results are presented on Table 7. Laboratory reports are presented in Appendix I.

4.5 Soil Investigation

For the purposes of this project the soil investigation included soil samples collected from borings associated with monitoring well installation and geoprobes.

The purpose of these borings was to collect soil samples from the given locations for VOCs, chromium, nickel, and zinc. The locations were selected in order to:

- ♦ verify present conditions at selected past sampling areas on both the Schneider and CPC sites
- ♦ collect near surface samples to evaluate potential surface releases of VOCs or metals or both

- ♦ collect samples from the water table interface in order to evaluate the potential for groundwater contamination

Eleven soil samples were collected from the soil borings associated with monitoring well installation in September 1999. Twenty-six soil samples were collected from the geoprobes advanced in October 1999. Samples were collected from native soils and not from surface gravel or gravel sub-base beneath asphalt or concrete pavement. Soil logs and geoprobe hole abandonment forms are presented in Appendix E.

1999 sample locations as well as the locations of samples collected from the Schneider Property by the WDNR in 1995 are shown on Figure 4-1.

Soil sampling results are discussed in Section 5.

5 Results of Investigation

The results section of this report presents laboratory data on the groundwater samples collected from the monitoring wells and bedrock borings within the study area. Also presented is laboratory data on the soil samples collected during the soil investigation.

MW-103 located on the Schneider property was damaged sometime after the first round of sampling in October 1999. Samples could not be obtained from this well during the remaining rounds.

5.1 Monitoring Well Sampling - VOC Results

Four rounds of samples were collected from the monitoring wells within the study area. These were collected in October 1999, March 2004, December 2004, and October 2005. Seventeen VOCs were detected. Table 5 presents the compounds ranked by total number of detects.

These detects can be grouped together by potential genesis.

- ♦ MTBE, 1,2-dichloroethane, toluene, xylenes, and sec-butylbenzene are related to gasoline. 1,2-Dichloroethane is added to leaded gasoline to remove the lead. It is also used as a solvent, dry cleaning agent, and a pesticide with carbon tetrachloride.
- ♦ Tetrachloroethylene (syn. perchloroethylene, PCE) trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), trans-1,2-dichloroethylene, 1,1-dichloroethylene, and vinyl chloride are related to vapor degreasing and metal cleaning operations as well as dry cleaning operations.
- ♦ Bromodichloromethane, bromoform, dibromochloromethane, and chloroform are associated with drinking water system disinfection.
- ♦ Methylene chloride and chloroform are breakdown products of carbon tetrachloride but are also common laboratory solvents. Methylene chloride is also commonly used to strip paint and furniture.
- ♦ Chlorobenzene can be used as a solvent for paints and for degreasing automobile parts but it is also a by-product of the anaerobic degradation of 1,4-dichlorobenzene a common pesticide.

The results of groundwater sampling are summarized on the groundwater data summary table, Table 3.

5.1.1 Horizontal Distribution of VOCs in Groundwater

In order to evaluate the extent and magnitude of VOC concentrations, Foth prepared iso-concentration maps. Since CMW-5 was abandoned between sampling intervals the iso-concentration maps were prepared using the results of the October 1999 and October 2005 rounds of groundwater sampling. Parameter concentrations are shown for both upper and lower

monitoring wells. These graphical representations of the data are provided in Appendix J. Figure 1-2 shows the monitoring well locations.

Field blanks associated with the March 2004 and October 2005 monitoring well sampling events exhibited low level detects of methylene chloride. These concentrations were 1.91 µg/l and 0.753 µg/l respectively. Methylene chloride was not detected in the groundwater samples collected during the corresponding sampling rounds. The field blank associated with the December 2004 monitoring well sampling event exhibited a chloroform detect at a concentration of 0.768 µg/l. MW-102, similar to the field blank, exhibited a concentration of 0.761 µg/l during the sampling event. It is likely that these detects of methylene chloride and chloroform are a result of laboratory contamination.

5.1.1.1 Water Table Monitoring Zone

The water table wells that were sampled as part of this investigation were MW-2, MW-3, MW-4A (CPC site), MW-103 (Schneider site), MW-104 (Alliance site), MW-102 (city of Chilton site), and MW-101 (Wingers site).

Total VOC iso-concentration maps were prepared for both the October 1999 and 2005 groundwater sampling rounds. Sample concentrations at MW-3 located near the northeast corner of the CPC site indicated elevated levels of VOCs. Other locations with significant levels of VOCs are MW-2 and MW-4A (CPC site) and MW-103 (Schneider property). Total VOC concentrations on the CPC site ranged between 460 µg/l and 96 µg/l (1999) and between 759 µg/l and 76 µg/l (2005). The total VOC concentration at MW-103 during the 1999 round was 225 µg/l. Concentrations in the remaining wells ranged between “non-detect” and 2.5 µg/l (1999) and between 0.69 µg/l and 5.11 µg/l (2005).

Iso-concentration maps were plotted for PCE, TCE, cis-1,2-DCE, and MTBE to evaluate the locations of the top four compounds with the largest number of detects.

The PCE iso-concentration maps indicate detects exceeding the PAL (0.5 µg/l) in the wells at the CPC site in 1999 and 2005. The largest concentrations (37.1 µg/l and 15 µg/l) were located at MW-4A. According to the 1999 iso-concentration map PCE was also present on the Schneider site in MW-103 at a concentration of 8.94 µg/l. No other monitoring wells exhibited detects of PCE.

The 1999 TCE iso-concentration map indicates detects exceeding the PAL (0.5 µg/l) in the wells at the CPC, Schneider and Wingers sites. A “hotspot” was located at MW-103 at a concentration of 101 µg/l. The 2005 iso-concentration map shows a “hotspot” centered around MW-2 and MW-3 on the CPC site with concentrations of 172 µg/l and 181 µg/l, respectively. Concentrations during 2005 could not be evaluated at MW-103 because the well was damaged. The 2005 iso-concentration map reflects no data for MW-103. MW-101 on the Wingers site has not detected TCE since the initial 1999 round.

A cis-1,2-DCE (PAL 7 µg/l) “hotspot” was present at MW-3 as shown on both the 1999 and 2005 iso-concentration maps. Concentrations ranged between 296 µg/l (1999) and 495 µg/l (2005). Lower detects of cis-1,2-DCE were also present at MW-2, MW-4A, and MW-103.

MTBE (PAL 12 µg/l) was detected at MW-4A, MW-103, and MW-104. Concentrations were persistent but below the PAL during the sampling rounds except for the 2005 round where MW-4A exhibited a concentration of 23.3 µg/l.

5.1.1.2 Piezometric Monitoring Zone

The piezometers that were sampled as part of this investigation were MW-4 (CPC site), MW-105P and MW-103P (Schneider site), MW-104P (Alliance site), MW-102P (city of Chilton site), and MW-101P (Wingers site). MW-4 was constructed by others and has a bottom elevation of about 813 NGVD. The piezometers installed for this investigation (MW-101P, MW-102P, MW-103P, MW-104P and MW-105P) were constructed to intercept the upper third of the aquifer as defined by the difference between the bottom of CMW-5's casing and the bottom of CMW-5. The piezometers were constructed in bedrock with a five foot well screen. The bottom elevation of the piezometers is around 775 NGVD. Appendix F presents the vertical distribution of monitoring wells and piezometers sampled during this investigation.

Piezometers were not installed adjacent to water table wells MW-2 and MW-3 on the CPC site, therefore, vertical changes in concentrations at these locations could not be evaluated.

Similar to the water table wells, total VOC iso-concentration maps were prepared for both the October 1999 and 2005 groundwater sampling rounds. The highest concentrations of total VOCs were located at MW-4 near the southeast corner of the CPC site. Total VOC concentrations were 8.2 µg/l and 3.9 µg/l at this location for the 1999 and 2005 sampling events, respectively. Low level VOCs were detected in the remaining piezometers including MW-101P at the Wingers site. In 2005, in addition to MW-4, low levels of VOCs were also detected in MW-104P and MW-103P.

The PCE iso-concentration maps indicate detects exceeding the PAL (0.5 µg/l) in MW-4 at the CPC site. Persistent concentrations ranged between 2.51 µg/l and 1.56 µg/l in the 1999 and 2005 sampling events. The only other detect of PCE was at MW-103P (0.356 µg/l) during the 1999 sampling event.

The 1999 TCE iso-concentration map indicates detects exceeding the PAL (0.5 µg/l) in the piezometers sampled during the investigation. Concentrations ranged between 0.456 µg/l (MW-104P) and 2.13 µg/l (MW-102P). MW-4 exhibited persistent TCE concentrations ranging between 0.61 µg/l (December, 2004) and 2.04 µg/l (October, 1999). The remaining piezometers did not detect TCE since 1999.

The 1999 cis-1,2-DCE (PAL 7 µg/l) iso-concentration map indicates minor detects located at MW-4, MW-105P and MW-103P. Concentrations ranged between 0.809 µg/l (MW-103P) and 2.69 µg/l (MW-105P). The second sampling round (March, 2004) exhibited cis-1,2-DCE detects at MW-4 (1.76 µg/l) and MW-103P (0.45 µg/l). Cis-1,2-DCE was not detected since March 2004.

MTBE was not detected in the piezometers at concentrations above the PAL (12 µg/l). In 1999 MW-104P and MW-4 exhibited detects of MTBE at concentrations of 3.76 µg/l and 1.9 µg/l

respectively. The 2005 iso-concentration map indicates low level MTBE detects at MW-104P, MW-103P, and MW-4 at concentrations ranging between 3.82 µg/l and 0.967 µg/l, respectively.

5.2 Monitoring Well Sampling - Zinc, Chromium and Nickel Results

Zinc, chromium, and nickel were included in the analytical protocols for the groundwater samples collected from the monitoring wells in the study area. Table 6 presents the number of detects and PAL exceedances observed.

Iso-concentration maps were prepared for the October 1999 and 2005 groundwater sampling rounds and are presented in Appendix I.

5.2.1 Nickel

Elevated Nickel concentrations were detected in monitoring wells MW-2 and MW-3. The ES (100 µg/l) was exceeded at MW-2 during all four sampling rounds. The PAL (20 µg/l) was exceeded at MW-3 during all four sampling rounds. Concentrations at MW-2 exceeded the ES and ranged between 310 µg/l and 213 µg/l. These concentrations appear to be decreasing. Nickel concentrations at MW-3 ranged between 68 µg/l and 26.4 µg/l and also appear to be decreasing. Nickel detects did not exceed the PAL in the remaining wells.

5.2.2 Chromium

Chromium concentrations exceeded the PAL (10 µg/l) in MW-2 during all sampling rounds except the March 2004 sampling round. Concentrations ranged between non-detect and 67.6 µg/l. MW-3 exhibited PAL exceedances during the December 2004 (13.2 µg/l) and October 2005 (16.2 µg/l) sampling rounds. Chromium detects did not exceed the PAL in the remaining wells.

5.2.3 Zinc

Zinc concentrations detected in the monitoring wells were generally low and did not exceed the 2,500 µg/l PAL. Concentration patterns also did not align with those exhibited for nickel and chromium given that zinc hotspots were not observed at MW-2 and MW-3. The majority of the detects (14) exhibited concentrations less than 6 µg/l. MW-4, MW-101P, and MW-104P exhibited four concentrations that were greater than 6 µg/l and less than 38 µg/l. Table 3 is a summary of the results.

5.3 Packer Sampling Results

Three rounds of discrete groundwater samples were collected from the four bedrock boreholes drilled during the investigation. Samples were collected from B-107, B-108, and B-109 in June 2000 (Round 1). After B-106 and B-110 were drilled to shale and B-107 and B-109 were extended to shale, samples were collected from B-106 and B-110 during January 2005 (Round 2). Samples were collected from all boreholes in October 2005 (Round 3). Bedrock borehole locations are shown on Figure 1-2. The results of Packer Test sampling are shown on Table 7.

Eleven VOCs were detected. Table 8 presents the compounds ranked by total number of PAL exceedances and then by the total number of detects.

A total of 52 samples were collected. Gasoline associated compounds (1,2-dichloroethane, toluene, MTBE, xylenes, and ethylbenzene) account for just over half the total detects and toluene alone accounts for just over a third of the total detects. PCE, TCE, cis-1,2-DCE, toluene, and MTBE have been detected during all three rounds. 1,4-Dichlorobenzene and ethylbenzene were only detected in the first round and 1,1,1-trichloroethylene was only detected in the second round.

Note: 1,4-Dichlorobenzene is used to make mothballs, deodorant blocks used in restrooms, and in animal holding facilities to control odors. It also has applications in fumigants, insecticides, lacquers, paints, and seed disinfection products.

5.3.1 Horizontal Distribution of VOC

Table 9 presents a summary of VOC detects by sampling event.

The following observations can be made on the horizontal distribution of VOC:

- ◆ B-110, the bedrock boring upgradient of CPC and west of CMW-5, exhibited persistent detects of cis-1,2-DCE, PCE, toluene, and TCE.
- ◆ B-108, located on the Schneider property and west of CMW-5, exhibited persistent detects of MTBE, PCE, and toluene. The total number of detects was significantly reduced from 35 in Round 1 to 10 in Round 3. 1,2-DCA, 1,4-DCB, cis-1,2-DCE, methylene chloride, and TCE were all detected in Round 1 but not in Round 3.
- ◆ B-107, located on city of Chilton property southeast of the Schneider property and southwest of CMW-5, exhibited persistent detects of toluene. 1,4-DCB, PCE, and TCE were detected in Round 1 but were not detected in Round 3.
- ◆ B-109, located in a farm field north of CMW-5, exhibited persistent detects of toluene. Ethylbenzene, methylene chloride, PCE, and xylenes were detected in Round 1 but not in Round 3. 1,2-DCA, cis-1,2-DCE, MTBE, and TCE were all detected in Round 3 but not in Round 1.
- ◆ B-106, located on Kaytee Products property east of CMW-5, exhibited persistent detects of toluene. MTBE and TCE were detected in Round 2 but were not present in Round 3.

Table 7 presents the groundwater sampling results. Also presented in Appendix J are graphical representations of the sampling intervals with detects and concentrations by sampling event.

5.3.2 Vertical Distribution of VOC

Round 1 - June 2000

B-107, B-108, and B-109 were sampled during this round. Only B-108 extended to the top of the Maquoketa shale. Detects at the shale contact included PCE, toluene, MTBE, cis-1,2-DCE, and 1,4-dichlorobenzene. Two packer intervals overlapped the three borings. These were 804 and 776 NGVD. Toluene was the common VOC detected in all borings at all intervals. PCE was detected in all three boreholes and, along with MTBE and cis-1,2-DCE, was found in all of B-108's six intervals. PCE was detected at 804 NGVD in B-107 and at 832 NGVD in B-109. TCE was not found below 720 NGVD at B-108. 1,4-Dichlorobenzene was detected in 804 NGVD and 776 NGVD at B-107 but not at 824 NGVD and not in B-109.

Total VOC concentrations in B-107 are highest (9 µg/l) at 804 NGVD and lowest (5.3 µg/l) at 776 NGVD and generally decrease with depth. Total VOC concentrations in B-109 are highest (6.6 µg/l) at 832 NGVD and lowest (2.7 µg/l) at 804 NGVD and also generally decrease with depth. Total VOC concentrations in B-108 are highest in two zones (16.8 µg/l and 15.9 µg/l) at 720 and 692 NGVD and lowest in two zones (10.9 µg/l and 12.3 µg/l) at 748 and 664 NGVD (shale interval).

Round 2 - January 2005

B-110 and B-106 were sampled during this round. During this event B-107 and B-109 were extended to the top of the Maquoketa shale but were not sampled. Detects at the shale interval at B-110 (660 NGVD) were toluene and 1,1,1-TCA. Detects at the shale interval at B-106 (702 NGVD) were TCE, toluene and MTBE. Three packer intervals overlapped the two borings sampled. These were 776, 748, and 720 NGVD. Toluene was detected in all samples except in the sample collected from B-110 at 776 NGVD. The graph of toluene concentrations for Round 2 presented in Appendix K, indicates concentrations increasing with depth at B-110 and decreasing with depth at B-106. TCE was detected in B-110 at 794 NGVD and in B-106 at 776, 748, 720, and 702 NGVD (shale). TCE concentrations increase with depth at B-106. PCE was detected in B-110 at intervals 776 and 720 NGVD but was not detected in B-106. MTBE was detected in B-106 at 720 and 702 NGVD but not in B-110.

In general total VOC concentrations were similar at B-110 in the shallow and two lower packer intervals. These intervals are 794, 692, and 660 (shale) NGVD. Total VOC concentrations in these intervals were 4 µg/l, 3.6 µg/l, and 3.3 µg/l, respectively. Concentrations were reduced in the three intervals between 776 and 720 NGVD. The corresponding concentrations were 0.6 µg/l, 0.5 µg/l, and 1.2 µg/l.

Round 3 - October 2005

All bedrock borings were sampled during this round. Detects were present at the shale interval in all of the borings. B-110 and B-109 exhibited TCE; B-108 exhibited PCE and MTBE; B-107, B-109, and B-106 exhibited toluene; and B-109 exhibited detects of cis-1,2-DCE and 1,2-DCA all at the shale interval. Three packer intervals overlapped the borings. These were 776, 748, and 702 NGVD. Toluene was detected in all intervals at B-109 and B-106 and in all intervals at B-107 except 794 NGVD. B-110 and B-108 only detected toluene at 702 NGVD. Toluene was the only compound detected at B-106. MTBE was detected in the intervals between 794 NGVD

and the shale interval at B-108 and two middle intervals (776 and 748 NGVD) at B-109. Cis-1,2-DCE was detected in the middle intervals (776 and 748 NGVD) and at the shale interval at B-109 and in the shallow interval (798 NGVD) just below the steel casing at B-110. TCE was detected at B-110 in all intervals except 776 NGVD. TCE was also detected between 748 NGVD and the shale interval at B-109. PCE was detected in the upper two intervals at B-110. B-108 also detected PCE in the upper interval below the steel casing and at the bottom two intervals.

Toluene concentrations increased with depth at B-107 and decreased with depth at B-106. Toluene concentrations increase in the middle intervals at B-109. TCE increased with depth at B-109 and B-110. PCE concentrations appear to decrease with depth at B-110. MTBE concentrations increase with depth at B-108 and, similar to toluene, increase in the middle intervals at B-109. MTBE concentrations decrease with depth at B-110.

Total VOC concentrations provide more obvious trends as B-107, B-108, and B-109 all have increasing concentrations with depth. B-110 and B-106 exhibit decreasing concentrations with depth.

Total VOC Concentration Comparison Between Sampling Rounds

- B-110 A comparison of peak concentration intervals indicates that total VOC concentrations have decreased between Round 2 and Round 3 whereas the middle interval concentrations have stayed similar. Concentration reductions at the peak intervals may be a result of rebound from discontinued use of CMW-5.
- B-109 Three deeper sampling intervals were added to B-109 in Round 3. Concentrations in the upper three packer zones have decreased since Round 1. Round 3 exhibited increasing concentrations with depth whereas Round 1 exhibited decreasing concentrations with depth.
- B-108 Concentrations have been reduced between Round 1 and Round 3. The concentration pattern in the middle zones 776 and 778 NGVD are similar between rounds whereas the deeper intervals including the shale interval indicated an increasing trend with depth in Round 3 versus an decreasing trend with depth in Round 1. This concentration “reversal” in the lower intervals shaped the overall trend of increasing concentrations with depth in Round 3.
- B-107 Three deeper intervals were added to B-107 during Round 2 but were not sampled until Round 3. Concentrations have decreased between Round 1 and Round 3. Round 1 exhibited a decrease in concentration with depth however by Round 3 this trend was reversed.
- B-106 Concentrations have decreased between Round 2 and Round 3. Round 2 exhibited an overall increase in concentration with depth. However, Round 3 exhibited single detects of toluene with low variation (stable) concentrations ranging between 1.1 µg/l and 0.4 µg/l.

5.4 CMW-5 Sampling Results

Four rounds of raw water samples were collected by Foth during the investigation between October 1999 and December 2004. Additional raw water results were also obtained from the WDNR's Drinking Water System Web Page and added to our review. This additional data set ranges between February 1999 and April 2004. There were 26 sampling events evaluated.

5.4.1 VOC Detects

Eight compounds were detected in samples collected from CMW-5. Table 10 presents these compounds ranked by the number of detects.

TCE concentrations ranged between 6.8 µg/l and non-detect. The Wis. Admin. Code NR 809 MCL level for TCE is 5 µg/l and was exceeded eight times. The maximum concentrations generally occurred between 2001 and 2003 given that six out of the eight exceedances occurred between this period. Total concentrations overall appeared to be decreasing slightly and may have a seasonal component.

Cis-1,2-DCE exhibited a concentration of 347 µg/l during the August 2003 sampling event. It is possible that this concentration is an outlier given that the average concentration without this data point is 0.5 µg/l. Cis-1,2-DCE concentrations ranged between 1.5 µg/l and non-detect without the August 2003 data point. The Wis. Admin. Code NR809 MCL for cis-1,2-DCE is 70 µg/l. Total concentrations overall appeared to be stable to decreasing slightly.

1,2-DCA concentrations ranged between 0.62 µg/l and non-detect. Wis. Admin. Code NR 809 MCL for 1,2-DCA is 5 µg/l. Total concentrations overall appeared to be stable.

MTBE was detected four times in the samples collected by Foth. MTBE concentrations were not reported on the WDNR's website. Concentrations ranged between 3.79 µg/l and 0.76 µg/l and appear to be increasing. An MCL has not been established for MTBE.

Methylene chloride concentrations were detected in June 2000 and July 2002. The June 2000 sample result (0.748 µg/l) was flagged as a laboratory contaminant. It is uncertain if the July 2002 concentration (0.38 µg/l) was flagged as no such data qualifier is present on the WDNR's web page. The MCL for methylene chloride is 5 µg/l.

Vinyl chloride was detected in February and April 1999 at concentrations of 0.18 µg/l and 0.26 µg/l, respectively. The MCL for vinyl chloride is 0.2 µg/l. This compound has not been detected since.

1,4-Dichlorobenzene was detected in the June 2000 round at a concentration of 0.219 µg/l and has not been detected since. The MCL is 75 µg/l. This compound is not listed on the WDNR's web page as an analyte.

PCE was detected only once since 1999. The detect of 0.16 µg/l occurred during the April 2004 round. The MCL for PCE is 5 µg/l.

VOC concentrations are summarized on Table 11.

VOC detects shared by both the monitoring wells and CMW-5 are: TCE, cis-1,2-DCE, 1,2-DCA, MTBE, methylene chloride, vinyl chloride, and PCE. CMW-5 samples and the packer samples share similar detects as those shared by CMW-5 and the monitoring wells except that vinyl chloride was not detected in the packer samples. Additionally, 1,4-dichlorobenzene was found in both the packer tests and CMW-5 during the June 2000 round.

5.4.2 Metals

Three rounds of samples were collected from CMW-5 and analyzed for chromium, nickel, and zinc to evaluate potential impacts. Chromium concentrations ranged between 3.1 µg/l and non-detect. Nickel concentrations ranged between 5.6 µg/l and non-detect. Zinc ranged between 24.2 µg/l and 27.4 µg/l. Chromium and nickel have an MCL of 100 µg/l. An MCL for zinc has not been established.

5.5 Soil Sample Results

Eleven soil samples were collected from the soil borings associated with monitoring well installation in September 1999. Twenty-six soil samples were collected from the geoprobes advanced in October 1999. Samples were collected from native soils and not from surface gravel or gravel sub-base beneath asphalt or concrete pavement. Samples were analyzed for VOCs, chromium, nickel, and zinc.

1999 sample locations as well as the locations of samples collected from the Schneider Property by the WDNR in 1995 are shown on Figure 4-1.

5.5.1 Surficial Soil Sample Results

Surficial soil samples were generally collected from the upper two feet of soil profile. Significant concentrations of TCE were detected at GP-8 (7,763 µg/kg), GP-10 (1,314 µg/kg) and GP-7 (162 µg/kg) located on the CPC site. Appendix J presents an iso-concentration map showing the horizontal distribution of the TCE detects. PCE was detected also at GP-10 at a concentration of 58 µg/kg. Other compounds detected at GP-7 and GP-8 were cis-1,2-DCE, trans-1,2-DCE, and 2,2-dichloropropane.

Table 12 presents a summary of VOC detects.

Chromium concentrations in the soil ranged between 5.52 mg/kg at GP-2 and 235 mg/kg at GP-8. Locations where soil concentrations were greater than 20 mg/kg are GP-7 (27.2 mg/kg), GP-14 (27.6 mg/kg), GP-10 (40.1 mg/kg), and GP-11 (40.4 mg/kg).

Nickel concentrations in the soil ranged from 5.18 mg/kg at MW-105P and 289 mg/kg at GP-8. Locations where soil concentrations were greater than 20 mg/kg are GP-11 (21.6 mg/kg), MW-103 (25.9 mg/kg), GP-14 (35.7 mg/kg), GP-7 (45.2 mg/kg), GP-10 (98.6 mg/kg), and GP-9 (126 mg/kg).

Zinc concentrations in the soil ranged between 17.9 mg/kg at GP-2 and 1,641 mg/kg at MW-103. Locations where zinc concentrations were greater than 40 mg/kg were GP-9 (47.3 mg/kg), GP-7

(66.4 mg/kg), GP-10 (73 mg/kg), MW-105P (95.3 mg/kg), GP-11 (157 mg/kg), GP-14 (181 mg/kg), GP-8 (213 mg/kg), and MW-103 (1,641 mg/kg).

Appendix L presents iso-concentration maps showing the horizontal distribution of these metals. Table 12 presents a summary of metal concentrations.

5.5.2 Groundwater Interface Soil Sample Results

Groundwater interface samples were generally collected from depths ranging between six and ten feet below ground surface. Samples were collected at this zone to provide an indication of potential impacts to groundwater at the given location. Soil samples collected at the groundwater interface exhibited not only an increase in the number of TCE detects but also an increase in concentration as compared to those collected from surficial soils. Significant concentrations of TCE were detected at GP-8 (56,318 µg/kg), GP-4 (7,908 µg/kg), GP-13 (3,641 µg/kg), and GP-10 (1,536 µg/kg). Appendix L presents an iso-concentration map showing the horizontal distribution of TCE at the groundwater interface. PCE was detected at GP-5 (737 µg/kg) and GP-6(134 µg/kg). GP-13, GP-10, and MW-103P exhibited concentrations of cis-1,2-DCE, and 2,2-dichloropropane. In addition to these compounds trans-1,2-DCE was detected at GP-10 and hexachlorobutadiene was detected at GP-13.

Petroleum-related compounds 1,2,4-trimethylbenzene, n-propylbenzene, n-butylbenzene, and sec-butylbenzene were detected at GP-117 in the Main St. right-of-way south of the CPC site.

Table 12 presents a summary of VOC detects.

6 Investigative Waste Management

Soil cuttings and purge water were generated during the installation of the monitoring wells and bedrock borings.

Soil cuttings generated during the installation of the monitoring well and bedrock borings B-107, B-108, and B-109 and purge water were containerized in 55 gal drums and temporarily stored on city of Chilton property until shipping/disposal arrangements were made. By May 6, 2002, 36 drums were transported and disposed of at Veolia Hickory Meadows Landfill in the town of Chilton, Wisconsin.

Soil cuttings generated during the deepening of B-107 and B-109 and drilling of B-106 and B-110 were stored in a roll-off dumpster on city of Chilton property until disposal arrangements were made. On February 17, 2005 approximately 12 tons of cuttings were disposed of at Veolia Hickory Meadows Landfill in the town of Chilton, Wisconsin.

Soil cutting disposal information is presented in Appendix M.

All purge water generated during the installation of monitoring wells and bedrock borings were disposed of at the Chilton Wastewater Treatment Plant.

7 Conclusions

Conclusions drawn from the results of the investigation are presented below. The conclusions are first organized by CMW-5 VOC detects, media and subsequently by geography in an attempt to correlate the presence of a VOC at a given location with those detected in CMW-5. Table 10 presents a ranking of VOC detects in CMW-5.

Since February 1999 raw water samples were collected from CMW-5 by the city of Chilton and published on the WDNR Drinking Water System web page. Persistent compounds detected include TCE, cis-1,2-dichloroethylene and 1,2-dichloroethane. Other compounds detected were methylene chloride, PCE, and vinyl chloride. Compounds that were detected in the samples collected by Foth but not reported on the WDNR web page were 1,4-dichlorobenzene and MTBE.

Trends for TCE, cis-1,2-dichloroethylene, and 1,2-dichloroethane concentrations presented on Table 11 were stable. Given the low number of detects, trends for MTBE, vinyl chloride, methylene chloride, 1,4-dichlorobenzene, and PCE could not be computed.

7.1 CMW-5 Detects

Trichloroethylene (TCE)

TCE has been detected in CMW-5 25 out of 26 sampling events documented in this report and has exceeded the MCL eight times. The MCL for this compound is 0.005 mg/L. TCE has been detected at the CPC site in surficial soils and at the water table interface and at the water table interface on the Schneider property. TCE has been detected consistently in the groundwater at the CPC site. TCE was detected on the Schneider site and all monitoring well locations during the 1999 groundwater sampling event but not in subsequent events.

Four rounds of groundwater samples were collected from the 13 monitoring wells across the investigation area. TCE exhibited the greatest number of detects and PAL exceedances. TCE was detected in the monitoring wells at all locations during the 1999 round. The highest concentration 101 µg/l was located at MW-103 a water table well located on the Schneider site. The next highest detects 46.2 µg/l and 40.4 µg/l were located in water table wells MW-3 and MW-4A on the CPC site. These concentrations are significantly reduced compared to those detected in September 1994 (down from 122 µg/l and 660 µg/l respectively) by CPC. It should be noted that MW-101 the water table well furthest away from the CPC and Schneider sites exhibited a 0.59 µg/l detect of TCE in the 1999 round but was not detected in subsequent rounds.

Subsequent rounds indicated an increase in TCE concentrations at water table wells MW-2 and MW-3 on the CPC site. MW-4A and MW-4 (piezometer) concentrations indicated a decreasing trend. MW-103 was damaged to the extent that samples could not be collected during the subsequent rounds. MW-103 should be repaired or replaced and incorporated into any future long term monitoring of the site.

TCE was not detected in the remaining wells during the subsequent rounds. Changes in water elevations due to seasonality may influence the concentrations in those wells that exhibit persistent detects of TCE. Additional sampling at regular intervals may bear this out.

In 1995 the WDNR collected groundwater samples from the Schneider property. TCE was detected at concentrations ranging from 3.9 µg/l (GS-11) to 9,700 µg/l (GS-14). The highest concentrations of TCE in the groundwater were generally located at the southwest portion of the property.

The 1999 TCE concentrations in piezometers indicate a sharp decrease in concentration with depth at well nest MW-4A/MW-4/MW-105P. This condition is similar at well nest MW-103/MW-103P on the Schneider site and is indicative of a local source. However the remaining well nests MW-101/MW-101P, MW-102/MW-102P, and MW-104/MW-104P exhibited an increase in concentration with depth. All piezometers except MW-4 did not exhibit detects of TCE in subsequent sampling rounds. Although MW-103 was damaged after the 1999 sampling event and given the 1999 detect of 101 µg/l, it is likely that concentrations were present at the water table after 1999.

TCE was detected in the groundwater at B-107 on the city of Chilton property and B-108 on the Schneider property during the 2000 packer sampling event. It was also detected at B-110 and B-106 (Kaytee Products sites) during the January 2005 event and B-109 and again at B-110 during the October 2005 event after CMW-5 was abandoned.

TCE was detected in all five bedrock borings. The location with the highest concentration of TCE was at B-106 at intervals 720 NGVD - 9.11 µg/l and 702 NGVD (shale contact) - 3.26 µg/l during the second round (January 2005). The occurrence of TCE at B-106 may be due to pumping effects of CMW-5 relocating contamination from the potential sources to the west or north or potentially due to some as yet unidentified source to the east. The latter scenario is possible due to a transitory flow reversal from the regional flow pattern of west-east to east-west near B-106 during pumping. TCE was not detected at B-106 during the last round of sampling in October 2005 presumably when the aquifer had been stabilized after CMW-5 was abandoned.

TCE was detected in B-108 on the Schneider Property during the first round of samples but not in the third round of samples. Similarly TCE was detected in only one sample interval at B-107 (804 NGVD) during the first sampling round at a concentration of 0.379 µg/l and not detected in the third sampling round.

B-109 TCE concentrations were non-detect in the upper three sampling intervals during the first and third sampling rounds but was detected in the bottom three intervals including the shale contact with concentrations exceeding the PAL during the third sampling event. These bottom three sample concentrations were increasing with depth. B-110 located upgradient of the CPC site and downgradient of the Mirro Plant and Larsens Cleaners sites exhibited TCE concentrations exceeding the PAL in the upper interval (794 NGVD) during the second round (single detect) and four out of five intervals during the third sampling round.

Cis-1,2-Dichloroethylene

Cis-1,2-DCE has been detected in CMW-5 23 times and exceeded the MCL one time. The MCL for this compound is 0.07 mg/L. Cis-1,2-DCE is a degradation by-product of PCE and TCE. Cis-1,2-DCE has been detected at the CPC site in surficial soils and at the water table interface and at the water table interface on the Schneider property. It has been detected in groundwater at the CPC and Schneider sites.

Cis-1,2-DCE has exhibited increasing trends in concentration in the water table wells on the CPC site. The highest concentrations of cis-1,2-DCE were present at MW-3. These concentrations exceeded the ES of 70 µg/l and ranged between 296 µg/l and 495 µg/l. The 1999 detect at MW-103 was 93.7 µg/l. The increasing trends observed may partially be a result of the degradation of PCE and TCE. The 1995 groundwater samples collected by the WDNR indicated cis-1,2-DCE concentrations ranging between non-detect and 1,500 µg/l (GS-2). The highest concentrations of cis-1,2-DCE in the groundwater were generally located at the northwest portion of the property.

Groundwater samples collected from B-108 (Schneider site) during the 2000 packer sampling event and from B-110 (Kaytee product site) during the January and October 2005 packer sampling event and B-109 (Schmahl site) during the October 2005 sampling event exhibited cis-1,2-DCE.

1,2-Dichloroethane

1,2-Dichloroethane was detected in CMW-5 21 times but has not exceeded the MCL. The MCL for this compound is 0.05 mg/L. 1,2-DCA has been detected at MW-4 on the CPC site and MW-103P on the Schneider site during the October 1999 sampling round at concentrations of 0.199 µg/l and 0.198 µg/l, respectively and in MW-4A on the CPC site at a concentration of 0.583 µg/l during the October 2005 round. Packer samples collected from B-108 on the Schneider property at elevations 748 NGVD, 776 NGVD, and 804 NGVD exhibited detects of 1,2-DCA at 0.17 µg/l, 0.195, and 0.154 µg/l during the June 2000 sampling event. An additional detect of 1,2-dichloroethane was present in the sample collected from B-109 on the Schmahl property from elevation 686.5 NGVD at a concentration of 3.24 µg/l. Based upon the pattern of detects it appears that 1,2-DCA has been persistent in the groundwater monitoring wells within the investigation area and has not been detected in the soil samples collected during the investigation. This compound may be a component of a mixture of chemicals released into the groundwater. Future detection patterns may change now that CMW-5 has been abandoned and groundwater conditions likely have "normalized". Any plans for additional groundwater monitoring should consider the installation of monitoring wells upgradient of well nest MW-4 and B-109.

Methyl tert-butyl ether (MTBE)

MTBE was detected in the four CMW-5 samples collected by Foth. WDNR's web page has not posted MTBE detects for CMW-5. MTBE, a gasoline additive, was not detected in soil samples collected during the investigation. It was consistently detected in groundwater at the water table wells and piezometers located on the CPC, Schneider, and the Alliance Milk Products sites.

Concentrations appear to be increasing at water table well MW-4A on the CPC site. MTBE was detected at B-108 in 1999, at B-106 in January 2005, and B-108 and B-109 during the October 2005. MTBE source areas would include leaking underground storage tank sites. Given that MTBE concentrations are increasing at MW-4A and the latest concentration was above the PAL it is appropriate to investigate the extent of MTBE groundwater contamination upgradient of MW-4A.

MTBE has been detected 20 times in monitoring wells with only one PAL exceedance. MTBE is an oxygenate added to gasoline to improve combustion and reduce air pollution. It has been intensively used in reformulated gasoline during the last 10 years. Its relatively high mobility and persistence has allowed it to travel rapidly through unsaturated soils to the water table. Toluene and xylenes, also typical components of gasoline, have been detected two times each with no PAL exceedances. These compounds are unrelated to chlorinated solvents and are likely associated with a release of motor fuels.

MTBE was detected at MW-4A, MW-4, MW-103, MW-104 and MW-104P during the 1999 round. MW-4A, MW-4, MW-103P, MW-104, MW-104P have all exhibited persistent detects of MTBE since the March 2004 round. The highest concentration of MTBE was at MW-4A at a concentration of 23.3 µg/l during the 2005 sampling event. This concentration exceeds the PAL and appears to be a part of an increasing trend in concentration. MTBE concentrations are higher in the water table wells compared to the piezometers. The 1995 groundwater samples collected by the WDNR indicated MTBE was detected in the groundwater at a concentration of 2.6 µg/l (GS-14B). The source or sources of MTBE contamination appear to be upgradient of MW-4A and MW-104.

MTBE was detected at B-108 in all six packer test intervals during Rounds 1 and 3. (B-108 was not sampled during Round 2.) MTBE concentration comparisons at B-108 indicate an overall reduction except within the zone between 710 and 670 NGVD. The concentrations within this zone remained similar - about 11 µg/l. This condition may be an indication of higher permeability between 710 and 670 NGVD.

Methylene Chloride

Methylene chloride was detected in samples collected from CMW-5 during the June 2000 and July 2002 sampling rounds. The June 2000 sample was collected by Foth. Previously mentioned methylene chloride and chloroform are breakdown products of Carbon tetrachloride but are also common laboratory solvents. Methylene chloride is also commonly used to strip paint and furniture. The June 2000 sample result (0.748 µg/l) was flagged as a laboratory contaminant therefore this detect should be considered suspect and not a result of site conditions.

Methylene chloride was not detected in surface soils collected for analysis during the investigation. However, transitory detects of methylene chloride occurred at B-108 and B-109 during the first Packer testing event in June 2000 and the first round of groundwater samples collected from monitoring wells MW-4A, MW-103P, and MW-102P in October 1999. The methylene chloride detects exhibited in the June 2000 packer samples were all flagged as a result of laboratory contamination.

Given the majority of detects were a result of laboratory contamination it would seem appropriate to not consider methylene chloride as a compound of interest at this time.

Vinyl Chloride

Vinyl chloride was detected in CMW-5 during the February and April 1999 sampling rounds. The April 1999 concentration exceeded the MCL. The MCL for this compound is 0.0002 µg/l. Vinyl chloride is a breakdown product of TCE. Vinyl chloride was not detected in surface soils collected for analysis during the investigation, but was detected in monitoring wells five times during sampling events. Detects were observed at MW-2, MW-3 and MW-103 during the 1999 round. Vinyl chloride was detected during the March 2004 round and October 2005 round at MW-3. The highest concentrations of vinyl chloride were observed at MW-3. These concentrations exceeded the ES of 0.2 µg/l and ranged between 7.34 µg/l and 26.4 µg/l. MW-3 exhibited a decreasing trend in vinyl chloride.

The 1995 groundwater samples collected by the WDNR indicated vinyl chloride concentrations ranging between non-detect and 75 µg/l (GS-10). The highest concentrations of vinyl chloride in the groundwater were generally located at the northwest portion of the property.

1,4-Dichlorobenzene

1,4-Dichlorobenzene was detected below the MCL in a CMW-5 sample collected by Foth during the June 2000 sampling event. The MCL for this compound is 0.075 mg/L. This compound was not published on the WDNR Drinking Water System web page. 1,4-Dichlorobenzene has been detected in B-108 in five out of six samples and in B-107 in two out of three samples collected during the June 2000 packer sampling event. The concentrations were detected below the PAL and ranged between 0.201 µg/l and 0.27 µg/l. 1,4-Dichlorobenzene is used as an insecticidal fumigant against clothes moths (moth balls) and as a deodorant for garbage and restrooms among other uses. Chlorobenzene, a breakdown product of 1,4-dichlorobenzene, was detected in MW-102P in the October 1999 groundwater sampling round. These compounds have not been detected since. Groundwater contamination sources have not been identified at this time.

Tetrachloroethylene (PCE)

PCE was detected in CMW-5 during the April 2004 sampling round. This detect was below the MCL (0.005 mg/L). PCE was detected in the wells on the CPC site, MW-103 and MW-103P during the 1999 round. MW-4A exhibited the highest concentrations. The concentrations exceeded the ES of 5 µg/l and ranged between 37.1 µg/l and 11.8 µg/l at MW-4A. The 1999 concentration in MW-103 was 8.94 µg/l. Similar to TCE the PCE concentrations decreased with depth at well nests MW-4A/MW-4/MW-105P and MW-103/MW-103P. PCE concentrations generally decreased over subsequent monitoring events at the CPC site. MW-105P and the remaining wells did not detect PCE. The 1995 groundwater samples collected by the WDNR indicated PCE concentrations ranging between non-detect and 260 µg/l. The highest concentrations of PCE in the groundwater were generally located at the southwest portion of the property.

PCE was detected in all borings except B-106. The majority of detects (6) occurred at B-108 during the first round - three of which exceeded the PAL. Samples collected from B-108 during the third round exhibited three detects of PCE all of which exceeded the PAL. PCE was detected in one sample collected from B-107 during the first round. This concentration was below the PAL. No samples collected from B-107 exhibited PCE concentrations in the third sampling round. B-109 exhibited a detect of PCE in the upper sample during the first sampling round. The corresponding concentration was below the PAL. PCE was not detected in B-109 during the third sampling event. B-110 exhibited detects of PCE in two samples collected from the second sampling round and two samples collected from the third round. The two detects during the second round and one detect during the third round exhibited PAL exceedances.

It is recommended that additional investigation activities be addressed to evaluate the extent of TCE and PCE exceedances near B-109 and B-110 in the bedrock aquifer. Any future plans to evaluate the extent of TCE contamination of the aquifer should include wells upgradient of B-110 and additional sampling of B-106 to confirm the presence of groundwater contamination at this location. Water table concentrations should also be evaluated north of the CPC site.

Additional piezometers should be installed to confirm groundwater flow direction in the deeper monitoring zones. Components of the investigation should include an evaluation of zones of preferential flow within the bedrock aquifer and a groundwater monitoring plan to track the changes in VOC concentrations in the area.

7.2 Other VOCs in Groundwater

Toluene and xylenes were not detected in the monitoring wells until the 2005 sampling event. Low levels of toluene were detected in water table wells MW-101 and MW-102 and low levels of xylenes were detected in MW-4A and MW-102. Their presence in the groundwater may be a result of CMW-5 no longer being pumped. The toluene and xylenes detects are very low and do not appear to be a concern.

Toluene was detected in groundwater samples collected from all five bedrock borings at concentrations less than 8 µg/l (PAL is 200 µg/l). Toluene concentrations were variable with depth and overall concentrations were reduced in Round 3 (October 2005). By contrast toluene was first detected in the monitoring wells during the October 2005 round. Water table wells MW-101 and MW-102 detected very low concentrations (0.689 µg/l and 0.331 µg/l, respectively). A B-106 packer sample was collected from an interval that overlapped the nearby MW-101P screen opening during the October 2005 round. This sample detected toluene whereas the sample collected from MW-101P did not. Nevertheless the presence of toluene in the bedrock groundwater interval likely indicates a petroleum or toluene source at some distance. Bedrock groundwater contamination appears to be affected by CMW-5 pumping given the overall reduction of toluene concentrations in the Round 3 packer samples collected after CMW-5 was abandoned.

Bromodichloromethane, bromoform, dibromochloromethane, and chloroform are associated with drinking water system disinfection. These compounds were detected at MW-102 which is located near CMW-5. It is likely that these detects reflect CMW-5 disinfection activities.

Trans-1,2-dichlorobenzene was detected in MW-2, MW-3 and MW-4A for a total of 10 detects and four PAL exceedances. A single detect of 1,1-Dichloroethylene at MW-3 exceeded the PAL during the March 2004 sampling round. These compounds were not detected in the samples collected from the bedrock borings and are breakdown products of PCE and TCE.

1,1,1-Trichloroethane was detected at B-110 during the January 2005 sampling round. It was detected at the top of the Maquoketa shale at a depth of approximately 190 feet (660 NGVD). The sample exhibited a concentration of 2.62 µg/l (PAL 40 µg/l). This detect as well as the TCE detects exhibited during the October 2005 samples indicates the presence of a source(s) of these compounds upgradient (west) of B-110.

7.3 Groundwater Metals Analysis

Groundwater samples were analyzed for chromium, nickel and zinc. CMW-5 was sampled for these metals during the October 1999, March 2004, and December 2004 monitoring events. Concentrations were low - well below their respective MCLs. MW-2 and MW-3, located on the CPC site exhibited the highest concentrations of chromium and nickel. Chromium concentrations ranged between non-detect and 67.6 µg/l at MW-2 and non-detect and 16.2 µg/l at MW-3. The PAL for chromium is 10 µg/l and the ES is 100 µg/l. These concentrations are significantly reduced compared to those detected in June 1994 (down from 3.2 mg/L and 1.1 mg/L respectively) by CPC. Chromium concentrations in the remaining wells were either non-detect or below the PAL.

The highest nickel concentrations were also found at MW-2 and MW-3. These concentrations ranged between 213 µg/l and 310 µg/l at MW-2 and 26.4 µg/l and 68 µg/l at MW-3. The PAL for nickel is 20 µg/l and the ES is 100 µg/l. These concentrations are significantly reduced compared to those detected in June 1994 (down from 834 µg/l and 106 µg/l respectively) by CPC. Nickel concentrations in the remaining wells were either non-detect or below the PAL. Chromium and nickel concentrations at MW-2 and MW-3 have been persistent and consistently above the PAL. The extent of chromium and nickel concentrations has not been demonstrated.

Zinc concentrations have been consistently below the PAL (2,500 µg/l) and do not appear to be a concern.

A combination of additional groundwater investigation and potential "hotspot" removal of soils in the area of MW-2 and MW-3 is recommended given the persistent detects of chromium and nickel at concentrations above PAL at MW-2 and MW-3.

7.4 Soil Analyses

TCE and other VOCs were detected in surface soils at both the Schneider and CPC sites. Three surficial soil samples were collected from the Schneider site as part of this investigation and five surface samples were collected by the WDNR in 1994 and analyzed for VOC. Results indicated that only one surficial soil sample, collected by the WDNR, near the northwest corner of the property along the river bank detected TCE at a concentration of 48.1 µg/kg (GS-18).

TCE was detected in surficial soils at three locations on the CPC site. The surficial sample collected beneath the driveway near the west side of the site exhibited the largest concentration

of TCE at 7,763 µg/kg (GP-8). GP-7 collected beneath the driveway and south of GP-8 exhibited a concentration of 162 µg/kg. A sample collected near the northeast corner of the CPC site exhibited a concentration of 1,314 µg/kg (GP-10).

Surficial soil samples were also analyzed for chromium, nickel, and zinc. Elevated chromium soil concentrations were located on the north side of the CPC site at GP-14 (27.6 mg/kg), GP-10 (40.1 mg/kg) and GP-11 (40.4 mg/kg) and beneath the driveway near the west side of the site - GP-7 (27.2 mg/kg). Elevated nickel-soil concentrations were located on the north side of the CPC site at GP-9 (126 mg/kg), GP-14 (35.7 mg/kg), GP-10 (98.6 mg/kg), and GP-11 (21.6 mg/kg). Elevated nickel concentrations were also detected near the west side of the CPC site beneath the driveway at GP-7 (45.2 mg/kg) and on the Schneider property at MW-103 (25.9 mg/kg). Elevated zinc concentrations were detected on the CPC and Schneider sites. The north side of the CPC site exhibited elevated zinc-soil concentrations at GP-9 (47.3 mg/kg), GP-10 (73 mg/kg), GP-11 (157 mg/kg) and GP-14 (181 mg/kg). The west side of the CPC site beneath the driveway also exhibited elevated zinc-soil concentrations at GP-8 (213 mg/kg) and GP-7 (66.4 mg/kg). The Schneider site exhibited elevated zinc-soil concentrations at MW-105P (95.3 mg/kg) and MW-103 (1,641 mg/kg).

At this point in the investigation the majority of the impacted surficial soils appear to be located on the CPC site. The extent of VOC contamination in the surficial soils does not appear to have been adequately investigated around GP-8 and GP-10 on the CPC site. The extent of metals contamination also should be investigated on the north side and beneath the driveway on the CPC site as well as the Schneider site around MW-105P and MW-103.

Soil samples were also collected at the water table interface to evaluate potential soil impacts at the water table. Soil contamination at the water table is also an indicator of impacts to groundwater. TCE was detected on the north side of the CPC site at GP-10 (1,536 µg/kg), on the west side beneath the driveway at GP-8 (56,318 µg/kg) and GP-13 (3,641 µg/kg) and on the south side of the site at GP-12 (705 µg/kg), GP-6 (286 µg/kg), GP-5 (755 µg/kg) and GP-4 (7,908 µg/kg). Impacts on the Schneider site were detected at GP-1 (29 µg/kg) and MW-103 (92 µg/kg). Impacts on the Schneider site were also detected in 1995 during a limited field investigation by the WDNR. The highest concentrations in 1995 were detected around the southwest corner of the site at GS-13 (441 µg/kg) and GS-14 (617 µg/kg). Since surficial soil samples were not collected at GS-13 and GS-14 additional surface sampling should be conducted to evaluate whether the impacts at GS-13, GS-14 and adjacent samples were a result of a surface release or off-site migration from the CPC site.

VOCs associated with motor fuels were detected at the water table interface at GP-117 across Main Street south of the CPC site. This may be a result of residual impacts from a nearby release of motor fuels. The compounds detected were n-propylbenzene (301 µg/kg), n-butylbenzene (225 µg/kg), 1,2,4-trimethylbenzene (223 µg/kg), and sec-butylbenzene (304 µg/kg). Benzene and toluene were detected in 1994 in soil samples collected near the northwest corner of the Schneider site. These concentrations were around 1 µg/kg and were collected at depths between 11 and 15 feet below grade.

Chromium, nickel and zinc soil concentrations at the water table interface exhibit markedly lower concentrations compared to surface concentrations but do not appear to be significant.

7.5 Potential Sources

Potential sources of CMW-5 solvent contamination were evaluated. Part of this evaluation included a review of federal and state databases such as CERCLIS, NPL, SWL and SPILLS. Additionally, the WDNR FACT System was also reviewed for information on hazardous waste generators in the area.

Western Industries Inc. (Chilton Metal Products), located at 300 E. Breed Street is currently classified as a small quantity generator of hazardous waste. This location is approximately 2,600 feet northwest and upgradient of CMW-5. 1,1,1-Trichloroethane and PCE wastes have been disposed of off-site in the past. According to EPA's Toxic Release Report Chilton Metal Products also shipped nearly 45,000 pounds of toluene between 1990 and 1993. There is also an active leaking underground storage tank site at this facility that is currently in the investigation phase. Free petroleum product exists at the site. 2006 Chilton Metal Products contamination investigation groundwater data, provided by the WDNR, indicated that water table groundwater flow direction is towards the south and bedrock groundwater flow direction is southeast towards CMW-5. According to the WDNR TCE has been detected in the groundwater both on and off-site. On-site TCE concentrations during 2005 were as high as 15,000 µg/l. Groundwater parameters detected in water table wells and piezometers located south of the Breed Street location included TCE and 1,2-DCE. The highest concentration of TCE was found in a bedrock well at a concentration of 46 µg/l (June 2006). The highest concentration of 1,2-DCE was found in a bedrock well at a concentration of 16 µg/l (March 2002). Given these detects in the bedrock wells, Chilton Metal Products should, at this time, be considered a potential source contributing to the concentrations exhibited in CMW-5.

Larsen's Cleaners is a closed dry cleaner located at 317 E. Main St. Larsen's Cleaners is approximately 1,300 feet west (upgradient) of CMW-5. A release of PCE was reported to the WDNR in 1999 (WDNR ID# 02-08-221491). According to WDNR records, soil samples contained as much as 17,000 µg/kg of PCE and as much as 2,900 µg/kg of TCE. Groundwater samples exhibited up to 530 µg/l of PCE and up to 180 µg/l of TCE. It is our understanding that the investigation of this contamination began in March 2007, but as of report time, no results have been received by the WDNR. Given the presence of TCE groundwater contamination at the site it is possible for concentrations to reach downgradient locations such as B-110. Additional investigation is necessary to evaluate extent of groundwater impacts to the area.

Mirro Plant #20 (Former) is a closed manufacturing facility located at 44 Walnut Street. This facility is approximately 1,300 feet west (upgradient) of CMW-5. It was listed as a small quantity generator of hazardous waste in the past. Spent halogenated solvents and PCE have been disposed of off-site in the past. This site is currently under investigation (WDNR ID# 02-08-520157) for the release of chlorinated and non-chlorinated solvents, chromium, and PAHs (polynuclear aromatic hydrocarbons). An investigation work plan had been approved by the WDNR in January 2006. B-110 is located upgradient of the CPC site but downgradient of known sources of solvent contamination (the former Mirro Plant #20 and Larsen's cleaners). Based upon this information, it is possible that these sources have contributed to the groundwater contamination detected at B-110. Additional information obtained from groundwater investigations at these locations may further substantiate this conclusion.

CPC, located at 420 E Main Street, is an active large quantity generator of hazardous waste. According to the current WDNR's FACT System, CPC has not generated solvent waste. The site has been under investigation since 1981 for a release of chlorinated solvents (WDNR ID #02-08-000040). This facility is approximately 600 feet west (upgradient) of CMW-5. Soil and groundwater contamination was found at this site. Surficial soil samples exhibited TCE concentrations ranging between non-detect and 7,763 µg/kg. Soil samples collected near the water table interface exhibited TCE concentrations ranging between non-detect and 56,318 µg/kg. Groundwater samples exhibited TCE concentrations between 3.55 µg/l and 181 µg/l in the shallow wells and between 0.61 µg/l and 2.04 µg/l in the deep well at the site. Given these concentrations and proximity to CMW-5 it is likely that these releases have impacted CMW-5.

The Schneider property is a vacant lot located at 476 E Main Street. The site has been investigated since 1995 for the presence of soil and groundwater contamination (WDNR ID #02-08000632). It is adjacent to (downgradient of) the CPC site. Three surficial soil samples were collected from the Schneider site as part of this investigation and five surface samples were collected by the WDNR in 1994 and analyzed for VOC. Results indicated that only one surficial soil sample, collected by the WDNR, near the northwest corner of the property along the river bank detected TCE at a concentration of 48.1 µg/kg (GS-18). The majority of the TCE concentrations were present at depth near the water table interface. The results of the WDNR's investigation indicated that TCE contamination was located in the groundwater and the soils at the water table interface within the south and central portion of the Schneider property indicating that the groundwater contamination extends beneath Main Street. The presence of concentrations of TCE in groundwater was documented as high as 9,700 ppb at the south edge of the site. The WDNR noted that the western perimeter of the property also contained substantial groundwater concentrations of cis-1,2-DCE and trans-1,2-DCE and vinyl chloride. Given that the majority of the TCE contamination was detected at the water table interface and the fact that the site is downgradient of the CPC site and the lack of surficial soil contamination detected, it appears that groundwater contamination emanating from the CPC site has impacted the Schneider property. Additional investigation may further substantiate this conclusion.

A known source location of MTBE contamination is Chilton Coop Service Oil Co. (WDNR ID#02-08-00684/DCOM ID#53014-0190-27) located at 28 Adams Street. This site is approximately 1,200 feet southwest (upgradient) of CMW-5 and monitoring wells MW-104 and MW-4A. According to the Wisconsin Department of Commerce web page MTBE has been detected in the groundwater at this site as high as 27,300 µg/l. Given this elevated level of MTBE in the groundwater upgradient of CMW-5 it is possible that this site could have contributed to the MTBE levels at CMW-5. Additional investigation of the bedrock groundwater at or near the site may substantiate this conclusion.

8 Recommendations

Based on the results of this investigation, the following is recommended:

1. MW-103 should be repaired or replaced and incorporated into any future long term monitoring of the Schneider site.
2. Additional regular sampling of the investigation area is warranted to evaluate effects of seasonal recharge and groundwater elevations on contaminant concentrations.
3. Any plans for additional groundwater monitoring should consider the installation of monitoring wells upgradient of well nest MW-4 and B-109.
4. Given that MTBE concentrations are increasing at MW-4A and the latest concentration was above the PAL it is appropriate to investigate the extent of MTBE groundwater contamination upgradient of MW-4A.
5. It is recommended that additional investigation activities be addressed to evaluate the extent of TCE and PCE exceedances near B-109 and B-110 in the bedrock aquifer. Any future plans to evaluate the extent of TCE contamination of the aquifer should include wells upgradient of B-110 and additional sampling of B-106 to confirm the presence of groundwater contamination at this location. Water table concentrations should also be evaluated north of the CPC site.
6. Additional piezometers should be installed to confirm groundwater flow direction in the deeper monitoring zones. Components of the investigation should include an evaluation of zones of preferential flow within the bedrock aquifer and a groundwater monitoring plan to track the changes in VOC concentrations in the area.
7. A combination of additional groundwater investigation and potential “hotspot” removal of soils in the area of MW-2 and MW-3 on the CPC site is recommended given the persistent detects of chromium and nickel at concentrations above PAL at MW-2 and MW-3.
8. The extent of VOC contamination in the surficial soils does not appear to have been adequately investigated around GP-8 and GP-10 on the CPC site. The extent of metals contamination also should be investigated on the north side and beneath the driveway on the CPC site as well as the Schneider site around MW-105P and MW-103. Removal of impacted surficial soils maybe required to remediate groundwater impacts.
9. Since surficial soil samples were not collected at GS-13 and GS-14 additional surface sampling should be conducted to evaluate whether the impacts at GS-13, GS-14 and adjacent samples were a result of a surface release or off-site migration from the CPC site.

10. At the Western Industries site, which is upgradient of CMW-5, solvents, including TCE, are present in the groundwater. Investigation of the extent of solvent contamination emanating from the site should progress further downgradient of the site.
11. If not already addressed contamination in the bedrock groundwater should be evaluated at Chilton Coop Service Oil Co.
12. Upon completion of the individual recognized source area investigations, the CMW-5 study area should be incorporated into a regional monitoring plan to track the effects of the area contaminated groundwater over time.

Tracking location and concentration of the affected groundwater would be of benefit to identify future well head protection areas, public drinking water treatment options, and potential impacts to other public and private wells in the area.

13. Given the presence of multiple sources of groundwater contamination, an area map should be prepared and maintained that shows the locations of monitoring wells and concentrations of groundwater contamination. This map would be helpful in addressing groundwater investigation needs between the various remediation sites that likely have overlapping contaminant plumes and potential uses for siting additional drinking water wells and wellhead protection areas.

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