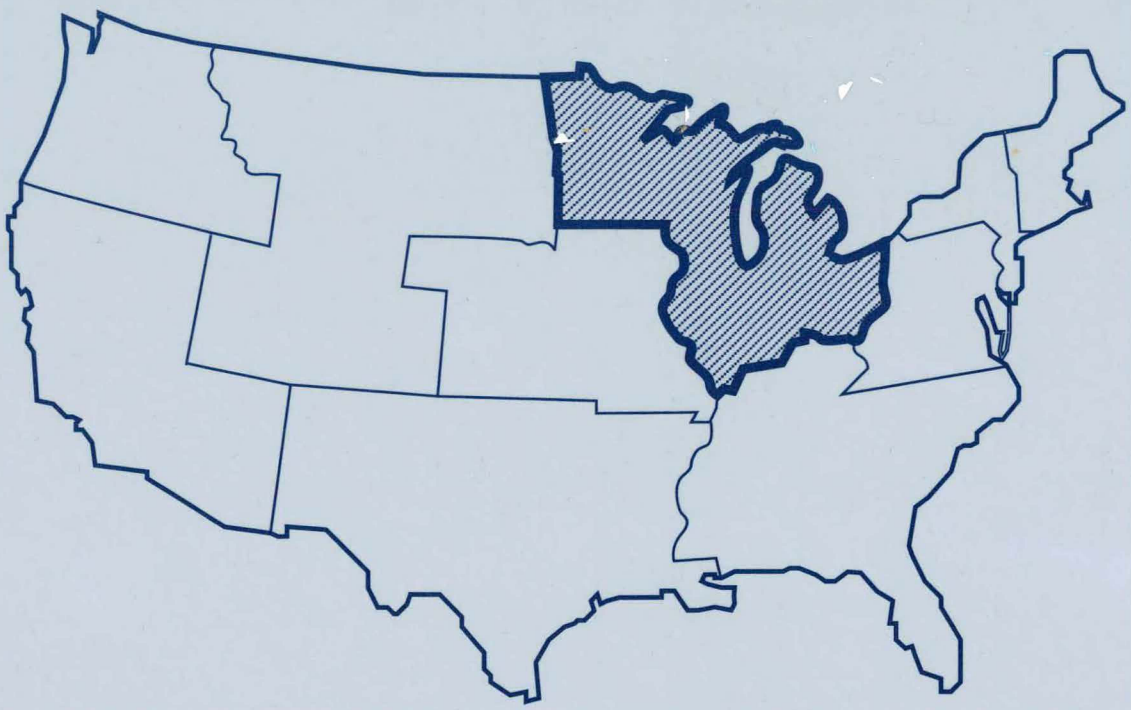
ARCS V

Remedial Activities at Uncontrolled Hazardous Waste Sites in Region V

3/4/97

EPA United States Environmental Protection Agency

[redacted]



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Startup Report

Groundwater Treatment System

N.W. Mauthe
City of Appleton, Wisconsin

Submitted by

CH2MHILL

March 4, 1997

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File N.W. Mauthe SF
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March 6, 1997

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Mr. Jon Peterson (SR-6J)
Remedial Project Manager
USEPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604

Dear Jon:

Subject: N.W. Mauthe Remedial Design
WA No. 100-56GR; Contract 68-W8-0040
Startup Report and Final O&M Manual

Please find enclosed the Startup Report and Final Operation and Maintenance (O&M) Manual for the Groundwater Treatment Facility at the N.W. Mauthe site in Appleton, Wisconsin.

The Startup Report was submitted under separate cover to the City of Appleton in conformance with the permit requirements. A copy of the cover letter to the City of Appleton is attached.

The Final O&M Manual is based on the draft O&M Manual submitted to you on October 11, 1996, and has been revised to reflect specific construction elements and fine-tuning of the system performed during facility start-up.

Please call if you have any questions or comments

Sincerely,

CH2M HILL

Cathy Barnett

Cathy Barnett
Site Manager

MKE/10017102.DOC/2
c: Stephen Nathan/PO/USEPA Region 5 (w/o attachment)
Peggy Hendrixson/CO/USEPA Region 5 (w/o attachment)
Gary Edelstein/WDNR (3 copies)
Alpheus Sloan III/PM/MKE
Ike Johnson/APM-OPNS/MKE
Louise Amundson/Design Manager/MKE
Carrie West/Library/Milwaukee
Jessica Garrett/City of Appleton
John Fleissner/QAM/Milwaukee
Jeff Keiser/RTL/MKE
Gail Gill/AA/Milwaukee

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March 6, 1997

116441.PP.PM

Ms. Jessica Garratt
Pretreatment Coordinator
City of Appleton
Department of Utilities—Wastewater Division
2006 E. Newberry St.
Appleton, WI 54915-2758

Dear Ms. Garratt:

Subject: N.W. Mauthe Superfund Site Groundwater Treatment Facility Startup Report

Please find enclosed a copy of the Startup Report for the Groundwater Treatment System at the N.W. Mauthe Superfund Site located at 725 S. Outagamie Street in Appleton. This document is being submitted in accordance with the "Second" Draft Permit issued for the site wastewater discharge on December 12, 1996, and includes the results of our monitoring during start-up and the early stages of routine operation.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I believe this information will be sufficient for development of the final discharge permit. If you have questions or need additional information, please call me or Erin Potts in our Milwaukee office at (414) 272-2426.

Sincerely,

CH2M HILL

Catherine Barnett, P.E.
Site Manager

MKE/10017102.DOC/1
Enclosure
c: Jon Peterson/USEPA Region 5
Gary Edelstein/WDNR
Erin Potts/CH2M HILL Milwaukee
Chris Liethen/CH2M HILL Milwaukee
Louise Amundson/CH2M HILL Milwaukee

Contents

Contents, Continued

SECTION 1

Introduction

This report provides the information used during startup of the N. W. Mauthe Groundwater Pretreatment System. The startup period described refers to the initial startup of the groundwater pretreatment facility from functional testing of equipment, startup by the construction contractor, adjustment of the process equipment to improve performance, to a steady-state pumping condition. The report gives an overview of the system, the pretreatment goals, and functions of the process equipment. Startup and shutdown procedures are discussed along with other information related to the operation of the system. Requirements for sampling, monitoring, and reporting during the startup period are described and analytical results are discussed. The report includes the following sections:

- Section 1—Introduction
- Section 2—Process and Instrumentation Description
- Section 3—Process Startup and Shutdown
- Section 4—Process Operations
- Section 5—Permit Limits, Monitoring, and Reporting
- Appendix A—Daily Log Sheets
- Appendix B—Monitoring and Reporting Requirements
- Appendix C—Analytical Results
- Appendix D—Material Safety Data Sheets

This report is intended only to provide an overview of the treatment system for the purpose of documenting the startup conditions. It does not present detailed descriptions or step-by-step programming/operation instructions of each piece of equipment. For more detailed descriptions of the process equipment and routine operations consult the Groundwater Treatment System O&M manual. For specific information on a given piece of process equipment, as well as requirements for instrument calibrations, consult the manufacturer's O&M manual. Manufacturers' O&M manuals have been supplied for each piece of equipment and are located at the treatment facility.

SECTION 2

Process and Instrumentation Description

This section presents an overview and functional description of the groundwater collection and pretreatment system. A Process Flow Diagram (PFD) for the treatment system is shown in Figure 2-1. The PFD provides an overview of the system in schematic form, defines each major process stream, and documents the expected hydraulic and mass loadings.

The groundwater is collected in three coarse sand-filled trenches which drain to two manholes. Groundwater is pumped from the lift stations to the storage tank in the groundwater pretreatment facility. Pretreated groundwater is discharged from the facility to the City of Appleton POTW. The purpose of the pretreatment facility is to treat groundwater for compliance with the City of Appleton POTW discharge requirements. The contaminants of concern in groundwater at the site relative to City of Appleton POTW discharge requirements are total and hexavalent chromium.

Groundwater Pretreatment System

The groundwater pretreatment system uses a fully automated batch treatment process designed for control of total chromium. Each batch operation treats approximately 2,600 gallons of influent groundwater and takes about 6 hours to complete a cycle (i.e., from the start of filling the reaction tank to finishing the discharge to the POTW).

Process Chemistry

The two major chemical treatment processes used in the batch operation are (1) hexavalent chromium reduction using ferrous sulfate, and (2) metal hydroxide precipitation and co-precipitation. These processes are described below.

Hexavalent Chromium Reduction

Ferrous sulfate ($FeSO_4$) is used to reduce hexavalent chromium (Cr^{6+}) to trivalent chromium (Cr^{3+}). As hexavalent chromium is reduced to trivalent chromium, ferrous iron is oxidized to ferric iron. Stoichiometrically, 3 moles of $FeSO_4$ are needed for every mole of Cr^{6+} reduced. Therefore, in theory, 3.2 mg of Fe^{2+} are needed for every 1.0 mg of Cr^{6+} in solution. The actual (stoichiometric) dosage required is determined by the PLC when the operator inputs the *Hach* test kit result of the influent water hexavalent chromium analysis into the PLC.

However, excess ferrous iron beyond the stoichiometric requirement is necessary because of competing reactions. A dosage safety factor must be applied to the calculated theoretical dosage requirement in order to ensure complete treatment of all hexavalent chromium. Jar tests conducted during the treatability study on groundwater from the Mauthe site showed that about 1.5 times the theoretical ferrous sulfate dosage was required to reduce all hexavalent chromium. A dosage safety factor of 2 was used initially during startup, and then lowered to 1.5 after it was concluded that all of the hexavalent chromium was sufficiently reduced (i.e., effluent hexavalent chromium equal to zero).

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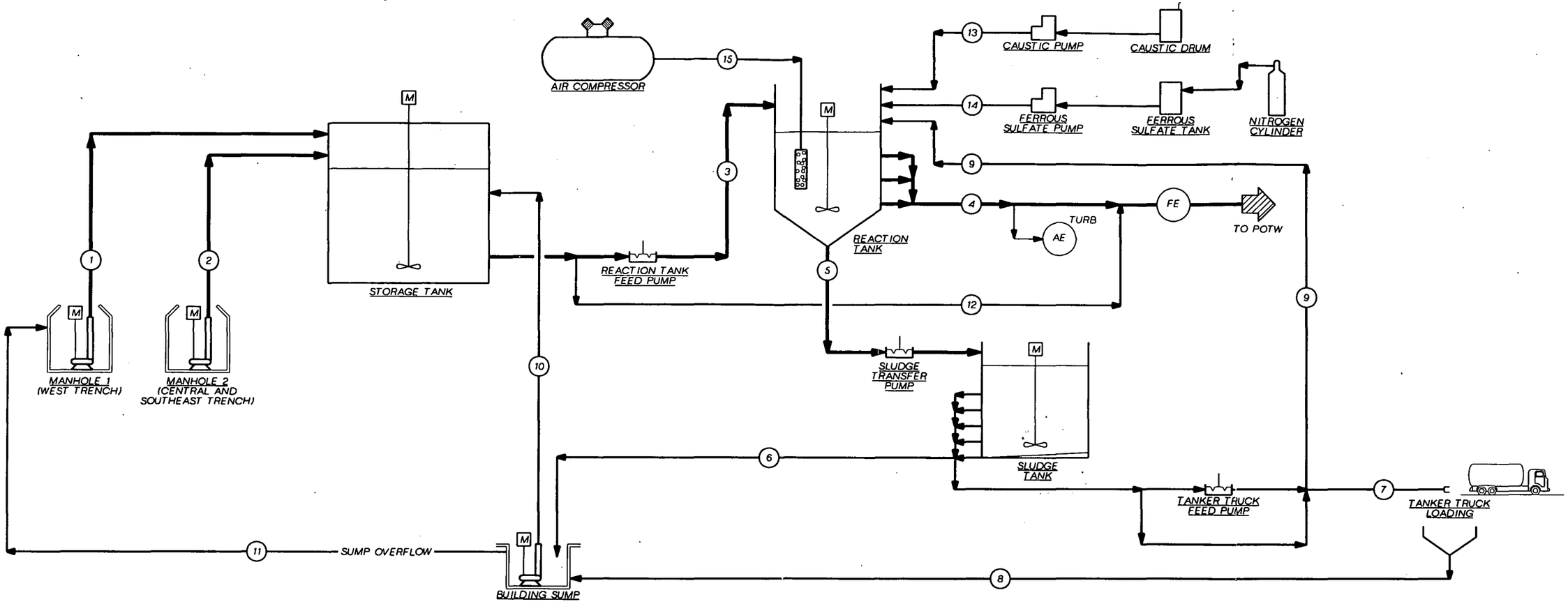
i:/104200/DRAWINGS/FIGURES/FIG3-1A.DGN



MAUTHE GROUNDWATER TREATMENT SYSTEM MASS BALANCE SUMMARY

ID	TYPE	PH	FLOW/VOLUME UNIT	FLOW/VOLUME AVG	FLOW/VOLUME MAX	INSTANTANEOUS FLOW UNIT	INSTANTANEOUS FLOW AVG	INSTANTANEOUS FLOW MAX	TSS, mg/L AVG	TSS, mg/L MAX
1	MANHOLE 1 EFFLUENT	6.0 - 8.0	GPD	1,300	1,300	GPM	43	43	5	30
2	MANHOLE 2 EFFLUENT	6.0 - 8.0	GPD	1,300	1,300	GPM	43	43	5	30
3	REACTION TANK INFLUENT	6.0 - 8.0	GPD	2,600	10,400	GPM	86	86	5	2000
4	REACTION TANK EFFLUENT	6.0 - 10.0	GPD	2,600	10,400	GPM	43	43	5	30
5	SLUDGE TANK INFLUENT	6.0 - 10.0	GAL/MON	500	1,500	GPM	4	12	1% SOLIDS	2% SOLIDS
6	SLUDGE TANK DECANT	6.0 - 10.0	GAL/MON	250	750	GPM	10	70	20	500
7	TANKER TRUCK INFLUENT	6.0 - 10.0	GAL/6 MON	1,500	4,000	GPM	10	70	2% SOLIDS	10% SOLIDS
8	TANKER TRUCK OVERFLOW	6.0 - 10.0	GAL/6 MON	-	4,000	GPM	-	30	2% SOLIDS	10% SOLIDS
9	SLUDGE RETURN	6.0 - 10.0	GAL/MON	-	1,050	GPM	-	35	2% SOLIDS	2% SOLIDS
10	BUILDING SUMP EFFLUENT	6.0 - 10.0	GPD	-	10,400	GPM	86	86	20	1% SOLIDS
11	BUILDING SUMP OVERFLOW	6.0 - 10.0	GPD	-	10,400	GPM	170	170	20	1% SOLIDS
12	STORAGE TANK BYPASS TO SEWER	6.0 - 8.0	GPD	10,000	10,000	GPM	170	170	5	30
13	SODIUM HYDROXIDE ADDITION (50%)	-	ml/D	260	950	ml/MIN	50	200	-	-
14	FERROUS SULFATE HEPTAHYDRATE ADDITION (25%)	-	ml/D	500	3,600	ml/MIN	50	300	-	-
15	REACTION TANK AERATION	-	SCFM	2	5	-	-	-	-	-

NOTE: TEMPERATURES ARE EXPECTED TO RANGE FROM 50 TO 70 DEGREES F BASED ON INFLUENT TEMPERATURE.

FIGURE 2-1
PROCESS FLOW DIAGRAM
N.W. MAUTHE SITE
APPLETON, WISCONSIN

CH2MHILL

Precipitation and Co-precipitation Reactions

Following the reduction of hexavalent chromium to the trivalent state, caustic (NaOH) is added to raise the pH and promote the formation of metal hydroxide precipitates. The metallic ion that must be precipitated out of solution is trivalent chromium, which precipitates as chromium hydroxide.

Ferric iron (resulting from the ferrous sulfate addition step) also precipitates out as ferric hydroxide. The presence of ferric hydroxide is an added benefit because it acts as a co-precipitant trapping other metal hydroxides in the ferric hydroxide matrix ,which increases their removal from solution. The presence of ferric hydroxide sludge in the reaction tank during the precipitation and flocculation steps enhances the treatment process because the sludge acts as a nucleation (or crystallization) site, upon which the new precipitates can form.

Reaction Tank Sludge Seeding

The reaction tank was seeded with a quantity of ferric hydroxide sludge prior to the startup of the batch treatment processing. The sludge seed was formed by adding approximately 40 gallons of ferrous sulfate to the reaction tank, aerating the reaction tank contents, and adjusting the pH with caustic to a pH of approximately 8 and settling the resultant sludge. This process was performed in four separate batches by adding 10 gallons of ferrous sulfate for each batch. The reaction tank contents were not discharged between batches. This process created a ferric hydroxide sludge which enhanced the removal of precipitated chromium during the settling phase.

Manhole Pumps

Pumps P-1-1 and P-1-2 in manholes MH- 1 and MH-2, respectively, convey groundwater from the collection trenches into the storage tank (T-2). Water levels in the manholes are controlled by float switches. The high level switch (3.33 feet for P-1-1 and 3.16 feet for P-1-2) activates the pump. The low level switch (0.75 feet for P-1-1 and P-1-2) shuts off the pump. A high-high level switch (4.0 feet for P-1-1 and P-1-2) in the manhole sends an alarm to the master control panel (MCP) and to the programmable logic controller (PLC) autodialer to notify the system operator of the excessively high water level condition in the manhole. Each manhole pump has a pumping capacity of 43 gallons per minute (gpm).

During startup the water levels were sufficiently high in the manholes to trigger the high-high alarms. After several batches were treated, the water levels dropped and the high-high alarms were reset.

Storage Tank

The purpose of the storage tank (T-2) is to store water from the collection system prior to treatment and to provide hydraulic equalization of the groundwater. The storage tank is a covered, flat-bottom, 9,000-gallon fiberglass reinforced plastic (FRP) tank. The storage tank includes a top-mounted, turbine-type, constant speed mixer (M-2) for the purpose of providing complete mixing of the tank's contents and for keeping any solids in suspension. The storage tank is also equipped with an ultrasonic level indicator that monitors water level in the storage tank and sends a signal to the PLC. If the water level in the storage tank reaches 10.0 ft, the level switch in the storage tank signals the PLC to shut down the

manhole pumps. When the water level drops to below 9.0 ft in the storage tank, the manhole pumps are reactivated.

A 3-inch-diameter gravity bypass pipeline allows the water in the storage tank to be discharged directly to the sanitary sewer. The bypass of the treatment system can ONLY be used if the contents of the tank have been analyzed and meet all City of Appleton POTW discharge criteria. This bypass was NOT used during startup.

Reaction Tank Feed Pump

The reaction tank feed pump (P-4) transfers water from the storage tank (T-2) to the reaction tank (T-5) for treatment. The reaction tank feed pump is an air-operated, double diaphragm pump with an 86-gpm capacity. A command from the PLC activates the pump to fill the reaction tank. When the working volume is attained in the reaction tank, the pump is shut off.

Reaction Tank

The reaction tank (T-5) is an open top 6,100-gallon FRP tank with a conical bottom. The conical bottom allows for collection and transfer of sludge. The volume of water treated and discharged is approximately 2,600 gallons each batch. The remaining tank volume below the discharge port is for sedimentation and solids storage. The tank volume below the discharge port also provides 2 feet of water above the interface with the settled solids to prevent turbulence which could result in entrainment of solids in the decant stream.

Chemical and physical processes for the treatment of total and hexavalent chromium occur in the reaction tank (T-5). The PLC automatically controls these process steps. The treatment steps are shown in Table 2-1.

TABLE 2-1
Batch Process Operation

Step in cycle	Description	Estimated Time (min)
Decant	Treated water from the previous batch is discharged to the City of Appleton POTW. The discharge is controlled by the PLC which opens the electronic flow control valve on the discharge pipe. The flow valve opens only after BOTH of the following conditions are met: (1) the required settling time has been reached [minimum allowable settling time entered by the operator at the PLC data access screen], and (2) the groundwater storage tank is full and another batch of groundwater is ready for treatment. When the water level in the reaction tank drains down to the lowest discharge port, the PLC closes the flow control valve in preparation for the fill cycle. Since the decant step does not begin until the storage tank reaches 4.0 ft, discharge to the POTW can occur less than once per day if the actual flows are less than the design average flow (2,600 gpd).	60–120

TABLE 2-1
Batch Process Operation

Step in cycle	Description	Estimated Time (min)
Fill	After the previously treated batch is discharged and the water in the storage tank hits the high level mark, the PLC commands the reaction tank feed pump to fill the reaction tank with water from the storage tank (T-2). When the reaction tank is full, the PLC shuts down the reaction tank feed pump.	30–700 (depends upon the reaction tank feed pump flow rate)
Ferrous Sulfate Addition	The PLC commands the ferrous sulfate metering pump to deliver the ferrous sulfate volume required to reduce hexavalent chromium to trivalent chromium. The PLC will calculate the required ferrous sulfate volume based on the operator input of ferrous sulfate and hexavalent chromium concentrations at the control screen. The PLC then starts the reaction tank mixer (M-5) (the speed and duration of the mixing are entered by the operator at the PLC data access module). The mixing time entered must be sufficient to ensure a complete reaction occurs.	15–30
Caustic Addition	After the ferrous sulfate addition, the PLC commands the caustic feed pump to deliver sodium hydroxide into the reaction tank until the pH set-point (input by the operator at the PLC data access module) is maintained. The elevated pH will cause precipitation of ferric hydroxide and chromium hydroxide. The PLC also commands the mixer to run at the speed and duration input by operator at the PLC data access module. Caustic addition stops when the set-point pH is reached and maintained within the allowable time window. The pH is measured by a dual pH probe system that has an additional feature in which an alarm will be triggered if the differential reading between the two probes exceeds a value of 1.4. The alarm will shut down the batch treatment process and will signal the autodialer to notify the system operator of the failure. Also, if the pH does not reach the set-point within 5 minutes after the start of the caustic addition step, the batch process will shutdown and the operator will be notified of the failure by the autodialer.	15–30
Aeration	During the same time as the caustic addition step, the PLC will activate the air diffuser in the reaction tank by opening a flow control valve on the air compressor line. Aeration of the reaction tank contents will oxidize any excess ferrous (soluble) iron remaining after the hexavalent chromium reduction to ferric (insoluble) iron. The aeration will continue for the length of time input by the operator at the PLC data access module for the caustic addition step, after which the flow control valve on the air compressor line will close.	15–30

TABLE 2-1
Batch Process Operation

Step in cycle	Description	Estimated Time (min)
Flocculation	After the caustic addition/aeration step the mixer will slow to a flocculation speed for a set time period (speed and duration input by operator at the control screen). Flocculation is typically set for 20 to 30 minutes. The flocculation step causes the precipitates to agglomerate and thereby improves settling.	20–30
Settling	Once the flocculation is complete, the PLC shuts the mixer off and allows the suspended particles to settle out of the bulk liquid and into the sludge holding area at the bottom of the reaction tank. The operator inputs the settling duration at the control screen. The PLC will not discharge the treated batch any sooner than the settling period input by the operator even if the storage tank is full.	120–240
Sludge Withdrawal	Occasional removal of a portion of the reaction tank sludge is required. Excess sludge will build up over time in the bottom of the reaction tank. Excess sludge is pumped from the reaction tank to the sludge tank (T-14) using the sludge transfer pump (P-13). The minimum and maximum sludge levels (after complete settling) are marked on the side of the reaction tank. The settled sludge volume should be maintained between these two marks. The operator can enter into the PLC data access module the frequency (i.e., after a how many batches) and the sludge pump operation time to transfer sludge to the sludge tank. The PLC will operate the sludge pump based on the entered data. The operator can also operate the sludge pump manually.	Operator Choice

The reaction tank has three 2-inch-diameter discharge pipes at different elevations on the side of the tank. The multiple discharge pipes allow for a distributed discharge of flow, thereby reducing turbulence. The turbulence is minimized to prevent entrainment of the solids in the discharge flow that are contained in the lower portion of the reaction tank. Additional tank components include a variable speed mixer, an ultrasonic water level indicator, two pH probes, and an air diffuser.

Reaction Tank Mixer

The mixer is a top-mounted, variable speed, turbine-type mixer. The mixer has two main functions during the batch process. First, the mixer provides high speed mixing during chemical addition (ferrous sulfate and caustic) phases to completely mix chemicals with the tank contents. Second, the mixer provides low shear mixing for flocculation of the metal hydroxide precipitates. The mixer speed is controlled by mixing speed settings input to the PLC data access module and are in terms of percent of maximum speed. Three speeds are used.

Following completion of startup by the construction contractor, the mixer shaft became disconnected and required additional parts and labor before it could become operational.

This resulted in a system shutdown from January 31, 1997 to February 11, 1997. The system shutdown prevented treatment of any groundwater during that time period and explains the reason for the data gap in the Sample Results Table in Appendix C.

Reaction Tank Level Detector

The ultrasonic level detector measures the water level in the reaction tank and inputs the level in terms of gallons to the PLC. The PLC uses the level information to control the batch operations (e.g., controlling the flow control valve during decant and the reaction tank feed pump during the reaction tank fill operation).

Reaction Tank Air Diffuser

The air diffuser is used to supply air (oxygen) to the reaction tank to oxidize any remaining ferrous iron not used during the reduction of hexavalent chromium. The diffuser is a fine-bubble, membrane-type diffuser and has a normal operating flow of up to 8 standard cubic feet per minute (scfm). The PLC provides air to the diffuser by opening a flow control valve on the reaction tank air line from the air compressor. The actual amount of air provided is controlled by the hand valve on the air line.

Reactor Tank pH Monitor

The reaction tank contains a dual probe pH monitor. The system measures and locally indicates pH concentration and inputs the signal to the PLC. An average of the pH signals from the two probes is used to control caustic feed in the batch operation. The pH in the reaction tank is continuously recorded, along with the effluent flow rate, using a 3/4-inch per hour, two-pen recorder.

Air Compressor

Compressed air supplied to the diaphragm pumps and reaction tank air diffuser is supplied by the plant air compressor (M-17). The rotary screw type compressor can supply 55 scfm of air at 125 pounds per square inch gauge (psig).

Ferrous Sulfate Feed System

Ferrous sulfate is a chemical reducing agent used to reduce hexavalent chromium to trivalent chromium. The ferrous sulfate is fed in liquid form (15 to 25 percent ferrous sulfate heptahydrate by weight) to the reaction tank using the ferrous sulfate feed system. The feed system consists of a 55-gallon drum of ferrous sulfate, a calibration column, a chemical metering pump, and a nitrogen tank with associated valves and pressure gauges.

A chemical supplier provides the ferrous sulfate solution in a 55-gallon drum which is placed on a secondary containment pallet. The appropriate volume of ferrous sulfate is pumped to the reaction tank when commanded by the PLC. The PLC calculates the correct volume after the operator inputs the hexavalent chromium, ferrous sulfate solution concentration, ferrous sulfate solution specific gravity, safety factor, and ferrous sulfate pump rate in L/min. at the control panel.

The nitrogen gas system provides a low pressure, inert, nitrogen blanket over the ferrous sulfate solution in the 55-gallon drum. The nitrogen blanket is used because the ferrous iron readily oxidizes to ferric iron when exposed to oxygen. A two-stage regulator supplies low

pressure (2 to 3 psig) to the ferrous sulfate drum so it is always under a slight positive pressure. A back pressure release valve prevents the ferrous sulfate drum pressure from exceeding 3 psig.

Caustic Feed System

Caustic (50 percent sodium hydroxide by weight) is added during the batch operation in order to increase the pH for the precipitation reaction. The sodium hydroxide is fed to the reaction tank in liquid form using the caustic feed system. The feed system consists of a 55-gallon drum of caustic, a calibration column, and a chemical metering pump.

A chemical supplier provides the caustic in a 55-gallon drum which is placed on a secondary containment pallet. Caustic is pumped to the reaction tank until the pH set point is reached, as commanded by the PLC. When the pH set point (or higher) is maintained for the required time window, the caustic addition is stopped. The system operator enters the pH set point (typically pH 8.0) in the control panel. The pH of 8.0 achieves the required conditions to promote effective chromium hydroxide precipitation while minimizing the excess sludge production observed at higher pHs. During startup it was observed that the pH dropped about 0.5 pH units during the settling period. The pH set point was then raised to pH 8.5 to achieve a pH of 8.0 during discharge.

Metering Pump Calibration

Prior to startup the ferrous sulfate chemical metering pump was calibrated using the 1,000-mL calibration column. The calibration column was filled by opening both the valve upstream of the calibration column (downstream of the 55-gallon drum) and the valve at the bottom of the calibration column. Once the column was full, the valve upstream of the calibration column was closed. The pump was then turned on and the time required to pump the volume out of the chemical calibration column, as well as the volume pumped (ml), was recorded.

The flow rate was then calculated in terms of mL/min. and converted to L/min. The calibration value obtained during startup was 200 L/min. This value was entered into the PLC data access model and used to calculate the length of time required for ferrous sulfate addition. However, the flow rate was not required for the caustic metering pump since the caustic addition step is pH dependent and not volume dependent.

Sludge Transfer Pump

The sludge transfer pump (P-13) is used to transfer sludge from the reaction tank (T-5) to the sludge tank (T-14). The pump can be operated automatically by the PLC or manually by the operator. In automatic mode, the operator inputs the frequency (i.e., transfer after how many batches of groundwater treated) and length of sludge pump operation (i.e., 5 min.) at the control screen. The rate of pumping is controlled at the pressure regulator at P-13.

Sludge Tank

The sludge tank (T-14) is an open top 4,800-gallon tank used to store and thicken (optionally) sludge transferred from the reaction tank. A tanker truck picks up sludge held in the tank for offsite disposal. The tank has a sloped bottom to facilitate sludge withdrawal during loading of the tanker truck. The tank can be mixed, but is primarily operated with

no mixing to promote sludge thickening and to reduce the cost of offsite disposal. In normal operation, the tank receives sludge and the supernatant is periodically drained.

Multiple manual decant ports are installed on the side of the sludge tank to allow for draining off the supernatant as the sludge thickens. Supernatant drained from the tank flows by gravity to the building sump, where it is returned to the storage tank (T-2) prior to treatment in the reaction tank (T-5).

The tank also contains a constant speed mixer and an ultrasonic level meter. The mixer (M-14) is a top-mounted, turbine-type, constant speed mixer used during sludge transfer operations. The mixer will be turned on before pumping the sludge to a tanker in order to homogenize the tank contents and improve pumpability. The ultrasonic level indicator monitors water level in the sludge tank and sends a signal to the PLC.

Tanker Truck Feed Pump

The tanker truck feed pump (T-16) is used to transfer sludge from the sludge tank (T-14) to a tanker truck for offsite treatment and disposal. The pump is not tied into the PLC and can only be operated manually. The transfer pump should be able to fill a standard tanker truck in about 1 hour. The transfer pump is also hard-piped to feed metal hydroxide sludge from the sludge tank back to the reaction tank when additional sludge is required in the reaction tank to promote co-precipitation.

Building Sump System

The building sump (T-18) collects spills and water from the building floor drains and includes air compressor drainage, tank drainage and overflow, and tanker truck loadout drainage. Water collected in the sump is returned to the storage tank (T-2) prior to treatment. If water is collected in the sump faster than it can be pumped out, the sump contains a 4-inch overflow pipe to divert the flow by gravity to Manhole No. 1.

Effluent Discharge Monitoring

At the end of the batch cycle, the treated water is discharged from the reaction tank (T-5) to the City of Appleton POTW. The effluent flow rate is continuously monitored by an electromagnetic flow meter. The electromagnetic flow meter is integrated to give total flow volume discharged from the facility. The total flow volume is indicated locally, while the flow rate is continuously recorded at the MCP. The flow rate is continuously recorded, along with the effluent pH, using a 3/4-inch per hour, two-pen recorder.

During most of the startup period, the effluent flow meter was not functioning properly and had to be replaced. The effluent flow values reported in Appendix C are based on the number of batches discharged with the volume of each discharge approximated at 2,600 gallons (based on reaction tank water level readings).

In addition to the on-line monitoring described herein, Section 5 of this manual describes other compliance and process-related sampling and monitoring.

Instrumentation and Control

This section describes the interaction of the instrumentation, the automated control system, and the process equipment. The PLC data access module at the MCP monitors and automatically controls most of the treatment processes and equipment. Only the tanker truck transfer pump and the air compressor are locally controlled. The system is intended to provide continuous batch process treatment dependent upon the presence of adequate process water, treatment chemicals, a functioning compressed air system, and PLC program. All equipment, with the exception of the reaction tank mixer, can be controlled locally in manual mode if necessary. The MCP includes the following:

- Annunciators that indicate an upset in the system and identify the location or type of the failure
- A strip chart recorder that continuously records reaction tank pH (average of 2 measurements) and effluent flow rate
- Data access module
- Autodialer
- PLC system
- Uninterruptable Power Supply (UPS)

The MCP is equipped with an audible alarm that will sound if there is an upset in the process or a failure of monitored equipment. Specific annunciators are listed below. The alarm settings were defined during startup.

Annunciators

The annunciators are LED type indicators which have dedicated windows or indicators for the following conditions:

- Manhole No. 1 Level HIGH-HIGH
- Manhole No. 2 Level HIGH-HIGH
- Storage Tank or Reaction Tank MIXER MALFUNCTION
- Storage Tank Level HIGH (alarm at 10.5 feet, reset at 10.25 feet) or LOSS-OF-ECHO
- Reaction Tank Volume HIGH (alarm at 5,000 gallons, reset at 4,975 gallons) or LOSS-OF-ECHO
- EXCESS pH DEVIATION between reaction tank pH meters (greater than 1.4)
- Caustic Supply LOW
- Ferrous Sulfate Supply LOW
- Discharge Valve FAIL (greater than 60 seconds to open or close)

- Effluent Flow Rate HIGH (greater than 175 gpm during decant) or LEAK (greater than 2.0 gpm during nondecant steps)
- Sludge Tank Level HIGH (alarm at 6.75 feet, reset at 6.5 feet) or LOSS-OF-ECHO
- Air Compressor Pressure LOW (below 60 psi)
- Building Sump Level HIGH-HIGH
- pH Did Not Reach Setpoint During Caustic Addition (within 5 minutes)
- PLC Failure

System Alarm Conditions

The PLC activates the autodialer alarm and the MCP audible alarm (if enabled) in response to a number of alarms that correspond to either a system shutdown or a system alert.

System Shutdown

A system shutdown halts the batch treatment operations until an operator acknowledges the alarm, addresses the alarm condition, and physically resets the MCP by pressing the RESET button on the MCP (below the PLC Data Access Module). The following alarm conditions correspond to a system shutdown:

- Reaction Tank MIXER MALFUNCTION
- Storage Tank Level HIGH (alarm at 10.5 feet, reset at 10.25 feet)
- Storage Tank Level Transmitter Failure (LOSS-OF-ECHO)
- Reaction Tank Volume HIGH (alarm at 5,000 gallons, reset at 4,975 gallons)
- Reaction Tank Level Transmitter Failure (LOSS-OF-ECHO)
- EXCESS pH DEVIATION between reaction tank pH meters (greater than 1.4)
- Caustic Supply LOW
- Ferrous Sulfate Supply LOW
- Discharge Valve FAIL (greater than 60 seconds to open or close)
- Air Compressor Pressure LOW (below 60 psi)
- pH Did Not Reach Setpoint During Caustic Addition (within 5 minutes)
- PLC Failure

System Alert

A system alert will not shutdown the batch treatment operations but will activate the autodialer alarm, the MCP audible alarm (if enabled), and the appropriate MCP annunciator. The following alarm conditions correspond to a system alert:

- Manhole No. 1 Level HIGH-HIGH
- Manhole No. 2 Level HIGH-HIGH
- Storage Tank MIXER MALFUNCTION
- Sludge Tank Level HIGH (alarm at 6.75 feet, reset at 6.5 feet)
- Sludge Tank Level Transmitter Failure (LOSS-OF-ECHO)
- Building Sump Level HIGH-HIGH
- Effluent Flow Rate HIGH (greater than 175 gpm during decant) or LEAK (greater than 2.0 gpm during nondecant steps)

Data Access Module

When in AUTOMATIC mode, the functions of the batch treatment system are controlled by the PLC. System variables (e.g., pH set points, variable speed mixer settings, durations of batch events) required to control batch operations are entered by the system operator at the data access module.

The batch system setpoints were programmed into the data access module during startup. The batch system variables are output on the data access module screens as shown in Table 2-2.

Switches

Manual operation of process equipment is accomplished with ON/OFF/AUTO and OPEN/CLOSE/AUTO type selector switches which function external to the PLC logic and allow plant operation in the event of a PLC failure. The PLC also provides inputs to an autodialer which will notify the system operator of a failure by phone or voice pager. The autodialer provides ALERT, SHUTDOWN, SAFETY, and PLC FAIL messages depending on type of system failure. The PLC has a "watch-dog timer" circuit to detect failure of the PLC program execution.

The control system activates an audible alarm to notify the operator of a alarm condition when the facility is manned and the alarm horn enabled. An ENABLE/DISABLE switch at the entry door allows the operator to turn off the audible alarm when the facility is unattended.

Autodialer

The autodialer phone number is (414) 991-9412. By dialing this number the operator can determine which alarm condition exists by listening to the computer-generated voice response and acknowledge that alarm condition by pressing 555. If the alarm is not acknowledged, the autodialer will continue dialing the list of phone numbers until an operator responds. The list of phone numbers that can be entered into the autodialer system can be as high as eight phone numbers and up to 32 digits for each number.

TABLE 2-2
Data Access Module Screens

Keypad F1	**Batch Reaction Times**	
	Decant Time	75 min. (minimum)
	Aeration Time	20 min. (minimum)
	Flocculation Time	20 min. (minimum)
	Settling Time	120 min. (minimum)
	Sludge Transfer Time	1 min. (minimum)
Keypad F2	**Batch Reaction Setpoints**	
	Reactor Batch Volume Level	4,800 gal (~2,600 gal batch size)
	Chromium Concentration	X mg/L (hexavalent chromium concentration as determined by the *Hach* colormetric test kit on the storage tank influent sample)
	pH setpoint	8.5 (default)
	Batches per sludge transfer	25 (default)
Keypad F3	**Ferrous Sulfate Data**	
	Safety Factor	1.5 (default)
	Ferrous Sulfate Specific Gravity	1.24 (Based on MSDS)
	Ferrous Sulfate Concentration	15% (Based on MSDS)
	Ferrous Sulfate Pumping Rate	0.200 L/min. (calibrated at pump)
Keypad F4	**Mixer Speed Settings (in terms of percent of maximum speed)**	
	Ferric Addition	95%
	Caustic Addition	70%
	Flocculation	35%
The data access module also functions to provide the following:		
Keypad F6	**Batch Process Instrument Readings**	
	pH probe 1	S.U.
	pH probe 2	S.U.
	Reaction Tank Effluent Flow	gpm
	Time Remaining in Each Batch Step	min.
Keypad F7	**Additional Batch Process Instrument Readings**	
	Reaction Tank Volume	gal
	Storage Tank Level	feet
	Sludge Tank Level	feet
	No. of Batches remaining until sludge transfer	
	Time Remaining in Each Batch Step	min.
Keypad F8	**Allows User to Scroll Through Screens**	
Keypad F10	**Enable/Disable Batch Process**	

Note: The keypad screen also alerts the operator if the system is disabled or shutdown with a flashing message box in each screen.

SECTION 3

Plant Startup and Shutdown

Introduction

This section provides the procedures followed during plant startup and shutdowns due to minor repairs.

Process Startup

The following instructions were followed to startup and operate the groundwater collection and treatment system. The system was started on January 14, 1997.

1. Checked that all breakers are energized at the motor control center (MCP).
2. Checked that all local motor switches are in AUTO.
3. Checked that all drain and bypass valves for the tanks and process equipment are closed.
4. Opened the following valves shown below:
   - Storage tank discharge valves (one discharge valve after the storage tank and one isolation valve ahead of the reaction tank feed pump)
   - Reaction tank feed pump discharge valve
   - Reaction tank discharge valves (three discharge lines)
   - Flow control valve (precedes electronic flow valve)
   - Caustic feed line (two valves after tank and one after pump)
   - Ferrous sulfate feed line (two valves after tank and one after pump)
   - Nitrogen tank supply valve
5. The batch process variables shown in Table 3-1 were input into the PLC data access module at the beginning of the startup period. These variables were adjusted during startup to test the performance of the system. These are the settings that are currently being used for operation.

TABLE 3-1
Default Settings for Process Variables

Process variable	Default setting
Time period allowed for decant step	75 min.
Time period for aeration/caustic addition step	20 min.
Time period for flocculation step	20 min.
Time period for settling step	120 min.
Time of sludge pump operation for each sludge transfer (if using AUTO mode for sludge transfer).	1 min.
Reactor batch volume level	4,800 gal.
Groundwater hexavalent chromium concentration for ferrous sulfate addition step (based on *Hach* Kit Test Results)	3.0 mg/L
pH setpoint for caustic addition step	8.5
Frequency for sludge transfers (if using AUTO mode for sludge transfer)	25 batches
Ferrous sulfate safety factor	2.0
Ferrous sulfate specific gravity (based on MSDS)	1.24
Ferrous sulfate feed concentration (as Fe^{2+}) for ferrous sulfate addition step (based on MSDS)	15%
Ferrous Sulfate Pump Rate (based on calibration column)	200 L/min.
Reaction tank mixer (M-5) speed for ferrous sulfate addition step	95%
Reaction tank mixer (M-5) speed for caustic addition step	70%
Reaction tank mixer (M-5) speed for flocculation step	35%

6. Inspected the nitrogen cylinder pressure, caustic tank, and ferrous sulfate tank levels to ensure they have adequate supply. Inspected the ferrous sulfate solution for signs of oxidation (reddish-brown coloration).
7. Turned on and calibrated the reaction tank pH meters after cleaning the pH probes.
8. Turned on the plant air compressor at the local ON/OFF switch. Verified that the compressor is on by checking the pressure indicator on the compressor panel. The pressure was 100 psig.
9. Verified that the pH/discharge flow rate recorder at the MCP were on . Visually inspected the recorder to determine proper operation.

10. Placed the following in AUTO mode at the local control location:

    - Building sump pump (P-18)
    - Reaction tank feed pump (P-4)
    - Caustic feed pump (P-8)
    - Ferrous sulfate feed pump (P-9)
    - Storage tank mixer (M-14)
    - Reaction tank mixer (M-5)
    - Electronic flow control valve (FV-10)

11. Started the batch process using the F10 ENABLE/DISABLE BATCH PROCESS keypad command at the data access module.

Plant Shutdown

During the startup period defined by this report the plant was shutdown for the reaction tank mixer repair which caused a short-term interruption of the process. The plant was also shutdown briefly to accommodate the flow meter replacement. Shutdown was performed in accordance with the O&M Manual.

During the reaction tank mixer repair, the following actions were conducted :

1. The batch process mode was shut off at the PLC data access module.
2. The manhole pumps and reaction tank feed pump were shutdown at the MCP.
3. The storage tank and reaction tank mixers were shutdown and locked-out at the MCP.
4. The reaction tank sludge was transferred to the sludge tank (after the repair the sludge was returned to the reaction tank).
5. The reaction tank water was drained to the building sump by opening the reaction tank drain valve. The building sump returned the reaction tank contents to the storage tank.

During the flow meter replacement the batch process mode was shut off at the PLC data access module. The batch process was restarted after the flow meter was replaced.

The system achieved steady-state operations on Thursday February 20, 1997. The system was briefly shutdown over the weekend. System operation was resumed on Monday February 24, 1997, when Midwest Contract Operations, Inc., the subcontracted operations company, overtook the operations.

SECTION 4

Process Operations

During startup, periodic inspections/calibrations and daily monitoring were performed to assess system operation. The daily log sheets used to record the data during startup of the plant are provided in Appendix A.

Reaction Tank

Periodic inspections/calibrations for the reaction tank components included the following:

- Checking the condition of the reaction tank feed pump and recording the reaction tank feed pump operating pressure.
- Cleaning both pH probes and calibrating the pH meter periodically.
- Checking the condition/color of the ferrous sulfate solution.
- Recording the sludge depth at the edge of the tank. If the sludge level was in excess of that desired for co-precipitation, wasting the appropriate volume of sludge to the sludge tank. If it was less than desired, modifying the sludge wasting variables at the PLC to decrease the amount of sludge wasted.
- Inspecting the operation of the discharge flow meter and recorder to ensure they were operating properly.
- Inspecting the condition and operation of the mixer and the ultrasonic level meter.
- Assessing the operation of the batch process by collecting a TSS sample for the reaction tank effluent and the storage tank contents every couple of days for the first week.

Chemical Feed Pumps

Periodic inspections/calibrations for the chemical feed pumps included the following:

- Observing the condition of the caustic and ferrous sulfate feed pumps
- Recording the pressure at the nitrogen tank (both tank pressure and discharge pressure) at the two stage regulators. If the discharge pressure exceeded 3 psi, the regulator was adjusted back to 2 psi. The ferrous sulfate storage tank was also observed for excessive pressure or nitrogen leaks.

Sludge Tank

Periodic inspections/calibrations for the sludge tank and sludge pumps included the following:

- Checking the condition and operating pressure of the sludge transfer pump and the tanker truck feed pump.
- Checking the level of sludge in the sludge tank. If the supernatant level above the sludge was significant, it was drained off using the decant ports on the sides of the sludge tank.

SECTION 5

Permit Monitoring and Reporting Requirements

The City of Appleton POTW Industrial User Permit (Permit No. 97-21) requires monitoring of the treatment system effluent and reporting in order to verify compliance. The POTW has designated the treatment system discharge as Outfall 001. Outfall 001 enters the City sewer at Manhole 30-14 on Melvin Street, between the intersections of Douglas Street and Outagamie Street. This section presents the regulatory monitoring and reporting requirements for the system during startup.

Sample Analyses and Monitoring Requirements

There were no numerical permit discharge limitations for Outfall 001 during startup. The only requirements were to monitor and report various parameters for each discharge event. The data will be used by the City of Appleton to establish a baseline treatability level for the final permit and is included in Appendix C.

Monitoring the treatment system included periodic sampling and analysis of the treated effluent. Appendix B lists the parameters that were sampled during startup, along with their required sampling frequency and analytical method.

The onsite laboratory equipment includes a *Hach* colormetric test kit for hexavalent chromium field analysis. Also included is a total suspended solids (TSS) apparatus, oven, and scale for analysis of suspended solids concentrations and sludge percent solids. Operating instructions were supplied for each piece of equipment and were consulted for equipment use and calibration.

Sample Collection

An influent (storage tank) and effluent (reaction tank effluent during decant step) sample were required to be collected for each and every batch processed during startup. The samples were analyzed for hexavalent chromium using the *Hach* colormetric test kit. The concentration values obtained for the hexavalent chromium analyses were recorded on the daily log sheet in Appendix A. The results from the influent sample were input into the MCP. A split of the samples was also sent to En-Chem, Inc., for total chromium analysis. A description of the sampling procedures followed during startup is listed below:

1. Two 500-mL bottles were labeled for each total chromium sample. The sample names were denoted as follows:

   AANo. No. No. A

   The first two letters represent the tank being sampled (i.e., ST = storage tank, RT = reaction tank). The next four numbers represent the month and day date (i.e., 0120 = January 20), and the last letter represents the batch number for that day (i.e., if there were 2 batches in 1 day the first batch would be denoted with an "A" and the second with a "B").

2. The sample port line was purged by opening the valve to drain for 1 minute prior to sample collection.
3. The sample was collected in a clean 1L-plastic beaker.
4. The two 500-mL bottles were filled up to the neck of the bottle (the bottles were prepreserved with nitric acid).
5. The sample time and date was recorded on the Chain-of-custody (along with other pertinent information).

Flow and pH Data

The City of Appleton also requires that a record be kept for the total flow discharged and the minimum and maximum pH values for each discharge event (decant step of batch cycle). For these requirements the value for the flow totalizer (on the wall next to the reaction tank) and the two values for the pH probes (shown both on the pH probe analyzers and the data access module screen) were recorded for each batch on the daily log sheets in Appendix A.

Since the flow meter was not working properly, the reaction tank volume measurements were used to estimate discharge flow (i.e., the flow totalizer values were not used). The volume measurements indicated that each batch discharged approximately 2,600 gallons. However, the first batch discharged was not a full batch and was therefore recorded as 1,775 gallons, as shown in Appendix C.

Reporting

Compliance reports summarizing the monitoring results during startup must be submitted to the POTW. The monitoring results must be reported to the POTW on the schedule in Appendix B. This startup report fulfills the compliance reporting requirements for the startup period. Copies of all analytical data and compliance reports will be kept onsite for 3 years.

Appendix A
Daily Log Sheets

Table A.1
Daily Log Sheet During Startup
N.W. Mauthe Site
Groundwater Pretreatment System

Parameter											
Date	1/14/97	1/15/97	1/15/97	1/16/97	1/17/97	1/18/97	1/19/97	1/20/97	1/20/97	1/21/97	1/21/97
Batch number	1	2	3	4	5	6	7	8	9	10	11
For Each Batch											
Effluent flow totalizer value after decant (gal)	6990	8760	11240	12500	13810	16040	18510	20280	21940	23440	24780
Batch volume (gal)	1775	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600
pH probe 1 value during decant	8.50	7.80	8.80	8.90	8.80	8.20	8.45	8.30	8.68	8.57	8.52
pH probe 2 value during decant	8.50	7.80	8.80	8.90	8.80	8.20	8.00	7.90	8.18	8.13	8.01
Reaction tank effluent sample number for total chromium	RT0114	RT0115A	RT0115B	RT0116	RT0117	RT0118	RT0119	RT0120	RT0120B	RT0121A	RT0121B
Storage tank effluent sample number for total chromium	ST0114	ST0115A	ST0115B	ST0116	ST0117	ST0118	ST0119	ST0120	ST0120B	ST0121A	ST0121B
Storage tank hexavalent chromium concentration (mg/L)	1.6	1.6	1.8	1.6	1.6	1.4	1.3	1.1	1.1	1	1
Reaction tank hexavalent chromium concentration (mg/L)	0	0	0	0	0	0	0	0	0	0	0
Daily											
Nitrogen tank pressure (psi)	2320	2320	2320	2030	1740	1160	650	650	650	650	650
Nitrogen tank discharge pressure (psi)	0	1.5	1.5	2	1	2	1.5	1	1	1	1
Reaction tank feed pump pressure (psi)	1	1	1	1	1	1	1	1	1	1	15
Periodically											
Clean pH probes						X					
Calibrate pH meter						X					
Reaction tank TSS (mg/L)		16				18		16			
Storage tank TSS (mg/L)		120				74		283			

Table A.1
Daily Log Sheet During Startup
N.W. Mauthe Site
Groundwater Pretreatment System

Parameter											
Date	1/21/97	1/22/97	1/22/97	1/22/97	1/22/97	1/23/97	1/23/97	1/23/97	1/24/97	1/24/97	1/25/97
Batch number	12	13	14	15	16	17	18	19	20	21	22
For Each Batch											
Effluent flow totalizer value after decant (gal)	26500	27780	29180	30640	32100	33370					
Batch volume (gal)	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600
pH probe 1 value during decant	8.53	8.53	8.56	8.56	8.56	8.63	8.76	8.79	8.82	8.62	8.79
pH probe 2 value during decant	8.01	7.97	8.01	8.01	8.01	8.08	8.12	8.11	8.13	8.05	8.09
Reaction tank effluent sample number for total chromium	RT0122A	RT0122B	RT0122C	RT0122D	RT0123A	RT0123B	RT0123C	RT0124A	RT0124B	RT0125	RT0126
Storage tank effluent sample number for total chromium	ST0121C	ST0122A	ST0122B	ST0122C	ST0122D	ST0123A	ST0123B	ST0123C	ST0124A	ST0124B	ST0125
Storage tank hexavalent chromium concentration (mg/L)	1	1	1	1	1.1	1.2	1.2	1.5	1.5	2.2	2.4
Reaction tank hexavalent chromium concentration (mg/L)	0	0	0	0	0	0	0	0	0	0	0
Daily											
Nitrogen tank pressure (psi)	600	600	600	600	550	550	550	550	550	550	550
Nitrogen tank discharge pressure (psi)	1	1	1	1	1	1	1	1	3	1	1
Reaction tank feed pump pressure (psi)	10	20	36	36	36	36	36	36	36	36	2
Periodically											
Clean pH probes						X					
Calibrate pH meter						X					
Reaction tank TSS (mg/L)											
Storage tank TSS (mg/L)											

Table A.1
Daily Log Sheet During Startup
N.W. Mauthe Site
Groundwater Pretreatment System

Parameter												
Date	1/26/97	1/27/97	1/28/97	1/29/97	1/30/97	1/31/97	2/11/97	2/11/97	2/11/97	2/12/97	2/12/97	2/19/97
Batch number	23	24	25	26	27	28	29	30	31	32	33	34
For Each Batch												
Effluent flow totalizer value after decant (gal)	Flow Meter Replacement											
Batch volume (gal)	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600
pH probe 1 value during decant	8.75	8.63	8.67	8.63	8.53	8.69	8.45	8.47	8.54	8.58	8.60	8.24
pH probe 2 value during decant	8.08	8.04	8.13	8.13	8.01	8.03	8.10	8.10	8.11	8.10	8.06	7.98
Reaction tank effluent sample number for total chromium	RT0127	RT0128	RT0129	RT0130	RT0131A	RT0131B	RT0211A	RT0211B	RT0212A	RT0212B	RT0214	RT0219
Storage tank effluent sample number for total chromium	ST0126	ST0127	ST0128	ST0129	ST0130	ST0131A	ST0211A	ST0211B	ST0211C	ST0212A	ST0212B	ST0219
Storage tank hexavalent chromium concentration (mg/L)	2.3	2.6	2.4	2.7	2.8	2.9	2.4	2.2	1.8	1.8	1.9	1.1
Reaction tank hexavalent chromium concentration (mg/L)	0	0	0	0	0	0	0	0	0	0	0	0
Daily												
Nitrogen tank pressure (psi)	525	525	525	525	525	522	520	520	520	520	520	510
Nitrogen tank discharge pressure (psi)	1	1	1	1	1	1	1	1	1.5	1.5	1.5	2
Reaction tank feed pump pressure (psi)	2	2	2	2	2	2	36	36	36	2	2	2
Periodically												
Clean pH probes												
Calibrate pH meter												
Reaction tank TSS (mg/L)												
Storage tank TSS (mg/L)												

Appendix B
Monitoring and Reporting Requirements

Attachement: Pretreatment Monitoring Synopsis (page 1 of 2)
Letter to C.G. Barnett, P.E. / CH2M Hill
Mauthe Site Draft Permit 12-12-96:City of Appleton I.U. #97 - 21

"Start-up" Monitoring and Proposed Permit Monitoring Synopsis
N. W. Mauthe Superfund Site / Chromium Remediation

Pretreatment Activity Phase: Start - Up					
Monitored Parameter:	**Type of Sampling:**	**Sampling Frequency:**	**Type of Testing:**	**Reporting Requirement:**	**Report Timing:**
Flow volume	Meter	Continuous when discharging		Daily Log to record totalized flow for each discharge event	Monthly, data submitted by 15th of month for previous month's activities
pH	Meter	Continuous when discharging		Continous monitoring is requested and Daily Log must record High, Low, and Average values for discharge event	Same
Chromium, hexavalent	Grab#1before treatment, Grab#2 after treatment	each batch treated and discharge	colorimetric test kit (not per Standard Methods)	Daily Log must record this as an influent and effluent value for the pretreatment system	Same
Chromium, total	Grab#1before treatment, Grab#2 after treatment	each batch treated and discharge	per Standard Methods, Certified Laboratory	Analytical report from Certified Laboratory	Submitt with Monthly Reports above

Attachement: Pretreatment Monitoring Synopsis (page 2 of 2)
Letter to C.G. Barnett, P.E. / CH2M Hill
Mauthe Site Draft Permit 12-12-96:City of Appleton I.U. #97 - 21

"Start-up" Monitoring and Proposed Permit Monitoring Synopsis
N. W. Mauthe Superfund Site / Chromium Remediation

Pretreatment Activity Phase: Steady-State with Authorized I.U. Permit 97-21					
Monitored Parameter:	**Type of Sampling:**	**Sampling Frequency:**	**Type of Testing:**	**Reporting Requirement:**	**Report Timing:**
Flow volume	Meter	Continuous when discharging		Daily Log to record totalized flow for each discharge event	Quarterly: 1.April 15 2.July 15 3.October 15 4.January 15
pH	Meter	Continuous when discharging		Continous monitoring is requested and Daily Log must record High, Low, and Average values for discharge event	Same
Chromium, hexavalent	Grab during discharge event	each batch treated and discharge	colorimetric test kit (not per Standard Methods)	Daily Log must record this as an effluent value	Same
Chromium, total	FPC* / Grab during discharge event	Quarterly	per Standard Methods, Certified Laboratory	Analytical report from Certified Laboratory	Submit with Quarterly Reports above
Local Limits	FPC / Grab	Annually	Same as above	Same as above	Submit with July 15 report

*Flow or Time Proportional Composite may not be suitable for this treatment activity depending on duration/ volume of discharge...."batch" may be assumed to be homogenous and a grab sample may program may be sufficient.

Appendix C
Analytical Data

Table C.1
Analytical Results
Samples Collected During Startup

Batch Number	Discharge Date	Discharge Volume gallons	Total Discharge Volume gallons	pH probe value 1	pH probe value 2	Influent Total Chromium (1) Concentration mg/L	Effluent Total Chromium (1) Concentration mg/L	Influent Hexavalent Chromium (2) Concentration mg/L	Effluent Hexavalent Chromium (2) Concentration mg/L	Notes
1	01/15/97	1,775	1,775	8.50	8.50	1.90	0.007	1.6	0	
2	01/15/97	2,600	4,375	7.80	7.80	1.60	0.011	1.6	0	
3	01/16/97	2,600	6,975	8.80	8.80	0.01	1.600	1.8	0	(3)
4	01/17/97	2,600	9,575	8.90	8.90	1.50	0.045	1.6	0	
5	01/18/97	2,600	12,175	8.80	8.80	1.40	0.094	1.6	0	
6	01/19/97	2,600	14,775	8.20	8.20	1.30	0.081	1.4	0	
7	01/20/97	2,600	17,375	8.45	8.00	1.40	0.069	1.3	0	
8	01/20/97	2,600	19,975	8.30	7.90	1.20	0.066	1.1	0	
9	01/21/97	2,600	22,575	8.68	8.18	1.10	0.050	1.1	0	
10	01/21/97	2,600	25,175	8.57	8.13	0.98	0.056	1.0	0	
11	01/21/97	2,600	27,775	8.52	8.01	0.95	0.053	1.0	0	
12	01/22/97	2,600	30,375	8.53	8.01	0.88	0.082	1.0	0	
13	01/22/97	2,600	32,975	8.53	7.97	0.92	0.062	1.0	0	
14	01/22/97	2,600	35,575	8.56	8.01	0.93	0.063	1.0	0	
15	01/22/97	2,600	38,175	8.56	8.01	1.00	0.080	1.0	0	
16	01/23/97	2,600	40,775	8.56	8.01	1.10	0.091	1.1	0	
17	01/23/97	2,600	43,375	8.63	8.08	1.10	0.091	1.2	0	
18	01/23/97	2,600	45,975	8.76	8.12	1.10	0.130	1.2	0	
19	01/24/97	2,600	48,575	8.79	8.11	1.90	0.070	1.5	0	
20	01/24/97	2,600	51,175	8.82	8.13	1.80	0.120	1.5	0	
21	01/25/97	2,600	53,775	8.62	8.05	2.00	0.028	2.2	0	
22	01/26/97	2,600	56,375	8.79	8.09	2.20	0.120	2.4	0	
23	01/27/97	2,600	58,975	8.75	8.08	2.30	0.075	2.3	0	
24	01/28/97	2,600	61,575	8.63	8.04	2.30	0.097	2.6	0	
25	01/29/97	2,600	64,175	8.67	8.13	2.30	0.110	2.4	0	
26	01/30/97	2,600	66,775	8.63	8.13	2.80	0.110	2.7	0	
27	01/31/97	2,600	69,375	8.53	8.01	3.00	0.036	2.8	0	
28	01/31/97	2,600	71,975	8.69	8.03	2.80	0.270	2.9	0	
29	02/11/97	2,600	74,575	8.45	8.10	1.90	1.100	2.4	0	
30	02/11/97	2,600	77,175	8.47	8.10	1.80	0.170	2.2	0	
31	02/12/97	2,600	79,775	8.54	8.11	2.30	0.074	1.8	0	
32	02/12/97	2,600	82,375	8.58	8.10	1.90	0.110	1.8	0	
33	02/14/97	2,600	84,975	8.60	8.06	1.90	0.210	1.9	0	
34	02/19/97	2,600	87,575	8.24	7.98	0.95	0.015	1.1	0	(4)

Notes:

(1) Total chromium analyses performed by En-Chem, Inc. using EPA Method 200.7.

(2) Hexavalent chromium analysis performed onsite using a *Hach* colorometiric test kit for hexavalent chromium.

(3) Influent and effluent total chromium samples appear to have been switched prior to analyses.

(4) Hexavalent chromium concentration exceeds total chromium concentration probably due to inaccuracies of the *Hach* colorometiric test kit for hexavalent chromium.

Appendix D
Material Safety Data Sheets

Ferrous Sulfate MSDS

Ferrous Sulfate Solution

MSDS

MATERIAL SAFETY DATA SHEET

For chemical emergencies—spill, leak, fire or exposure, call CHEMTREC (800)424-9300.

EAGLEBROOK, INC.

SECTION 1 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

SUPPLIER	•	Eaglebrook, Inc. 1150 Junction Avenue Schererville, Indiana 46375
PHONE NUMBERS	•	(219) 322-2560, (800) 428-3311
EMERGENCIES	•	CHEMTREC (800) 424-9300
TRADE NAME	•	Ferrous Sulfate
CHEMICAL FAMILY	•	Inorganic salts
FORMULA	•	$FeSO_4$
SYNONYM	•	Iron (II) sulfate

SECTION 2 COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT	PERCENT	ACGIH TLV	CAS NUMBER
Ferrous sulfate	13.0-16.3	1 mg/m³ TWA	7720-78-7
Sulfuric acid	<6	1 mg/m³ TWA	7664-93-9

SECTION 3 HAZARDS IDENTIFICATION

Emergency overview-irritating to skin, eyes, and mucous membranes.

NFPA RATINGS

Health	2
Flammability	0
Reactivity	1
Special Hazards	Corrosive

SECTION 4 FIRST AID MEASURES

INHALATION Move to fresh air. Give artificial respiration if breathing has stopped. If breathing is difficult, give oxygen. Get medical attention.

EYE CONTACT Flush with plenty of water. Get medical attention.

SKIN CONTACT Wash with soap and water. Remove any contaminated clothing and wash before reuse. If irritation develops, get medical attention.

INGESTION If conscious, drink water or milk of magnesia. DO NOT induce vomiting. Get medical attention.

SECTION 5 FIRE FIGHTING MEASURES

FLASH POINT	NA
FLAMMABLE LIMITS	NA
AUTOIGNITION	NA
HAZARDOUS COMBUSTION PRODUCT	Sulfur oxides
FIRE FIGHTING INSTRUCTIONS	Use whatever extinguishing media that is appropriate. Respiratory and eye protection required.
FIRE AND EXPLOSION HAZARDS	Sulfuric acid could react with metals to produce hydrogen.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Evacuate all unnecessary personnel from the area. Wear appropriate personal protective equipment, and contain and eliminate the release. Neutralize with lime, limestone, or soda ash. This will generate carbon dioxide, so additional ventilation may be necessary. Collect the residues for proper disposal. Notify the appropriate authorities.

SECTION 7 HANDLING AND STORAGE

Keep containers closed. Do not store in metal containers, because the metal will dissolve and generate hydrogen. Vent rubber lined steel containers to avoid pressure build up if the lining fails.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION	There should be enough local ventilation to keep the TLV below the ACGIH limits.
GLOVES	Use neoprene or equivalent. Never use leather.
EYES	Wear chemical goggles or a face shield.
RESPIRATOR	Use an approved respirator with acid mist cartridges, if necessary.
CLOTHING	Protective clothing, if necessary, should be neoprene or equivalent.

When cleaning, decontaminating or performing maintenance on tanks, containers, piping systems and accessories, and in any other situations where airborne contaminants and/or dust could be generated, use proper protective equipment to protect against ingestion or inhalation. HEPA or air supplied respirators, full Tyvek coveralls with head cover, gloves and boots (or chemical suits, gloves and boots) are suggested.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point	220-235°F
Specific Gravity (H_2O=1)	1.16-1.25
Vapor Pressure (mm Hg)	NA

Percent Volatile by Vol.	NA
Vapor Density (Air=1)	NA
Evaporation Rate (BuAc=1)	NA
Solubility in Water (%)	Infinite
Appearance	Blue green liquid, slight acidic odor
pH	<1
Freezing Point	Consult your Eaglebrook representative for cold weather handling recommendations.

SECTION 10 STABILITY AND REACTIVITY

STABILITY Stable above 50°F. Starts recrystalizing below 50°F.

HAZARDOUS POLYMERIZATION Does not occur.

HAZARDOUS DECOMPOSITION Produces sulfur oxides.

CONDITIONS TO AVOID Contact with bases or alkalies.

INCOMPATIBLE MATERIALS Metals and metal alloys.

SECTION 11 TOXICOLOGICAL INFORMATION

TOXICOLOGICAL FINDINGS Tests on laboratory animals indicate material may produce adverse mutagenic effects. Cited in RTECS.

SECTION 12 ECOLOGICAL INFORMATION

No data available.

SECTION 13 DISPOSAL CONSIDERATIONS

This material is an RCRA regulated hazardous waste upon disposal due to the corrosivity characteristic. Any residues and/or rinse waters from cleaning of tanks, containers, piping systems and accessories may be a hazardous characteristic waste and must be properly disposed of in accordance with all federal, state, and local laws. Recycle whenever possible.

SECTION 14 TRANSPORT INFORMATION

SHIPPING NAME Corrosive Liquids. Acidic, Inorganic, N.O.S., (Ferrous Sulfate)

HAZARD CLASS 8

DOT NUMBER UN3264

PACKING GROUP II

SECTION 15 REGULATORY INFORMATION

CERCLA RQ 6100-7600 liquid pounds. (Depending on ferrous sulfate concentration.)
Sulfuric acid is a reportable chemical under Section 313 of EPCRA (40 CFR 372).

CHRONIC HAZARD No

FIRE HAZARD No

SECTION 16 OTHER INFORMATION

The information in this document is considered to be reliable, but Eaglebrook does not accept any responsibility for its accuracy. This information is not intended as a warranty of the product's suitability for use with any other material or product, or in any application or process.

—Prepared by Michael M. Miller
September 3, 1996

Sodium Hydroxide MSDS

HYDRITE CHEMICAL CO.

300 N. PATRICK BLVD. (53045-5816)
DRAWER # 0948
BROOKFIELD, WI 53008-0948
OFFICE: 414/792-1450
FACSIMILE: 414/792-8721

January 2, 1997

CH0902
CH2M HILL
411 E. WISCONSIN STE 1600

MILWAUKEE, WI 532022211

ATTENTION: MSDS Coordinator

In the interest of worker safety, we have enclosed Material Safety Data Sheets (MSDS) for your review. (Please see attached list). The information contained in these Material Safety Data Sheets is designed to meet requirements under the OSHA Hazard Communication Standard (29 CFR 1910.1200). As a matter of policy, Hydrite Chemical Co. will distribute Material Safety Data Sheets with the first order for a product, upon any formal request, and whenever revisions are made.

These Material Safety Data Sheets contain necessary information about product hazards and proper handling. This data relates only to the specific material designated and does not relate to its use in combination with any other material or process. Hydrite Chemical Co. believes that the factual data contained in the enclosed sheets are correct. The opinions expressed in them are those of qualified experts regarding the results of tests conducted; however, since conditions of use are outside our control, they are not to be taken as a warranty or representation for which Hydrite Chemical Co. assumes legal responsibility.

Accompanying the MSDS is the Environmental Data Sheet (EDS) which contains additional regulatory information. The EDS must not be detached from the MSDS. Any copying and redistribution of the MSDS must include the EDS. Part 2 of the EDS contains notification of any substances contained in the product which are subject to the Environmental Protection Agency Toxic Chemical Reporting Requirements (SARA Title III), Section 313. Suppliers are required to notify all recipients of products containing chemicals subject to Section 313. You are also required to forward this notification to anyone you may distribute the product to.

Hydrite Chemical Co. strongly urges you, as is required by law, to provide the warnings and information in the enclosed Material Safety Data and Environmental Data Sheets to your employees, customers, handlers, people exposed to, or users of any of these products, and to properly train them in safe product handling.

If you have any questions, please contact either your Hydrite Sales or Customer Service Representative.

Sincerely,

Nancy O'Melia
Hydrite Chemical Co.
Technical Writer/Regulatory, Health & Safety

Enclosure

CH2M HILL
411 E. WISCONSIN STE 1600
MILWAUKEE ,WI 532022211

CH090-2
000

12-30-96

ATTN: MSDS Coordinator

Enclosed are the following Material Safety and Environmental Data Sheets for your review:

MSDS/EDS #	PRODUCT NAME
HY94-1 AL-0050-XX 1	CAUSTIC SODA LIQUID 50%

MATERIAL SAFETY DATA SHEET

12/30/96

PRODUCT NAME: CAUSTIC SODA LIQUID 50% PAGE 1

DISTRIBUTED BY: HYDRITE CHEMICAL CO.
300 N. PATRICK BLVD.
BROOKFIELD,WI 530080948
(414) 792-1450
24 HOUR EMERGENCY # - (414) 277-1311
CHEMTREC EMERGENCY # - (800) 424-9300

MSDS#:HY941AL0050XX

PREPARED BY:SMJ/NAO
04/25/94

MANUFACTURED BY: OCCIDENTAL, PPG, AND VULCAN

SECTION I - PRODUCT INFORMATION

TRADE NAME: CAUSTIC SODA LIQUID 50%
CHEMICAL NAME SYNONYMS: Sodium Hydroxide
Lye

C.A.S. REGISTRY #: 1310-73-2
CHEMICAL FAMILY: Alkali

FORMULA: 50% NaOH

DOT PROPER SHIPPING NAME: SODIUM HYDROXIDE SOLUTION

D.O.T. HAZARD CLASS: 8 (CORROSIVE MATERIAL)

D.O.T. IDENTIFICATION #: UN1824 D.O.T. LABEL: CORROSIVE

SECTION II - HAZARDOUS INGREDIENTS

INGREDIENT	PERCENT	TLV LEVEL	PEL LEVEL
Sodium Hydroxide	50%	C 2 mg/m3	C 2 mg/m3

NOTE :C denotes Ceiling Limit.

MATERIAL SAFETY DATA SHEET

12/30/96

SECTION III - PHYSICAL DATA

BOILING POINT (DEG. F): 293
FREEZING POINT (DEG.F): 41 - 51
VAPOR PRESSURE (MM HG): 6.3 @ 104F
VAPOR DENSITY (AIR=1) : N.A.
SOLUBILITY IN WATER: Complete

SPECIFIC GRAVITY: 1.53 @ 60F
PERCENT VOLATILE
BY VOLUME%: N.A
EVAPORATION RATE(N.A.): N.A.

APPEARANCE AND ODOR: Clear, colorless to slightly turbid liquid. No odor.

SECTION IV - FIRE EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED): None.

FLAMMABLE LIMITS LEL: N.A. UEL: N.A.

EXTINGUISHING MEDIA: For fires in area use appropriate media. For example: Water spray. Dry Chemical. Carbon Dioxide. Alcohol Foam.

SPECIAL FIRE FIGHTING PROCEDURES: Evacuate area of unprotected personnel. Wear protective clothing, chemical safety goggles and face shield. Cool fire-exposed containers with water spray. Product generates heat upon addition of water, with possible spattering. Run-off from fire control may cause pollution.

UNUSUAL FIRE EXPLOSION HAZARDS: Product may react with some metals (ex.: Aluminum, Zinc, Tin, etc.) to release flammable Hydrogen gas.

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: C 2 mg/m3 (OSHA 29 CFR 1910.Z-1-A)
C 2 mg/m3 (ACGIH 1993-94)

MATERIAL SAFETY DATA SHEET

12/30/96

SECTION V - HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE

EYE CONTACT: CORROSIVE - Causes severe burns and destruction of tissues. Small quantities can result in permanent damage and loss of vision. Contact may cause blindness.

SKIN CONTACT: CORROSIVE - Irritating to skin. Corrosive action causes burns and frequently deep ulceration with ultimate scarring.

INHALATION: CORROSIVE - Causes burns to respiratory tract. Inhalation of dust or mists can cause damage to the upper respiratory tract and to the lung tissue depending upon the extent of exposure.

INGESTION: CORROSIVE - Ingestion can cause very serious damage to the mouth, esophogus, stomach, and other tissues with which contact is made, and may be fatal.

OTHER: ROUTES OF EXPOSURE: Product can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed. TARGET ORGANS: Eyes. Skin. Respiratory System. MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Preexisting eye and skin disorders may be aggravated by exposure.

EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes. Hold eyelids open during this flushing with water. Call a physician immediately.

SKIN CONTACT :Flush area with water while removing contaminated clothing and shoes. Follow by washing with soap and water. Do not reuse clothing or shoes until cleaned. If irritation

SECTION V - HEALTH HAZARD DATA

persists, get medical attention. Do not apply oils or ointments unless ordered by the physician. If skin feels slippery, caustic may still be present in sufficient quantities to cause rash or burn. Continue washing skin until slick skin feeling is gone.

INGESTION: If conscious, drink a quart of water. DO NOT induce vomiting. CALL A PHYSICIAN immediately. If unconscious or in convulsions, take immediately to a hospital or a physician. NEVER induce vomiting or give anything by mouth to an unconscious victim. After dilution with water, fruit juice or diluted vinegar may be administered to accomplish neutralization. Several glasses of milk or several ounces of milk of magnesia may be given for their soothing effect.

INHALATION: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. CALL A PHYSICIAN.

SECTION VI - REACTIVITY DATA

STABILITY: _X_STABLE ___UNSTABLE
CONDITIONS TO AVOID: Contact with water may cause violent reaction with evolution of heat. To dilute: Add product slowly to lukewarm water; not water to product.

INCOMPATABILITY: Acids. Metals such as Aluminum, Zinc, Tin, etc. Organic Nitro Compounds. Chlorinated and Fluorinated Hydrocarbons, acetaldehyde, chlorine trifluoride, hydroquinone, maleic anhydride, phosphorous pentoxide, and tetrahydrofuran. Organic materials. Acrolein. Phosphorus. Trichloroethylene. Food sugars. Deadly carbon monoxide gas can form in enclosed or poorly ventilated areas or tanks when alkaline products contact food, beverage, or dairy products. Do not enter such areas until they have been well ventilated and carbon monoxide and oxygen levels have been determined to be within OSHA acceptable limits. If carbon monoxide and oxygen levels cannot be measured, wear NIOSH-approved,

MATERIAL SAFETY DATA SHEET

12/30/96

SECTION VI - REACTIVITY DATA

self-contained breathing apparatus.

HAZARDOUS DECOMPOSITION PRODUCTS: May react with certain metals to produce flammable Hydrogen Gas. May react with various food sugars to form Carbon Monoxide. Reacts with Phosphorus to form spontaneously flammable Phosphine. Reacts with Trichlorethylene to form spontaneously flammable Dichloroacetylene.

HAZARDOUS POLYMERIZATION: ___MAY OCCUR _X_WILL NOT OCCUR

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: CORROSIVE MATERIAL. Evacuate unprotected personnel from area. Maintain adequate ventilation. Use proper Safety Equipment. Contain spill, place into drums for proper disposal. Neutralize remaining residue with dilute Hydrochloric Acid solution and dispose of properly. Avoid direct discharge to sewers and surface waters. Notify authorities if entry occurs. CAUTION: Caustic Soda may react violently with acids and water.

WASTE DISPOSAL METHOD: Observe all Local, State, and Federal Regulations. Dispose of at approved Waste Treatment Facility. If approved, neutralize material and flush to sewer. DO NOT pressurize, cut, weld, braze, solder, drill, grind or expose empty containers to heat, flame, sparks or other sources of ignition.

SECTION VIII - SPECIAL PROTECTION INFORMATION

CONSULT SAFETY EQUIPMENT DISTRIBUTOR

RESPIRATORY PROTECTION: If recommended Exposure Limits are exceeded wear: NIOSH-Approved respirator for dusts and mists. NIOSH-Approved self-contained breathing apparatus. Do not exceed limits established by the respirator manufacturer. Respiratory

MATERIAL SAFETY DATA SHEET

12/30/96

SECTION VIII - SPECIAL PROTECTION INFORMATION

protection programs must comply with 29 CFR 1910.134.

VENTILATION: Maintain adequate ventilation. Do not use in closed or confined space. Keep levels below recommended Exposure Limits. To determine exposure levels, monitoring should be performed regularly. Avoid mist formation.

PROTECTIVE GLOVES: Rubber (Latex). Neoprene. Polyvinyl Chloride.

EYE PROTECTION: Chemical Safety Goggles. Face shield. Do not wear contact lenses.

OTHER PROTECTIVE EQUIPMENT: Eye-wash station. Safety shower. Rubber apron. Chemical safety shoes. Rubber boots. Protective clothing.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:
CORROSIVE MATERIAL. Store in cool, well-ventilated area, out of direct sunlight. Do not freeze. Keep containers tightly closed. Highly corrosive to most metals with evolution of Hydrogen Gas. Store away from incompatable materials. Do not store in unlabeled or mislabeled containers. *** ANSI/NSF Standard 60 Maximum Use Level = 100 mg/l ***

OTHER PRECAUTIONS: Avoid contact with skin and eyes. Do not swallow. Avoid dust or mist formation. Use with adequate ventilation. Avoid breathing mists or dusts. Wash thoroughly after handling. Do not eat, drink, or smoke in work area.

MATERIAL SAFETY DATA SHEET

12/30/96

PRODUCT NAME: CAUSTIC SODA LIQUID 50% PAGE 7

SECTION X - SUPPLEMENTAL HEALTH INFORMATION

CARCINOGEN CONTENT

%	PPM	INGREDIENT	IARC	NTP	OSHA

NOTE : This product does not contain greater than 0.1% of the known or potential carcinogens listed in NTP, IARC, or OSHA.

LD50 ORAL : Rabbit: 1350 mg/kg (Oxy Chem)
LD50 SKIN : Rabbit 50 mg/24 H (Anhydrous NaOH)
LC50 INHALATION : No Data

** ** ** ** ** ** ** ** ** ** ** **

The data in this Material Safety Data Sheet relates only to the specific material designated and does not relate to its use in combination with any other material or process. The data contained is believed to be correct. However, since conditions of use are outside our control it should not be taken as a warranty or representation for which HYDRITE CHEMICAL CO. assumes legal responsibility. This information is provided solely for your consideration, investigation, and verification.

HYDRITE CHEMICAL CO.
CAUSTIC SODA LIQUID 50%
AL-0050
04/25/94

ENVIRONMENTAL DATA SHEET

INFORMATION CONTAINED MUST NOT BE DETACHED FROM THE MSDS AND ANY COPYING AND REDISTRIBUTION OF THE MSDS SHALL INCLUDE COPYING AND REDISTRIBUTION OF THE ENVIRONMENTAL DATA SHEET.

PRODUCT NAME: CAUSTIC SODA LIQUID 50% PAGE 1

EDS#: HY941-AL0050-XX-EDS
EMERGENCY NUMBER: (414) 792-1450
(414) 277-1311
CHEMTREC: (800) 424-9300

PART 1: PRODUCT/COMPOSITION

NO.	COMPONENT	CAS NUMBER	PERCENT
P	CAUSTIC SODA LIQUID 50%	1310-73-2	100%
	TYPICAL DISTRIBUTION		
1	Sodium Hydroxide	1310-73-2	50%

PART 2: SARA TITLE III INFORMATION

NO.	RQ (LBS) (*1)	TPQ (LBS) (*2)	SEC 313 (*3)	313 CATEGORY (*4)	311/312 CATEGORIES (*5)
P	*	N/A	N	N/A	A-C-R
1	1,000	N/A	N	N/A	A-C-R

NOTE:* RQ is dependent upon individual ingredients.

FOOTNOTES

*1 = REPORTABLE QUANTITY OF CERCLA HAZARDOUS SUBSTANCE, 40 CFR PART 302, TABLE 302.4
*2 = THRESHOLD PLANNING QUANTITY, EXTREMELY HAZARDOUS SUBSTANCE, SEC. 302
*3 = TOXIC CHEMICAL, SEC. 313
*4 = CATEGORY AS REQUIRED BY SEC 313 (40 CFR 372.42), MUST BE USED ON TOXIC RELEASE INVENTORY FORM
*5 = HAZARD CATEGORY FOR SARA SEC. 311/312 REPORTING
A = IMMEDIATE (ACUTE) HEALTH HAZARD
C = DELAYED (CHRONIC) HEALTH HAZARD
P = SUDDEN RELEASE OF PRESSURE HAZARD
F = FIRE HAZARD
R = REACTIVE HAZARD

ENVIRONMENTAL DATA SHEET

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PRODUCT NAME: CAUSTIC SODA LIQUID 50%

PART 2: SARA TITLE III INFORMATION

PART 3: CERCLA INFORMATION

EPA - COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT. UNDER EPA - CERCLA ("SUPERFUND") RELEASES TO AIR, LAND OR WATER MAY BE REPORTABLE TO THE NATIONAL RESPONSE CENTER, 800-424-8802 (CIRCUMSTANCES SURROUNDING THE RELEASE AND CLEANUP DETERMINE REPORTABILITY).

THE REPORTABLE QUANTITY FOR THIS PRODUCT IS: 2000# BASED ON SODIUM HYDROXIDE CONTENT.

PART 4: RCRA INFORMATION

REFER TO LATEST EPA OR STATE REGULATIONS REGARDING PROPER DISPOSAL.

HAZARDOUS WASTE NUMBER = D002 (40 CFR 261.22)

PART 5: HMIS/NFPA LABEL INFORMATION

	HMIS	NFPA	KEY
HEALTH:	3	3	0 - MINIMAL
FLAMMABILITY:	0	0	1 - SLIGHT
REACTIVITY::	2	1	2 - MODERATE
WARNING	N/A		3 - SERIOUS
WARNING	N/A		4 - SEVERE

PERSONAL PROTECTION RATING TO BE SUPPLIED BY USER DEPENDING ON USE CONDITIONS.

HMIS = HAZARDOUS MATERIALS IDENTIFICATION SYSTEM
NFPA = NATIONAL FIRE PROTECTION ASSOCIATION 704

ENVIRONMENTAL DATA SHEET

INFORMATION CONTAINED MUST NOT BE DETACHED FROM THE MSDS AND ANY COPYING AND REDISTRIBUTION OF THE MSDS SHALL INCLUDE COPYING AND REDISTRIBUTION OF THE ENVIRONMENTAL DATA SHEET.

PART 5: HMIS/NFPA LABEL INFORMATION

HEALTH, FLAMMABILITY, AND REACTIVITY RATINGS SHOULD ONLY BE USED AS A GUIDE. THE MATERIAL SAFETY DATA SHEET FOR THE PRODUCT SHOULD BE CONSULTED WHEN ASSESSING HAZARD INFORMATION.

PART 6: PROPOSITION 65

IF YOUR BUSINESS RESIDES IN THE STATE OF CALIFORNIA OR IF YOU SUPPLY PRODUCTS DIRECTLY OR INDIRECTLY INTO CALIFORNIA, WE ARE PROVIDING THIS INFORMATION TO YOU PURSUANT TO THE CALIFORNIA SAFETY DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (COMMONLY KNOWN AS PROPOSITION 65). THIS LAW REQUIRES, IN PART, THAT "NO PERSON IN THE COURSE OF DOING BUSINESS SHALL KNOWINGLY AND INTENTIONALLY EXPOSE ANY INDIVIDUAL TO CHEMICAL KNOWN TO THE STATE TO CAUSE CANCER OR REPRODUCTIVE TOXICITY WITHOUT FIRST GIVING CLEAR AND REASONABLE WARNING TO SUCH INDIVIDUAL..." (SECTION 25249.6). THE ACT DOES NOT EXEMPT FROM THE WARNING REQUIREMENT "AN EXPOSURE FOR WHICH THE PERSON RESPONSIBLE CAN SHOW THAT THE EXPOSURE POSES NO SIGNIFICANT RISK..." (SECTION 25249.10).

IT HAS NOT BEEN FEASIBLE TO SUBJECT ALL PRODUCTS TO THE DETAILED ANALYSES REQUIRED TO DETERMINE WHETHER EACH OF THE MATERIALS KNOWN TO CALIFORNIA TO CAUSE CANCER OR REPRODUCTIVE TOXICITY IS PRESENT IN DETECTABLE QUANTITIES. HOWEVER, BASED ON AVAILABLE DATA, THE FOLLOWING CHEMICALS LISTED BY THE GOVERNOR OF CALIFORNIA MAY BE PRESENT IN THIS PRODUCT:

CHEMICAL		CONCENTRATION *
ASBESTOS	(FEB 27, 1987)	< .075 ppm
NICKEL	(OCT 1, 1987)	< 10 ppm
LEAD	(FEB 27, 1987)	< 10 ppm
ARSENIC	(FEB 27, 1987)	< 0.005 ppm
CADMIUM	(OCT 1, 1987)	< 0.005 ppm

* IMPURITY LEVELS

* NOT TO BE CONSTRUED AS SPECIFICATIONS UNLESS SO INDICATED.

ENVIRONMENTAL DATA SHEET

INFORMATION CONTAINED MUST NOT BE DETACHED FROM THE MSDS AND ANY COPYING AND REDISTRIBUTION OF THE MSDS SHALL INCLUDE COPYING AND REDISTRIBUTION OF THE ENVIRONMENTAL DATA SHEET.

PART 6: PROPOSITION 65

NOTE: The date refers to the initial appearance of the chemical on the list. Based on the manufacturers' evaluation of the above concentration(s) of impurities present in the product's ingredients, the product is believed to not pose a hazard to human health if handled and used as directed on the Material Safety Data Sheet. This information is provided to assure compliance with the requirements of Proposition 65.

** ** ** ** ** ** ** ** ** ** ** **

The data in this Environmental Data Sheet relates only to the specific material designated and does not relate to its use in combination with any other material or process. The data contained is believed to be correct. However, since conditions of use are outside our control it should not be taken as a warranty or representation for which HYDRITE CHEMICAL CO. assumes legal responsibility. This information is provided solely for your consideration, investigation, and verification.

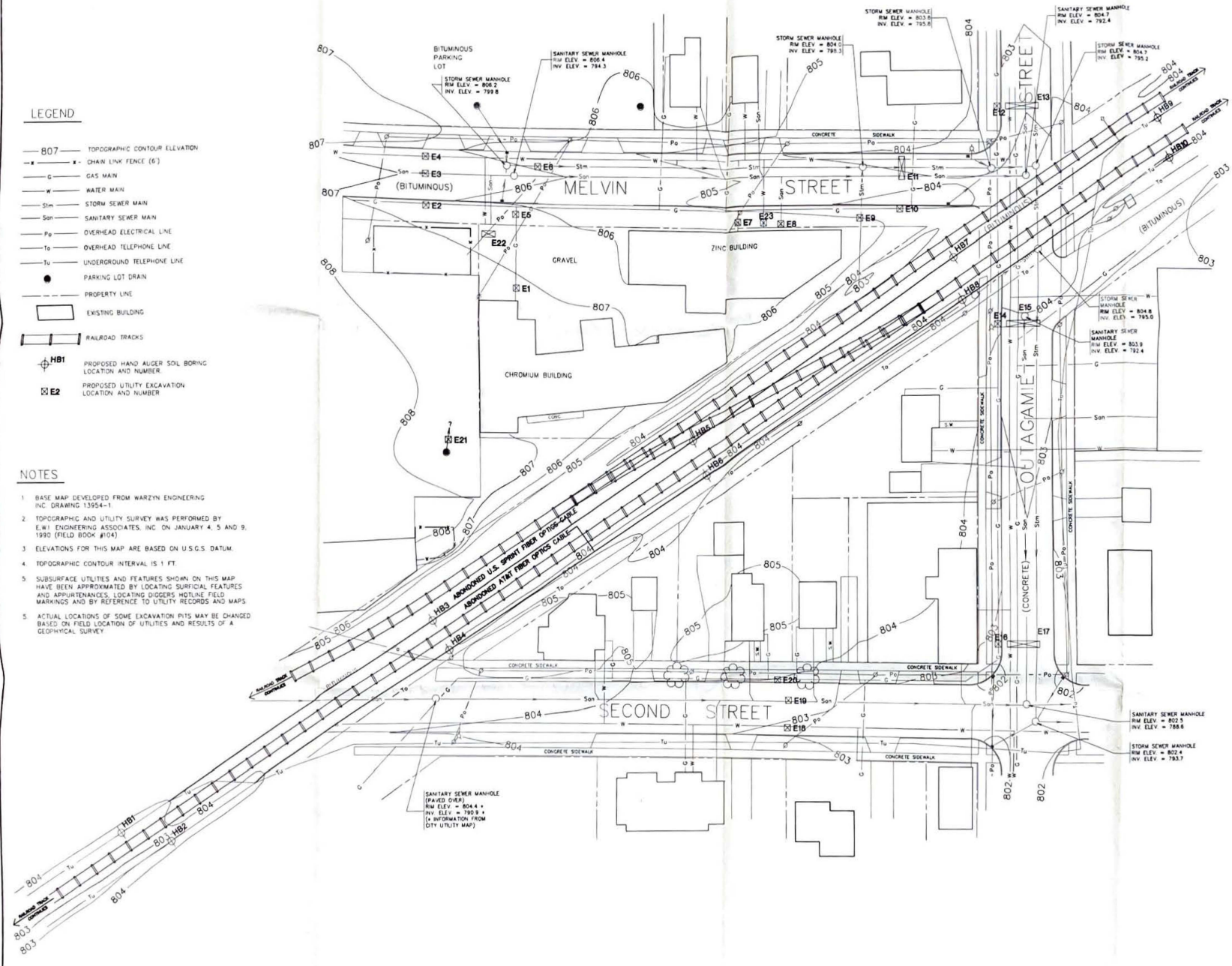

FIGURE 5

PROPOSED UTILITY SAMPLING LOCATIONS

RI/FS WORK PLAN
N.W. MAUTHE COMPANY
APPLETON, WISCONSIN

Designed By
Drawn By JSM
Checked By TAPB
Approved By
Date 10-16-90
Reference
File /PDP\ 13954\FIG2

WARZYN ENGINEERING INC.

Printed OCT 1 6 1990
Sheet Number OF
Drawing Number 13954 10

WARZYN