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Cook Composites and Polymers

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February 15, 1993

Mr. Robert Dean Smith
U.S.Environmental Protection Agency
RCRA Enforcement Branch
77 West Jackson Blvd. HRE-8J
Chicago, IL 60604

RE: Site Investigation and Continuing Interim Corrective Measures Workplan

Dear Mr. Smith:

Enclosed are two copies of the CCP Site Investigation and Continuing Interim Corrective Measures Workplan. The document in its entirety consists of the Workplan, the Quality Assurance Project Plan (QAPjP)(Appendix A), the Field Sampling Plan (FSP)(Attachment 1 to Appendix A), and the RMT Health and Safety Plan (Appendix B).

The Workplan, QAPjP, and FSP incorporate the site investigation design outlined by CCP and RMT and agreed to by USEPA and WDNR representatives in Chicago on December 17, 1992. Subsequent communications regarding the risk assessments to be performed at off-site locations left several issues unresolved; therefore, the off-site investigations presented in this workplan have been designed based on the contaminants of concern and the potential risks posed by contaminants that may be present in soils at these locations.

We look forward to your technical review.

Sincerely,

Daniel Grasset
Vice President Operations
Cook Composites and Polymers

Attachments

cc: Jill Fermanich (WDNR - 3 copies)
Craig Bostwick (CCP - 2 copies)
Franklin Schultz (SE District WDNR - 2 copies)
Jim Rickun (RMT)

RMT, Inc.
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Madison, WI 53708-8923
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Recvd 3-1-93

AGENCY REVIEW COPY

DRAFT SITE INVESTIGATION AND CONTINUING INTERIM CORRECTIVE MEASURES WORKPLAN

COOK COMPOSITES AND POLYMERS
SAUKVILLE, WISCONSIN

FEBRUARY 1993

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Project Hydrogeologist

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Stacy McAnulty, P.E.
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Air Pollution Engineering

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EXECUTIVE SUMMARY

This Draft Site Investigation and Continuing Interim Corrective Measures Workplan describes the soil and groundwater investigations required by USEPA Region V to be performed at the Cook Composites and Polymers (CCP) Saukville, Wisconsin, facility. Continuing interim corrective measures already in place at the site include an operating groundwater remediation system and ongoing groundwater monitoring. The focus of this Workplan are the outstanding work items (including groundwater characterization and aquifer testing) and the additional work items (including soil characterization to be conducted at potential source areas). The major objectives of the proposed investigation are 1) to collect data necessary to determine whether or not additional corrective measures are necessary for potential remaining on-site sources of groundwater contamination; and 2) to quantify the risk to public health posed by potential off-site sources resulting from CCP operations.

The scope of work for the soil investigation includes sampling soils at three on-site locations (former urethane laboratory/hazardous waste incinerator, former dry well, and former tank farm storage area) and the two off-site locations (Logeman property and Churchyard). Samples will be analyzed for known and potential contaminants of concern in groundwater, based on existing data and facility operations.

The scope of work for the groundwater investigation includes a one-time Appendix IX sampling of wells installed in the shallow and deep aquifers to fully characterize groundwater impacts. Ongoing monitoring for volatile organic compounds (VOCs) will continue at the site, to ensure that the groundwater remedial systems continue to effectively control impacted groundwater. An aquifer pumping test is also part of the investigation; data generated will be used to evaluate the hydraulic relationship between CCP and Village of Saukville removal wells, and to evaluate hydraulic connections between the shallow and deep aquifers.

The results of the site investigation and continuing measures will be documented in the Additional Studies Report, as required by the USEPA Region V. Depending on the results of this investigation, the required Corrective Measures study which follows may include evaluation of remedial options for soils in the areas of concern.

Section 1
INTRODUCTION

This Workplan is submitted by Cook Composites and Polymers (CCP) for the RCRA site investigation and continuing interim corrective measures at the Saukville, Wisconsin, facility. This Workplan has been prepared to satisfy, in part, the RCRA requirements presented in the United States Environmental Protection Agency's (USEPA's) July 24, 1992, letter to CCP. The Workplan requirements were clarified through two meetings held with the USEPA and the Wisconsin Department of Natural Resources (WDNR) on September 9, and December 17, 1992. USEPA requirements for the Quality Assurance Project Plan (QAPjP) were also discussed at the December 17, 1992, meeting.

The Workplan includes on-going and outstanding tasks required by the 1987 Corrective Action Order on Consent (CAO V-W-88-R-002), and additional tasks required by the USEPA's July 1992 letter. The additional tasks will be performed pursuant to Section IX, Additional Work of the CAO. Tables 1-1 and 1-2 clarify the relationship between the on-going, outstanding, and additional corrective measures. Tasks addressed by this Workplan are identified in these tables and discussed below.

The on-going tasks (Table 1-1) include monitoring and evaluating the groundwater remediation system that has operated since 1987. Outstanding tasks (Table 1-1) include aquifer testing to evaluate the Village's water supply, off-site soil investigations to develop soil protection standards, and groundwater characterization to develop groundwater protection standards. The additional tasks (Table 1-2) include on-site soil investigations to determine if corrective measures are necessary, replacement of an existing well, and preparation of the Quality Assurance Project Plan (QAPjP) to address the on-going outstanding, and additional tasks. The Workplan presents these corrective measures without further distinction between on-going, outstanding, and additional tasks.

TABLE 1-1

STATUS OF CORRECTIVE MEASURES ORIGINALLY REQUIRED UNDER THE 1987 CAO

Task	Description	Status	Outstanding or On-Going Tasks Included in This Workplan
1	Past and Current Conditions	**Complete** Task 1 Report (Hatcher-Sayre, 1986)	None
2	Schedules	**Ongoing**	The site investigation and continuing interim corrective measures schedule
3	Support Plans	**Outstanding**	Support plans to complete Task 3
4	Village Water Supply Evaluation; Development of Soil and Groundwater Protection Standards	**Outstanding**	Aquifer testing will be performed to evaluate the Village water supply; off-site soil investigations will be performed to develop soil protection standards; Appendix IX groundwater characterization will be performed to develop groundwater protection standards
5	Groundwater Remediation System Evaluation	**Ongoing**	Groundwater monitoring and remediation system evaluation

TABLE 1-2

ADDITIONAL CORRECTIVE MEASURES RECENTLY REQUIRED UNDER SECTION IX <u>ADDITIONAL WORK</u> OF CAO*

Additional Task Description	Additional Tasks Included in This Workplan
Groundwater Monitoring Well Replacement	One existing well will be abandoned and replaced
Investigation of Potential On-Site Sources of Groundwater Contamination	Three on-site areas of concern will be investigated to determine if they are contributing contaminants to groundwater
Development of Investigative Approach for Potential Off-Site Sources of Groundwater Contamination	Methods to investigate two (previously identified) off-site areas of concern
Preparation of Quality Assurance Project Plan (QAPjP) that addresses outstanding, on-going, and additional tasks	The QAPjP is included in Appendix A
Additional Studies Report	To be developed, after site investigation is complete
Corrective Measures Study	To be performed, if necessary
Corrective Measures Study Report	To be developed, if necessary
Evaluation of the Groundwater Remediation following Implementation of Soil Corrective Measures	To be performed, if necessary

* The USEPA letter to CCP dated July 24, 1992, presents the additional work requirements, which were clarified by subsequent meetings held on September 9, and December 17, 1992.

The Workplan includes the following planning elements required by the RCRA corrective action process:

- Project Management Plan
- Data Management Plan
- Quality Assurance Project Plan
- Health and Safety Plan

This Workplan first presents the objectives and scope of work. Next, the project management plan, a project description, site investigation plan, and the data management plan are described. Finally, the approach for performing the baseline risk assessment is presented, and the Workplan is completed by the project schedule.

The QAPjP and RMT Health and Safety Plan are appended to the Workplan. The QAPjP includes the following attachments:

- Attachment 1 - Field Sampling Plan
- Attachment 2 - RMT Standard Operating Procedures
- Attachment 3 - Sample Bottle Specification
- Attachment 4 - Laboratory Precision and Accuracy Control Limits

A community relations plan was approved through an earlier submittal to the USEPA and, therefore, is not included.

Section 2

OBJECTIVES AND SCOPE OF WORK

The objectives of the site investigation and continuing interim corrective measures are as follows:

- To collect data necessary to determine whether or not additional corrective measures are necessary to remediate remaining on-site sources that may be contributing to groundwater contamination
- To quantify the risk to public health posed by potential off-site sources resulting from CCP operations
- To evaluate whether current and proposed pumping programs will continue to effectively control off-site migration of impacted groundwater
- To continue groundwater containment and remediation
- To continue groundwater monitoring to protect potential receptors, to provide early warning of unanticipated contaminant migration, and to assess the progress of groundwater cleanup

The approach in meeting these objectives was developed from known past disposal practices of the facility. Based on these practices, the primary contaminants of concern at the site are volatile organic compounds (VOCs). Since 1987, shallow groundwater at the site has been found to contain high concentrations of benzene, toluene, ethylbenzene, and xylene (BTEX) compounds. Information available from on-going groundwater corrective measures and closure of the former hazardous waste incinerator area (under NR 600 Wisconsin Administrative Code) will be used to augment the site investigation sampling program.

The objectives of this Workplan are a logical progression from the objectives of the initial corrective measures performed at the site. These objectives included the following:

- To reduce contaminant migration from on-site soils to groundwater, by controlling surface water infiltration
- To dewater the glacial overburden by removing contaminated groundwater and thereby reducing contaminant migration from overburden soils to groundwater
- To control the groundwater contaminant plume and thereby protect the Village of Saukville water supply wells

The scope of work for the soil investigation includes sampling soils at three on-site and two off-site potential source locations. An ash pile will also be investigated at one off-site location. Samples will be analyzed for VOCs and semivolatiles in order to determine whether or not these areas are contributing contaminants to groundwater. The scope of work for the soils investigation includes assessing the risk to human health at the two off-site locations.

The approach in the development of the data collection program to characterize these areas includes the following:

- On-site sources will be investigated to determine whether the soils have been affected and are contributing contaminants to groundwater.
- Soils will be analyzed for parameters from Appendix IX (40 CFR Part 264) that reflect potential and known contaminants of concern in the groundwater, based on existing data and facility operations.
- Existing data for Target Compound List (USEPA, 1991) volatiles and semivolatiles at Area 1 will be used based on confirmational soil results from this investigation.

Groundwater monitoring is also included in the Workplan scope. Analysis for VOCs will continue on a regular basis and, in addition, a one-time Appendix IX sampling event will be conducted to fully characterize impacts to groundwater. One new monitoring well will be installed during the investigation, to replace an existing monitoring well that is frequently dry. Finally, aquifer testing will be performed to evaluate the effectiveness of future pumping scenarios at CCP and the Village wells to both control the migration of affected groundwater and to provide for the increasing water supply needs of the Village.

Section 3

PROJECT MANAGEMENT PLAN

3.1 Project Organization

The USEPA, the WDNR, CCP, and RMT, Inc. (RMT) (CCP's technical consultant) are active in the site investigation and continuing interim corrective measures at the CCP site. An organizational chart for the site investigation and continuing interim corrective measures is shown on Figure 3-1.

The designated Remedial Project Manager for the USEPA Region V is Robert Smith. The designated WDNR Project Manager is Jill Fermanich. The Project Coordinator for CCP is Craig Bostwick, and the Project Director for RMT is James Rickun.

The RMT project team is composed of engineers, hydrogeologists, chemists, industrial hygienists, scientists, and support staff. The multi-disciplinary project team provides resources and experience for completing the work in a systematic and comprehensive manner.

3.2 Key Individuals

Key individuals are defined as persons having responsibility for major work activities, technical direction, quality assurance, primary coordination with outside parties, and overall project management. The individuals assigned these responsibilities for this project are identified below (also see Figure 3-1).

KEY RMT PERSONNEL

Person	RMT Position Title	Project Assignment
James Rickun	Program Manager Air Pollution Engineering	Project Director
Stacy McAnulty, P.E.	Senior Project Engineer	Project Coordinator
Gwen Porus	Project Hydrogeologist	Site Coordinator/Site Health and Safety Representative
Chris Hansen, C.I.H.T.	Corporate Health and Safety Director	Health and Safety Coordinator
Eric Gredell, P.E.	Consulting Engineer	QC - Engineering
Tom Stolzenburg, Ph.D.	Manager, Applied Chemistry Department	QA Coordinator
Carol McCartney, Ph.D	Consulting Hydrogeologist	QA - Risk Assessment
Greg Graf	Quality Assurance Officer	QA Manager - RMT Laboratories

PROJECT ORGANIZATION

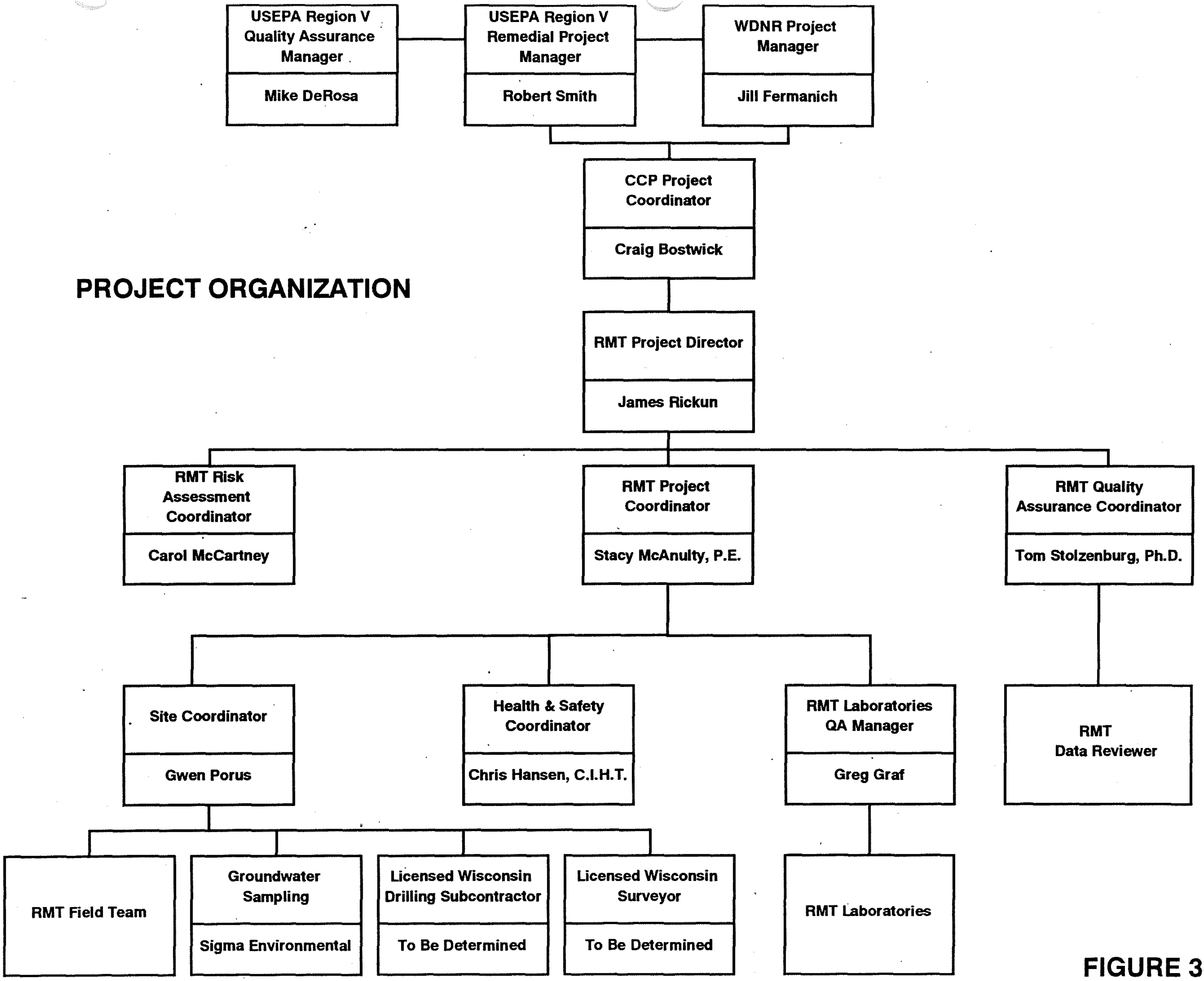


FIGURE 3-1

3.3 Responsibilities of Key Personnel

Site investigation activities will be performed by RMT. Sigma Environmental of Oak Creek, Wisconsin, will continue to perform groundwater sampling activities. Responsibilities of key personnel include the following:

- ***Project Director*** - Responsible for meeting the overall project objectives and identifying and resolving major project issues. Provides QC review and conformance with project plans, and on-going review for logic and reasonableness of interim results. Approves and signs major outputs. Coordinates activities of QA and QC reviewers to provide objective oversight. Serves as the primary point of contact for communications with CCP, the USEPA, and the WDNR.

- ***Quality Assurance Coordinator*** - Responsible for ensuring that all QA/QC procedures are being followed, including review of all QA/QC procedures and documentation, and review of data and project reports. Responsible for internal performance and system audits.

- ***Quality Control Reviewers*** - Responsible for discipline-specific reviews of portions of data, evaluations, and project reports.

- ***Project Coordinator*** - Responsible for coordination of the overall effort. Ensures that project objectives are met. Understands how all of the technical pieces are interrelated and the factors that affect each. Facilitates communications among disciplines so that interim findings or changes in workscope or schedule are understood by the entire team. Responsible for efficient and logical work progress. Serves as the secondary point of contact for communications with CCP, the USEPA, and the WDNR. Communicates technical work progress to the project director.

- ***Site Coordinator*** - Provides technical supervision, oversight, and review for daily on-site operations. Is responsible for on-site conformance with project plans, schedule, and procedures. Performs daily review and signing of notes and logs. Responsible for initiating corrective action on problems encountered in the field. Maintains on-going coordination with the project coordinator on work progress, interim results, and problems.

- ***Quality Assurance Manager*** - **RMT Laboratories** - Ensures that RMT Laboratories meets QA/QC standards specified in the QAPjP. Responsible for performance and reporting of analyses of environmental samples using methods described in the QAPjP. Responsible for initiating corrective actions required in the laboratory.

- ***Peer-Level QC Reviewers*** - Responsible for on-going checks of calculations, procedures, issues, and logic in the field and office.

3.4 Analytical Laboratory Qualifications

Soil, groundwater, and quality control samples (duplicates, trip blanks, and field blanks) will be analyzed at RMT Laboratories in Madison, Wisconsin. The qualifications of RMT's analytical laboratory, including facilities and equipment, were audited and approved by the USEPA Region V for the CLOW RCRA Corrective Action. The QA Manager will be responsible for ensuring that RMT Laboratories meets the QA/QC standards specified in the QAPjP. The validation of the analytical data will be performed by an RMT Data Reviewer not affiliated with RMT Laboratories.

Section 4
PROJECT DESCRIPTION

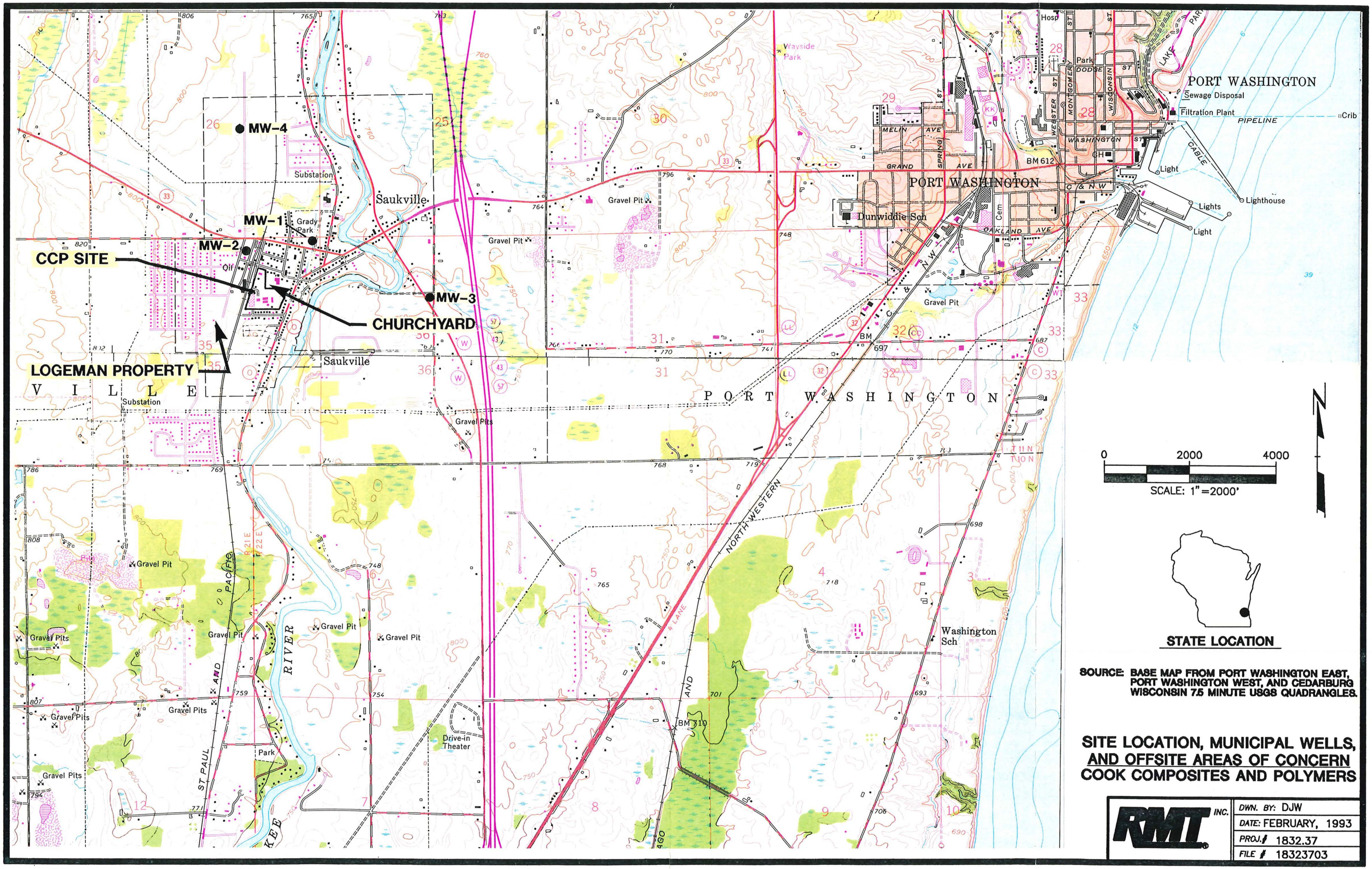
Detailed information concerning the facility history, nature and extent of contamination, and interim corrective measures is provided in the Corrective Measures Task 1—Description of Past and Current Conditions, Site Construction Documentation Report, Volumes I through III (Hatcher-Sayre, 1986). The summary provided below includes information pertinent to this Workplan.

4.1 Site and Facility Description

The facility is located in the Village of Saukville, Wisconsin (Figure 4-1), and has been operated by CCP since 1991. The property is approximately 11.5 acres in size and is bounded by residential properties on all sides except the western border, which is zoned industrial. The Milwaukee River flows south, approximately 1,000 feet east of the site, and Lake Michigan is located approximately 2 miles to the east. Two of the four municipal wells owned by the Village of Saukville (MW-1 and MW-2) are located within 1,500 feet of the facility (Figure 4-1). Well MW-2 is not used for water supply purposes.

The plant was originally operated as a cannery. Freeman Chemical Company, a former owner, installed the resin manufacturing equipment in 1949. Since that time, the plant site has grown geographically, by acquiring additional properties to the east, southeast, and west of the original site, and by the addition of equipment (kettles, tanks, and buildings for adjusting, blending, thinning, rinsing, and storing raw materials and finished products).

Since 1949, the plant has manufactured alkyd, polyester, and urethane synthetic resins. As a result of production, two hazardous wastes are presently generated at CCP: waste rinse solvent and reaction water. In the past, waste resin and spill residues from "U"-listed chemicals may have been generated. A new hazardous waste incinerator, permitted in 1989 is located on the property. The waste rinse solvent and reaction water are disposed at the hazardous waste incinerator.



SOURCE: BASE MAP FROM PORT WASHINGTON EAST, PORT WASHINGTON WEST, AND CEDARBURG WISCONSIN 7.5 MINUTE USGS QUADRANGLES.

SITE LOCATION, MUNICIPAL WELLS, AND OFFSITE AREAS OF CONCERN COOK COMPOSITES AND POLYMERS

RMT INC.	DWN. BY: DJW
	DATE: FEBRUARY, 1993
	PROJ.# 1832.37
	FILE # 18323703

FIGURE 4–1

4.2 Continuing Interim Corrective Measures

Since 1979, when odors were first detected in the Saukville drinking water, CCP (formerly Freeman Chemical Corporation) has been actively involved with the Village of Saukville and the WDNR to assure that the Village water supply is protected. Trichloroethylene (not used by CCP) and ethylbenzene were first detected in municipal well MW-2. After 1979, this well was no longer used for Village water supply. Beginning in 1983, CCP began conducting regular groundwater monitoring at Village wells and several private wells.

In the mid-1980s, CCP constructed an extensive groundwater remediation system which both pumps and collects groundwater. Construction included installation of 2,000 feet of shallow groundwater collection trenches, five dolomite pumping wells, and approximately 3 acres of concrete pavement. Remediation is accomplished by interception of the contaminated groundwater by underground trenches and wells followed by pumping of the affected groundwater from the aquifer. The withdrawal of groundwater induces the flow of impacted groundwater toward the pumping wells at the site. The extracted groundwater is then either discharged to the Village's water treatment system or used as noncontact cooling water by the facility. Noncontact cooling water is discharged to the Milwaukee River according to CCP's NPDES permit. Since operation of this remedial system began in 1987, no contamination has been reported in Village wells.

In addition to the groundwater remediation system, interim remedial measures conducted in the past include the following:

- Installation of an extensive site-wide surface water collection system
- Construction of the surface water storage basin
- Remediation of the former dry well, involving the removal of the concrete structure, 60 cubic yards of soil, and 4,000 gallons of water
- Removal of buried tanks, lines, and associated soil
- Repair of the nearby Laubenstein well casing (PW-08) to minimize vertical migration of contaminants

- Reconditioning of municipal well MW-3 at the request of the Village
- Replacement of surface soil at the Church yard ball field.

The on-going remedial measures include groundwater monitoring activities performed according to the objectives of the receptor, perimeter, and remediation progress monitoring programs. Monitoring results are reported to the USEPA and the WDNR on a quarterly basis. Analytical results are also transmitted electronically to the USEPA and the WDNR. In addition, an annual groundwater report is compiled to evaluate the effectiveness of the on-going groundwater remediation.

4.3 Summary of Subsurface and Groundwater Conditions

Overburden soils at the site consist of clay, silt, sand, and gravel of glacial till, glaciolacustrine, and glaciofluvial origin. These sediments generally range from approximately 10 to 25 feet in thickness. The stratigraphic order of the deposits from the ground surface down is typically sand and silt overlying a laterally continuous layer of laminated silt and clay (glaciolacustrine) above dense clay (glacial till). A thin layer of sand and gravel (glacial outwash) lies between this till unit and bedrock.

The bedrock aquifer beneath the site is the Niagara Dolomite, which is highly fractured in its upper 10 to 15 feet and contains abundant solution channels and cavities at depth. Due to fracturing, the dolomite appears to be hydraulically connected to the glacial overburden unit. The elevation of the bedrock surface is highly variable across the site. A bedrock high (20 feet below ground surface [BGS]) is located near the center of the site, and a dramatic closed depression in the bedrock surface, located in the northeastern corner of the site, has been characterized as a karst feature. In this area, the depth to bedrock is up to 205 feet BGS.

Shallow groundwater in the glacial overburden flows generally east to southeast toward the Milwaukee River. Flow is affected both by the presence of the karst feature, which induces localized radial and downward flow, and the pumping of glacial overburden wells in the southwestern corner of the site. Contaminated groundwater in the overburden is captured by these pumping wells and the Ranney Collector (drain) system present on-site.

Groundwater flow in the shallow dolomite is inward toward the center of the site, and is influenced by pumping at dolomite wells W-21A, W-30, and MW-2. Pumping of these wells is part of the remedial program to control off-site movement of contaminated groundwater.

Regional groundwater flow in the deep dolomite aquifer is to the east. Locally, the flow direction is influenced by extensive pumping of the dolomite aquifer by the Village for water supply, and by CCP to maintain control of the contaminant plume. The Village (population approximately 4,000) typically removes 800 to 1,300 gpm for water supply. According to the Village Water Supply Superintendent, future water demands are expected to increase groundwater removal to 1,500-1,600 gpm by the end of 1990s because of increased residential and industrial needs (Dickman, 1993).

Groundwater monitoring has been conducted at the facility since 1983. The present monitoring network consists of 44 sampling points, including 20 glacial overburden wells, 12 shallow dolomite wells, six deep dolomite wells, three Ranney collectors (shallow drains that collect groundwater), and three publicly owned treatment works (POTW) sampling points. The POTW sampling points are included because shallow groundwater from the site is discharged to the sanitary sewer for treatment at the POTW. Recent groundwater quality results indicate that the shallow groundwater in the glacial overburden contains BTEX at levels ranging from approximately 30 μg/L in perimeter well W-20 to 800,000 μg/L in on-site well W-47. Wells completed in the fractured shallow dolomite have lower BTEX levels, ranging from approximately 6 μg/L to 8,400 μg/L. Only one well open to the deeper dolomite (W-30) contained BTEX (220 μg/L). This well serves as the main pumping well to control the plume at the site, and typically removes 385 gpm.

The groundwater quality results support the need for investigation of the potential source areas of concern discussed in the previous subsection. Elevated BTEX levels have been reported in shallow groundwater monitoring wells at the following locations:

- Area 1 - Former urethane laboratory/hazardous waste incinerator (W-47)
- Area 2 - Former dry well (W-6A)

- Area 3 - Former tank farm area (W-43)
- Area 5 - Churchyard property (W-37)

A substantial reduction in total VOCs occurred during the early stages of groundwater removal activities; however, the data indicate that continued pumping is necessary to control plume movement. Future increasing water supply needs of the Village and continued pumping by CCP will require further evaluation of the aquifer systems to maintain control of the plume.

4.4 Areas of Concern

Five on- and off-site areas of concern have been identified as potential contributing sources of VOCs to groundwater at the site. Areas 1, 2, 3, and 5 are shown on Figure 4-2, and Area 4 is located on Figure 4-1. Soil sampling during this investigation will be performed at each of the five locations, which are briefly described below:

- **Area 1 - Former Urethane Laboratory/Hazardous Waste Incinerator**

  Used to burn reaction water from 1968 to 1989. As a result of incinerator operations, spills, and laboratory disposal of spent solvents, high levels of BTEX are present in soils in this area.

- **Area 2 - Former Dry Well**

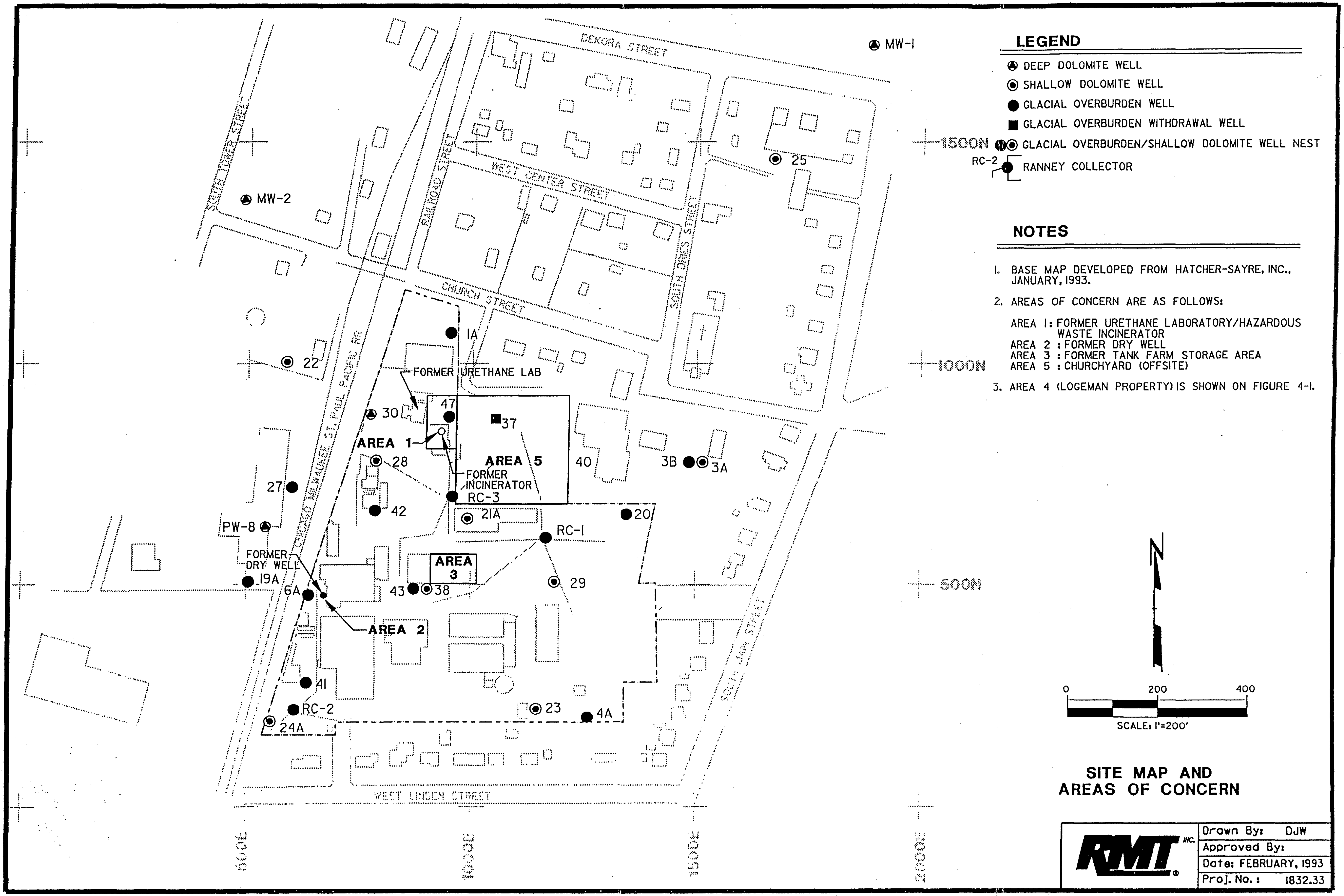
  Used from approximately 1952 through 1968 to dispose of reaction water as approved by the Wisconsin Division of Water Pollution Control (WDWPC, 1952). The well consisted of a pit with a sand and gravel base. The well was removed in 1986 and the area was remediated.

- **Area 3 - Former Tank Farm Storage Area**

  Originally supported on a stone base bermed with earth. Although the tanks did not leak, spills may have occurred during routine tank filling. Currently, this area is occupied both by new tank and storage containment structures, and by the hazardous waste incinerator/small storage facility.

- **Area 4 - Logeman Property** (off-site)

  An air curtain incinerator, consisting of an 8- to 10-foot-deep concrete pit, was formerly operated in this area. The pit is presently covered by a wooden platform. The incinerator was used in the past primarily to burn diatomaceous earth. Reaction water was used occasionally to quench the fires, and cracks in the concrete pit may have allowed releases to the ground. An ash pile, covered with 60 ft^3 of soil in 1972, is also located on the property. The ash was produced during operation of the air curtain incinerator.



LEGEND

- ◉ DEEP DOLOMITE WELL
- ◎ SHALLOW DOLOMITE WELL
- ● GLACIAL OVERBURDEN WELL
- ■ GLACIAL OVERBURDEN WITHDRAWAL WELL
- ●◎ GLACIAL OVERBURDEN/SHALLOW DOLOMITE WELL NEST
- RC-2 ● RANNEY COLLECTOR

NOTES

1. BASE MAP DEVELOPED FROM HATCHER-SAYRE, INC., JANUARY, 1993.
2. AREAS OF CONCERN ARE AS FOLLOWS:

   AREA 1: FORMER URETHANE LABORATORY/HAZARDOUS WASTE INCINERATOR
   AREA 2 : FORMER DRY WELL
   AREA 3 : FORMER TANK FARM STORAGE AREA
   AREA 5 : CHURCHYARD (OFFSITE)
3. AREA 4 (LOGEMAN PROPERTY) IS SHOWN ON FIGURE 4-1.

SITE MAP AND AREAS OF CONCERN

RMT INC.

Drawn By: DJW
Approved By:
Date: FEBRUARY, 1993
Proj. No.: 1832.33

FIGURE 4-2

Reference Files

Ref. File 1 = bmrmt.dgn
Ref. File 2 = bmclient.dgn
Ref. File 3 = border.dgn
Ref. File 4 = •no ref name•
Ref. File 5 = •no ref name•
Ref. File 6 = •no ref name•
Ref. File 7 = •no ref name•
Ref. File 8 = •no ref name•
Ref. File 9 = •no ref name•
Ref. File 10 = •no ref name•

Logical Names

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(2) bmc
(3) bdr
(4) •no ref logical•
(5) •no ref logical•
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(8) •no ref logical•
(9) •no ref logical•
(10) •no ref logical•

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(2) 1-63
(3) 1-63
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- **Area 5 - Churchyard** (off-site)

  May have been affected by past disposal practices at Area 1. Past overland flow of spent solvents may have migrated onto a small section of the Churchyard.

Section 5

SITE INVESTIGATION PLAN

5.1 Sampling Network Design and Rationale

The sampling network design and rationale are described in Tables 5-1 and 5-2 for soils and groundwater, respectively. The soil sampling locations in each of the five areas of concern are shown on Figures 5-1 and 5-2. Figure 5-3 illustrates the locations of the groundwater sampling points.

5.1.1 Selection of Soil Sampling Locations

The rationale for selected sampling locations is supported by the Comments Response Memorandum (RMT, 1992b), which discusses past disposal practices at the five areas of concern.

The selection of specific soil boring locations was based on the following:

- Results of soil investigations performed at the former urethane laboratory/hazardous waste incinerator (Hatcher-Sayre, 1991b) (RMT, 1992a and 1993)
- Groundwater quality and flow data (Hatcher-Sayre, 1988, 1990, 1991a, and 1992)
- Interviews with CCP production management employees regarding past disposal practices
- Observations made during a site visit to identify drilling feasibility at the five areas

5.1.2 Selection of Groundwater Sampling Points

The selection of groundwater sampling points which meet the groundwater monitoring objectives was based on groundwater quality and flow data. Wells selected for Appendix IX characterization were previously approved by the USEPA.

TABLE 5-1

SOIL SAMPLING NETWORK DESIGN AND RATIONALE

Area of Concern	Past Disposal Practices	Sampling Objectives	Data Collection		Data Use	Data Quality Objectives
			Number of Locations	Parameters		
Area 1: Former Urethane Laboratory/ Hazardous Waste Incinerator	Solvents disposal on ground Reaction water incineration	Confirm existing soil results for VOCs and SVOCs[1]	One boring to bedrock, sampled continuously at 2-foot intervals	Appendix IX VOCs; one at-depth sample for Appendix IX SVOCs.	Evaluate need for remediation	Confirmational (DQO Level 4)
Area 2: Former Dry Well	Reaction water disposal	Determine whether area is contributing BTEX to groundwater and if SVOCs are of concern	One boring to bedrock, sampled continuously at 2-foot intervals	Appendix IX VOCs; one at-depth sample for Appendix IX SVOCs	Evaluate need for remediation	Confirmational (DQO Level 4)
Area 3: Former Tank Farm Storage Area	Spills of BTEX and styrene from tank filling operations	Determine whether area is contributing BTEX to the groundwater and if SVOCs are of concern	Two borings to bedrock, sampled continuously at 2-foot intervals	Appendix IX VOCs; one at-depth sample for Appendix IX SVOCs	Evaluate need for remediation	Confirmational (DQO Level 4)
Area 4: Logeman Property	Ash pile	Verify waste characteristics and vertical extent of ash pile	Three surface samples; one boring through waste, sampled at three depths (top, middle, and bottom of ash pile)	Appendix IX metals and Appendix IX VOCs	Risk assessment Evaluate need for remediation	Confirmational (DQO Level 4)
	Buried containers of dried resin and solid debris; occasional reaction water disposal at incinerator pit	Determine whether area is contributing BTEX to groundwater and if SVOCs are of concern	Two borings to bedrock, sampled continuously at 2-foot intervals	Appendix IX VOCs; one at-depth sample for Appendix IX SVOCs	Risk assessment Evaluate need for remediation	Confirmational (DQO Level 4)
	None - background conditions	Obtain background chemical soils data from non-impacted area for comparison with soil samples taken from potentially affected areas	Two surface samples at western edge of Area 4	Appendix IX VOCs, SVOCs, and metals	Evaluate degree of impact to soils above background conditions at Areas 1 through 5	Confirmational (DQO Level 4)
Area 5: Churchyard	Potential overland flow of spilled solvents from Area 1	Delineate nature, depth, and lateral extent of impacts beyond CCP eastern property line	Five borings to bedrock, sampled continuously at 2-foot intervals	Field-screen all samples for VOCs using portable GC; Appendix IX VOCs and SVOCs on selected samples[2]	Plume definition Evaluate need for remediation Risk assessment	Portable GC (DQO Level 2 for plume definition and DQO Level 4 for Risk assessment) Confirmational (DQO Level 4)
	Ball field	Determine whether BTEX and SVOCs are of concern throughout ball field	Ten locations sampled at the surface to 2 feet and 4 to 6 feet	Field-screen for VOCs at 2- and 6-foot depths using portable GC; Appendix IX VOCs on samples collected from below the topsoil replacement zone	Risk assessment	Portable GC (DQO Level 4 for risk assessment) Confirmational (DQO Level 4)

NOTE:

[1] Existing data were collected under a WDNR-approved closure of the former hazardous waste incinerator. A total of 24 borings were installed and sampled to approximately 12 feet. Existing analytical results include VOCs and TCL semivolatiles.

[2] Appendix IX VOCs and SVOCs will be analyzed for two samples collected at 2-foot depths that appear to be impacted based on field GC results.

VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
BTEX = benzene, toluene, ethylbenzene, and xylene compounds
TCL = Target Compound List

TABLE 5-2
GROUNDWATER MONITORING NETWORK DESIGN AND RATIONALE

Monitoring Objectives		Rationale	Sampling Frequency	Data Collection					Data Uses	Data Quality Objectives
				No. of Locations	Sampling Locations			Parameters		
Receptor Monitoring	Protect current potential receptors	The groundwater contaminant plume is controlled by a network of pumping wells and shallow drain systems. Continued monitoring is required at receptor points (municipal wells and the POTW[1], which receives shallow groundwater collected from the site) because xylene was detected at municipal wells before groundwater remediation.	Quarterly	9-10	Municipal Wells MW-01 MW-02[2] MW-03 MW-04	POTW Influent Effluent Sludge	Discharge to POTW (Ranney Collectors)[3] RC-1 RC-2 RC-3	Municipal Wells & POTW VOCs by Method 8240 (Table 3) Discharge to POTW (Ranney Collectors) VOCs by Method 8020 (Table 3)	• Confirm safe drinking water quality. • Monitor environmental releases of VOCs at the POTW. • Monitor discharges of VOCs from the facility to the POTW to document facility contribution of VOCs.	Confirmational (DQO Level 4) with "CLP-like" reporting.
Perimeter Monitoring	Provide warning of unanticipated contaminant migration	Perimeter monitoring is necessary for the upper aquifer, because this is the most highly impacted groundwater. Perimeter well results since 1988 have been relatively consistent indicating that contaminant migration is not anticipated.	Semiannually	12	Glacial Overburden W-01A W-03B W-04A[4] W-08A (proposed) W-20 W-27	Shallow Dolomite W-03A W-07 W-22 W-23 W-25	Deep Dolomite PW-08	VOCs by Method 8240 (Table 3)	• Develop trend analyses of total VOCs over time. • Identify significant changes in contaminant concentrations at perimeter locations.	Confirmational (DQO Level 4) with "CLP-like" reporting.
Remediation Progress Monitoring	Assess groundwater cleanup progress	Remediation progress wells are located within the contaminant plume. Total VOC concentrations have reached 800 mg/L in the shallow groundwater. Assessing the relative levels and reduction in VOCs in response to remedial measures is a long-term monitoring objective.	Annually during current groundwater remediation activities. Semiannually after initiation of future soil remediation activities.	13	Glacial Overburden W-06A W-19A W-37 W-41 W-42 W-43 W-47	Shallow Dolomite W-21A W-24A W-28 W-29 W-38	Deep Dolomite W-30	VOCs by Method 8020 (Table 4)	• Develop trend analyses of total VOCs over time. • Evaluate effectiveness of on-going groundwater corrective measures and future soil remediation activities.	Confirmational (DQO Level 4) with "CLP-like" reporting, if possible. High levels of BTEX may interfere with achieving this DQO.
Contaminant Characterization	Characterize contaminants present in groundwater	VOCs are the primary constituents of concern in groundwater, based on the facility process of resin manufacturing. However, full Appendix IX analyses are necessary to complete contaminant characterization.	One-time event	8	Glacial Overburden W-06A W-44[5] W-47	Shallow Dolomite W-21A W-24A W-28 W-29	Deep Dolomite W-30	Appendix IX with the exclusion of pesticides/herbicides and dioxins/furans	• Characterization of groundwater.	Confirmational (DQO Level 4) with "CLP-like" reporting, if possible. High levels of BTEX may interfere with achieving this DQO except at wells W-24A, W-28, and W-30.

NOTES:

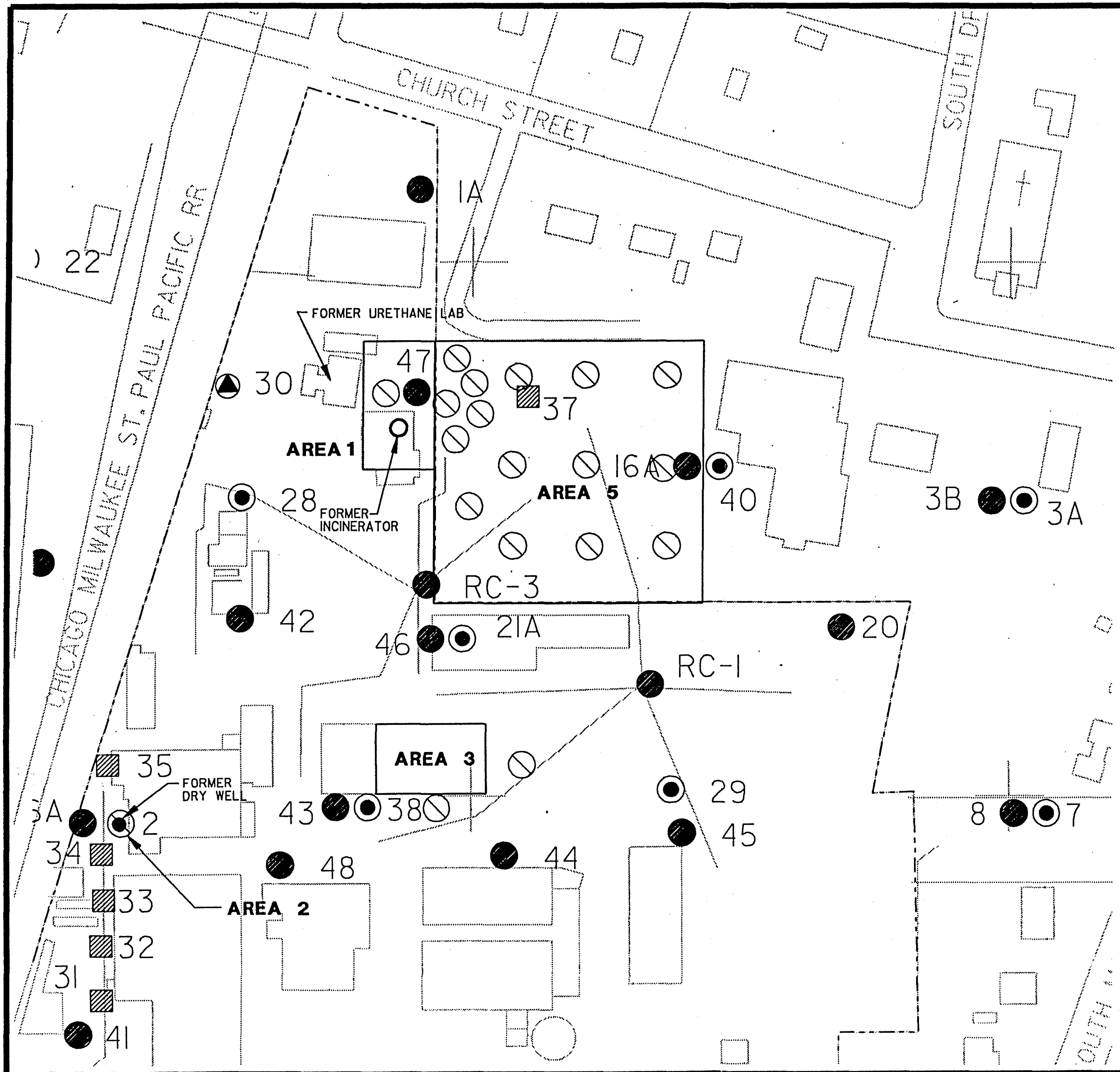
[1] Publicly owned treatment works.

[2] MW-02 will be sampled annually. This well is not used for water supply purposes, and the Village does not routinely pump this well.

[3] Ranney Collectors are shallow drain systems located in the glacial overburden and keyed into bedrock. These drains collect shallow groundwater, which is discharged to the sanitary sewer.

[4] Well W-04A is periodically dry.

[5] Well W-44 is typically dry.



LEGEND

- ◉ DEEP DOLOMITE WELL
- ⊙ SHALLOW DOLOMITE WELL
- ● GLACIAL OVERBURDEN WELL
- ▨ GLACIAL OVERBURDEN WITHDRAWAL WELL
- ●⊙ GLACIAL OVERBURDEN/SHALLOW DOLOMITE WELL NEST
- RC-2 ● RANNEY COLLECTOR
- ⊘ SOIL SAMPLING LOCATIONS

NOTES

1. BASE MAP DEVELOPED FROM HATCHER-SAYRE, INC., JANUARY, 1993.
2. AREAS OF CONCERN ARE AS FOLLOWS:
3. AREA 1: FORMER URETHANE LABORATORY/HAZARDOUS WASTE INCINERATOR
   AREA 2 : FORMER DRY WELL
   AREA 3 : FORMER TANK FARM STORAGE AREA
   AREA 5 : CHURCHYARD (OFFSITE)
4. AREA 4 (LOGEMAN PROPERTY) IS SHOWN ON FIGURE 5-2.

N

0 100 200

SCALE: 1"=100'

SOIL SAMPLING LOCATION MAP: AREAS 1, 2, 3, AND 5

RMT INC.

Drawn By:	DJW
Approved By:	
Date: FEBRUARY, 1993	
Proj. No.:	1832.33

FIGURE 5-1

RMT COMPUTER AIDED DESIGN & DRAFTING

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Plot Date = Wed Feb 17 13:19:18 1993
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Ref. File 2 = bmclient.dgn
Ref. File 3 = border.dgn
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Levels

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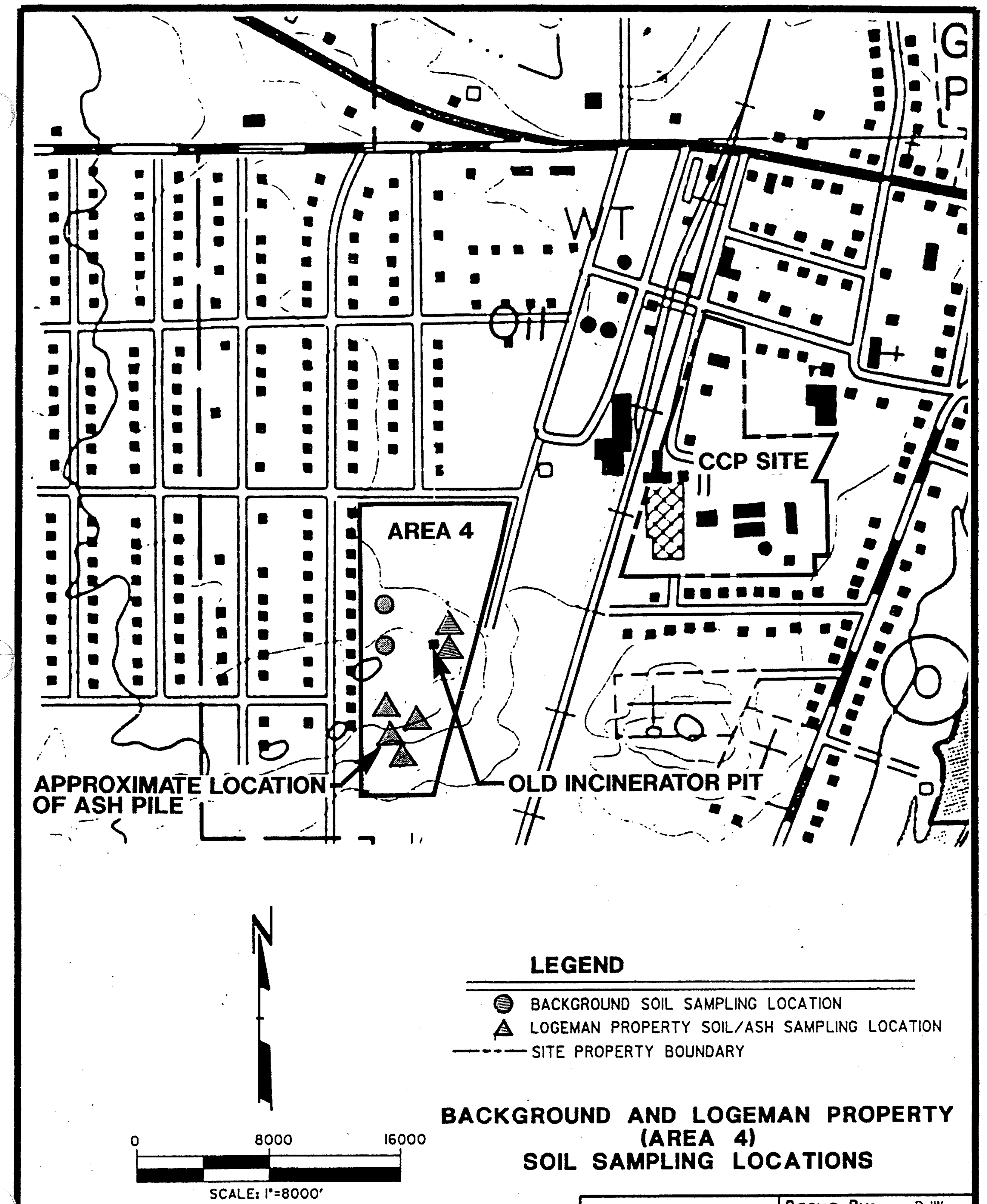
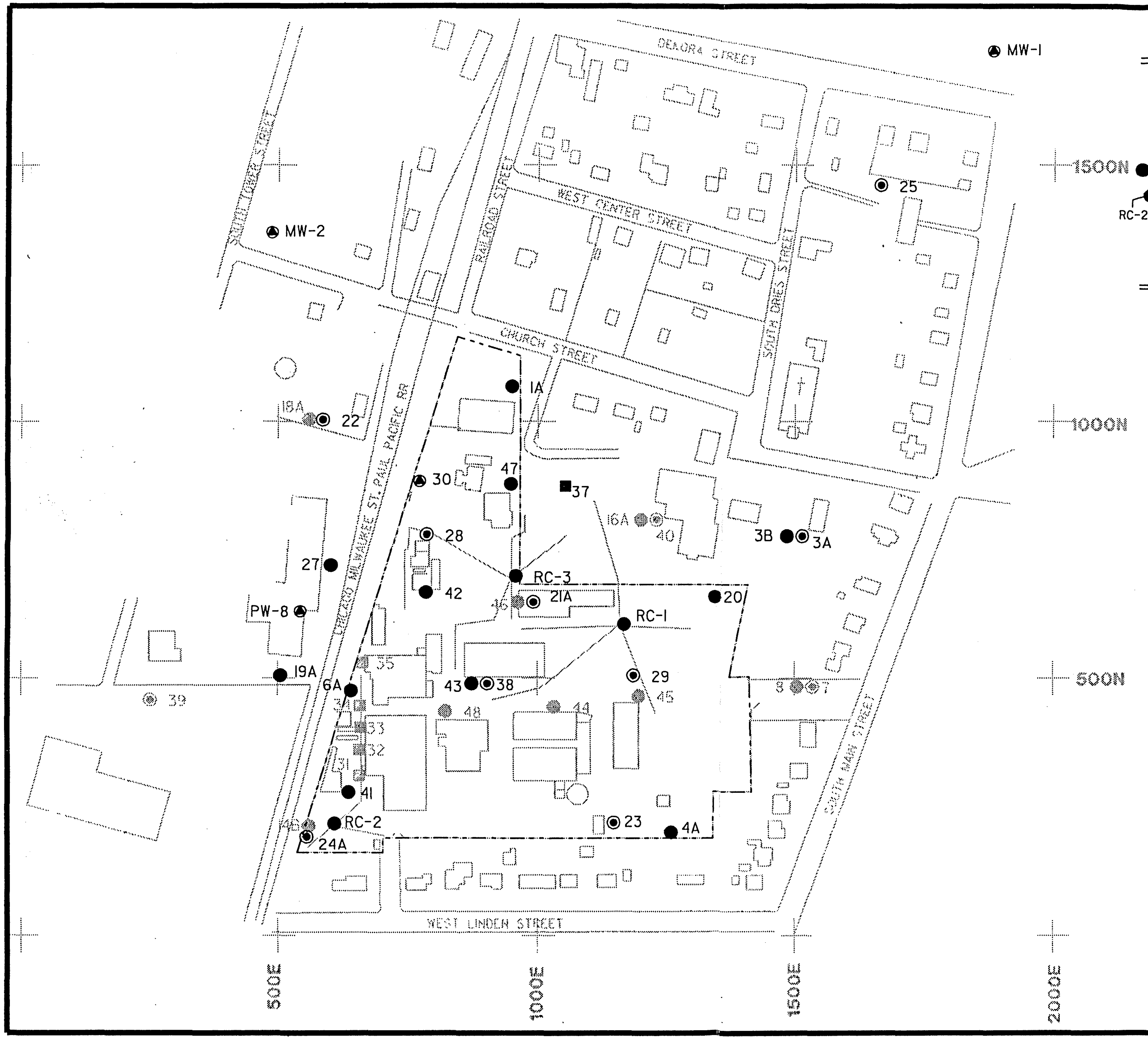


BACKGROUND AND LOGEMAN PROPERTY
(AREA 4)
SOIL SAMPLING LOCATIONS

SOURCE : PORT WASHINGTON WEST, WISCONSIN 7.5 MINUTE USGS TOPOGRAPHIC QUADRANGLE.

Drawn By:	DJW
Approved By:	
Date:	JANUARY, 1993
Proj. No.:	1832.37

FIGURE 5-2

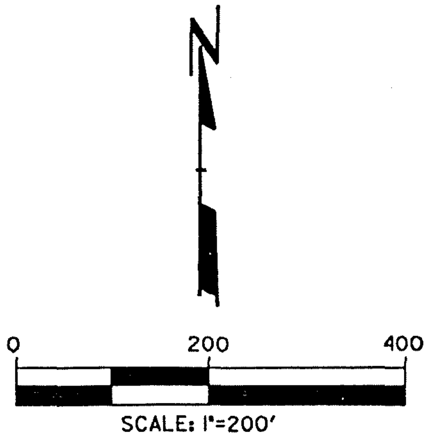


LEGEND

- ● DEEP DOLOMITE WELL
- ◉ SHALLOW DOLOMITE WELL
- ● GLACIAL OVERBURDEN WELL
- ■ GLACIAL OVERBURDEN WITHDRAWAL WELL
- ●◉ GLACIAL OVERBURDEN/SHALLOW DOLOMITE WELL NEST
- RC-2 ● RANNEY COLLECTOR

NOTES

1. BASE MAP WAS DEVELOPED FROM HATCHER-SAYRE, INC.
2. SAMPLING POINTS ARE HIGHLIGHTED.
3. PROPOSED WELL W-08A (TO REPLACE W-8) WILL ALSO BE MONITORED.
4. MUNICIPAL WELLS MW-3 AND MW-4 WILL ALSO BE MONITORED (SEE FIGURE 3-1 OF THE WORKPLAN FOR LOCATIONS).
5. POTW SAMPLING POINTS POTW-I, POTW-E, AND POTW-S WILL ALSO BE MONITORED.



GROUNDWATER SAMPLING POINTS

RMT INC.

Drawn By:	DJW
Approved By:	
Date:	FEBRUARY, 1993
Proj. No.:	1832.33

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Reference Files

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Logical Names

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Levels

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RMT COMPUTER AIDED DESIGN & DRAFTING

FIGURE 5-3

5.2 Description of Site Investigations

The site investigations will include soil sampling at the five areas of concern as shown in Table 5-1 and described in the FSP. The sampling programs are discussed briefly below.

- **Area 1 - Former Urethane Laboratory/Hazardous Waste Incinerator**

  To confirm existing VOC and SVOC soils results from this area, one boring will be drilled to bedrock and sampled continuously at 2-foot intervals. The boring will be located north of Building 7. All samples will be analyzed for Appendix IX VOCs, and one sample taken at depth will be analyzed for Appendix IX SVOCs. The data will be considered Level 4 data quality for confirming soil impacts in this area.

- **Area 2 - Former Dry Well**

  To determine whether soils in this area are contributing BTEX/SVOC to groundwater, one boring will be drilled to bedrock and sampled continuously at 2-foot intervals. The boring will be drilled at the location of the former dry well. The analytes, sample interval for analysis, and data quality objective are the same as for Area 1.

- **Area 3 - Former Tank Farm Storage Area**

  To determine whether soils in this area are contributing BTEX/SVOC to groundwater, two borings will be drilled to bedrock and sampled continuously at 2-foot intervals. The borings will be located south and east of Area 3 due to drilling rig access difficulties. The analytes, sample intervals and analysis, and data quality objective are the same as for Areas 1 and 2.

- **Area 4 - Logeman Property**

  To verify the waste characteristics and vertical extent of the ash pile, three surface locations and one boring drilled through the pile will be sampled. The boring will be sampled at the surface, middle, and bottom of the pile, and all samples will be analyzed from Appendix IX VOCs and Appendix IX metals. To determine whether soils in the area of the old incinerator pit are contributing BTEX/SVOC to groundwater, two borings will be drilled to bedrock and sampled continuously at 2-foot intervals. All samples will be analyzed for Appendix IX VOCs, and one sample taken at depth in each boring will be analyzed for Appendix IX SVOCs. The data from Area 4 surface samples (0-2 feet) will be used to perform a risk assessment for direct contact with soils. All Appendix IX results will be considered Level 4 data quality for this evaluation.

- **Area 5 - Churchyard**

  Potential Spilled Solvent Area

  To delineate the nature, depth, and lateral extent of VOCs beyond CCP's eastern property line in the Churchyard ball field, five borings will be installed to bedrock. One boring will be located within the suspected area of impact from overload flow based on plant staff recollection. Four borings will be located outside this area. Borings will be sampled continuously at 2-foot intervals.

  Portable GC analyses of VOCs in soil headspace will be conducted for samples recovered from the borings. GC results will be considered level 2 data quality for delineating the extent of VOC impacts. GC results at the 2- and 6-foot depths will be considered level 4 data quality for assessing the future risk of potential soil pore gas migration into basements.

  Appendix IX VOCs and SVOCs will be analyzed for samples collected at 2-foot depths that appear to be impacted based on the portable GC results. These results will be used 1) to characterize the nature of contamination; and 2) to assess the risk of direct contact at this location. Appendix IX VOC results will be considered level 4 data for characterizing the VOC contamination and for assessing the risk of direct contact with soil.

  Ball Field

  Ten grid locations will be sampled at surface to 2-foot and 4- to 6-foot-depth intervals throughout the remainder of the Churchyard ball field.

  Portable GC analyses of VOCs in the soil headspace will be conducted for all of the samples. GC results will be considered level 4 data quality for assessing the risk of potential soil pore gas migration into basements.

  Appendix IX VOCs will be analyzed in all of the near-surface samples. Because the top 6 to 8 inches of soil have been replaced in the past, samples for chemical analysis will be obtained from 1- to 2-foot depths. Appendix IX VOC results will be considered level 4 data quality for assessing the risk of direct contact with soil.

5.3 Data Uses and Data Quality Objectives

The intended data uses are presented in Tables 5-1 and 5-2 for soil and groundwater, respectively.

Uses for soil data include the following:

- To evaluate the need for remediation at the areas of concern (if corrective measures are needed, they will be evaluated during the Corrective Measures Study).
- To perform baseline risk assessments at off-site locations
- To determine whether a plume is present at the Churchyard ball field

Uses for groundwater data include the following:

- To confirm safe drinking water quality at receptor wells
- To monitor VOC discharges from CCP to the POTW
- To monitor environmental releases of VOCs from the POTW
- To develop trend analyses of total VOCs over time for perimeter monitoring and remediation progress monitoring wells
- To identify significant changes in contaminant concentrations at perimeter locations
- To evaluate the effectiveness of on-going groundwater corrective measures and future soil remediation activities
- To characterize groundwater contamination
- To evaluate the effectiveness of pumping programs to control impacted groundwater

Data quality objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during investigative activities. Since DQOs are based on the end uses of the data to be collected, different data uses may require different levels of data quality. There are five analytical levels defined by the USEPA which address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. Data to be collected for this investigation are categorized as follows:

- Screening (DQO Level 1) - This provides the lowest data quality but the most rapid results.

- Field Analyses (DQO Level 2) - This provides rapid results and better quality than in Level 1.

  Portable gas chromatograph data will be collected to meet DQO Level 2 objectives and used to map the extent of a possible solvent plume in the Churchyard. Near real-time analyses of headspace over soil using a portable GC is equal to or more sensitive than laboratory analysis of VOCs because losses during transport and storage are avoided. For this reason the portable GC will be more effective in mapping the solvent plume.

- Confirmational (DQO Level 4) - This provides the highest level of data quality and is used for purposes of risk assessment and evaluation of remedial alternatives. These analyses require full SW 846 analytical and data validation procedures in accordance with USEPA recognized protocol, except in the case of portable GC results from soil vapor headspace analysis conducted in the Churchyard. Soil vapor headspace measurements will be conducted with a portable GC and will be considered DQO Level 4 for purposes of assessing the future risk of soil gas migration into underground structures such as basements.

5.4 Aquifer Testing and Flow Modeling

Aquifer testing at the CCP site will allow more accurate characterization of the dolomite aquifer, which will be used to improve the definition of the hydraulic relationship between the Village and CCP dolomite pumping wells. Data collected during aquifer testing will be used to determine the aquifer parameters (e.g., transmissivity, storativity, leakance). The parameters will then be input into a groundwater flow model which will be used to evaluate the efficacy of several possible long-term groundwater withdrawal schemes for the Village municipal wells and CCP's remediation wells. A critical input to the model will be the representation of the Milwaukee River as a boundary condition; the proximity of the River to the site and the Village wells may exert an influence on potential future groundwater withdrawal schemes.

The aquifer testing program, involves recovery well tests in one shallow dolomite well (on-site) and one deep municipal well. The use of the municipal well will require cooperation from the Village of Saukville. The schedule and design of the test will be confirmed following discussions with CCP and representatives from the Village. Village restrictions on water use will likely require that the aquifer testing be performed in April or May. A discussion of previous data and the aquifer testing program are presented below.

Background

The focus of groundwater remediation at the site is withdrawal of contaminated groundwater from the dolomite aquifer, principally through a deep dolomite well (W-30) located on CCP property. Localized reversal of the groundwater gradient away from the Village well field and toward the original source of pollutants is accomplished by the pumping of W-30, which is expected to slowly flush the dolomite aquifer of contaminated groundwater.

The Village well field consists of four wells. In 1979, ethylbenzene and trichloroethylene (not used by CCP) were detected in well MW-2. In the past, well MW-1 also reportedly drew in slugs of impacted water periodically. VOCs have not been detected above reporting limits at either well since 1987, and MW-2 is no longer used for Village water supply. No impacts have been detected at well MW-3 (located on the east side of the Milwaukee River). VOCs were detected at the reporting limit (5 μg/L) once at well MW-4. No impacts have been detected at well MW-4 since 1988.

Because pumping W-30 at a higher rate may potentially reduce water levels in Village wells MW-2 and MW-4, various pumping schemes have been considered that might both allow continued remediation of the dolomite aquifer and also satisfy the future water supply needs of the Village.

These schemes include the following:

a. Pumping MW-3 and MW-4 for potable water, pumping W-30 for remediation and CCP cooling water, and taking MW-2 and MW-1 out of service

b. Pumping MW-3, MW-4, and MW-1 for potable water; pumping W-30 (and perhaps the Laubenstein well, PW-8) for cooling water and remediation; and taking MW-2 out of service

c. Pumping MW-3 and MW-4 for potable water; pumping wells MW-2, W-30, MW-1, and perhaps the Laubenstein well for remediation and cooling

All the wells now being used by the Village have undergone some form of performance testing. A major aquifer test using wells MW-1, MW-2, MW-3, MW-4, and the Laubenstein well was conducted in the summer of 1984. Data were obtained on the effect of one well's pumping on the other wells, and the probable range of transmissivity and coefficient of storage values of the dolomite aquifer were determined. These aquifer test results will be reviewed prior to performing the tests described below.

Aquifer Testing Program

The aquifer testing program will consist of two separate aquifer tests, a literature search to determine the geologic setting of the Milwaukee River, and groundwater flow modeling.

The two aquifer tests will be performed separately. One of the tests will be performed to determine the aquifer properties of the deep dolomite. During this test, the pump in Village well MW-1 will be turned off for a period of approximately 2 days. Recovery will be measured in the other deep dolomite wells on- and off-site (MW-2, MW-3, MW-4, W-30, and PW-8). The second test will be performed to determine the aquifer properties of the fractured shallow dolomite zone. During this test, the pump in CCP well MW-21A will be turned off for a period of approximately 3 days. Recovery will be measured in the other shallow dolomite wells on- and off-site (W-3A, W-7, W-22, W-23, W-24A, W-25, W-28, W-29, W-38, W-39, and W-40). If recovery within the time period estimated for either of the two tests is insufficient to obtain aquifer properties, the tests will be extended until sufficient data have been collected.

A literature search focusing on the Milwaukee River will be conducted to determine the depth of the river, the thickness of river bed deposits and underlying sediments, and the elevation of the bedrock surface in the vicinity of the river. This information will be used to evaluate the potential for hydraulic connection between the river and the dolomite bedrock in which the deep pumping wells are located. The results of this evaluation will in turn direct the design of the groundwater flow model for the site.

Using the aquifer parameters determined from the pumping tests, and the Milwaukee River evaluation, a groundwater flow model incorporating boundary conditions appropriate for the site will be developed and calibrated. The model will then be used to evaluate different dolomite pumping well combinations. The optimal pumping well combinations will be those that capture the dissolved contaminants with on-site pumping wells while minimizing drawdown at the Village wells.

Section 6

DATA MANAGEMENT PLAN

The production, organization, and use of data is important in maintaining the overall quality and validity of the project. This Data Management Plan describes the general procedures that will be followed to manage the data that will be generated during the site investigation and continuing interim corrective measures.

6.1 Field Activities

Documentation requirements for the various field activities are described in the QAPjP (Appendix A). The RMT Site Coordinator will be responsible for maintaining originals of all field notes, records, and log books during the field activities.

At the end of each field activity, the RMT Site Coordinator will collect all original notes, records, log-book entries, and other information prepared by the field staff during that activity. The Site Coordinator will perform an initial quality control review of the information and data received from the field crew. The original documents will be maintained in the central project file, according to the document control procedures described in Subsection 6.4.

6.2 Sample Management and Tracking

The chain-of-custody procedures described in the QAPjP (Appendix A) will be used at all times to document the condition and location of all sample containers and samples. Special attention will be given to chain-of-custody procedures because of the importance of these procedures to the validation of the analytical data.

6.3 Data Validation and Documentation

6.3.1 Analytical Data

Procedures for validation of analytical data, as described in the QAPjP, will be strictly followed. Only analytical data that have been fully validated and that meet all requirements defined in the approved Workplan will be entered into the final database for use in preparing project outputs.

Chemical data will be electronically transferred from the laboratory computer database into an engineering database to facilitate data tracking, sorting, validation, interpretation, and reporting. This process for transferring information will minimize transcription errors, and prevent inadvertent alteration of laboratory results. Computer disks will be retained with other original project documents.

All laboratory data packages will be received and logged-in by the Site Coordinator. Originals of all laboratory reports will be kept together in the central project file. A laboratory data management coordinator will perform initial validation of the data from the original laboratory reports, consisting of a check of data completeness. Data which satisfy this initial validation check will be electronically transferred from the original laboratory reports to the computer database. Full data validation for the criteria described in Section 11 of the QAPjP will be completed by the Data Reviewer. The values in the computer database will be qualified appropriately based on the validation review. Validated data will be used by the technical staff in preparing the various project outputs.

6.3.2 General Data

General project data, consisting of data and information other than laboratory results, will be managed according to RMT's standard operating policies and procedures. Examples of general project data are correspondence, telephone call memoranda, meeting notes, calculation and work sheets, surveying notes, reduction sheets, photographs, trip reports, and soil boring and well construction logs. After undergoing RMT's standard QA/QC reviews, originals or copies of all general project data will be maintained in the central project file and managed according to the document control procedures described in Subsection 6.4.

6.4 Document Control

Originals of all project-related documents will be maintained in secured (lockable), limited-access files at RMT's office in Madison, Wisconsin. Access to the files will be limited to the following persons:

- Key RMT personnel and administrative personnel responsible for maintaining the project file.

- Authorized representatives of the WDNR or the USEPA.
- Authorized representatives of CCP.

A sufficient amount of file elements or sub-headings will be set up under each major file section to facilitate document retrieval. A current index of file headings will be maintained. As a QC measure, all documents initially sent to the file will be routed through the RMT Project Coordinator to check for proper document logging and QC records (if applicable).

One reproducible copy of each formal output (draft and final) will be maintained in the project file. Reproducible copies of all figures will also be included with the records. Document retention procedures will be in accordance with RMT's standard policy.

Section 7

BASELINE RISK ASSESSMENT

A baseline risk assessment will be performed for the soil pathway at the Logeman property and the Churchyard, the two off-site areas of concern. The soil pore gas pathway will be evaluated at the Churchyard under future land-use conditions. The potential migration of pore gas into basements will not be evaluated at the Logeman property because this property is zoned industrial. Likewise, on-site threats to public health at the CCP facility will not be evaluated because the site is operating, and is fenced, and access is controlled.

Specific objectives of the risk assessment are as follows:

- To provide an analysis of baseline risk and help determine the need for action at off-site areas of concern
- To provide a basis for determining levels of chemicals that can remain at the areas and still be adequately protective of public health
- To provide a basis for comparing the relative beneficial impacts of various remedial alternatives following implementation
- To provide a consistent process for evaluating and documenting public health threats at off-site areas of concern

The results of the baseline risk assessments will be used as follows:

- To develop corrective action goals
- To evaluate whether a "no-action" remedial alternative is appropriate
- To assist decision makers in determining whether additional response action is necessary at the Logeman and Churchyard properties
- To document the magnitude of risk at off-site areas and the primary causes of that risk

The baseline risk assessment will be performed in general accordance with the USEPA Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (USEPA, 1989) and supplemental guidance, as appropriate.

The baseline risk assessment will consist of four steps. Each step is described briefly below and presented on Figure 7-1.

7.1 Data Collection and Evaluation

This step involves gathering and analyzing site data relevant to the human health evaluation and identifying the potential contaminants of concern. Based on available results from groundwater sampling and analysis and the known past disposal practices at the two off-site locations, the primary constituents of concern are VOCs. At the Logeman property ash pile, metals may also be of potential concern due to the occasional incineration of scrap metal.

Appendix IX VOC and metals results will be used to evaluate the current and future risks posed by direct contact or ingestion of soil and ash. For the Churchyard, portable GC VOC results from soil headspace analyses will be used to evaluate risks posed by soil pore gas potentially migrating into basements under a future land-use scenario. This method provides direct measurement of potential exposure concentrations.

7.2 Exposure Assessment

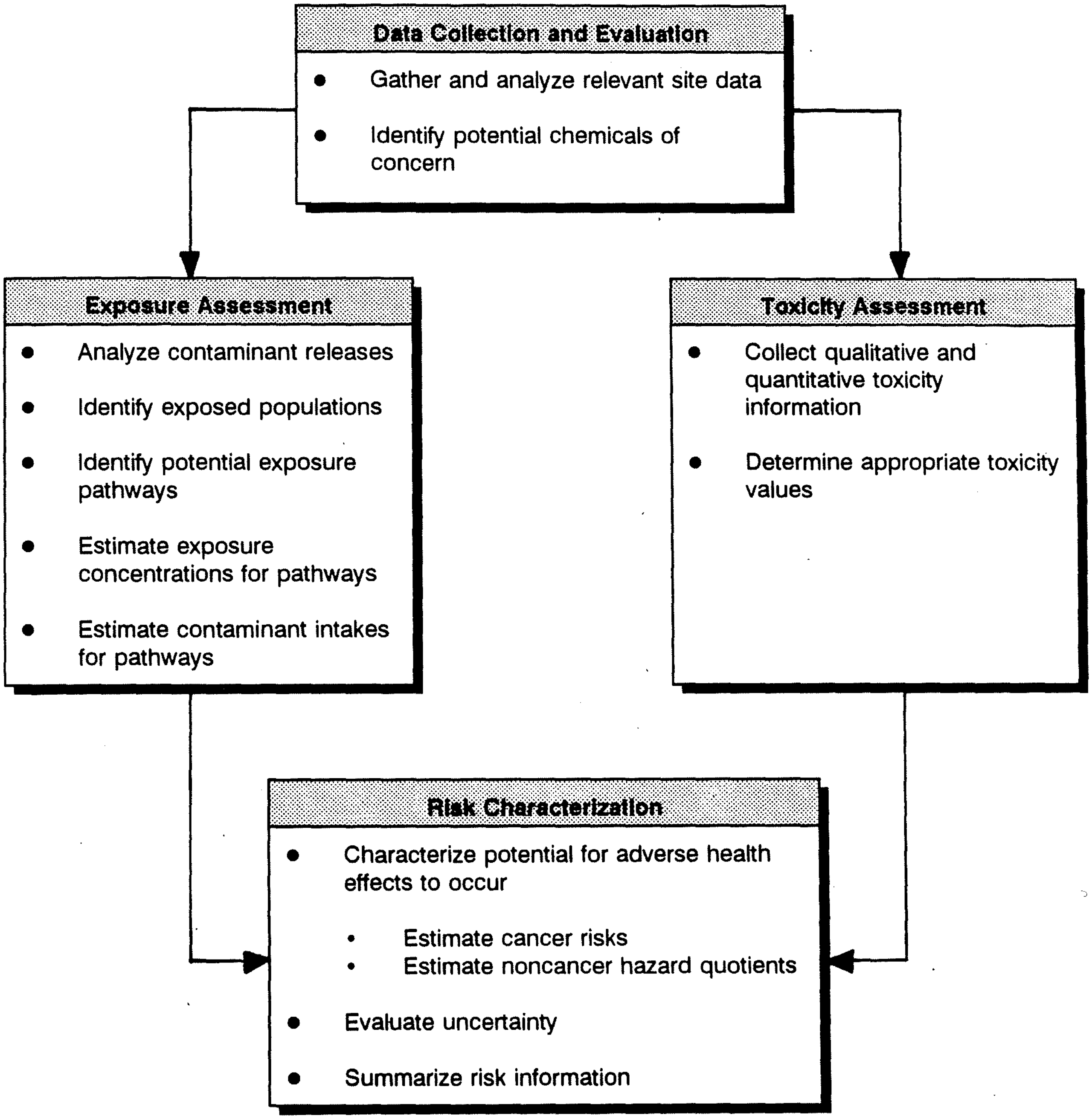
This step is conducted to estimate the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed. Current exposure estimates will be determined based on existing conditions at the off-site areas.

The Logeman property is presently a vacant field that is bordered by residences on one side. The Churchyard contains a ball diamond that is used during the school year. Topsoil was replaced in several areas of the ball field. Future exposure estimates will be evaluated at the Churchyard, assuming a house is constructed in the ball field. This scenario represents a reasonable future land use.

Chemical intakes for reasonable maximum exposure scenarios will be estimated for the current and future land uses described above.

FIGURE 7-1

BASELINE RISK ASSESSMENT



7.3 Toxicity Assessment

Appropriate toxicity values will be determined for the contaminants of concern. The toxicity assessment will be based on the Integrated Risk Information System (IRIS) and the Health Effects Assessment Summary Tables (HEAST), which are the USEPA-preferred sources.

7.4 Risk Characterization

This step summarizes and combines outputs of the exposure and toxicity assessments in order to characterize baseline risk, both quantitatively and qualitatively. The potential for adverse health effects will be estimated for both cancer risks and noncancer hazards, assuming no remedial action is taken at the site. An interpretation of the results and uncertainties associated with the analysis will be developed.

The baseline risk assessment results will be included in the Additional Studies Report.

Section 8

PROJECT SCHEDULE

The estimated schedule for completion of the Site Investigation and Continuing Interim Measures is presented on Figure 8-1.

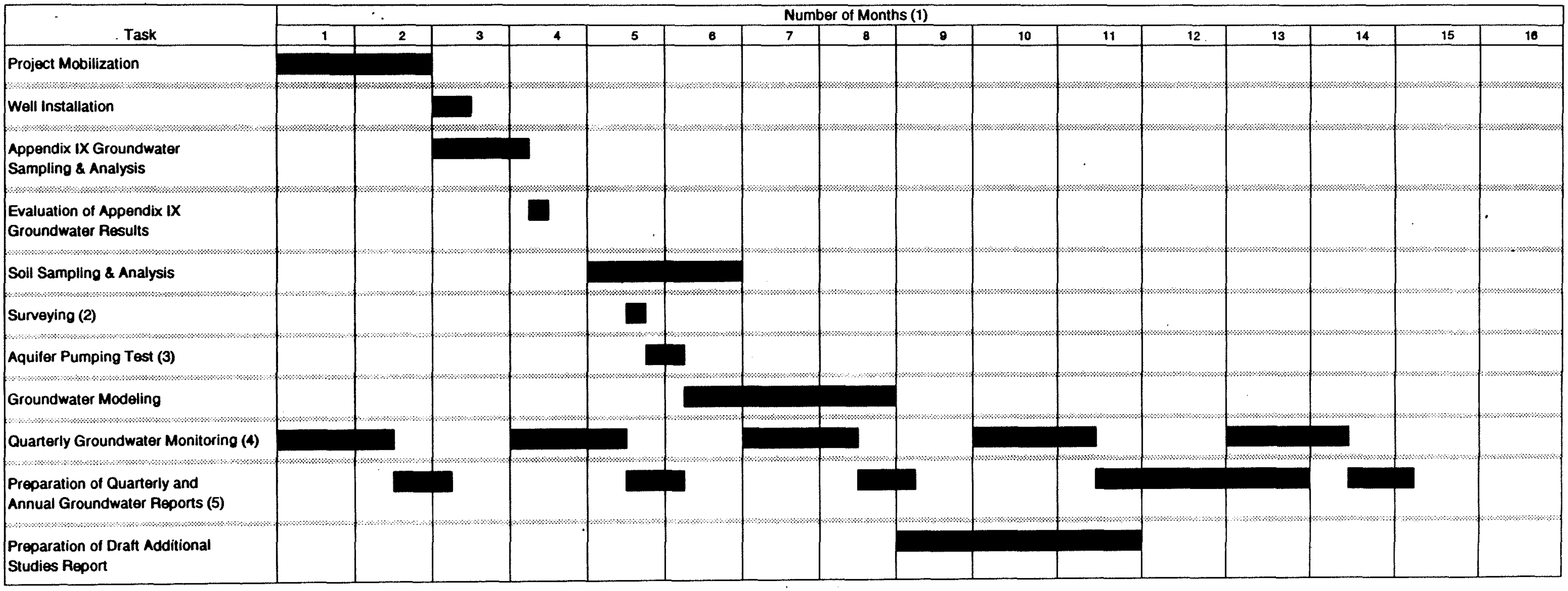
Project mobilization will occur within 2 months of USEPA and WDNR approval of the Workplan. As shown on Figure 8-1, the Appendix IX groundwater sampling and analysis will be one of the first tasks to be performed. The results from this task will be used to guide the soil sampling and analysis to be conducted at the five on- and off-site areas of concern. The balance of the fieldwork (with the exception of quarterly groundwater monitoring), including replacement well installation, surveying, and aquifer testing, will be completed within 6 months of Workplan approval.

Preparation of the draft Additional Studies Report will require 3 months. This deviates somewhat from the schedule contained in Attachment 2 of the letter from USEPA Region V to Craig Bostwick of CCP (dated July 24, 1992). The schedule included in the letter calls for submittal of the draft Additional Studies Report within 30 days of completion of the fieldwork. The additional time shown on Figure 8-1 is necessary due to the complexity of the Appendix IX analysis, the need to incorporate groundwater monitoring data into the report, and the level of analysis required for aquifer pumping test results. The final report will be submitted within 30 days of receiving the USEPA's and the WDNR's comments on the draft report.

Delays during the fieldwork portion of the investigation may affect the schedule presented on Figure 8-1. A significant delay may occur due to Village water-use restrictions, which might dictate that aquifer testing be performed only in April or May. Depending on the time required for Workplan approval and the actual restrictions on aquifer testing, schedule revisions may be necessary.

FIGURE 8-1

SCHEDULE FOR SITE INVESTIGATION AND CONTINUING INTERIM CORRECTIVE MEASURES



Notes:

(1) Number of months from date of USEPA/WDNR approval of the Workplan, QAPjP, and Field Sampling Plan.

(2) Surveying includes locating soil borings and newly installed wells.

(3) Performance of the aquifer pumping test may be limited to the months of April and May because of village water use restrictions.

(4) Quarterly groundwater monitoring will be performed in January, April, July, and October.

(5) Quarterly groundwater reports will include progress reports of corrective action activities. Quarterly groundwater reports are submitted in March, June, September, and December. The annual groundwater report is submitted in February.

1832.37:g:\data\gail\lotus:cook1119.wk1

Section 9

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APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

APPENDIX A
QUALITY ASSURANCE PROJECT PLAN

COOK COMPOSITES AND POLYMERS
SAUKVILLE, WISCONSIN

SITE INVESTIGATION AND CONTINUING INTERIM CORRECTIVE MEASURES

PREPARED BY
RMT, INC.
MADISON, WISCONSIN

PREPARED FOR
COOK COMPOSITES AND POLYMERS

FEBRUARY 1993
REVISION 0

QUALITY ASSURANCE PROJECT PLAN (QAPjP)

COOK COMPOSITES & POLYMERS
SAUKVILLE, WISCONSIN

Approved by ______________________________ Date: ________________
Craig Bostwick, Project Coordinator
Cook Composites & Polymers

Approved by ______________________________ Date: ________________
Jim Rickun, Project Director, RMT

Approved by ______________________________ Date: ________________
Jill Fermanich, Project Manager, WDNR

Approved by ______________________________ **Date:** ________________
Tom Stolzenburg
Quality Assurance Officer, RMT

Approved by ______________________________ **Date:** ________________
Gregory Graf, Quality Assurance Manager
RMT Laboratories

Approved by ______________________________ **Date:** ________________
Robert Smith, Project Manager
USEPA Region V

Approved by ______________________________ **Date:** ________________
Mike DeRosa, Quality Assurance Officer
USEPA Region V

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Section 3.0

PROJECT DESCRIPTION

3.1 Introduction

3.1.1. Overall Project Objectives

The overall project objectives for the Cook Composite & Polymers (CCP) site are the following:

- To collect data necessary to determine whether or not additional corrective measures are necessary to remediate remaining on-site sources of groundwater contamination
- To quantify the risk to public health posed by potential off-site sources which originated from facility operations
- To evaluate whether current and proposed pumping programs will continue to effectively control off-site migration of impacted groundwater
- To continue groundwater containment and remediation

To accomplish these objectives, the following tasks will be performed:

- Soil sampling at three on-site and two off-site locations. The focus of the soils testing will be to determine the vertical extent and nature of potential contaminants in the soil which may be affecting groundwater.
- A baseline risk assessment at the two off-site locations.
- An aquifer pumping test in the deep dolomite aquifer to evaluate current pumping programs and to balance future Village water supply needs with hydraulic control of the plume.
- Continued sampling of remediation progress, perimeter, and receptor monitoring wells.

3.1.2. Project Status/Phase

Extensive interim corrective measures have been completed at the site, including tank and well removals, pipeline abandonments, concrete paving of the site, installation of a surface water collection system and holding basin, and installation of a shallow groundwater drain and pumping wells to control and remediate impacted groundwater. Groundwater remediation began in 1987, and has been effective in controlling the plume, resulting in slowly decreasing VOC concentrations in groundwater.

The work described here has been required by the USEPA in order to investigate and remediate, as necessary, remaining potential source areas that may be contributing contaminants to groundwater. This project represents a continuing phase of site investigation and interim corrective measures designed to further reduce risks to human health and the environment.

3.1.3 QAPjP Preparation Guidelines

The United States Environmental Protection Agency (USEPA) requires that all environmental monitoring and measurement efforts mandated or supported by the USEPA participate in a centrally managed quality assurance (QA) program.

Any party generating data under this program has the responsibility to implement minimum procedures to ensure that the precision, accuracy, completeness, and representativeness of its data are known and documented. To ensure the responsibility is met uniformly, each party must prepare a written QA Project Plan (QAPjP) covering each project it is to perform.

The QAPjP presents the organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities associated with the RCRA Site Investigation/Continuing Interim Corrective Measures for the CCP facility. The QAPjP also describes the specific protocols which will be followed for sampling, sample handling and storage, chain-of-custody, and laboratory analysis.

All laboratory QA/QC procedures will be in accordance with applicable professional technical standards, USEPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPjP is prepared by RMT, Inc. (RMT), on behalf of CCP in accordance with all USEPA QAPjP guidance documents, and, in particular, the USEPA Region V Quality Assurance Project Plan (QAPjP) Element Checklist, the Region V Content Requirements for the Preparation of RCRA QAPjPs, and the Region V Model QAPjP (1991).

3.2 Site/Facility Description

3.2.1 Location

CCP's Saukville Plant is centrally located in the Village of Saukville, Wisconsin. A portion of the U.S. Geological Survey (USGS) 7.5-minute topographic map surrounding the Village of Saukville is shown on Figure 3-1.

3.2.2 Facility/Site Size, Borders, and Features

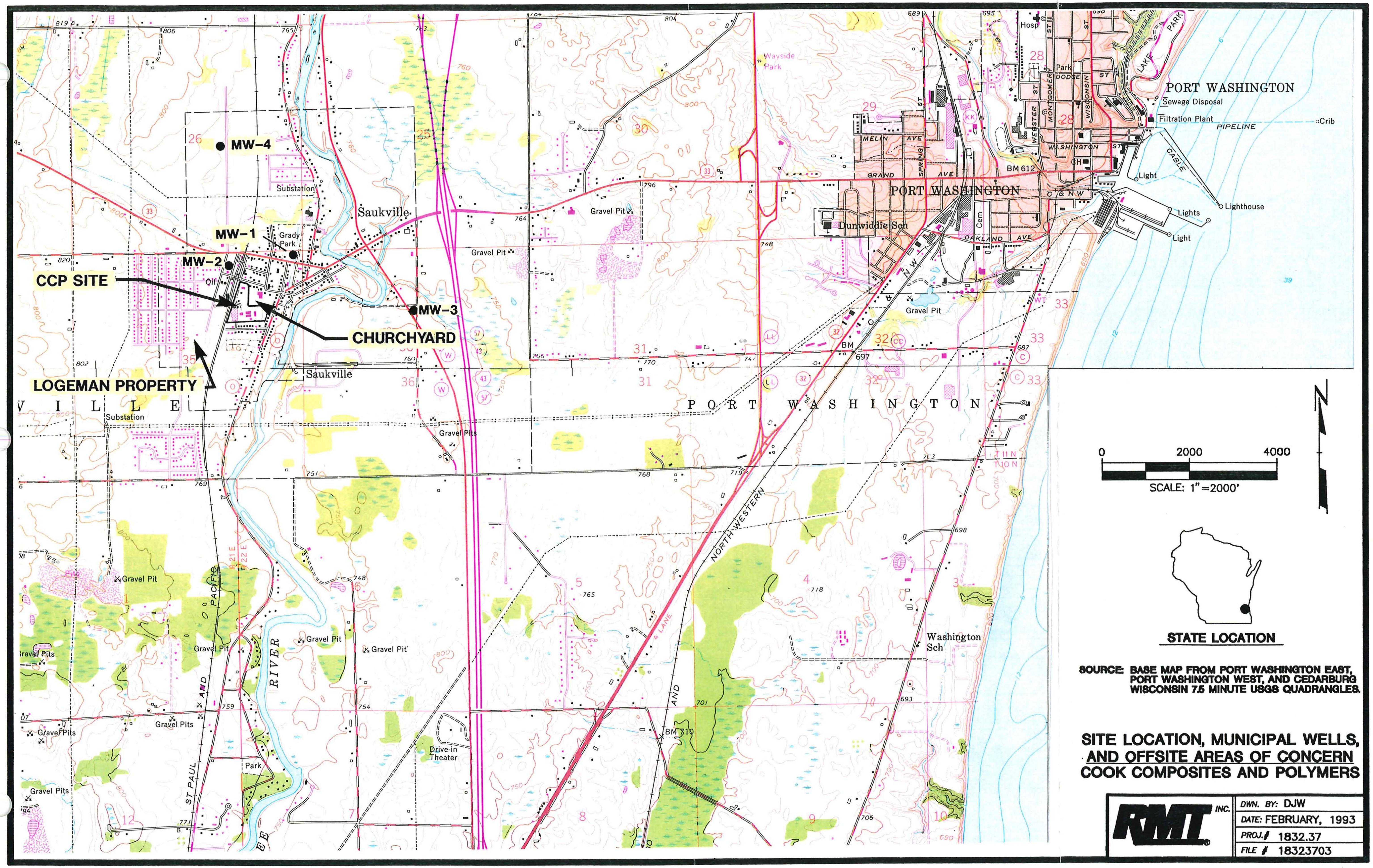
CCP's property is approximately 11.5 acres in size (Figure 3-2). The property is bounded by residential properties on all sides except the western border which is zoned industrial. The Milwaukee River flows south approximately 1,000 feet east of the site, and Lake Michigan is located approximately 2 miles to the east. Two of the four municipal wells owned by the Village (MW-1 and MW-2) are located within 1,500 feet of the facility. Well MW-2 is not used for water supply purposes.

3.2.3 Areas of Concern

Five on- and off-site areas of concern have been identified as potential contributing sources of VOCs to groundwater at the site. Areas 1, 2, 3, and 5 are shown on Figure 3-2, and Area 4 is located on Figure 3-1. Soil sampling during this investigation will be performed at each of the five locations, which are briefly described below:

- **Area 1 - Former Urethane Laboratory/Hazardous Waste Incinerator**

  Used to burn reaction water from 1968 to 1989. As a result of incinerator operations, spills, and laboratory disposal of spent solvents, high levels of BTEX are present in soils in this area.



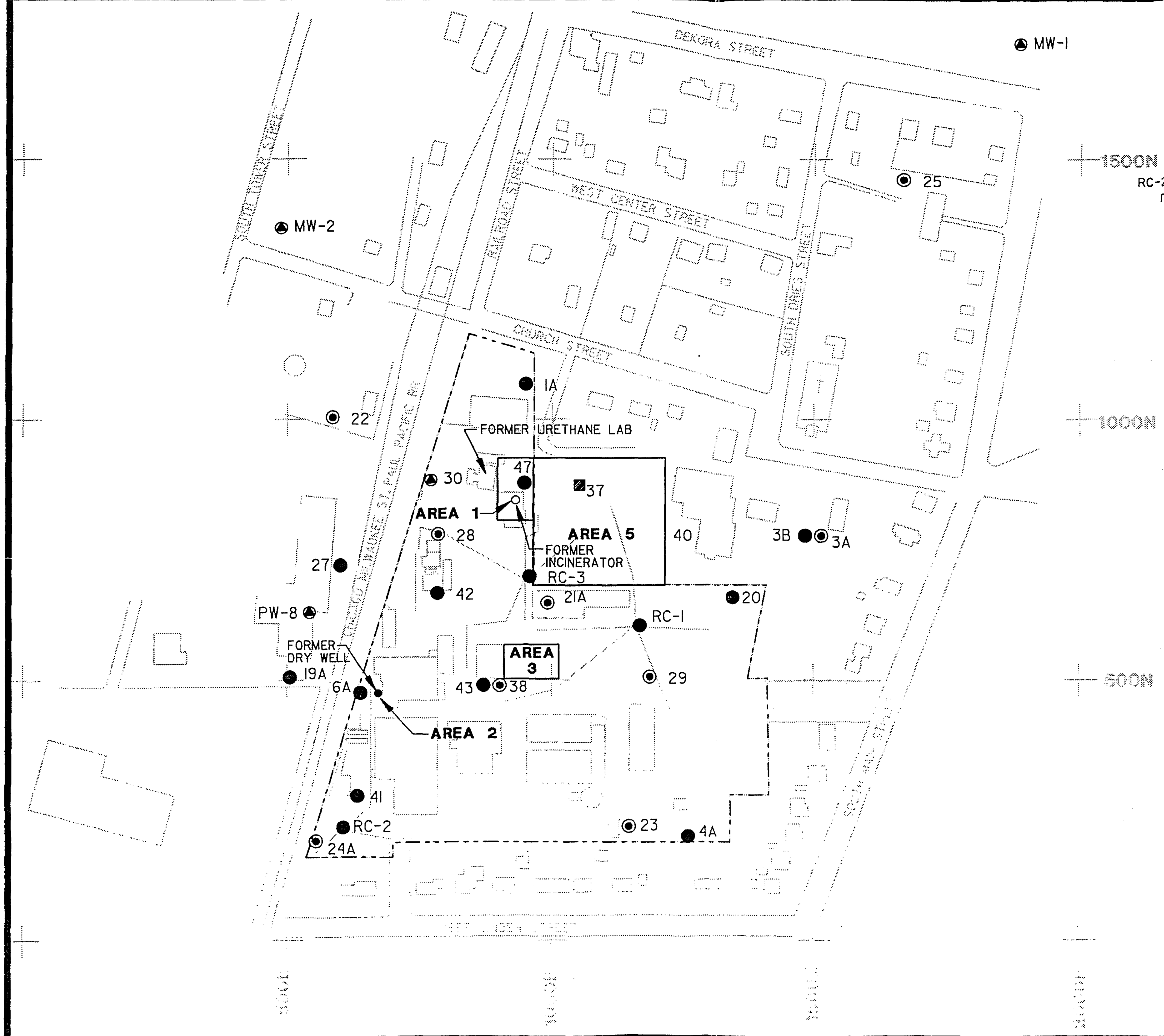
SOURCE: BASE MAP FROM PORT WASHINGTON EAST, PORT WASHINGTON WEST, AND CEDARBURG WISCONSIN 7.5 MINUTE USGS QUADRANGLES.

SITE LOCATION, MUNICIPAL WELLS, AND OFFSITE AREAS OF CONCERN COOK COMPOSITES AND POLYMERS

RMT INC.

DWN. BY:	DJW
DATE:	FEBRUARY, 1993
PROJ.#	1832.37
FILE #	18323703

FIGURE 3-1



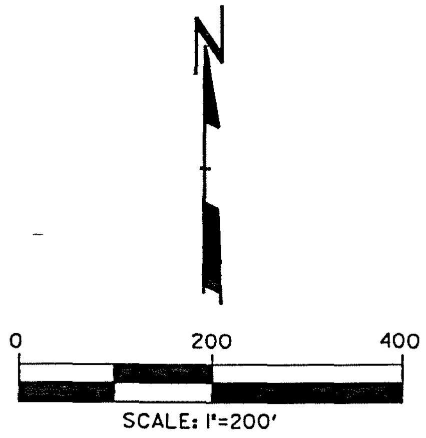
LEGEND

- ◬ DEEP DOLOMITE WELL
- ◉ SHALLOW DOLOMITE WELL
- ● GLACIAL OVERBURDEN WELL
- ■ GLACIAL OVERBURDEN WITHDRAWAL WELL
- ●◉ GLACIAL OVERBURDEN/SHALLOW DOLOMITE WELL NEST
- RC-2 ● RANNEY COLLECTOR

NOTES

1. BASE MAP DEVELOPED FROM HATCHER-SAYRE, INC., JANUARY, 1993.
2. AREAS OF CONCERN ARE AS FOLLOWS:

   AREA 1: FORMER URETHANE LABORATORY/HAZARDOUS WASTE INCINERATOR
   AREA 2 : FORMER DRY WELL
   AREA 3 : FORMER TANK FARM STORAGE AREA
   AREA 5 : CHURCHYARD (OFFSITE)
3. AREA 4 (LOGEMAN PROPERTY) IS SHOWN ON FIGURE 3-1.



SCALE: 1"=200'

SITE MAP AND AREAS OF CONCERN

RMT INC.

Drawn By:	DJW
Approved By:	
Date:	FEBRUARY, 1993
Proj. No.:	1832.33

RMT COMPUTER AIDED DESIGN & DRAFTING

FIGURE 3-2

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Ref. File 8 = •no ref name•
Ref. File 9 = •no ref name•
Ref. File 10 = •no ref name•

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(2) bmc
(3) bdr
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(5) •no ref logical•
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(7) •no ref levels•
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(9) •no ref levels•
(10) •no ref levels•

- **Area 2 - Former Dry Well**

  Used from approximately 1952 through 1968 to dispose of reaction water as approved by the Wisconsin Division of Water Pollution Control (WDWPC, 1952). The well consisted of a pit with a sand and gravel base. The well was removed in 1986 and the area was remediated.

- **Area 3 - Former Tank Farm Storage Area**

  Originally supported on a stone base bermed with earth. Although the tanks did not leak, spills may have occurred during routine tank filling. Currently, this area is occupied both by new tank and storage containment structures, and by the hazardous waste incinerator/small storage facility.

- **Area 4 - Logeman Property** (off-site)

  An air curtain incinerator, consisting of an 8- to 10-foot-deep concrete pit, was formerly operated in this area. The pit is presently covered by a wooden platform. The incinerator was used in the past primarily to burn diatomaceous earth. Reaction water was used occasionally to quench the fires, and cracks in the concrete pit may have allowed releases to the ground. An ash pile, covered with 60 ft^3 of soil in 1972, is also located on the property. The ash was produced during operation of the air curtain incinerator.

- **Area 5 - Churchyard** (off-site)

  May have been affected by past disposal practices at Area 1. Past overland flow of spent solvents may have migrated onto a small section of the Churchyard.

3.2.4 Local Topography, Geology, and Hydrogeology

Site topography is fairly level, sloping gradually to the Milwaukee River east of the site. Local topographic highs of approximately 40 feet in elevation are located to the south and southwest.

Overburden soils at the site consist of clay, silt, sand, and gravel of glacial till, glaciolacustrine, and glaciofluvial origin. These sediments generally range from approximately 10 to 25 feet in thickness. The stratigraphic order of the deposits from the ground surface down is typically sand and silt overlying a laterally continuous layer of laminated silt and clay (glaciolacustrine) above dense clay (glacial till). A thin layer of sand and gravel (glacial outwash) lies between this till unit and bedrock.

The shallow bedrock beneath the site is the Niagara Dolomite, which is highly fractured in its upper 10 to 15 feet and contains abundant solution channels and cavities at depth. Due to fracturing, the dolomite appears to be hydraulically connected to the glacial overburden unit. The elevation of the bedrock surface is highly variable across the site. A bedrock high (20 feet below ground surface [BGS]) is located near the center of the site, and a dramatic closed depression in the bedrock surface, located in the northeastern corner of the site, has been characterized as a karst depression. In this area, the depth to bedrock is up to 205 feet BGS.

Shallow groundwater in the glacial overburden flows generally east to southeast toward the Milwaukee River. Flow is affected both by the presence of the karst feature, which induces localized radial and downward flow, and pumping of glacial overburden wells in the southwestern corner of the site. Groundwater flow in the shallow dolomite is inward toward the center of the site, and is influenced by pumping at dolomite wells W-21A, W-30, and MW-2. Pumping of these wells is part of the remedial program to control off-site movement of contaminated groundwater.

3.3 Site/Facility History

3.3.1 General History

The Saukville Plant was originally operated as a cannery. Freeman Chemical Co., the former owner, installed the resin manufacturing equipment in 1949. Since that time, the plant site has grown geographically, by acquiring additional properties to the east, southeast, and west of the original site, and by the addition of equipment (kettles, tanks, and buildings for adjusting, blending, thinning, rinsing, and storing raw materials and finished products). CCP assumed ownership of the facility in 1990.

Since 1949, the plant has manufactured alkyd, polyester, and urethane synthetic resins. The alkyd and polyester resins are produced by a condensation reaction; the urethane resins are produced either by blending or by an isocyanate reaction. Alkyd resins are used in the coatings industry to make paints and varnishes. Polyester resins are sold to the reinforced plastics industry for use in fiberglass boats and molded polyester parts. Urethane resins are widely used for insulation, sheeting, and seating applications.

3.3.2 Past Activities

A remediation scheme consisting of six elements was initiated beginning in 1986:

- Dewatering of the glacial overburden at the site to remove contaminated groundwater.
- Removal of buried tanks and on-site source areas of contamination.
- Repair of the casing of the nearby Laubenstein well (PW-8).
- Reconditioning of one of the Village wells.
- Reversing the direction of groundwater flow in the dolomite aquifer so that it moves toward the site by installing and pumping an on-site system of one deep and several shallow dolomite wells.
- Directing surface runoff drainage to a collecting basin.

All of these remedial actions have been completed, and the collection systems have been operating since July 1987. A complete description of project background, and details on monitoring well and piezometer construction materials and techniques, appears in Hatcher-Sayre (1986).

3.3.3 Current Status

As a result of production, two hazardous wastes are presently generated at CCP: waste rinse solvent and reaction water. These wastes are burned at the hazardous waste incinerator (permitted in 1989) at the Saukville facility. In the past, waste resin and spill residues from U-listed chemicals may have been generated.

Groundwater monitoring has been conducted at the facility since 1984. The monitoring network consists of 44 sampling points, including 20 glacial overburden wells, 12 shallow dolomite wells, and six deep dolomite wells, three Ranney collectors (shallow drains that collect groundwater) and three publicly owned treatment works (POTW) sampling points. The POTW sampling points are included because shallow groundwater from the site is discharged to the sanitary sewer system for treatment at the POTW. Recent groundwater quality results indicate that the shallow groundwater in the glacial overburden contains benzene, toluene, ethylbenzene, and xylene (BTEX) at levels ranging from approximately 30 μg/L in perimeter well W-20 to 800,000 μg/L in on-site well W-47. Wells completed in the fractured shallow dolomite have lower BTEX levels, ranging from approximately 6 μg/L to 8,400 μg/L. Only one well open to the deeper dolomite (W-30) contained BTEX (220 μg/L). This well serves as the main pumping well to control the plume at the site, and typically removes 385 gpm.

The groundwater monitoring program at the site is ongoing, to assess remediation progress, track perimeter well concentrations, and check groundwater quality at receptor well locations.

A substantial reduction in total VOCs occurred during the early stages of groundwater removal activities; however, the data indicate that continued pumping is necessary to control the plume movement. Future increasing water supply needs of the Village and continued pumping by CCP will require further evaluation of the aquifer systems to maintain control of the plume.

3.3.4 Target Compounds

Target compounds (the list of parameters to be analyzed to meet the project objectives) are listed in Tables 3-1 to 3-3.4. A summary of the sample matrices and associated analytes is shown in Tables 3-4 and 3-5. It is expected that high levels of BTEX may cause some difficulties in analyzing water samples. The following procedure will be used to address this difficulty. For samples with high BTEX, the

TABLE 3-1

VOLATILE ORGANIC COMPOUNDS BY METHOD 8240

Parameter	Reporting Limits[a]
	Water (µg/L)
Chloromethane	10
Bromomethane	10
Vinyl chloride	10
Chloroethane	10
Methylene chloride	5
Acetone	10
Carbon disulfide	5
1,1-Dichloroethene	5
1,1-Dichloroethane	5
1,2-Dichloroethene (total)	5
Chloroform	5
1,2-Dichloroethane	5
2-Butanone	10
1,1,1-Trichloroethane	5
Carbon tetrachloride	5
Vinyl acetate	10
Bromodichloromethane	5
1,2-Dichloropropane	5
trans-1,3-Dichloropropene	5
Trichloroethene	5
Dibromochloromethane	5
1,1,2-Trichloroethane	5
Benzene	5
cis-1,3-Dichloropropene	5
Bromoform	5
4-Methyl-2-pentanone	10

TABLE 3-1 (CONTINUED)

VOLATILE ORGANIC COMPOUNDS BY METHOD 8240

Parameter	Reporting Limits[a] Water (µg/L)
2-Hexanone	10
1,1,2,2-Tetrachloroethane	5
Tetrachloroethene	5
Toluene	5
Chlorobenzene	5
Ethylbenzene	5
Styrene	5
Xylenes (total)	5

Note:

[a] Specific quantitation limits are highly matrix dependent. The reporting limits are provided for guidance and may not always be achievable.

TABLE 3-2

VOLATILE ORGANIC COMPOUNDS BY METHOD 8020

Parameter	Reporting Limits[a] (µg/L)
	Water
Benzene	1.0
Toluene	1.0
Ethylbenzene	1.0
Chlorobenzene	1.0
Xylenes (total)	3.0
1,4-Dichlorobenzene	1.0
1,3-Dichlorobenzene	1.0
1,2-Dichlorobenzene	1.0

Note:

[a] The lowest reporting limits will be established by determining the sample dilution at which the highest concentration target analyte is within the calibration, and then running a sample aliquot at a dilution 10 times stronger. Therefore, each sample will be analyzed twice to quantify the highly concentrated analytes as well as those at lower concentrations, without unduly impacting the instrument.

TABLE 3-3.1

APPENDIX IX VOLATILE COMPOUNDS BY METHOD 8240

Parameter	Reporting Limits[a]	
	Water (µg/L)	Soil (µg/kg)[b]
Chloromethane	10	10
Bromomethane	10	10
Dichlorodifluoromethane	5	5
Vinyl chloride	10	10
Acetonitrile	50	50
Chloroethane	10	10
Iodomethane	5	5
Methylene chloride	5	5
Acrolein	100	100
Acetone	10	10
Acrylonitrile	25	25
Carbon disulfide	5	5
Propionitrile	100	100
Trichlorofluoromethane	5	5
1,1-Dichloroethene	5	5
3-Chloro-1-propene	5	5
1,1-Dichloroethane	5	5
1,2-Dichloroethene (total)	5	5
Chloroform	5	5
1,2-Dichloroethane	5	5
2-Butanone	10	10
Methacrylonitrile	100	100
Dibromomethane	5	5
1,1,1-Trichloroethane	5	5
Isobutanol	100	100
Carbon tetrachloride	5	5
Vinyl acetate	10	10
Bromodichloromethane	5	5

TABLE 3-3.1 (CONTINUED)

APPENDIX IX VOLATILE COMPOUNDS BY METHOD 8240

Parameter	Reporting Limits[a]	
	Water (µg/L)	Soil (µg/kg)[b]
2-Chloro-1,3-butadiene	5	5
1,2-Dichloropropane	5	5
trans-1,3-Dichloropropene	5	5
Trichloroethene	5	5
Dibromochloromethane	5	5
1,1,2-Trichloroethane	5	5
Benzene	5	5
cis-1,3-Dichloropropene	5	5
1,2-Dibromoethane	5	5
Bromoform	5	5
1,1,1,2-Tetrachloroethane	5	5
4-Methyl-2-pentanone	10	10
2-Hexanone	10	10
1,2,3-Trichloropropane	5	5
trans-1,4-Dichloro-2-butene	50	50
1,1,2,2-Tetrachloroethane	5	5
Tetrachloroethene	5	5
Toluene	5	5
Chlorobenzene	5	5
Ethylbenzene	5	5
1,2-Dibromo-3-chloropropane	5	5
Styrene	5	5
Xylenes (total)	5	5

Note:

[a] The lowest reporting limits will be established by determining the sample dilution at which the highest concentration target analyte is within the calibration, and then running a sample aliquot at a dilution 10 times stronger. Therefore, each sample requiring dilution will be analyzed twice to quantify the highly concentrated analytes as well as those at lower concentrations, without unduly impacting the instrument.

[b] Reporting limits listed for soil/sediment are based on wet weight.

TABLE 3-3.2

APPENDIX IX SEMIVOLATILE COMPOUNDS BY METHOD 8270

Parameter	**Reporting Limits**[a]	
	Water (µg/L)	Soil (µg/kg)[b]
n-Nitrosodimethylamine	20	670
n-Nitrosomethylethylamine	20	670
Methyl methanesulfonate	20	670
n-Nitrosodiethylamine	20	670
Ethyl methanesulfonate	20	670
Pentachloroethane	20	670
Aniline	20	670
Phenol	10	330
bis(2-Chloroethyl)ether	10	330
2-Chlorophenol	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
Benzyl alcohol	10	330
1,2-Dichlorobenzene	10	330
bis(2-Chloroisopropyl)ether	10	330
n-Nitroso-di-n-propylamine	10	330
2-Methylphenol	10	330
Acetophenone	20	670
n-Nitrosopyrrolidine	20	670
Hexachloroethane	10	330
n-Nitrosomorpholine	20	670
o-Toluidine	20	670
3-Methylphenol	20	670
4-Methylphenol	10	330
Nitrobenzene	10	330
n-Nitrosopiperidine	20	670
a,a-Dimethylphenethylamine	20	670
Isophorone	10	330
2-Nitrophenol	10	330

TABLE 3-3.2 (CONTINUED)

APPENDIX IX SEMIVOLATILE COMPOUNDS BY METHOD 8270

Parameter	Reporting Limits[a]	
	Water (µg/L)	Soil (µg/kg)[b]
2,4-Dimethylphenol	10	330
bis(2-Chloroethoxy)methane	10	330
2,4-Dichlorophenol	10	330
1,2,4-Trichlorobenzene	10	330
Naphthalene	10	330
2,6-Dichlorophenol	20	670
4-Chloroaniline	20	670
Hexachloropropene	20	670
Hexachlorobutadiene	10	330
p-Phenylenediamine	100	3300
n-Nitrosodi-n-butylamine	20	670
Safrole	20	670
4-Chloro-3-methylphenol	10	330
2-Methylnaphthalene	10	330
1,2,4,5-Tetrachlorobenzene	20	670
Hexachlorocyclopentadiene	10	330
2,4,6-Trichlorophenol	10	330
2,4,5-Trichlorophenol	50	1700
2-Chloronaphthalene	10	330
Isosafrole	20	670
2-Nitroaniline	50	1700
1,4-Naphthoquinone	20	670
Acenaphthylene	10	330
1,3-Dinitrobenzene	20	670
Dimethyl phthalate	10	330
2,6-Dinitrotoluene	10	330
Acenaphthene	10	330
3-Nitroaniline	50	1700

TABLE 3-3.2 (CONTINUED)

APPENDIX IX SEMIVOLATILE COMPOUNDS BY METHOD 8270

Parameter	**Reporting Limits**[a]	
	Water (µg/L)	Soil (µg/kg)[b]
2,4-Dinitrophenol	50	1700
Dibenzofuran	10	330
Pentachlorobenzene	20	670
2-Naphthylamine	20	670
2,4-Dinitrotoluene	10	330
4-Nitrophenol	50	1700
1-Naphthylamine	20	670
Fluorene	10	330
4-Chlorophenyl phenyl ether	10	330
5-Nitro-o-toluidine	20	670
Diethyl phthalate	10	330
4-Nitroaniline	50	1700
4,6-Dinitro-2-methylphenol	50	1700
n-Nitrosodiphenylamine	10	330
Diphenylamine	20	670
4-Bromophenyl phenyl ether	10	330
1,3,5-Trinitrobenzene	20	670
Phenacetin	20	670
Hexachlorobenzene	10	330
4-Aminobiphenyl	20	670
Pentachlorophenol	50	1700
Pentachloronitrobenzene	20	670
Phenanthrene	10	330
Anthracene	10	330
Dinoseb	20	670
Di-n-butyl phthalate	10	330
4-Nitroquinoline-1-oxide	20	670
Methapyrilene	20	670
Fluoranthene	10	330

TABLE 3-3.2 (CONTINUED)

APPENDIX IX SEMIVOLATILE COMPOUNDS BY METHOD 8270

Parameter	Reporting Limits[a]	
	Water (µg/L)	Soil (µg/kg)[b]
Pyrene	10	330
Aramite	100	3300
p-Dimethylaminoazobenzene	20	670
3,3′-Dimethylbezidine	20	670
Butyl benzyl phthalate	10	330
2-Acetylaminofluorene	20	670
Benzo(a)anthracene	10	330
Chrysene	10	330
3,3′-Dichlorobenzidine	20	670
bis(2-Ethylhexyl)phthalate	10	330
Di-n-octyl phthalate	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
7,12-Dimethylbenzanthracene	20	670
Benzo(a)pyrene	10	330
Hexachlorophene	500	17000
3-Methylcholanthrene	20	670
Indeno(1,2,3-c,d)pyrene	10	330
Dibenzo(a,h)anthracene	10	330
Benzo(g,h,i)perylene	10	330
Pronamide	200	6700
2,3,4,6-Tetrachlorophenol	20	670
1,4-Dioxane	20	670
Methyl methacrylate	20	670
Pyridine	20	670
Ethyl methacrylate	20	670

TABLE 3-3.2 (CONTINUED)

APPENDIX IX SEMIVOLATILE COMPOUNDS BY METHOD 8270

Parameter	Reporting Limits[a]	
	Water (µg/L)	Soil (µg/kg)[b]
2-Picoline	20	670
o,o,o-Triethylphosphorothioate	20	670
Diallate	20	670
Chlorobenzilate	20	670

Note:

[a] The lowest reporting limits will be established by determining the sample dilution at which the highest concentration target analyte is within the calibration, and then running a sample aliquot at a dilution 10 times stronger. Therefore, each sample requiring dilution will be analyzed twice to quantify the highly concentrated analytes as well as those at lower concentrations, without unduly impacting the instrument.

[b] Reporting limits listed for soil/sediment are based on wet weight.

TABLE 3-3.3

APPENDIX IX PCB COMPOUNDS BY METHOD 8081

Parameter	Reporting Limits[a] (µg/L)
Aroclor-1016	0.50
Aroclor-1221	0.50
Aroclor-1232	0.50
Aroclor-1242	0.50
Aroclor-1248	0.50
Aroclor-1254	1.0
Aroclor-1260	1.0

Note:

[a] Specific quantitation limits are highly matrix dependent. The reporting limits are provided for guidance and may not always be achievable. Reporting limits are based on a wet weight.

TABLE 3-3.4

APPENDIX IX METALS

Parameter	**Reporting Limits**[a]	
	Water (µg/L) Filterable Metals	Soil (mg/kg)
Antimony	10	2
Arsenic	3	0.6
Barium	50	5
Beryllium	5	0.5
Cadmium	5	1
Chromium	10	1
Cobalt	50	5
Copper	20	2
Lead	3	0.6
Mercury	0.2	0.04
Nickel	40	4
Selenium	3	0.6
Silver	10	1
Thallium	3	0.6
Tin	500	50
Vanadium	50	5
Zinc	20	2

Note: [a] Specific reporting limits are highly matrix dependent. The reporting limits are provided for guidance and may not always be achievable. Limits are based on wet weight.

TABLE 3-4
SUMMARY TABLE OF SAMPLING AND ANALYSIS PROGRAM - SOILS

Area of Concern	Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples			Field Quality Control Samples[1]						MS/MSD[2,3]			Matrix[4]
							Field Duplicates			Field Blanks						
				No.[5]	Frequency[6]	Total	No.	Frequency	Total	No.	Frequency	Total	No.	Frequency	Total	Total
Former Urethane Laboratory/ Hazardous Waste Incinerator	Soil	None	Appendix IX VOC	8	1	8	1	1	1	–	–	–	1	1	1	9
			Appendix IX SVOC+	1	1	1	*	–	–	–	–	–	1	1	1	1
Former Dry Well	Soil	None	Appendix IX VOC	8	1	8	1	1	1	–	–	–	1	1	1	9
			Appendix IX SVOC+	1	1	1	*	–	–	–	–	–	1	1	1	1
Former Tank Farm Storage Area	Soil	None	Appendix IX VOC	16	1	16	2	1	2	–	–	–	1	1	1	18
			Appendix IX SVOC+	2	1	2	*	–	–	–	–	–	1	1	1	2
Logeman Property	Ash	None	Appendix IX VOC	6	1	6	1	1	1	–	–	–	1	1	1	7
			Appendix IX Metals	6	1	6	1	1	1	–	–	–	1	1	1	7
Logeman Property	Soil and Background Soil	None	Appendix IX VOC	18	1	18	2	1	2	–	–	–	1	1	1	20
			Appendix IX SVOC+	4	1	4	1*	1	1	–	–	–	1	1	1	5
			Appendix IX++ Metals	2	1	2	1	1	1	–	–	–	1	1	1	3

TABLE 3-4 (CONTINUED)
SUMMARY TABLE OF SAMPLING AND ANALYSIS PROGRAM - SOILS

Area of Concern	Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples			Field Quality Control Samples[1]						MS/MSD[2,3]			Matrix[4]
							Field Duplicates			Field Blanks						
				No.[5]	Frequency[6]	Total	No.	Frequency	Total	No.	Frequency	Total	No.	Frequency	Total	Total
Churchyard	Soil	Portable GC		~60	1	~60	3	1	3	–	–	–	–	–	–	63
			Appendix IX VOC	12	1	12	2	1	2	–	–	–	1	1	1	14
			Appendix IX SVOC+	2	1	2	*	–	–	–	–	–	1	1	1	2

NOTES:

\+ Excludes pesticides/PCBs, herbicides, and dioxins/furan.

++ Only background soils will be analyzed for Appendix IX metals.

* The most important QC information for soils of different types is the MS/MSD, which will be conducted in each sampling area. However, the field duplicate frequency for SVOCs will be conducted on the lumped total (10) of soil samples.

[1] The field quality control samples also include trip blanks, which are required for VOA water samples. One trip blank, which consists of two 40-mL glass vials for water samples, is shipped with each shipping cooler of VOA samples.

[2] Matrix sample/spike duplicates (MS/MSD) are required for organic analysis. Samples designated for MS/MSD analysis will be collected, with extra sample volumes, at a frequency of one per group of 20 or fewer investigative samples. Triple the normal sample volumes will be collected for VOAs and double the normal sample volumes will be collected for extractable organics, and PCBs.

[3] For inorganic analysis, no extra sample volume is required.

[4] The number of samples to be collected for MS/MSD is not included in the matrix total. The number of trip blank samples is also excluded from the matrix total.

[5] The number column refers to the number of that type of analysis to be conducted per sampling event.

[6] The frequency column refers to the number of sampling events to be conducted.

TABLE 3-5

SUMMARY TABLE OF SAMPLING AND ANALYSIS PROGRAM - GROUNDWATER

Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples			Field Quality Control Samples[1]						MS/MSD[2,3]			Matrix[4]
						Field Duplicates			Field Blanks						
			No.[5]	Frequency[6]	Total*	No.	Frequency	Total	No.	Frequency	Total	No.	Frequency	Total	Total
Groundwater Remediation Progress Monitoring	pH, temperature, Specific Conductance	VOC 8020 list	13	Annual	13	2	Annual	2	2	Annual	2	1	Annual	1	17
Groundwater Receptor and Perimeter Monitoring	pH, temperature, Specific Conductance	VOC 8020 list	3	Quarterly	61	1-3	Quarterly	8	1-3	Quarterly	8	1-2	Quarterly	6	77
		VOC 8240 list	6 or 7	Quarterly											
		VOC 8240 list	12	Semiannually											
Groundwater Contaminant Characterization (W-43 will be sampled if W-44 is dry)	pH, temperature, Specific Conductance	Appendix IX VOC +10 TICs	8	1	8	1	1	1	1	1	1	1	1	1	10
		Appendix IX SVOC** +10 TICs	8	1	8	1	1	1	1	1	1	1	1	1	10
		Appendix IX Metals (filtered)	8	1	8	1	1	1	1	1	1	–	–	–	10
		Appendix IX PCBs	8	1	8	1	1	1	1	1	1	1	1	1	10

NOTES:

* Totals reflect annual total.
* Excludes pesticides, herbicides, and dioxins/furans.

[1] The field quality control samples also include trip blanks, which are required for VOA water samples. One trip blank, which consists of two 40-mL glass vials for water samples, is shipped with each shipping cooler of VOA samples.
[2] Matrix sample/spike duplicates (MS/MSD) are required for organic analysis. Samples designated for MS/MSD analysis will be collected, with extra sample volumes, at a frequency of one per group of 20 or fewer investigative samples. Triple the normal sample volumes will be collected for VOAs and double the normal sample volumes will be collected for extractable organics, and PCBs.
[3] For inorganic analysis, no extra sample volume is required.
[4] The number of samples to be collected for MS/MSD is not included in the matrix total. The number of trip blank samples is also excluded from the matrix total.
[5] The number column refers to the number of that type of analysis to be conducted per sampling event.
[6] The frequency column refers to the number of sampling events to be conducted on an annual basis.

reporting limits for both VOCs and semivolatiles will be established by determining the sample dilution at which the highest concentration target analyte is within the calibration, and then running a sample aliquot at a dilution 10 times stronger. Therefore, each sample requiring dilution will be analyzed twice to quantify the highly concentrated analytes as well as those at lower concentrations, without duly impacting the instrument.

3.4 Project Objectives

3.4.1 Specific Objectives and Tasks

Specific objectives and tasks are described below for the proposed soil and groundwater investigations at the site.

Soil

Three on-site locations and two off-site locations as described in Subsection 3.2.2 and 3.2.3 will be investigated to determine whether the areas are contributing volatile organic compounds (VOCs) to groundwater. (Semivolatile constituents will also be analyzed, even though the primary concern for groundwater contamination is from VOCs).

In addition, at the Logeman property (off-site), the waste characteristics and vertical extent of an ash pile will be verified. A baseline risk assessment will be performed at the Logeman property. At the Churchyard ball field (off-site), the area potentially affected by the overland flow of spilled solvents will be delineated. The remainder of the ball field will also be investigated for risk assessment purposes.

Groundwater

Groundwater monitoring for VOCs will continue at the site to accomplish the following objectives:

- To protect current potential receptors (receptor monitoring on a quarterly basis)

- To provide early warning of unanticipated contaminant migration (perimeter monitoring on a semiannual basis)
- To assess progress of groundwater cleanup (remediation progress monitoring on an annual basis)

In addition, a one-time Appendix IX sampling event will be conducted to fully characterize impacts to groundwater. Because pesticides, herbicides, and dioxins/furans were not used at the facility, these constituents will be excluded from the Appendix IX testing program.

Aquifer pump testing and groundwater modeling of the dolomite aquifer will also be performed in order to evaluate the effectiveness of future pumping schemes to control impacted groundwater and to determine the effect of increased Village water supply needs on the aquifer.

3.4.2 Project Target Parameters and Intended Data Uses

3.4.2.1 Field Parameters

A portable GC (Photovac 10S50) will be used to measure VOCs in soil headspace from samples collected in the Churchyard ball field. The primary VOCs of interest are benzene, toluene, ethylbenzene, and xylene, as evidenced by the documented groundwater contamination at the site. Temperature, specific conductance, and pH will be measured in all groundwater samples.

3.4.2.2 Laboratory Parameters

Tables 3-1 through 3-3.4 list the analytes to be measured in site soil and groundwater samples.

3.4.2.3 Intended Data Uses

The intended data uses are presented in Tables 5-1 and 5-2 of the Workplan for soil and groundwater, respectively.

Uses for soil data include the following:

- To evaluate the need for remediation at the areas of concern (if corrective measures are needed, they will be evaluated during the Corrective Measures Study)
- To perform baseline risk assessments at off-site locations
- To define whether a plume is present at the Churchyard ball field

Uses for groundwater data include the following:

- To confirm safe drinking water quality at receptor wells
- To monitor VOC discharges from CCP to the POTW
- To monitor environmental releases of VOCs from the POTW
- To develop trend analyses of total VOCs over time for perimeter monitoring and remediation progress monitoring wells
- To identify significant changes in contaminant concentrations at perimeter locations
- To evaluate the effectiveness of on-going groundwater corrective measures and future soil remediation activities
- To characterize groundwater contamination
- To evaluate the effectiveness of pumping programs to control impacted groundwater

3.4.2.4 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during investigative activities. Since DQOs are based on the end uses of the data to be collected, different data uses may require different levels of data quality. There are five analytical levels which address various data uses and the QA/QC effort and methods required to achieve the desired level of quality.

Data collected for this investigation are categorized as follows:

- Screening (DQO Level 1) - This provides the lowest data quality but the most rapid results.
- Field Analyses (DQO Level 2) - This provides rapid results and better quality than in Level 1.

  Portable gas chromatograph data will be collected to meet DQO Level 2 objectives and used to map the extent of a possible solvent plume in the Churchyard. Near real-time analyses of headspace over soil using a portable GC is equal to or more sensitive than laboratory analysis of VOCs because losses during transport and storage are avoided. For this reason the portable GC will be more effective in mapping the solvent plume.
- Confirmational (DQO Level 4) - This provides the highest level of data quality and is used for purposes of risk assessment and evaluation of remedial alternatives. These analyses require full SW 846 analytical and data validation procedures in accordance with USEPA recognized protocol, except in the case of portable GC results from soil vapor headspace analysis conducted in the Churchyard. Soil vapor headspace measurements will be conducted with a portable GC and will be considered DQO Level 4 for purposes of assessing the future risk of soil gas migration into underground structures such as basements.

3.5 Sample Network Design and Rationale

3.5.1 Sample Network by Task and Matrix

Refer to Section 5 of the Workplan.

3.5.2 Site Maps of Sampling Locations

Refer to Figures 5-1 and 5-2 of the Workplan.

3.5.3 Rationale of Selected Sampling Locations

Refer to Section 5.1 of the Workplan.

3.5.4 Sample Network Summary Table

Tables 3-4 and 3-5 summarize the sampling and analysis program for soils and groundwater, respectively.

3.6 Project Schedule

3.6.1 Anticipated Date of Project Mobilization

Project mobilization will begin within 2 months of Workplan approval by the USEPA and the WDNR. However, if circumstances beyond the control of CCP or RMT occur, a delay in project mobilization may result.

3.6.2 Task Bar Chart and Associated Time Frames

Figure 3-3 illustrates the tasks and associated time frames for performing the site investigation and continuing interim corrective measures.

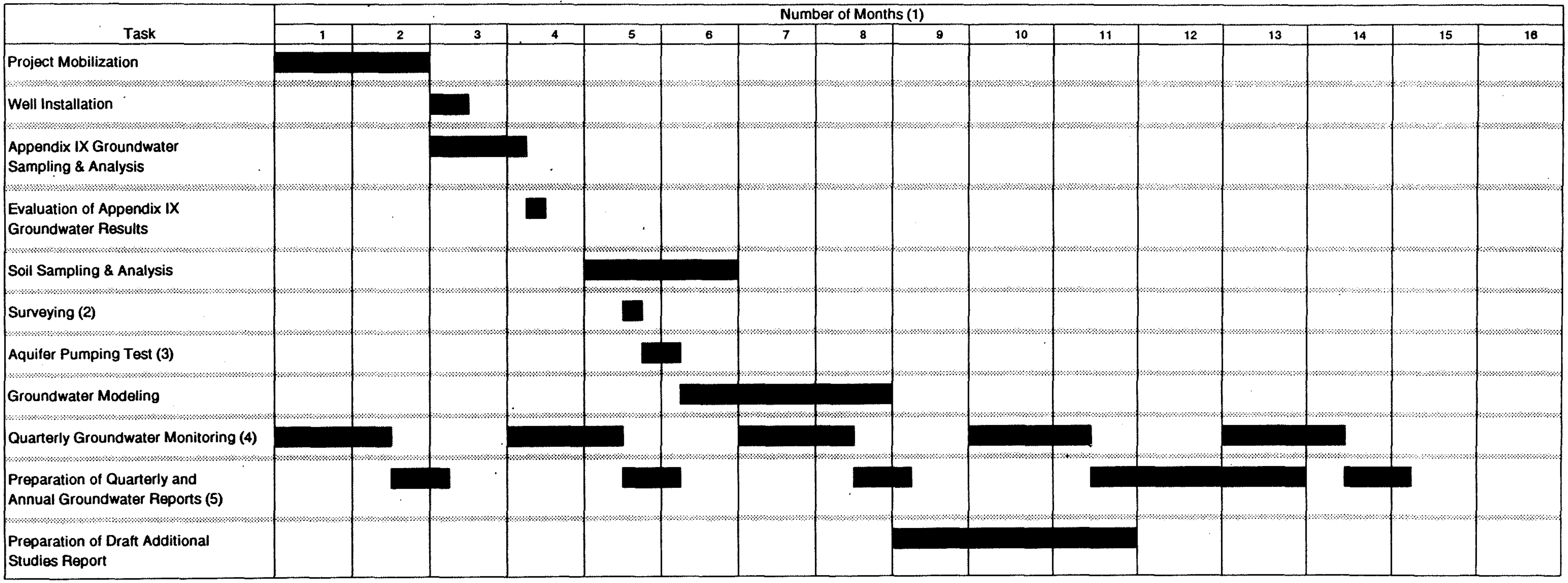
Project mobilization will occur within 2 months of the USEPA's and the WDNR's approval of the Workplan. As shown on Figure 3-3, the Appendix IX groundwater sampling and analysis will be one of the first tasks to be performed. The results from this task will be used to guide the soil sampling and analysis to be conducted at the five on- and off-site areas of concern. The balance of the fieldwork (with the exception of quarterly groundwater monitoring) including replacement well installation, surveying, and aquifer testing, will be completed within 6 months of Workplan approval.

Preparation of the draft Additional Studies Report will require 3 months. This deviates somewhat from the schedule contained in Attachment 2 of the letter from the USEPA Region V to Craig Bostwick of CCP (dated July 24, 1992). The schedule included in the letter calls for submittal of the draft Additional Studies Report within 30 days of completion of the fieldwork. The additional time shown on Figure 8-1 is necessary due to the complexity of the Appendix IX analysis, the need to incorporate groundwater monitoring data into the report, and the level of analysis required for aquifer pumping test results. The final report will be submitted within 30 days of receiving the USEPA's and the WDNR's comments on the draft report.

Delays during the fieldwork portion of the investigation may affect the schedule presented in Figure 3-3. A significant delay may occur due to Village water use restrictions, which might dictate that aquifer testing be performed only in April or May. Depending on the time required for Workplan approval and the actual restrictions on aquifer testing, schedule revisions may be necessary.

FIGURE 3–3

SCHEDULE FOR SITE INVESTIGATION AND CONTINUING INTERIM CORRECTIVE MEASURES



<u>Notes:</u>

(1) Number of months from date of USEPA/WDNR approval of the Workplan, QAPjP, and Field Sampling Plan.
(2) Surveying includes locating soil borings and newly installed wells.
(3) Performance of the aquifer pumping test may be limited to the months of April and May because of village water use restrictions.
(4) Quarterly groundwater monitoring will be performed in January, April, July, and October.
(5) Quarterly groundwater reports will include progress reports of corrective action activities. Quarterly groundwater reports are submitted in March, June, September, and December. The annual groundwater report is submitted in February.

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Section 4.0

PROJECT ORGANIZATION AND RESPONSIBILITY

4.1 Project Organization Chart

Figure 4-1 shows the project organization.

4.2 Management Responsibilities

Operational responsibilities involving execution and direct management of the technical and administrative aspects of this project have been assigned as follows:

> ***CCP Project Coordinator*** - Craig Bostwick, the Project Coordinator, serves as CCP's Corporate Environmental Compliance Manager and, along with the plant manager, coordinates RCRA activities at the Saukville facility.
>
> ***RMT Project Director*** - Jim Rickun, the Project Director, is the primary liaison between the contractors and CCP. He directs the overall project activities and is responsible for the schedule, costs, and technical performance of the project. He also provides support and input for the project coordinator.
>
> ***RMT Project Coordinator*** - The Project Coordinator, Stacy McAnulty, is responsible for the scheduling and coordination of the project activities. She will direct the field activities, laboratory analyses, data analysis, and report preparation.

4.3 Quality Assurance Responsibilities

QA Coordinator - The QA Coordinator, Tom Stolzenburg, is responsible for ensuring that all QA/QC procedures are being followed. This includes reviewing all QA/QC procedures and documentation, and reviewing data and project reports. He is also responsible for internal performance and system audits.

4.4 Laboratory Responsibilities

RMT Laboratories QA Manager - Gregory Graf, the RMT QA Manager, ensures that RMT Laboratories meets the QA/QC standards specified in the QAPjP. He is responsible for the performance and reporting of analyses of environmental samples using methods described in this document. He is responsible for initiating any corrective actions required in the laboratory.

PROJECT ORGANIZATION

FIGURE 4-1

4.5 Field Responsibilities

Site Coordinator - Gwen Porus, the Site Coordinator, is responsible for ensuring that all QA/QC procedures are being followed in the field. This involves communicating QC procedures and reviewing field reports to ensure compliance. She is responsible for initiating corrective action on any problems encountered in the field.

Section 5.0

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT OF DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

5.1 Precision

5.1.1 Definition

PRECISION is the agreement of a set of results among themselves, or the ability to reproduce a number.

5.1.2 Field Precision Requirements

Precision requirements for field analyses are discussed in Subsection 9.1.

5.1.3 Laboratory Precision Requirements

The laboratory precision control limits are shown in Attachment 4. Control limits are updated periodically.

5.2 Accuracy

5.2.1 Definition

ACCURACY is the nearness of a result or of the arithmetic mean of a set of results to the true value.

5.2.2 Field Accuracy Requirements

Accuracy requirements for field analyses are discussed in Subsection 9.1.

5.2.3 Laboratory Accuracy Requirements

The laboratory accuracy control limits are shown in Attachment 4. Control limits are updated periodically.

5.3 Completeness

5.3.1 Definition

COMPLETENESS is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

5.3.2 Completeness Requirements

It is expected that RMT Laboratories will provide data meeting QC acceptance criteria for 90 percent or more of all samples tested using this QAPjP. The data completeness requirements analyses will be 90 percent or better. Following completion of the analytical testing, the percent completeness will be calculated by the following equations:

$$\text{completeness (\%)}: = \frac{\text{(number of valid data)}}{\text{(number of samples collected for each parameter analyzed)}} \times 100$$

5.4 Representativeness

5.4.1 Definition

REPRESENTATIVENESS expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol.

5.4.2 Measures to Ensure Representativeness of Field and Laboratory Data

The sampling network was designed to provide data representative of site conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to RCRA protocol. The rationale of the sampling network is discussed in detail in the Workplan.

Representativeness will be satisfied by ensuring that the FSP is followed, proper sampling techniques are used, proper analytical procedures are followed, and holding times of samples are not exceeded in the laboratory. Representativeness will be assessed by the analyses of field-duplicated samples.

5.5 Comparability

5.5.1 Definition

COMPARABILITY expresses the confidence with which one data set can be compared to another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPjP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

5.5.2 Measures to Ensure Comparability of Field Data

The field GC procedures are designed to provide for consistent analytical methodology, which is the basis for comparability. In particular, daily calibration procedures for field instrumentation are intended to establish a comparable basis from one set of analyses to the next.

5.5.3 Measures to Ensure Comparability of Laboratory Data

One of the objectives of the QAPjP is to set up procedures to provide for a consistent basis for analysis of site samples. To the extent that the QAPjP procedures are followed (as verified by data validation), analytical results are comparable in that consistent methodology is used to conduct chemical measurement.

Section 6

SAMPLING PROCEDURES

6.1 Field Sampling by Matrix

Refer to Subsections 2.1 and 2.2 of the FSP.

6.2 Field QC Sample Collection/Preparation Procedures

Refer to Subsection 2.3 of the FSP.

6.3 Sample Preservation/Containers/Holding Times

Sample preservation, containers, and holding times are summarized in Table 6-1 and Section 6 of the FSP.

RMT uses precertified bottles from the manufacturer. The cleaning procedures used by the manufacturer are listed in Attachment 3. A copy of the certification will be kept in the project file.

6.4 Decontamination Procedures

Refer to Section 7 of the FSP.

6.5 Sample Packaging and Shipment Procedures

Refer to Section 3 of the FSP.

TABLE 6-1

SAMPLE CONTAINERS AND PRESERVATION METHODS

Sample Matrix	Parameter	Container(s)	Field Preservation Method	Holding Time
Groundwater	Appendix IX Filterable Metals	1-liter plastic bottle	Filter with 0.45-micron millipore filter; cool to 4°C, add nitric acid to pH < 2	6 months (except for mercury - 28 days)
	8240 8020 or Appendix IX Volatile Organic Chemicals	3 x 40-mL VOA vial with Teflon septum cap	Add hydrochloric acid to pH < 2, cool to 4°C	14 days
	Appendix IX Semivolatile Organic Chemicals or PCBs	2 x 1-L amber glass with Teflon-lined cap	Cool to 4°C	7 days to extraction; 40 days to analysis
Soil	Appendix IX Volatile Organic Chemicals	2 x 60-ml glass VOA vial cap	Cool to 4°C	14 days
	Appendix IX Semivolatile Organics	8-ounce wide-mouthed glass bottles (Teflon-lined lid)	Cool to 4°C	Extract within 14 days; analyze within 40 days after extraction
	Appendix IX Metals	125-ml glass (Teflon-lined lid)	Cool to 4°C, protect from light	6 month (except for mercury - 28 days)

Section 7.0

SAMPLE CUSTODY

The chain-of-custody protocol consists of three elements: 1) field chain-of-custody procedures (sample collection); 2) laboratory procedures; and 3) final evidence files custody procedures. Final project files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area.

7.1 Field Chain-of-Custody Procedures

7.1.1 Sample Collection and Sample Tags

The following procedures will be practiced during all field activities:

- The geologist or hydrogeologist will be personally responsible for the care and custody of the samples until they are transferred or properly dispatched. The number of people handling the samples should be kept to a minimum.
- All bottles will be tagged with sample numbers and locations.
- Sample tags will be completed for each sample using waterproof ink, unless prohibited by weather conditions. If freezing weather conditions are encountered, a logbook notation will explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function.
- The Site Coordinator will review all field activities to determine whether proper custody procedures were followed during the fieldwork and to decide with the CCP Project Coordinator if additional samples are required.

7.1.2 Field Logbooks/Documentation

The field logbook will be used to record all data-collection activities performed. Entries will be as detailed as possible so that personnel can reconstruct a particular site situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following information:

- Person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- Project end date

Logbook entries will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be noted. The names of visitors to the site, and the purpose of their visit will also be recorded in the field logbook. Notebooks will be used to document photographs taken, by recording photograph number, site conditions, and pertinent field observations. The location, sampling interval, and identification numbers of blind QC samples will also be recorded in the field notebook.

Measurements made and samples collected will be recorded. All entries will be made in ink, and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected or a measurement is made, a detailed description of the location of the station shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

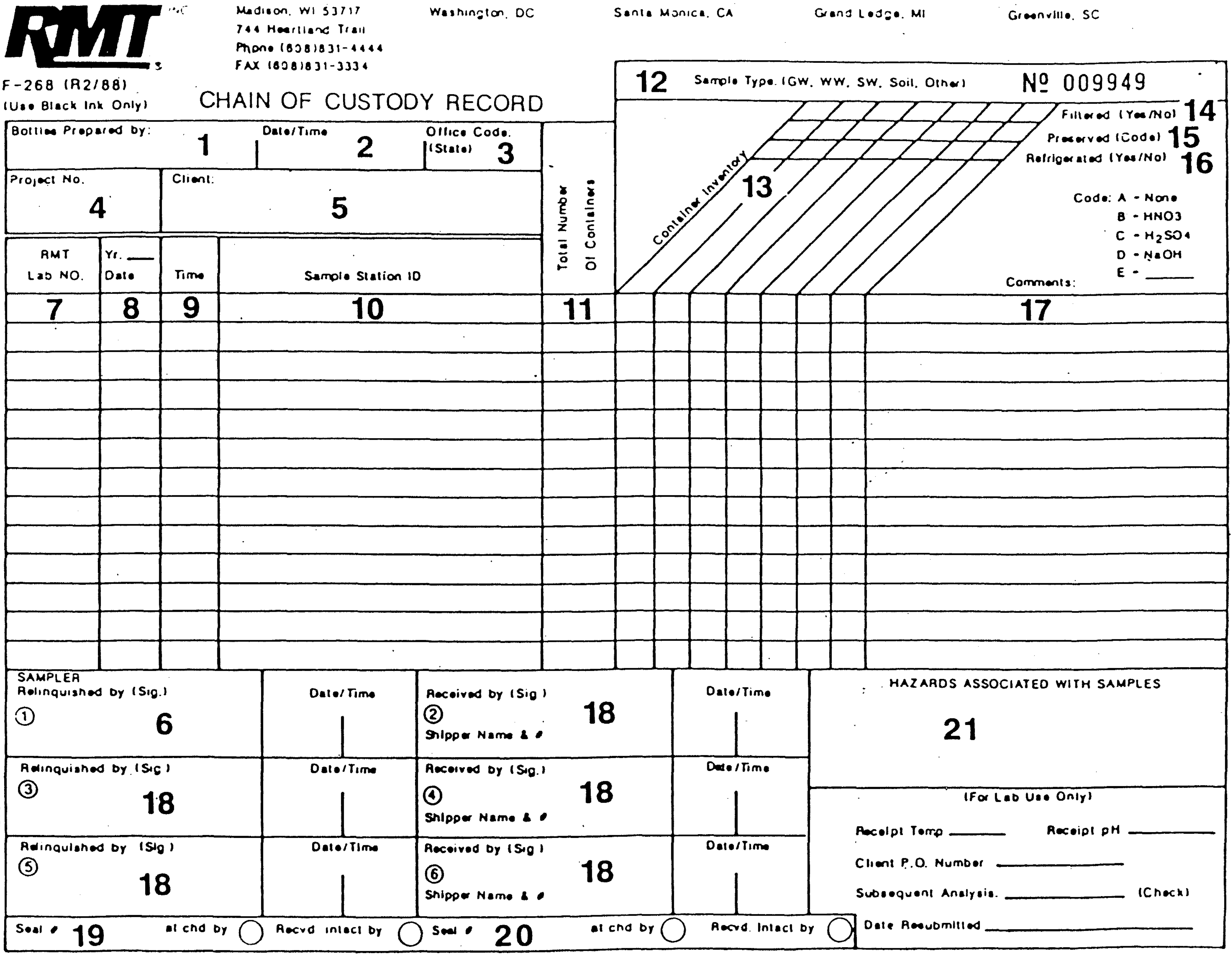
Samples will be collected following the sampling procedures documented in the QAPjP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, and volume and number of containers. The sample identification number will be assigned prior to sample collection. Field duplicate samples and field blank samples, which will receive an entirely separate sample identification number, will be noted under the sample description. Samples to be used for MS/MSD will be designated to the laboratory.

7.1.3 Transfer of Custody and Shipment Procedures

Sample possession must be traceable from the time of collection to ultimate disposal through the use of chain-of-custody procedures. Chain-of-Custody Forms must accompany all samples and sample shipping containers to document their transfer from the field to the laboratory. The procedures to be implemented are as follows:

- Prepare laboratory sample containers in the laboratory with pre-applied labels, and apply chain-of-custody seals to the shipping containers.
- Properly identify and label each sample in the field with indelible, waterproof ink.
- Complete in the field Chain-of-Custody Forms indicating sample identification, containers filled, sampling date, sampling time, sample collector, and sample preservation, if applicable. This information will also be noted in the field notebooks maintained on the site.
- Repack shipping containers with samples, Chain-of-Custody Forms, and ice packs. Each set of samples to be shipped together in a single shipping container will be assigned a Chain-of-Custody Form, which will travel with the shipping container.
- Seal and ship containers to the appropriate laboratory. Common carriers or intermediate individuals shall be identified on the Chain-of-Custody Form, and copies of all bills-of-lading will be retained.
- In the laboratory, receive and check shipping containers for broken seals or damaged sample containers. If no problems are noted, samples will be logged into the laboratory, and the Chain-of-Custody Form will be completed. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.
- Include copies of the Chain-of-Custody Form with the analytical data.
- Return unused sample containers to the laboratory with the Chain-of-Custody Forms.

An example Chain-of-Custody Form is shown on Figure 7-1. The form should be filled out legibly in black ink. Errors will be corrected by drawing a single line through the



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F-268 (R2/88)
(Use Black Ink Only)

CHAIN OF CUSTODY RECORD

12 Sample Type (GW, WW, SW, Soil, Other)

№ 009949

Bottles Prepared by: 1

Date/Time 2

Office Code (State) 3

Project No. 4

Client: 5

Filtered (Yes/No) 14

Preserved (Code) 15

Refrigerated (Yes/No) 16

Code: A - None
B - HNO3
C - H_2SO_4
D - NaOH
E - ______

RMT Lab NO.	Yr. ___ Date	Time	Sample Station ID	Total Number Of Containers	Container Inventory 13							Comments:
7	8	9	10	11								17

SAMPLER Relinquished by (Sig.) ① 6	Date/Time	Received by (Sig.) ② Shipper Name & # 18	Date/Time
Relinquished by (Sig.) ③ 18	Date/Time	Received by (Sig.) ④ Shipper Name & # 18	Date/Time
Relinquished by (Sig.) ⑤ 18	Date/Time	Received by (Sig.) ⑥ Shipper Name & # 18	Date/Time

Seal # 19 at chd by ○ Recvd intact by ○ Seal # 20 at chd by ○ Recvd. Intact by ○

HAZARDS ASSOCIATED WITH SAMPLES 21

(For Lab Use Only)

Receipt Temp ______ Receipt pH ______

Client P.O. Number ______

Subsequent Analysis ______ (Check)

Date Resubmitted ______

FIGURE 7–1

incorrect information and entering the correct information. All corrections will be initialed and dated by the person making the correction. This procedure applies to words or figures inserted or added to a previously recorded statement.

A checklist of information that must be included on the Chain-of-Custody Form (Figure 7-1) is as follows:

1.* ***Bottles prepared by*** - The laboratory providing the bottles must sign here.

2. ***Date / Time*** - To be filled out by the person preparing the bottles.

3. ***Office code*** - To be filled out by the person preparing the bottles.

4. ***Project no.*** - To be completed by the laboratory.

5. ***Client*** - To be completed by the laboratory.

6. ***Sampler*** - The person collecting the samples must sign his name and print his name under their signature, and fill out the date and time the sampler relinquishes the samples to either the laboratory or shipper.

7. ***RMT laboratory no.*** - This number is a unique identification number assigned by the laboratory.

8. ***Year / Date*** - The year and date the samples are collected.

9. ***Time*** - The time the sample is collected. This time **MUST** also be noted on the sample bottle.

10. ***Sample station ID*** - The location of the sample, e.g., Boring 1, Tank 17.

11. ***Total number of containers*** - Add up all of the bottles filled and note total here.

12. ***Sample type*** - Circle sample type listed on Chain-of-Custody Form.

13. ***Container inventory*** - To be completed by the laboratory providing the bottles.

14. ***Filtered*** - Place Y (yes) or N (no) to indicate whether the (groundwater) sample in a particular bottle is filtered or not.

* The numbers of the items correspond to the numbers on the Chain-of-Custody Form (Figure 7-1).

15. ***Preserved*** - To be completed by the laboratory.

16. ***Refrigerated*** - To be completed by the laboratory.

17. ***Comments*** - Sampler may provide additional information about a sample, e.g., odor.

18. ***Relinquished by / Received by*** - This part of the form is a record of the individuals who actually had the samples in their custody. The spaces must be used in chronological order as the Chain-of-Custody Form is transferred with the samples.

    (1) Sampler signs when relinquishing custody.
    (2) Person accepting custody of samples from sampler signs.
    (3) Person in (2) must sign when relinquishing custody.
    (4)-(6) These are completed as necessary in the same manner as above.

    Note: If commercial carriers are used, the name of the carrier, airbill number, and date and time of relinquishing is written by sample entry or field personnel and the airbill is attached to the Chain-of-Custody Form.

    The final signature is that of the person receiving the samples at the laboratory.

19. ***Seal #*** - If applicable.

20. ***Seal #*** - If applicable.

21. ***Hazards associated with samples*** - This section is for field use. It can include any known or suspected hazard associated with the samples. Sample entry may add information to this section based on project manager or supervisor communication to the laboratory after samples are received. Laboratory group supervisors will use any hazard information to update and advise their analysts before work is started.

Completed Chain-of-Custody Forms will be placed in a plastic bag, sealed, and taped to the inside cover of the shipping container. After the samples are iced, the coolers will be sealed, dated, and shipped to the laboratory using an overnight delivery service. Samples will be received from the carrier and logged into the laboratory. In the event that samples are shipped for Saturday delivery, or delivered to the laboratory directly by the sampler after hours, arrangements will be made to have the appropriate personnel present to receive and log the samples upon their arrival. Sample coolers will not be left unattended.

A separate sample receipt will be prepared whenever samples are split with a government agency. The receipt will be marked to indicate with whom the samples are being split. The person relinquishing the samples to the agency should request the agency representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this will be noted on the receipt and in the field notebook.

If a Chain-of-Custody Form is damaged in shipment, a written statement will be prepared by the person who collected the samples listing the samples that were recorded on the damaged form and describing when and how the samples were collected. The statement should include information contained in field logbook entries regarding the sample. This statement will be submitted to the Site Coordinator and RMT Project Coordinator for further action, as necessary.

7.2 Laboratory Chain-of-Custody Procedures

Laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis, and storage of data are described in the RMT SOP (Attachment 1).

7.3 Final Evidence Files Custody Procedures

RMT is the custodian of the evidence files and maintains the contents of evidence files for investigative activities, including all relevant records, laboratory reports, logs, raw field data, field notebooks, photographs, subcontractor reports, and data reviews in a secured, limited-access area and under custody of the RMT Project Director.

RMT Laboratories maintains the file of raw analytical data and QA/QC documentation. This file includes, but is not limited to, sample Chain-of-Custody Forms, work orders, Acknowledgement Forms, RMT Laboratory Information Management System (LIMS) Change

Forms, instrument detection limits tabulations, all raw analytical data and bench sheets, and copies of laboratory communication records associated with the project.

Raw inorganic data system printouts will include date of analysis, analyst's name, parameters determined, calibration curve, calibration verifications, method blanks, sample number and any dilutions performed, sample duplicates, spikes, and control samples. QC sample results will be indicated on the analytical bench sheets and will include sample spikes, sample duplicates, initial and continuous calibration verification of standards and blanks, standard procedural blanks, laboratory control samples, and ICP interference check samples.

Raw organic data system printouts will include date of analysis, analyst's name, compounds determined, matrix spikes, matrix spike duplicates, surrogate spike recoveries, chromatograms, GC/MS spectra, and computer printouts.

The final evidence files will be kept as discrete project files and will be available upon request by the USEPA or the WDNR. Access to the final evidence files will be controlled, as described in Section 6 of the Workplan.

Section 8.0

CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of the instruments used for performing field measurements and laboratory analyses. These instruments will be calibrated prior to each use or on a scheduled, periodic basis. Calibration requirements are summarized in Table 8-1.

8.1 Field Instrument Calibration

Instruments used during field sampling will be examined to confirm that they are in good operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that notations concerning prior equipment problems are not overlooked, and that all necessary repairs to equipment have been carried out. A spare pH electrode and two thermometers will be sent to sampling locations where measurements of pH and temperature are required, including those locations where the specific conductivity probe/thermometer is required.

Field instruments requiring calibration will include a pH meter, a thermometer, a specific conductivity meter, and a portable gas chromatograph. The pH meter will be calibrated with standard buffer solutions prior to fieldwork. In the field, the meter will be calibrated with two buffers before use. Calibration procedures and calibration frequency will be recorded in a field logbook. General calibration procedures for the pH meter, the specific conductivity meter, and the thermometer are described below. Calibration procedures for the portable GC are described in the SOP (Attachment 2). The portable GC will be calibrated every 4 hours at a minimum. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

TABLE 8-1
SUMMARY OF OPERATIONAL CALIBRATION REQUIREMENTS

Instrument	Calibration Standards Used, Initial & Daily Minimum	Acceptance Limits	Corrective Actions	Reference
Atomic Absorption Spectrophotometer	Initial: 3 levels and blank	r value > 0.995	Make new standards or establish new calibration curve	1,2,4
	Initial Calibration Verif.	± 10% of true value		
	Initial Calibration Blank	± Abs. Dif. of Instrument Detection Limit (IDL)		
	QA Reference Sample	Within laboratory established QC limits		
	Continuing: (every 10 samples)			
	Mid-range Calibration Verif.	± 10% of true value		
	Continuing Calibration Blank	± Abs. Dif. of IDL		
Inductively Coupled Plasma Emission Spectrophotometer	Initial: 2 levels and blank	r value > 0.995	Make new standards or establish new calibration curve	3,4
	Initial Calibration Verif.	± 10% of true value		
	Initial Calibration Blank	± Abs. Dif. of IDL		
	QA reference sample	Within laboratory established QC limits		
	Continuing: (every 10 samples)			
	Mid-range Calibration Verif.	± 10% of true value		
	Continuing Calibration Blank	± Abs. Dif. of IDL		
GC/MS	Initial: 5 levels	%RSD <30% for CCP*	Make new standard, or establish new calibration curve	1,4
	Daily: 1 level	±30% of initial curve for CCP		
		Min RF 0.05 for SPCC**		
Gas Chromatograph Aroclors	Initial: 3 levels of one Aroclor Single point remainder	Calibration factors <10% RDS for curve	Make new standards or establish new calibration curve	1,4
	Daily: 1 level of check standard	±10% of original curve		
Volatiles 8020	Initial: Minimum of 5 levels range 1 to 40 ppb	Correlation coefficient >0.995	Make new standard or establish new calibration curve	1
	Daily: 20 ppb check standard	Within laboratory Establish QC Acceptance limits	Make new standard or establish new calibration curve	

References:
1) EPA SW-846, "Test Methods for Evaluating Solid Waste."
2) USEPA Methods for Chemical Analysis of Water and Wastes, 1979.
3) USEPA 200.7, 1982.
4) CLP - Statement of Work
* Calibration check compounds
** System performance check compounds

pH Meter Self-Test and Checkout Procedures

1. Attach BNC shorting plug to top of meter.

2. Press the POWER key and QUICKLY press the YES key to start the self-test.

3. After code 7 a "O" will appear on the display. Press each key (the numeric digits will change and a beep will sound).

NOTE: All keys must be pressed within 10 seconds otherwise an error message will appear.

NOTE: To change a value, press one of the arrow up and arrow down keys. The first digit will flash. Continue scrolling until the first digit equals the correct value, and then press yes. The second digit will flash. Scroll to the correct value, and then press yes. When all digits have been changed, press yes to enter the new value.

4. After the self test, the meter will be in MEASURE mode indicated by the legend MEASURE on the display.

5. Press the mode key until pH mode indicator is displayed. Main display should read a steady 7.00 ± 0.02. Press 2nd CAL, and when the display flashes 7.00, press YES. If the display does not read 7.00, scroll until it does, and then press YES.

6. Press MEASURE. The main display should read 10.0 with the legend SLP in the lower display. If so, press YES. If not, scroll until the display reads 100.0, and then press YES.

7. The meter advances to MEASURE and the display should read a steady 7.00.

8. Press the mode key to enter millivolt mode. 0.0 ± .1 should read a steady 7.00.

9. Press the mode key to enter REL mV mode. 0.0 ± .1 should be displayed. Press 2nd CAL then press YES to enter the value 0.0. Display should read a steady 0.0.

10. After steps 1 through 6 have been successfully completed, the meter is ready for use with electrodes. Remove the shorting plug, attach the electrode, and proceed with the CALIBRATION PROCESS.

pH Electrode Checkout Procedures

1. Testing electrode operation:
    a. Connect electrode to a working meter.
    b. Set function switch to absolute mV mode.
    c. Immerse electrode in fresh pH 7 buffer.
    d. Displayed value should be 0 ± 30 mV.
    e. Rinse electrode and immerse in fresh pH 4 buffer.
    f. Displayed value should be approximately 160 mV greater than in Step d.
2. If the electrode fails this procedure, return it to RMT for rejuvenation and use the back-up electrode.

pH Calibration with Two Buffers

1. Connect electrode to meter.
2. Place electrode into the first buffer (7.00).
3. Press the MODE key until the pH mode indicator is displayed.
4. Press 2nd CAL. CALIBRATE will be displayed above the main readout, and the time since the last calibration will be displayed. After a few seconds, P1 will be displayed in the lower field.
5. Wait for a stable pH display (READY will be displayed in right corner of screen) and then press the up arrow key. The first digit will start flashing. Scroll until the correct value appears in the first digit, and then press YES. The second digit will start flashing. Scroll until the correct value appears in the second digit, and then press YES. Continue in this manner until all digits have been correctly entered.

    The display remains frozen for two seconds and then P2 is displayed in the lower field indicating that the meter is ready for the second buffer.
6. Rinse electrode and place into the second buffer (4.01). Wait for a stable pH display, and then enter the correct value as described above.

The electrode slope is then displayed (for a BRIEF moment so watch carefully since this number needs to be recorded on the calibration log) in the main field with SLP in the lower field. The meter automatically advances to MEASURE mode.

7. Rinse electrode, and place into sample. Record pH directly from the meter display.

The calibrations performed, standards used, and sample pH values obtained are to be recorded in the field notebook. The calibration checks should be within ±0.1 pH unit. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement in the field, as necessary.

Temperature Calibration

Temperature measurements are performed using a thermometer. The thermometers will be inspected before each field trip to ensure that there is no mercury separation. The thermometers should be rechecked in the field before and after use to ensure that the readings are within ±1 degree of actual temperature and that the mercury is still intact; this information will be noted in the field logbook. The thermometers are calibrated biannually by immersing them in a bath of known temperature until equilibrium is reached. The thermometers are discarded if found to be more than 10 percent in error. The reference thermometer used for the bath calibration is National Bureau of Standards (NBS) traceable.

Conductivity Meter Calibration

The conductivity cells of the specific conductivity meter will be cleaned and checked against known conductivity standards before fieldwork. In the field, the instrument will be checked daily with NBS traceable standards. The calibration procedure is described below.

- Place the probe in conductivity calibration standard solution.
- Set temperature knob for temperature of standard solution.
- Turn to appropriate scale, and set the instrument for the value of calibration standard.
- Rinse off the electrode with distilled water.

- Measure the conductivity of distilled water to be used for a field blank, making sure that the temperature is set correctly for the temperature of the solution to be tested.
- If the conductivity of the blank (distilled water) is high, it must be discarded and a new blank sample must be procured.

All readings and calibrations should be recorded in the field notebook.

8.2 Laboratory Instrument Calibration

Calibration is required to demonstrate that instruments used to perform quantitative chemical analysis are operating properly. Correct operation is important in meeting sensitivity requirements and in establishing detection limits. There are two types of calibration: 1) operational calibration which is performed prior to instrument usage (i.e., standard curves); or 2) periodic calibration which is performed at prescribed intervals.

8.2.1 Calibration Program

All instruments and equipment which measure a quantity shall be controlled by a formal calibration program. Development and implementation of the calibration program shall be the responsibility of the RMT Laboratories Inorganic and Organic Group Supervisors.

Calibration Procedures

Recognized procedures (USEPA, ASTM, manufacturer's instructions) shall be used when available. Written calibration procedures shall include the reference materials to be used, calibration technique, acceptable performance limits, frequency, and documentation.

Equipment Identification

All equipment that is subject to calibration shall be labeled with a unique number.

Calibration Frequency

The calibration frequencies specified in the referenced analytical methods will be followed.

Calibration Reference Standards

Physical standards (weights, certified thermometers) shall be traceable to nationally recognized standards (e.g., NBS) which are at least four to ten times as accurate as the equipment requirements. When possible, physical standards shall be recalibrated every three years by a certified external agency.

Chemical reference standards shall be National Bureau of Standards, Standard Reference Materials (SRMs), standards provided by the United States Environmental Protection Agency (USEPA), or vendor-certified materials traceable to these standards.

Calibration Failure

Equipment that fails calibration shall be removed from service or tagged to indicate that it is out of calibration. The equipment shall be repaired and recalibrated before reuse. A record of all such occurrences shall be maintained with the equipment calibration file.

Calibration Records

Calibration records shall be maintained for each piece of equipment which requires calibration. This information shall include instrument name and number, calibration frequency and acceptance limits, date of calibration, calibration instructions, identity of person performing the calibration, calibration date, and records of any failures or repairs. Records for each instrument shall be maintained in a separate folder. A calendar shall be maintained by the Group Supervisors listing the dates of calibration for all instruments that require periodic calibration in their laboratory.

For instruments that are calibrated on an operational basis, calibration generally consists of determining instrument response against compounds of known composition and concentration or the preparation of a standard response curve of the same compound at different concentrations. Records of these calibrations shall be maintained in a log book kept with each instrument. This log book, prepared by the analyst, shall contain instrument name and number, notice of calibration failure and repairs, and a brief record of all calibrations performed.

8.2.2 Operational Calibration

Operational calibration usually involves measuring a standard response or preparing a standard calibration curve. Operational calibration for the major pieces of equipment in the RMT Laboratories is discussed below. The procedures used for each major piece of equipment are summarized in Table 8-1.

General Calibration Procedures

The analyst shall eliminate, or minimize, the source of errors by proper selection of method, equipment, solvents, and gases. Since even the best quality materials may contain interfering substances, the analyst shall analyze a method blank. The preparation of a standard curve may be necessary to certify the method.

Method Blank/Preparation Blank

The method blank shall be prepared by following the procedure step-by-step, including the addition of all solvents and reagents in the quantities specified by the method. If this cumulative blank interferes with the determination, steps shall be taken to reduce or eliminate the interferences. If this cannot be done, the magnitude of the interference shall be considered when calculating the concentration of a compound. A method blank shall be run with each group of twenty or fewer samples, or at least once every twelve hours.

Preparation of Standard Calibration Curve

Preparation of a standard calibration curve shall require the preparation and analysis of standard solutions by mixing the species to be analyzed with the appropriate solvent that is used to introduce the species into the instrument. The concentrations of the standard solutions shall cover the working range of the instrument, and the sample measurements shall be made within this range or the data shall be qualified. The calibration curve shall be prepared by plotting instrument response versus concentration of the species analyzed so that sample concentrations can be determined.

8.2.3 GC/MS Calibration Procedures

Documentation of GC/MS mass calibration and abundance pattern, response factor stability, and internal response and retention time shall be done by the analyst.

Tuning and GC/MS Mass Calibration

Prior to analyzing any samples, and on a twelve-hour basis, decafluorotriphenylphosphine (DFTPP) shall be analyzed for base/neutral and acid (BNA) compounds or p-bromofluorobenzene (BFB) for volatile compounds. The ion abundance criteria (Tables 8-2 and 8-3) for an injection of 50 ng of the appropriate compound shall be met before any samples, blanks, or standards are analyzed.

Calibration of the GC/MS System

Internal Standard Calibration

A minimum of five concentrations shall be used to establish the linearity of response. Typical linear ranges are limit of quantitation (LOQ) to 160 ng for semivolatiles, and LOQ to 1,000 ng for volatiles.

Volatile Compounds by Methods 8240 and 8260

Initial calibration of volatiles is performed at 20, 50, 100, 150, and 200 ug/L. Cases where the 200 ug/L concentration saturates the detector shall be documented, and a four-point curve shall be used for that compound.

Semivolatile Compounds by Method 8270

Initial calibration of semivolatiles is performed at 20, 50, 80, 120, and 160 total nanograms. Nine compounds (benzoic acid; 2,4-dinitro-phenol; 2,4,5-trichlorophenol;

TABLE 8-2
DFTPP KEY IONS AND ION ABUNDANCE CRITERIA

MASS	ION ABUNDANCE CRITERIA
51	30.0 - 60.0 percent of mass 198
68	Less than 2.0 percent of mass 69
70	Less than 2.0 percent of mass 69
127	40.0 - 60.0 percent of mass 198
197	Less than 1.0 percent of mass 198
198	Base peak, 100 percent relative abundance
199	5.0 - 9.0 percent of mass 198
275	10.0 - 30.0 percent of mass 198
365	Greater than 1.00 percent of mass 198
441	Present but less than mass 443
442	Greater than 40 percent of mass 198
443	17.0 - 23.0 percent of mass 442

Note: Whenever the laboratory takes corrective action which may change or affect the tuning criteria for DFTPP or BFB (e.g., ion source cleaning or repair, etc.), the unit must be verified prior to initiating sample analysis.

DFTPP and BFB criteria should be met before any samples, sample extracts, blanks, or standards are analyzed. Any samples analyzed when tuning criteria have not been met may require re-analysis.

TABLE 8-3
BFB KEY IONS AND ABUNDANCE CRITERIA

MASS	ION ABUNDANCE CRITERIA
50	15.0 to 40.0 percent of mass 95
75	30.0 to 60.0 percent of mass 95
95	base peak, 100 percent relative abundance
96	5.0 to 9.0 percent of mass 95
173	less than 2.0 percent of mass 174
174	greater than 50.0 percent of mass 95
175	5.0 to 9.0 percent of mass 174
176	greater than 95.0 percent, but less than 101.0 percent of mass 174
177	5.0 to 9.0 percent of mass 176

Note: Whenever the laboratory takes corrective action which may change or affect the tuning criteria for DFTPP or BFB (e.g., ion source cleaning or repair, etc.), the unit must be verified prior to initiating sample analysis.

DFTPP and BFB criteria should be met before any samples, sample extracts, blanks, or standards are analyzed. Any samples analyzed when tuning criteria have not been met may require re-analysis.

2-nitroaniline; 3-nitroaniline; nitroaniline; 4-nitrophenol; 4,6-dinitro-2-methylphenol; pentachlorophenol) use only the four highest concentrations since detection at less than 50 ng is usually not possible.

Internal Standard Calibration (VOCs and Semivolatiles)

The response factor will be calculated for each compound at each concentration level using the following equation:

$$RF = \frac{A_x}{A_{is}} X \frac{C_{is}}{C_x}$$

Where A_x = Area of the characteristic ion for the compound to be measured.

A_{is} = Area of the characteristic ion for the specific internal standards.

C_{is} = Concentration of the internal standard (ng/ul).

C_x = Concentration of the compound to be measured (ng/ul).

Calibration Check Compound Response (CCC)

The RF from the initial calibration shall be used to calculate the percent relative standard deviation (% RSD) for compounds identified as calibration check compounds:

$$\% \ RSD = \frac{\sigma}{\bar{x}} X \ 100$$

Where RSD = Relative standard deviation.

σ = Standard deviation of initial five response factors (per compound).

$\bar{x}$ = Mean of initial five response factors (per compound).

The % RSD for each individual Calibration Check Compound shall be less than 30 percent. These criteria and system performance check compound (SPCC) specifications shall be met for the initial calibration to be valid. Calibration check compounds are listed in Table 8-4.

System Performance Check Compound (SPCC) Response

A system performance check shall be performed so that minimum average response factors are met before the calibration curve is used.

For volatiles, the five system performance check compounds (SPCCs) shall be: chloromethane; 1,1-dichloroethane; bromoform; 1,1,2,2-tetrachloroethane; and chlorobenzene. The minimum acceptable average response factor (RF) for these compounds shall be 0.3 except for bromoform which shall be 0.25. These compounds typically have RFs of 0.4 to 0.6.

For semivolatiles, the SPCCs shall be: n-nitroso-di-n-propylamine; hexachlorocyclopentadiene; 2,4-dinitrophenol; and 4-nitrophenol. The minimum acceptable average RF for these compounds shall be 0.05. These compounds (SPCCs) typically have very low RFs (0.1 to 0.2).

Continuing Calibration (GC/MS)

A calibration standard containing all volatile or semivolatile HSL compounds as well as all required surrogates, shall be performed each 12 hours, including prior to and after analysis. The RF data from the standards for each 12-hour period will be compared to the average RF from the initial calibration for a specific instrument. A system performance check will be made each 12 hours. If the SPCC criteria are met, a comparison of RFs will be made for all continuing calibration compounds. This is the same check that is applied during the initial calibration. If the minimum response factors are not met, the system will be evaluated and a corrective action will be taken before sample analysis begins.

TABLE 8-4

CALIBRATION CHECK COMPOUNDS

SEMIVOLATILE CALIBRATION CHECK COMPOUNDS

Acenaphthene

1,4-Dichlorobenzene

Hexachlorobutadiene

N-Nitroso-di-n-phenylamine

Di-n-octylphthalate

Fluoranthene

Benzo(a)pyrene

4-Chloro-3-Methylphenol

2,4-Dichlorophenol

2-Nitrophenol

Phenol

Pentachlorophenol

2,4,6-Trichlorophenol

VOLATILE FRACTION CALIBRATION CHECK COMPOUNDS

1,1-Dichloroethene

Chloroform

1,2-Dichloropropane

Toluene

Ethylbenzene

Vinyl Chloride

Volatiles Organics Via Method 8020

The standard technique for volatile analysis is purge and trap gas chromatography using photoionization and electroanalysis detectors. Initial calibration is performed at 1, 2, 5, 10, 20, 30, and 40 ppb. A minimum of five levels will comprise the calibration curve by the external standard method. The correlation coefficient shall be ≥ 0.995. The working calibration curve for each compound will be verified on a daily basis. Acceptance criteria for curve verification will be based on laboratory-established limits. Table 8-1 summaries the requirements.

8.2.4 Calibration of the Inductively Coupled Argon Plasma Spectrophotometer (ICP)

This technique involves the nebulization of samples which are then excited by a radio-frequency inductively coupled plasma. The intensities of the spectral lines are monitored by photomultiplier tubes controlled by a computer system. A background correction technique is required to compensate for variable background contribution to any measured spectral line.

Spectral interferences can be four types as follows:

Interference	Solution
Overlap of spectral line from another element	Computer correction of raw data by monitoring interfering element
Unresolved overlap of molecular band spectra	Selection of an alternate wavelength
Contribution from continuous or recombination phenomena	Background correction adjacent to the analyte line
Stray light from line emission of high concentration elements	Background correction adjacent to the analyte line

Physical interferences are usually traceable to high dissolved solids contents or acid concentrations which cause changes in viscosity and surface tension. Solutions include use of a peristaltic pump, sample dilution, utilization of the methods of standard addition, or an internal standard compensation. Chemical interferences, such as molecular compound formation, ionization effects, and solute vaporization effects, are usually not a problem with ICP but, where present, can be minimized by careful selection of operating conditions, buffering of the sample, matrix matching, or standard addition procedures.

Calibration for the ICP will include the following:

- Instrument detection limits (IDL) will be determined quarterly.
- Linear range analysis (LRA) will be verified quarterly.
- Interference check samples (ICS) will be verified quarterly.
- At least two working standards will be analyzed to establish a calibration curve within the working range of the instrument per 8 hours. One of the standards will be a blank.
- The correlation coefficient (r) of the calibration curve will be 0.995 or greater.
- Calibration will be immediately followed by a second source initial calibration verification (ICV), an initial calibration blank (ICB), and a reference sample (EPA, ERA, etc.) when available.
- A second source continuing calibration verification (CCV) at the midpoint of the calibration curve, and continuing calibration blank (CCB) will be analyzed after every 10 samples.
- The calibration verification will read ±10% of the true value. If the ICV or CCV is out of this range, the instrument will be recalibrated, verified, and then the previous 10 samples will be reread.
- The calibration blank will read ± the IDL of the instrument. If the ICB or CCB is outside this limit, then the instrument will be recalibrated, verified, and the previous group of samples will be rerun.
- The system will be rinsed between each standard and sample.

- After completion of sample analysis, the continuing calibration verification and blank will be re-analyzed.

Table 8-1 summarizes these requirements.

8.2.5 Calibration of the Atomic Absorption Spectrophotometer (AA)

In operating a graphite furnace AA system, lamp intensity and alignment, slit width, wavelength, matrix modifier, and furnace temperature program will be held constant throughout a run.

During cold vapor AA analysis, these variables will be held constant: lamp alignment and intensity, slit width and wavelength, background correction, cell alignment, and air flow from the pump. The prevention of moisture condensation in the cell and air lines is critical during analysis.

In AA analysis, the acid concentration of the standards and samples will be closely matched, as will the reagent levels in the standards and samples of cold vapor analysis.

Calibration for the AA will include the following:

- Instrument detection limits (IDLs) will be determined quarterly.
- A calibration blank and three working standards for GFAA and four working standards for CVAA will be analyzed to establish a calibration curve within the linear working range of the instrument.
- Calibration will be immediately followed by a second source initial calibration verification (ICV), an initial calibration blank (ICB), and a reference sample (EPA, ERA, etc.) when available.
- A continuing calibration verification (CCV) at the midpoint of the calibration curve, and continuing calibration blank (CCB) will be analyzed after every 10 samples.

- The calibration verification will read ±10 percent of the true value. If the ICV or CCV is out of this range, the instrument will be recalibrated, verified, and then the previous 10 samples will be reread.
- The calibration blank will read ± the IDL of the instrument. If the ICB or CCB is outside this limit, then the instrument will be recalibrated, verified, and then the previous samples will be reread.
- After completion of sample analysis, the CCV and CCB will be re-analyzed.

Table 8-1 summarizes these requirements.

Section 9.0

ANALYTICAL AND MEASUREMENT PROCEDURES

9.1 Field Analytical and Measurement Procedures

Proper field analytical methods and procedures will be followed. The following steps are taken so that the analytical data gathered in the field are both valid and unbiased:

- Field technicians are trained in the use of each piece of equipment.
- Operation manuals accompany each piece of equipment in the field.
- Preventive maintenance programs are carried out on a scheduled basis.
- Spare components are taken into the field in case of equipment failure or damage.
- Instruments are calibrated on a daily basis and rechecked at various times daily.
- Readings and calibrations are documented.
- Daily QC checks of field notes are performed.

The accuracy, sensitivity, and precision of the field analytical techniques (pH, temperature, and specific conductivity) are dependent upon the specifications for the instruments used, as well as the QC techniques employed during their use. Specifications have been excerpted from the instrument instruction manuals.

Measurement of Temperature - A groundwater sample will be collected after purging a monitoring well. One portion of the sample will be placed in a container and immediately tested for temperature.

All field thermometers will be calibrated initially and semiannually against a National Bureau of Standards (NBS) certified thermometer. Field measurements of groundwater samples will be recorded to the nearest 0.5°C.

Each field thermometer will be visually inspected before each field trip and daily while in use to verify that it is not cracked and that there are no air spaces or bubbles in the mercury. Cross-checks and duplicate field analysis must agree within + 1°C.

A logbook will be maintained with each thermometer's RMT property number recorded. All calibration information, names of individuals making the calibrations, and dates will be recorded.

Measurement of Conductivity - The specific conductivity of the water sample will be measured in the same groundwater sample used for the temperature measurement. A portable specific conductivity meter (YSI Model 33 S-C-T), wheatstone bridge type or equivalent, will be used to measure the specific conductivity of the groundwater sample.

The calibration solution concentration and composition are as follows: potassium chloride, 0.010 Molar, 1,413 micro-ohms per centimeter.

Each meter will be inspected for physical damage before each field trip and daily while in the field. Batteries and conductivity cells will be cleaned and checked daily, and every ten or fewer investigative samples will be checked against known standards as described in the instrument's operations manual.

Reference will be made to the instrument's operations manual for temperature - conductivity calculations. Duplicate field measurements will be taken once for every ten samples collected. The results should agree within ± 10 umhos/cm and will be recorded in field notebooks.
A logbook will be maintained with the specific conductivity meter's RMT property numbers. All repairs, calibrations, and field time usage will be noted. The logbook will include dates, repairs made, and the name of the person(s) making the repairs.

Results will be expressed in micromhos/centimeter (μmhos/cm) corrected to 25°C, and reported to the nearest 5 units.

Probe Use:

1. Obstructions near the probe can disturb readings. At least 2 inches of clearance must be allowed for non-metallic, underwater objects. Metallic objects, such as pliers or weights, should be kept at least 6 inches from the probe.

2. Gentle agitation by raising and lowering the probe several times during a measurement ensures flow of specimen solution through the probe and improves the time response of the temperature sensor.

YSI Model 33 S-C-T Meter - Specifications

Range: 0-500, 0-5,000, 0-50,000 μmhos/cm.

Meter Accuracy:	± 2.5% max. error at 500, 5,000, and 50,000 plus probe accuracy. ± 3.0% max. error at 250, 2,500, and 25,000 plus probe accuracy.
Probe Accuracy:	± 2% of reading.
Readability:	2.5 μmhos/cm on 500 μmhos/cm range. 25 μmhos/cm on 5,000 μmhos/cm range. 250 μmhos/cm on 50,000 μmhos/cm range.

Measurement of pH - After purging, a portion of a groundwater sample will be tested for temperature and specific conductance. A separate portion will be placed in a second container for a field pH measurement.

The pH measurements will be made electrometrically using a combination electrode, an automatic temperature compensator probe, and portable pH meter with the following specifications:

Orion Model 250A

pH range	-2.00 to 19.99
Resolution	0.01/0.1
Relative accuracy	±0.02

Slope	80 to 120 percent
Temperature range	-5.0 to 105.0°C
Resolution	0.1°C
Relative accuracy	±1.0°C
Power requirements	One 9V alkaline battery
Environmental requirements	5 to 45°C and 5 to 85 percent relative humidity, non-condensing

The measurements will be recorded to the nearest 0.1 pH unit. Reference will be made to the instrument's operations manual for pH measurement procedures and instrument operation instructions.

The meter will be checked before each field trip and daily while in the field for any mechanical or electrical failures, weak batteries, and cracked or fouled electrodes. The meter and electrode also will be checked against standard buffer solutions of known pH values (e.g., 4, 7, and 10) as described in the instrument's operations manual. While in the field, the meter will be checked several times per day (or every ten or fewer investigative samples) against fresh buffers. In case of an apparent discrepancy in a pH measurement, the electrode will be checked with pH 7.0 buffer and recalibrated to the closest reference buffer. The sample will then be reanalyzed. Duplicate analyses will be taken once for every ten measurements and must agree within 0.1 pH units. If measurements do not agree, the meter will be recalibrated and/or replaced as necessary. The buffer solution containers will be refilled each day from fresh stock solution.

Decontamination of the pH probe and cup will be done by rinsing each three times with distilled water. A new disposable cup will be used for each well to prevent possible cross contamination.

A logbook will be maintained and will contain the RMT property number of each pH meter. All calibrations and repairs will be noted in the logbook indicating the date, repairs made, the name of the person(s) making the repairs, calibration records, and the time used in the field for each meter.

Portable GC

The gas chromatograph will be operated following the procedures set forth in the Photovac, Inc., instruction manual. Gas standards will be prepared daily by appropriate dilution of headspace over the pure solvent. Standards are prepared in gas sample bottles, using the carrier air from the GC as a diluent of the neat solvent headspace. The Photovac model 10S50 can analyze only gas-phase samples, so all standards and samples must be in the gas phase prior to injection.

Procedure

1. Blanks and standards are injected as part of the GC warmup. If the standard does not give an appropriate response, the standard is reinjected. If the response is still low, the syringe needle is checked for plugging by injecting air into a VOA vial filled with water, and replacing it if plugged. If the general GC response seems very low compared to standards, the photoionization lamp is replaced.
2. If the standards or replicate injections are not reproducible, the syringe needle is changed and the replication checked again.
3. Injection port septa in the GC are changed after every 50 to 75 injections.
4. Syringes are cleaned after every sample by removing the plunger and exposing the syringe to the ambient air.
5. If syringe contamination is suspected, a sample of the carrier air is injected. Contaminated syringes are stored until they can be cleaned by baking in a 100°C oven.

Documentation

- Sample VOC concentrations from duplicate runs will be recorded onto sample data sheets and stored with the GC operating sheets in the GC analysis project notebook.

- Every GC injection will be recorded on the GC operations sheets with information on the injection number, injection time, injection volume, gain, and sample identification.
- The GC recorder output for each day will be marked with the date, run number, and well boring number, and saved for future reference.
- Results will be QC checked in RMT's Madison office by comparing the tabulated results with the original chromatogram.

Two VOA vials are filled approximately half full with soil for each sample and allowed to equilibrate for at least 15 minutes at ambient laboratory temperature. A headspace sample from one vial will then be extracted and analyzed on the gas chromatograph. The second vial will be held as a backup in case problems are encountered with the first sample. Gas samples are collected in gas sample bottles containing a septum port. Samples are extracted through the septum with a syringe and directly injected into the GC.

Analyses will be performed as follows:

- The run (series of samples) is started with an instrument blank and syringe blank. A standard is injected for calibration.
- Gas samples of the headspace vapors from soil samples are injected and analyzed. Injections are repeated until the peaks of interest are on scale. If there are problems with an injection, it will be repeated until the measurement is duplicated to within 15 percent of the previous run. All sample runs that are to be used for calculation are repeated (i.e., replicate injections of the same sample).
- Syringe cleanliness is checked by injecting clean air whenever there may be potential syringe contamination. If syringe contamination is found, the syringe needle will be replaced, and the syringe will be cleaned with air and rechecked before being put back into service.
- GC outputs for parameters of interest are recorded on a data sheet and corrected for injection volume and gain, as appropriate. Final results are tabulated on a separate sheet. Both the data sheet and final results are reviewed by a senior chemist for quality control.

- Limits of Detection (LOD) were calculated from the detector response (in PPB-V/V-sec), the minimum area recorded by the GC (100 mV-sec), and the injection volume as follows:

$$\text{LOD, PPB} = (\text{response to standard, } \frac{\text{(PPB - V)}}{\text{V - sec}} \; (0.100 \text{ V - sec}) \; \frac{\text{(std. inj. vol. [uL])}}{\text{(sample inj. vol. [uL])}}$$

Standard preparation descriptions are given in the Table 9-1. A commercially prepared gas standard is used for vinyl chloride. All other standards are prepared by dilution of headspace over the neat solvent.

There are two aspects to calibrating the GC—calibrating the retention times recognition and calibrating the integrator response factor (i.e., the conversion factor for calculating concentration from V-sec). The response factor calibration is done at the start of each working day, using a freshly prepared standard. The standard concentrations are not stable over long time periods (e.g., hours) in the gas sample bottles due to loss through the septa and stopcocks. Therefore, the standards need to be prepared fresh for standardizing the response factor. The GC response factor changes very slowly as the lamp ages, and frequent calibration is not necessary. The GC is recalibrated if the reading for a new standard is more than 10 percent different than the prepared concentration.

Retention time calibration (i.e., making sure the GC is identifying the peaks properly) is done more frequently than response factor calibration. Retention times shift with changes in carrier gas flow rate and column temperature, both of which may drift during a day's operation. Retention time calibration is done at least every 4 hours, or more frequently if there is a question of peak identification. Retention time calibration is done using the standard prepared for that day. The same standard can be used throughout the day, since the compounds in the standard stay the same, and changes in concentrations are irrelevant for this purpose.

TABLE 9-1

GAS STANDARD PREPARATION PROCEDURE

Compound		Gas Concentration ppm (µL/L)
Benzene		9.8
Toluene	Commercially prepared by Scott Gases	19.9
Ethylbenzene		20.4
o-Xylene		20.8
m-Xylene		20.5
p-Xylene		20.3

9.2 Laboratory Analytical and Measurement Procedures

RMT Laboratories will use the analytical methods specified for the parameters listed in Section 3. Detailed descriptions of the analytical methods can be found in "Test Methods for Evaluating Solid Waste, Chemical/Physical Methods (SW-846) (USEPA, 1990)." Method numbers are shown in Tables 9-2 and 9.3.

TABLE 9-2

SUMMARY OF SAMPLE PREPARATION, CLEANUP, AND ANALYSIS METHODS FOR ORGANIC CONSTITUENTS

Analyte Group	Matrix	Sample Preparation	Sample Cleanup[a]	Sample Analysis
Volatile Organic Compounds	Groundwater	5030	NA	8240, 8020
	Soil	5030	NA	8260
Semivolatile Organic Compounds	Groundwater	3510	3640	8270
	Soil	3550	3640	8270
PCB	Groundwater	3510	3640, 3660	8081

Notes:

All numbered methods are taken from SW 846 (USEPA, 1990).

[a] Laboratory will match appropriate sample cleanup to anticipated interferences.

NA Not applicable.

TABLE 9-3

SUMMARY OF SAMPLE PREPARATION, CLEANUP, AND ANALYSIS METHODS FOR METALS

Parameter	EPA Analysis Method	Extraction/Digestion Method
SOILS		
Antimony	7041	3005, 3050
Arsenic	7060	3050
Barium	6010	3050
Beryllium	6010	3050
Cadmium	6010	3050
Chromium	6010	3050
Cobalt	6010	3050
Copper	6010	3050
Lead	7421	3050
Mercury	7470	7471
Nickel	6010	3050
Selenium	7740	3050
Silver	6010	3005, 3050
Thallium	7841	3050
Tin	RMT SOP 2.08	3050
Vanadium	6010	3050
Zinc	6010	3050
GROUNDWATER - FILTERED		
Antimony	7041	3005
Arsenic	7060	7060, 7740
Barium	6010	3005
Beryllium	6010	3005
Cadmium	6010	3005
Chromium	6010	3005
Cobalt	6010	3005
Copper	6010	3005
Lead	7421	3020
Mercury	7470	7470
Nickel	6010	3005

TABLE 9-3 (CONTINUED)

SUMMARY OF SAMPLE PREPARATION, CLEANUP, AND ANALYSIS METHODS FOR METALS

Parameter	EPA Analysis Method	Extraction/Digestion Method
Selenium	7740	7060, 7740
Silver	6010	3005
Thallium	3020	3020
Tin	RMT SOP 2.08	RMT SOP 2.01
Vanadium	6010	3005
Zinc	6010	3005
All numbered methods, except where indicated are from SW 846 (USEPA, 1990).		

Section 10.0

INTERNAL QUALITY CONTROL CHECKS

10.1 Field QC Checks

QC procedures for pH, specific conductivity, and temperature measurements are limited to checking the reproducibility of the measurement by obtaining multiple readings on a single sample or standard and by calibrating the instruments. Assessment of field sampling precision and bias will be made through collection of field duplicates and field blanks in accordance with the applicable procedures described in the FSP at the frequency indicated in the Tables 3-4 and 3-5 of this QAPjP.

10.2 Laboratory QC Checks

There are two types of quality assurance used by RMT Laboratories to ensure the production of analytical data of known and documented usable quality: program quality assurance and analytical method quality control.

RMT Laboratories has a written Quality Assurance/Quality Control program which provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. Compliance with the QA/QC program is coordinated and monitored by the laboratory Quality Assurance Unit (QAU), which is independent of the operating departments.

The stated objectives of the laboratory QA/QC Program are as follows:

- To ensure that all procedures are documented, including any changes in administrative and/or technical procedures
- To ensure that all analytical procedures are conducted according to sound scientific principles and that they have been validated
- To monitor the performance of the laboratory by a systematic inspection program and provide for a corrective action as necessary
- To collaborate with other laboratories in establishing quality levels, as appropriate
- To ensure that all data are properly recorded and archived

All laboratory procedures are documented in writing as either Standard Operating Procedures (SOPs) or Method Procedures (MPs) which are edited and controlled by the QAU. Internal quality control procedures for analytical services will be conducted in accordance with standard operating procedures and the individual method requirements in a manner consistent with appropriate SW-846 analytical methods. These specifications include the types of audits required (sample spikes, surrogate spikes, reference samples, controls, blanks), the frequency of each audit, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria for these audits.

The following internal quality control checks will be conducted:

- Spikes
    - Matrix spikes (organic and inorganic)
    - Matrix spike duplicates (organic)
    - Laboratory control spikes (inorganic)
    - Surrogates and internal standards (organic)
- Duplicates (field and sample)
- Blanks (field, trip, and method)
- Mass tuning for mass spectral analyses
- Confirmation with second column gas chromatographic analyses
- Calibration standards

The laboratory will document, in the data package provided, that both initial and ongoing instrument and analytical QC functions have been met. Any samples analyzed in nonconformance with the QC criteria will be reanalyzed by the laboratory, if sufficient sample volume is available. It is expected that a sufficient volume of samples will be collected for reanalyses.

Section 11.0

DATA REDUCTION, VALIDATION, AND REPORTING

11.1 Data Reduction

11.1.1 Field Data Reduction Procedures

Raw data from field measurements and sample collection activities will be appropriately recorded in the field logbook. If the data are to be used in the project reports, they will be reduced or summarized, and the method of reduction will be documented in the report.

11.1.2 Laboratory Data Reduction Procedures

RMT Laboratories will perform in-house analytical data reduction under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other notations which would caution the data user of possible unreliability. Data reduction, by the laboratory, will be conducted as follows:

- Raw data produced by the analyst is turned over to the respective area supervisor.
- The supervisor reviews the data for attainment of quality control criteria as outlined in the QA/QC program and/or established USEPA methods and for overall reasonableness.
- Upon acceptance of the raw data by the supervisor, a computerized report is generated and sent to the Laboratory QA Officer.
- The Laboratory QA Officer will complete a thorough audit of reports at a frequency of one in 10.
- The QA Officer and laboratory supervisor, in conjunction with the CCP Project Coordinator, will decide whether any sample reanalysis is required.
- Upon acceptance of the preliminary reports by the QA Officer, final reports will be generated and signed by the Laboratory Section Supervisor.

Data reduction procedures will be those specified in the SW-846 for inorganic and organic analyses, and will include "CLP-like" deliverables.

11.2 Data Validation

11.2.1 Procedures Used to Validate Field Data

The data reviewer will review field notes and Chain-of-Custody Forms to determine that procedures specified in the FSP have been followed.

11.2.2 Procedures Used to Validate Laboratory Data

RMT's data validation will be accomplished under the direction of RMT's QA/QC Coordinator. The RMT Data Reviewer will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate, and blank results provided by the laboratory. An evaluation of data accuracy, precision, sensitivity, and completeness, based on criteria in Section 5, will be performed, following the guidance documents prepared for data validation:

- Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses - USEPA, February 1988.
- Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses - USEPA, July 1988.

The Data Reviewer will identify any out-of-control data points and data omissions and will interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the RMT Project Coordinator in conjunction with the CCP Project Coordinator, based on the extent of the deficiencies and their importance in the overall context of the project.

All data generated for CCP during this study will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided by RMT Laboratories, as well as additional flags and comments of the Data Reviewer (see Tables 11-1 and 11-2). The data reviewer will assess the useability of results against the data quality objectives (DQOs).

11.3 Data Reporting

11.3.1 Field Data Reporting

Field data reporting will consist of field logs documenting site activities and the sample Chain-of-Custody Forms.

11.3.2 Laboratory Data Reporting

RMT Laboratories will prepare and retain full analytical and QC documentation as required by the QAPjP and SW-846. Such retained documentation need not be hard (paper) copy, but may be in other storage media (e.g., magnetic tape). As needed, with CCP's review and approval, RMT Laboratories will supply a hard copy of the retained information.

RMT Laboratories will report the data in the same chronological order in which it is analyzed along with the QC data. RMT Laboratories will provide the following information to RMT in each analytical data package submitted:

1. Cover sheets listing the samples included in the report, and narrative comments describing problems encountered in analysis.

2. Tabulated results of inorganic and organic compounds identified and quantified.

3. Analytical results for QC sample spikes, sample duplicates, standard procedural/method blanks, surrogate recoveries, MS/MSD results.

4. Raw data system printouts (or legible photocopies) identifying date of analysis, analyst's name, parameters determined, calibration curve, calibration verifications, method blanks, sample results, and any dilutions, sample duplicates, spikes, and control samples will be retained in the Laboratory project file.

For organic analyses, the data packages must include matrix spikes, matrix spike duplicates, surrogate spike recoveries, chromatograms, GC/MS spectra, and computer printouts. The laboratory flags to be used to qualify results are shown in Table 11-1. Summary data tables will be included in quarterly and annual groundwater reports.

TABLE 11-1
LABORATORY QUALIFIERS (I)

I	Inorganic Data
B	Reported value is < (CRQL) but > instrument detection limit (IDL)
N	Spiked sample recoveries not within control limits
S	Reported value determined by the Method of Standard Additions (MSA)
U	Analyte less than instrument detection limit
W	Post-digestion spike for GFAA analysis out of control limits (85-115%), while sample absorbance less than 50% of spike absorbance.
*	Duplicate analysis not within the assigned control limits
I	**Organic Chemical Data**
B	Analyte present in method blank
Q	Reported value less than the reporting limit but greater than the method detection limit.
U	Analyte not detected

TABLE 11-2
DATA VALIDATION QUALIFIERS (II)

I	II	Organic Chemical Data
	b	Analyte present in associated trip blank
B	U	Analyte present at less than 10 times the concentration in associated laboratory method blank (B) for common laboratory contaminants, or less than 5 times the blank concentration of other compounds and is therefore qualified as non-detectable (U) according to USEPA data validation procedures (USEPA, 1991).
	Ub	Analyte present at less than 10 times the concentration in associated trip blank (b) for common laboratory contaminants, or less than 5 times the blank concentration of other compounds and is therefore qualified as non-detectable (U) according to USEPA data validation procedures (USEPA, 1991).
	R	The results are rejected due to serious questions about the ability to determine the presence or absence of the analyte in the sample.

Section 12.0

PERFORMANCE AND SYSTEMS AUDIT

12.1 Field Performance and Systems Audit

12.1.1 Internal Field Audits

The RMT Site Coordinator will conduct a field audit, including the following:

- Field documentation procedures
- Calibration procedures for field measurements (i.e., pH, specific conductance, portable GC)
- Sampling equipment cleaning procedures
- Chain-of-Custody Form completion

12.1.2 External Field Audits

External field audits will be conducted by USEPA Region V Central Region Laboratory (CRL).

12.2 Laboratory Performance and Systems Audit

12.2.1 Internal Laboratory Audit

Internal laboratory audits will be conducted by the RMT Laboratories QA Manager. On an annual basis, the following will be checked:

- Documentation of sample receiving/log-in
- Sample storage
- Internal chain-of-custody
- Instrument operating records

Performance audits will consist of a review of the data validation information provided by the Data Reviewers. The records of particular interest will be field duplicate data, data validation flags, and data useability assessments.

12.2.2 External Laboratory Audit

External laboratory audits are conducted by USEPA Region V CRL.

Section 13.0

PREVENTIVE MAINTENANCE

13.1 Field Instrument Preventive Maintenance

The equipment used in the field for chemical measurements for this project includes a pH meter, a conductivity meter, and a portable GC (Photovac 10S50). A thermometer will also be used. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. The procedures are described in the FSP. The procedures for the portable GC are described in the SOP (Attachment 2).

Field instruments will be checked and calibrated daily before use and as described in Section 8 of QAPjP. Calibration checks will be documented. Critical spare parts, such as pH probes and batteries, will be kept on-site to reduce down time. Backup instruments and equipment should be available on-site or within 1 day via shipment to avoid delays in the field schedule.

13.2 Laboratory Instrument Preventive Maintenance

As part of their QA/QC program, a routine preventive maintenance program is conducted by RMT Laboratories to minimize the occurrence of instrument failure and other system malfunctions. RMT Laboratories has an internal group to perform routine scheduled maintenance, and to repair or to coordinate with the vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications or under service contracts.

All maintenance activities are required to be documented in logbooks to provide a history of maintenance records.

Section 14.0

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

14.1 Precision Assessment

Precision of laboratory analysis will be assessed by comparing the analytical results between matrix spike/matrix spike duplicate (MS/MSD) for organic analysis, and laboratory duplicate analyses for inorganic analysis. The relative percent difference (% RPD) will be calculated for each pair of duplicate analysis using the Equation 14-1.

$$\% \text{ RPD} = \frac{S - D}{(S + D)/2} \times 100 \qquad \text{Equ. 14-1}$$

Where: S = First sample value (original or MS value)
D = Second sample value (duplicate or MSD value)

14.2 Accuracy Assessment

Accuracy of laboratory results will be assessed for compliance with the established QC criteria that are described in Section 5 of the QAPjP using the analytical results of method blanks, reagent/preparation blanks, matrix spike/matrix spike duplicate samples, and field blanks. The percent recovery (% R) of matrix spike samples will be calculated using Equation 14-2.

$$\% \text{ R} = \frac{A - B}{C} \times 100 \qquad \text{Equ. 14-2}$$

Where:

A = The analyte concentration determined experimentally from the spiked sample

B = The background level determined by a separate analysis of the unspiked sample

C = The amount of the spike added

14.3 Completeness Assessment

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation 14-3.

$$\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100 \qquad \text{Equ. 14-3}$$

It is expected that RMT Laboratories will provide data meeting QC acceptance criteria for 95 percent or more for all samples tested. The data completeness of laboratory and field requirements is 90 percent or better.

Section 15.0

CORRECTIVE ACTION

15.1 **Field Corrective Action**

Technical staff and project personnel will be responsible for reporting to the RMT Site Coordinator all suspected technical or QA nonconformances or suspected deficiencies in any activity or issued document. The Site Coordinator will assess the situation in conjunction with the RMT QA/QC Coordinator. If it is determined that the situation has affected data quality, a nonconformance report requiring corrective action will be completed by the RMT Site Coordinator.

The RMT Site Coordinator will be responsible for the following:

- Evaluating all reported nonconformances
- Controlling additional work on nonconforming items
- Determining future actions to be taken
- Maintaining a log of nonconformances
- Reviewing nonconformance reports and corrective actions taken
- Ensuring that nonconformance reports are included in the final project files

If appropriate, the Site Coordinator will ensure that no additional work dependent on the nonconforming activity is performed until corrective actions are completed.

Corrective action for field measurement nonconformance may include the following:

- Repeating the measurement to check for error
- Checking adjustments for ambient conditions such as temperature
- Checking batteries
- Checking calibration
- Replacing the instrument or measurement devices
- Stopping work (if necessary)

The RMT Site Coordinator may be required to adjust the sampling programs to accommodate site-specific needs. When it becomes necessary to modify a program, the field person will notify the RMT Site Coordinator of the anticipated change and will implement the necessary changes after approval of the RMT Site Coordinator is obtained. Program changes will be documented and signed by the initiators and the RMT Site Coordinator. The RMT Site Coordinator for the CCP site is responsible for the controlling, tracking, and implementing the identified changes. Reports on all changes will be distributed to all affected parties.

15.2 Laboratory Corrective Action

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event.

Laboratory personnel are alerted that corrective actions may be necessary if any of the following occur:

- QC data are outside the warning or acceptable windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels.
- Undesirable trends are detected in spike recoveries or RPD between duplicates.
- There are unusual changes in detection limits.
- Deficiencies are detected by the QA Department during internal or external audits or from the results of performance evaluation samples.
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors and checks the instrument calibration, spike and calibration mixes, or instrument sensitivity. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, manager, and/or QA department for further investigation. The corrective action procedure will be discussed with the CCP Project Coordinator and full documentation placed in the RMT Laboratories project file whether the problem is resolved or not.

15.3 Corrective Action During Data Validation and Data Assessment

Data validation corrective actions typically consist of requesting corrections to laboratory reports. The Data Reviewer will notify RMT Laboratories of incomplete or erroneous reports and will request the issuance of corrected versions. Final summary data tables will not be issued until all data have been validated and all corrections are made.

Section 16.0

QUALITY ASSURANCE REPORTS TO MANAGEMENT

The quarterly and annual reports on the CCP site and any report summarizing the soil investigation will include a section by the Data Reviewer on data validation/data useability. The section will indicate whether the data can be used for the purposes intended based on an evaluation of compliance with control limits, results of audits, and compliance with procedures specified in the QAPjP and the FSP.

Section 17.0

REFERENCES

Hatcher-Sayre. 1986. Corrective measures, task I - description of past and current conditions. Site construction documentation report. Volumes 1 through 3.

MacDonald, M.G. and A.W. Harbaugh. 1984. A modular three-dimensional finite-difference groundwater flow model. U.S. Geological Survey.

USEPA. 1990. Test methods for evaluating solid waste; physical/chemical methods. SW-846.

USEPA Contract Laboratory Program. 1991. National functional guidelines for organic data review. Document No. OLM01.0.

USEPA Data Review Work Group. 1988. Laboratory data validation functional guidelines for evaluating inorganics analyses.

ATTACHMENT 1

FIELD SAMPLING PLAN

REVISION 0

FEBRUARY 1993

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

List of Tables

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Section 1

SUMMARY OF SAMPLING ACTIVITIES

During investigative activities at the areas of concern, soils, ash, and groundwater (including POTW monitoring points) will be sampled. The network design and rationale for the sampling activities are discussed in Section 5 and summarized in Tables 5-1 and 5-2 of the Workplan.

1.1 Soil Sampling Program

Soils will be sampled at each of the areas of concern, which are described in Subsection 4.2 of the Workplan. Table 1-1 summarizes the soil sampling program to be performed by area, including sample location designation, sample interval, field measurements, laboratory parameters, and field QC samples. Soil sampling locations for on-site Areas 1, 2, and 3 and off-site Area 5 (Churchyard property) are shown on Figure 1-1. Soil sampling locations for background samples and for off-site Area 4 (Logeman property) are shown on Figure 1-2. Ash samples will be collected at four locations on the Logeman property.

A number of the sampling locations will be sampled continuously to bedrock. The depth to bedrock is anticipated to vary from approximately 15 to 20 feet. For purposes of this sampling program, the depth to bedrock was assumed to be 16 feet, and therefore the total number of samples to be collected at each boring location is shown as eight.

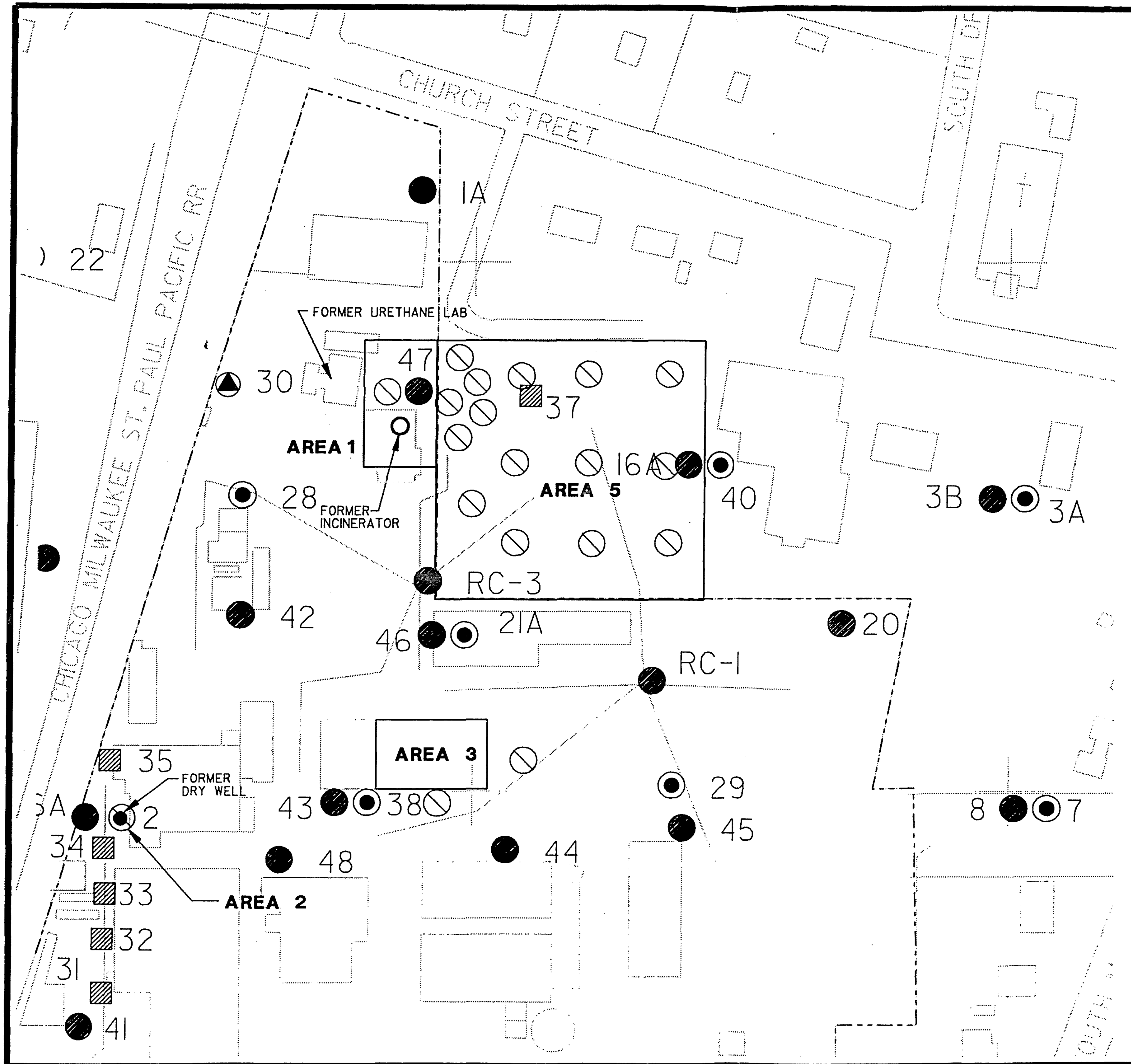
1.2 Groundwater Sampling Program

Groundwater monitoring at the site will be performed according to the programs outlined in Tables 1-2(a) through 1-2(d) and Table 1-3. Sampling points include the Ranney collectors (shallow drains), glacial and dolomite monitoring wells, municipal wells, and POTW sampling points. The locations of the monitoring points are shown on Figure 1-3.

TABLE 1-1
SOIL SAMPLING PROGRAM

Area of Concern	Sample Matrix	Sample Type/Depth	Location Designation	Sampling Interval	Field Measurements	Laboratory Parameters	Total Investigative Samples	Field Quality Control Samples		
								Total Field Duplicates	Total Matrix Spikes/MS Duplicates	Total Trip Blanks
Area 1: Former Urethane Laboratory/Hazardous Waste Incinerator	Soil	One boring to 16 feet	1B1	Continuous (2-foot intervals) for VOC; 14 to 16 feet for SVOC	None	Appendix IX VOC	8	1 (F01)	1 (MS/MSD01)	1 (TB date)
						Appendix IX SVOC	1		1 (MS/MSD02)	
Area 2: Former Dry Well	Soil	One boring to 16 feet	2B1	Continuous (2-foot intervals) for VOC; 14 to 16 feet for SVOC	None	Appendix IX VOC	8	1 (F02)	1 (MS/MSD03)	1 (TB date)
						Appendix IX SVOC	1		1 (MS/MSD04)	
Area 3: Former Tank Farm Storage Area	Soil	Two borings to 16 feet	3B1 3B2	Continuous (2-foot interval) for VOC; 14 to 16 feet for SVOC	None	Appendix IX VOC	16	2 (FB03, FB04)	1 (MS/MSD05) 1 (MS/MSD06)	2 (TB dates)
						Appendix IX SVOC	2			
Area 4: Logeman Property	Ash	One boring to 12 feet; three surface samples	4B1, 4S1, 4S2, 4S3	Surface, middle, and bottom of boring for VOC and metals; surface samples for VOC and metals	None	Appendix IX VOC	6	1 (FB05)	1 (MS/MSD07)	2 (TB dates)
						Appendix IX metals	6	1 (FB06)	1 (MS/MSD08)	*
	Soil	Two borings to 16 feet; two background surface samples	4B2, 4S3, 4S4, 4S5	Continuous (2-foot intervals) for VOC; 14 to 16 feet for SVOC; background surface samples for VOC, SVOC, and metals	None	Appendix IX VOC	18	2 (FB07,08)	1 (MS/MSD09)	
						Appendix IX SVOC	4	1 (FB09)	1 (MS/MSD10)	*
						Appendix IX metals	2	1 (FB10)	1 (MS/MSD11)	
Area 5: Churchyard	Solvent Area Soils	Five borings to 16 feet	5B1 5B2 5B3 5B4 5B5	Continuous (2-foot intervals) for GC analysis; two impacted samples at 2-foot depth for VOC and SVOC	Portable GC		40	2		
						Appendix IX VOC	2	1	1 (MS/MSD12)	1 (TB date)
						Appendix IX SVOC	2		1 (MS/MSD13)	
	Ballfield Soils	Ten borings to 6 feet	5B6 5B7 5B8 5B9 5B10 5B11 5B12 5B13 5B14 5B15	0 to 2 feet and 4 to 6 feet for GC analysis; 1 to 2 feet for VOC	Portable GC		20	1	**	
						Appendix IX VOC	10	1		1 (TB date)

* Assumes Logeman soil and ash to be shipped together.
** MS/MSD samples are accounted for by solvent area MS/MSD samples.



LEGEND

- ▲ DEEP DOLOMITE WELL
- ◉ SHALLOW DOLOMITE WELL
- ● GLACIAL OVERBURDEN WELL
- ■ GLACIAL OVERBURDEN WITHDRAWAL WELL
- ●◉ GLACIAL OVERBURDEN/SHALLOW DOLOMITE WELL NEST
- RC-2 ● RANNEY COLLECTOR
- ⊘ SOIL SAMPLING LOCATIONS

NOTES

1. BASE MAP DEVELOPED FROM HATCHER-SAYRE, INC., JANUARY, 1993.
2. AREAS OF CONCERN ARE AS FOLLOWS:
3. AREA 1 : FORMER URETHANE LABORATORY/HAZARDOUS WASTE INCINERATOR
   AREA 2 : FORMER DRY WELL
   AREA 3 : FORMER TANK FARM STORAGE AREA
   AREA 5 : CHURCHYARD (OFFSITE)
4. AREA 4 (LOGEMAN PROPERTY) IS SHOWN ON FIGURE 1-2.

N

0 100 200

SCALE: 1"=100'

SOIL SAMPLING LOCATION MAP: AREAS 1, 2, 3, AND 5

RMT INC.

Drawn By: DJW
Approved By:
Date: FEBRUARY, 1993
Proj. No.: 1832.33

RMT COMPUTER AIDED DESIGN & DRAFTING

FIGURE 1-1

Levels
(1) 1,5,10,30,36-40,46-50
(2) 1-63
(3) 1-63
(4) •no ref levels•
(5) •no ref levels•
(6) •no ref levels•
(7) •no ref levels•
(8) •no ref levels•
(9) •no ref levels•
(10) •no ref levels•

...gical Names
(1) bmr
(2) bmc
(3) bdr
(4) •no ref logical•
(5) •no ref logical•
(6) •no ref logical•
(7) •no ref logical•
(8) •no ref logical•
(9) •no ref logical•
(10) •no ref logical•

Reference Files
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Ref. File 2 = bmclient.dgn
Ref. File 3 = border.dgn
Ref. File 4 = •no ref name•
Ref. File 5 = •no ref name•
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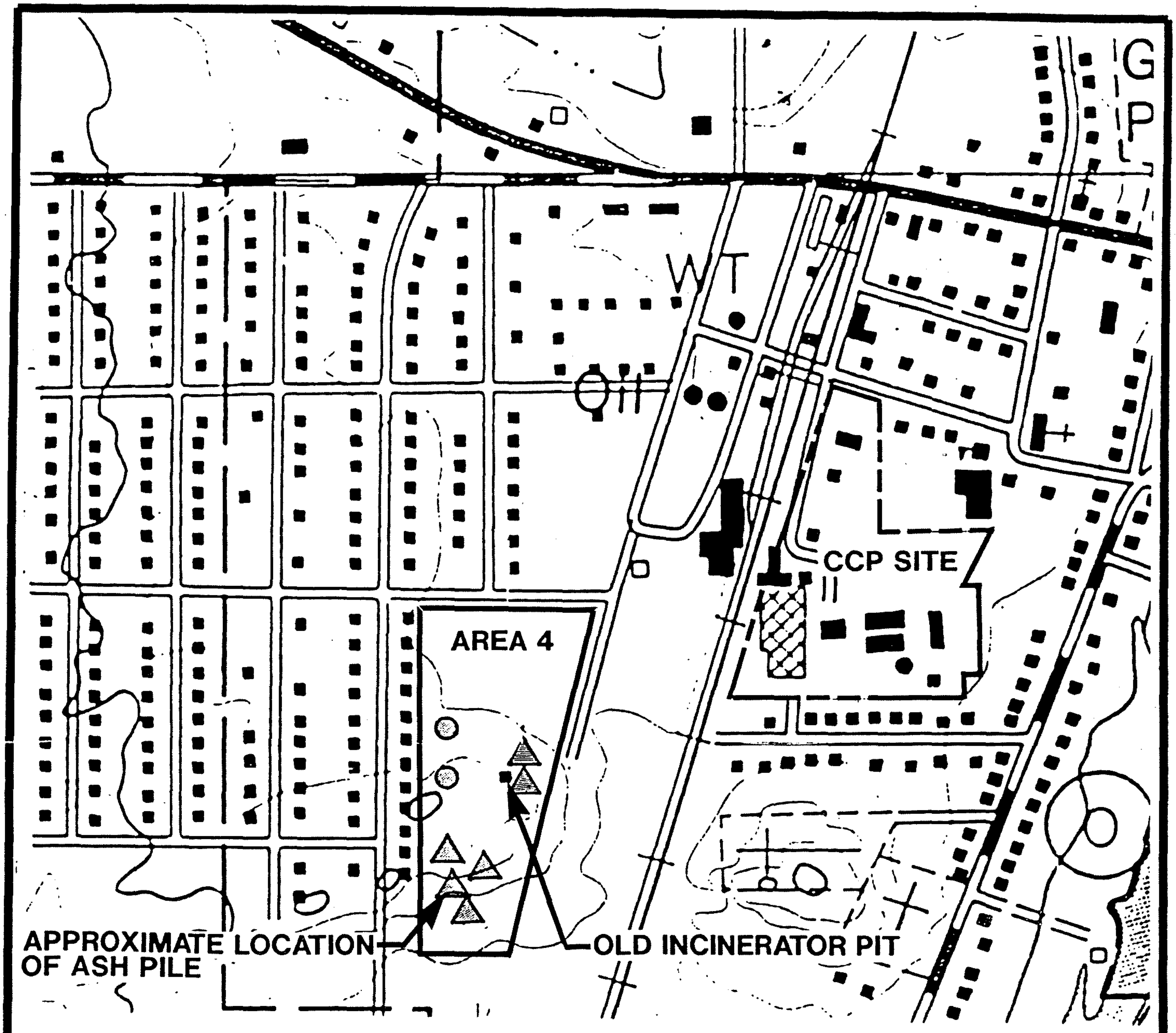
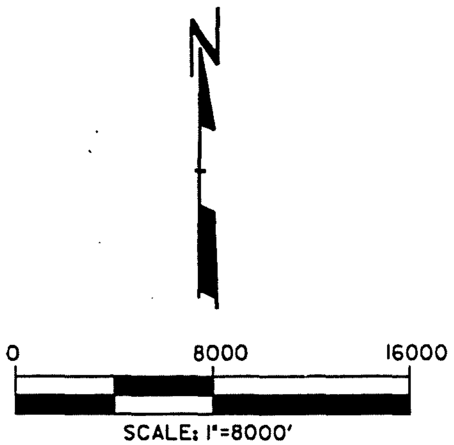




LEGEND

● BACKGROUND SOIL SAMPLING LOCATION
▲ LOGEMAN PROPERTY SOIL/ASH SAMPLING LOCATION
---- SITE PROPERTY BOUNDARY

BACKGROUND AND LOGEMAN PROPERTY (AREA 4) SOIL SAMPLING LOCATIONS

SOURCE : PORT WASHINGTON WEST, WISCONSIN 7.5 MINUTE USGS TOPOGRAPHIC QUADRANGLE.

RMT INC.	Drawn By: DJW
	Approved By:
	Date: JANUARY, 1993
	Proj. No.: 1832.37

FIGURE 1-2

TABLE 1-2(a)
GROUNDWATER SAMPLING PROGRAM
JANUARY EVENT

January Event	Well Type	Sample Locations	Matrix	Field Measurements[1]	Laboratory Analyses	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]
Receptor Monitoring	Ranney Collectors	RC-1	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		RC-2	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		RC-3	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
	Municipal Wells	MW-01	GW	Water level, pH, temp., specific conductivity	VOC 8240 list		1		1 MS/MSD 01	2
		MW-03	GW	Water level, pH, temp., specific conductivity	VOC 8240 list	1 F01	1			2
		MW-04	GW	Water level, pH, temp., specific conductivity	VOC 8240 list		1	1 D01		2
	Publicly Owned Treatment Works	POTW-I (influent)	WW	None[7]	VOC 8240 list		1			1
		POTW-E (effluent)	WW	None[7]	VOC 8240 list		1			1
		POTW-S (sludge)	WW	None[7]	VOC 8240 list		1			1
					TOTALS[8]:	1	9	1	4	15

Notes:

[1] Water level measurements will be performed at existing wells that are not sampled.

[2] Field blanks will be collected by rinsing deionized water through the decontaminated sampling device prior to sample collection. Field blanks are collected at a frequency of one field blank per ten or fewer investigative samples. Field blanks are used to assess the potential for introducing contamination via the sampling device.

[3] Investigative samples consist of groundwater and POTW influent, effluent, and sludge.

[4] Field duplicates will be collected at a frequency of one field duplicate per ten or fewer investigative samples. Field duplicates are used to assess sampling and analytical reproducibility.

[5] Extra sample volumes will be provided to perform sample dilutions if necessary. The extra sample volumes identified as MS/MSD will be used to perform matrix spikes/matrix spike duplicates. One MS/MSD sample will be collected for every 20 or fewer investigative samples.

[6] The total number of samples to be collected includes field blanks, investigative samples, field duplicates, and extra sample volumes used for sample dilutions or as MS/MSD samples.

[7] Monitoring at the publicly-owned treatment works (POTW) does not include field measurements: high organic concentrations in these samples interfere with pH and specific conductivity measurements, rendering them of questionable value.

[8] One trip blank will accompany each sample shipment and will be analyzed for VOCs by Method 8240. Trip blanks are used to assess the potential for sample contamination due to contaminant migration during sample shipment and storage. Trip blanks will be labeled as "TB" and date (month, day, year) as six numerals "011493".

[9] Each sample will be collected by filling (no headspace) three 40-mL glass vials with Teflon septa.

[10] Sample containers will have HCl preservative added in the laboratory prior to sampling. Cool samples to 4°C.

TABLE 1-2(b)
GROUNDWATER SAMPLING PROGRAM
APRIL EVENT

April Event	Well Type	Sample Locations	Matrix	Field[1] Measurements	Laboratory Analyses	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]
Receptor Monitoring	Ranney Collectors	RC-1	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		RC-2	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		RC-3	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
	Municipal Wells	MW-01	GW	Water level, pH, temp., specific conductivity	VOC 8240 list		1		1 MS/MSD 01	2
		MW-03	GW	Water level, pH, temp., specific conductivity	VOC 8240 list	1 F01	1			2
		MW-04	GW	Water level, pH, temp., specific conductivity	VOC 8240 list		1	1 D01		2
	Publicly Owned Treatment Works	POTW-I (influent)	WW	None[7]	VOC 8240 list		1			1
		POTW-E (effluent)	WW	None[7]	VOC 8240 list		1			1
		POTW-S (sludge)	WW	None[7]	VOC 8240 list		1			1
Perimeter Monitoring	Glacial Overburden Wells	W-01A	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list	1 F02	1			2
		W-03B	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1	1 D02		2
		W-04A	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-08A (proposed)	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-20	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-27	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1

TABLE 1-2(b) (CONTINUED)
GROUNDWATER SAMPLING PROGRAM
APRIL EVENT

April Event	Well Type	Sample Locations	Matrix	Field[1] Measurements	Laboratory Analyses	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]
Perimeter Monitoring (Continued)	Shallow Dolomite Wells	W-03A	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list	1 F03	1			2
		W-07	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-22	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-23	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1	1 D03		2
		W-25	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
	Deep Dolomite Wells	PW-08	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1		1 MS/MSD 02	2
					TOTALS[7]:	3	21	3	5	32

Notes:

[1] Water level measurements will be performed at existing wells that are not sampled.

[2] Field blanks will be collected by rinsing deionized water through the decontaminated sampling device prior to sample collection. Field blanks are collected at a frequency of one field blank per ten or fewer investigative samples. Field blanks are used to assess the potential for introducing contamination via the sampling device.

[3] Investigative samples consist of groundwater and POTW influent, effluent, and sludge.

[4] Field duplicates will be collected at a frequency of one field duplicate per ten or fewer investigative samples. Field duplicates are used to assess sampling and analytical reproducibility.

[5] Extra sample volumes will be provided to perform sample dilutions if necessary. The extra sample volumes identified as MS/MSD will be used to perform matrix spikes/matrix spike duplicates. One MS/MSD sample will be collected for every 20 or fewer investigative samples.

[6] The total number of samples to be collected includes field blanks, investigative samples, field duplicates, and extra sample volumes used for sample dilutions or as MS/MSD samples.

[7] Monitoring at the publicly-owned treatment works (POTW) does not include field measurements; high organic concentrations in these samples interfere with pH and specific conductivity measurements, rendering them of questionable value.

[8] One trip blank will accompany each sample shipment and will be analyzed for VOCs by Method 8240. Trip blanks are used to assess the potential for sample contamination due to contaminant migration during sample shipment and storage. Trip blanks will be labeled as "TB" and date (month, day, year) as six numerals "011493".

[9] Each sample will be collected by filling (no headspace) three 40-mL glass vials with Teflon septa.

[10] Sample containers will have HCl preservative added in the laboratory prior to sampling. Cool samples to 4°C.

TABLE 1-2(c)
GROUNDWATER SAMPLING PROGRAM
JULY EVENT

July Event	Well Type	Sample Locations	Matrix	Field[1] Measurements	Laboratory Analyses	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]
Receptor Monitoring	Ranney Collectors	RC-1	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		RC-2	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		RC-3	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
	Municipal Wells	MW-01	GW	Water level, pH, temp., specific conductivity	VOC 8240 list		1		1 MS/MSD 01	2
		MW-02	GW	Water level, pH, temp., specific conductivity	VOC 8240 list		1			1
		MW-03	GW	Water level, pH, temp., specific conductivity	VOC 8240 list	1 F01	1			2
		MW-04	GW	Water level, pH, temp., specific conductivity	VOC 8240 list		1	1 D01		2
	Publicly-Owned Treatment Works	POTW-I (influent)	WW	None[7]	VOC 8240 list		1			1
		POTW-E (effluent)	WW	None[7]	VOC 8240 list		1			1
		POTW-S (sludge)	WW	None[7]	VOC 8240 list		1			1
Remediation Progress Monitoring	Glacial Overburden Wells	W-06A	GW	Water level, pH, temp., specific conductivity	VOC 8020 list	1 F02	1		1	3
		W-19A	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1	1 D02		2
		W-37	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		W-41	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1 MS/MSD 02	2
		W-42	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		W-43	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		W-47	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2

TABLE 1-2(c) (CONTINUED)
GROUNDWATER SAMPLING PROGRAM
JULY EVENT

July Event	Well Type	Sample Locations	Matrix	Field[1] Measurements	Laboratory Analyses	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]
Remediation Progress Monitoring (Continued)	Shallow Dolomite Wells	W-21A	GW	Water level, pH, temp., specific conductivity	VOC 8020 list	1 F03	1		1	3
		W-24A	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1			1
		W-28	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1			1
		W-29	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1			1
		W-38	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
	Deep Dolomite Well	W-30	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1	1 W-D30		2
					TOTALS[8]:	3	23	3	12	41

Notes:

[1] Water level measurements will be performed at existing wells that are not sampled.

[2] Field blanks will be collected by rinsing deionized water through the decontaminated sampling device prior to sample collection. Field blanks are collected at a frequency of one field blank per ten or fewer investigative samples. Field blanks are used to assess the potential for introducing contamination via the sampling device.

[3] Investigative samples consist of groundwater and POTW influent, effluent, and sludge.

[4] Field duplicates will be collected at a frequency of one field duplicate per ten or fewer investigative samples. Field duplicates are used to assess sampling and analytical reproducibility.

[5] Extra sample volumes will be provided to perform sample dilutions if necessary. The extra sample volumes identified as MS/MSD will be used to perform matrix spikes/matrix spike duplicates. One MS/MSD sample will be collected for every 20 or fewer investigative samples.

[6] The total number of samples to be collected includes field blanks, investigative samples, field duplicates, and extra sample volumes used for sample dilutions or as MS/MSD samples.

[7] Monitoring at the publicly-owned treatment works (POTW) does not include field measurements; high organic concentrations in these samples interfere with pH and specific conductivity measurements, rendering them of questionable value.

[8] One trip blank will accompany each sample shipment and will be analyzed for VOCs by Method 8240. Trip blanks are used to assess the potential for sample contamination due to contaminant migration during sample shipment and storage. Trip blanks will be labeled as "TB" and date (month, day, year) as six numerals "011493".

[9] Each sample will be collected by filling (no headspace) three 40-mL glass vials with Teflon septa.

[10] Sample containers will have HCl preservative added in the laboratory prior to sampling. Cool samples to 4°C.

TABLE 1-2(d)
GROUNDWATER SAMPLING PROGRAM
OCTOBER EVENT

October Event	Well Type	Sample Locations	Matrix	Field[1] Measurements	Laboratory Analyses	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]
Receptor Monitoring	Ranney Collectors	RC-1	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		RC-2	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
		RC-3	GW	Water level, pH, temp., specific conductivity	VOC 8020 list		1		1	2
	Municipal Wells	MW-01	GW	Water level, pH, temp., specific conductivity	VOC 8240 list		1		1* MS/MSD 01	2
		MW-03	GW	Water level, pH, temp., specific conductivity	VOC 8240 list	1 F01	1			2
		MW-04	GW	Water level, pH, temp., specific conductivity	VOC 8240 list		1	1 D01		2
	Publicly Owned Treatment Works	POTW-I (influent)	WW	None[7]	VOC 8240 list		1			1
		POTW-E (effluent)	WW	None[7]	VOC 8240 list		1			1
		POTW-S (sludge)	WW	None[7]	VOC 8240 list		1			1
Perimeter Monitoring	Glacial Overburden Wells	W-01A	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list	1 F02	1			2
		W-03B	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1	1 D02		2
		W-04A	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-08A (proposed)	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-20	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-27	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1

TABLE 1-2(d) (CONTINUED)
GROUNDWATER SAMPLING PROGRAM
OCTOBER EVENT

October Event	Well Type	Sample Locations	Matrix	Field[1] Measurements	Laboratory Analyses	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]
Perimeter Monitoring (Continued)	Shallow Dolomite Wells	W-03A	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list	1 F03	1			2
		W-07	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-22	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
		W-23	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1	1 D03		2
		W-25	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1			1
	Deep Dolomite Well	PW-08	GW	Water level, pH, temperature, specific conductivity	VOC 8240 list		1		1 MS/MSD 02	2
					TOTALS[7]:	3	21	3	5	32

Notes:

[1] Water level measurements will be performed at existing wells that are not sampled.

[2] Field blanks will be collected by rinsing deionized water through the decontaminated sampling device prior to sample collection. Field blanks are collected at a frequency of one field blank per ten or fewer investigative samples. Field blanks are used to assess the potential for introducing contamination via the sampling device.

[3] Investigative samples consist of groundwater and POTW influent, effluent, and sludge.

[4] Field duplicates will be collected at a frequency of one field duplicate per ten or fewer investigative samples. Field duplicates are used to assess sampling and analytical reproducibility.

[5] Extra sample volumes will be provided to perform sample dilutions if necessary. The extra sample volumes identified as MS/MSD will be used to perform matrix spikes/matrix spike duplicates. One MS/MSD sample will be collected for every 20 or fewer investigative samples.

[6] The total number of samples to be collected includes field blanks, investigative samples, field duplicates, and extra sample volumes used for sample dilutions or as MS/MSD samples.

[7] Monitoring at the publicly-owned treatment works (POTW) does not include field measurements; high organic concentrations in these samples interfere with pH and specific conductivity measurements, rendering them of questionable value.

[8] One trip blank will accompany each sample shipment and will be analyzed either for VOCs by Method 8240. Trip blanks are used to assess the potential for sample contamination due to contaminant migration during sample shipment and storage. Trip blanks will be labeled as "TB" and date (month, day, year) as six numerals "011493".

[9] Each sample will be collected by filling (no headspace) three 40-mL glass vials with Teflon septa.

[10] Sample containers will have HCl preservative added in the laboratory prior to sampling. Cool samples to 4°C.

TABLE 1-3
GROUNDWATER CHARACTERIZATION

One-Time Event	Well Type	Sample Locations	Matrix	Field Measurements	Laboratory Analyses[1]	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]	Sample Containers	Preservatives/ Holding Time[7]
Groundwater Characterization	Glacial Overburden Wells	W-06A	Groundwater	Water level, pH, temp., specific conductivity	Appendix IX VOCs	1 FO1	1		1	3	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX SVOCs		1		1	2	Fill two 1-L amber glass bottles with Teflon lined cap per sample	Cool to 4°C (7 days to extraction, 40 days to analysis)
					Appendix IX PCBs		1			1	Fill two 1-L amber glass bottles with Teflon lined cap per sample	Cool to 4°C (7 days to extraction, 40 days to analysis)
					Appendix IX Metals (filtered)		1			1	Fill one 1-L plastic bottle per sample	Fill with 0.45-micron millipore filter; cool to 4°C, and nitric acid to pH < 2 (6 months)
		W-44[8]	Groundwater	Water level, pH, temp., specific conductivity	Appendix IX VOCs		1		1	2	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX SVOCs		1		1	2	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX PCBs		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX Metals (filtered)		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
		W-47	Groundwater	Water level, pH, temp., specific conductivity	Appendix IX VOCs		1		1	2	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX SVOCs		1		1	2	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX PCBs		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX Metals (filtered)		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)

TABLE 1-3 (CONTINUED)
GROUNDWATER CHARACTERIZATION

One-Time Event	Well Type	Sample Locations	Matrix	Field Measurements	Laboratory Analyses[1]	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]	Sample Containers	Preservatives/ Holding Time[7]
Groundwater Characterization (Continued)	Shallow Dolomite Wells	W-21A	Groundwater	Water level, pH, temp., specific conductivity	Appendix IX VOCs	1 FO2	1		1	3	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX SVOCs		1		1	2	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX PCBs		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX Metals (filtered)		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
		W-24A	Groundwater	Water level, pH, temp., specific conductivity	Appendix IX VOCs		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX SVOCs		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX PCBs		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX Metals (filtered)		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
		W-28	Groundwater	Water level, pH, temp., specific conductivity	Appendix IX VOCs		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX SVOCs		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX PCBs	1 F03	1			2	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX Metals (filtered)		1			1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)

TABLE 1-3 (CONTINUED)
GROUNDWATER CHARACTERIZATION

One-Time Event	Well Type	Sample Locations	Matrix	Field Measurements	Laboratory Analyses[1]	No. of Field Blanks[2]	No. of Invest. Samples[3]	No. of Field Duplicates[4]	No. of Extra Samples[5]	Total No. of Samples[6]	Sample Containers	Preservatives/ Holding Time[7]
Groundwater Characterization (Continued)		W-29	Groundwater	Water level, pH, temp., specific conductivity	Appendix IX VOCs		1		1	1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX SVOCs		1		1	1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX PCBs		1		1	1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX Metals (filtered)		1		1	1	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
	Deep Dolomite Well	W-30	Groundwater	Water level, pH, temp., specific conductivity	Appendix IX VOCs		1	1 D01	1 MS/MSD01	3	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX SVOCs		1	1 D02	1 MS/MSD02	3	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX PCBs		1	1 D03	1 MS/MSD02	3	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					Appendix IX Metals (filtered)	1 F004	1	1 D04		3	Fill (no headspace) three 40-mL glass vials with Teflon® septa per sample	HCl (added in laboratory prior to sampling) cool to 4°C and protect from light (14 days)
					TOTALS[9]:	4	32	4	11	51		

NOTES:

[1] Appendix IX VOC and SVOC analyses will include 10 tentatively identified compounds (TICs).

[2] Field blanks will be collected by rinsing deionized water through the decontaminated sampling device prior to sample collection. Field blanks are collected at a frequency of one field blank per ten or fewer investigative samples. Field blanks are used to assess the potential for introducing contamination via the sampling device.

[3] Investigative samples consist of groundwater.

[4] Field duplicates will be collected at a frequency of one field duplicate per ten or fewer investigative samples. Field duplicates are used to assess sampling and analytical reproducibility.

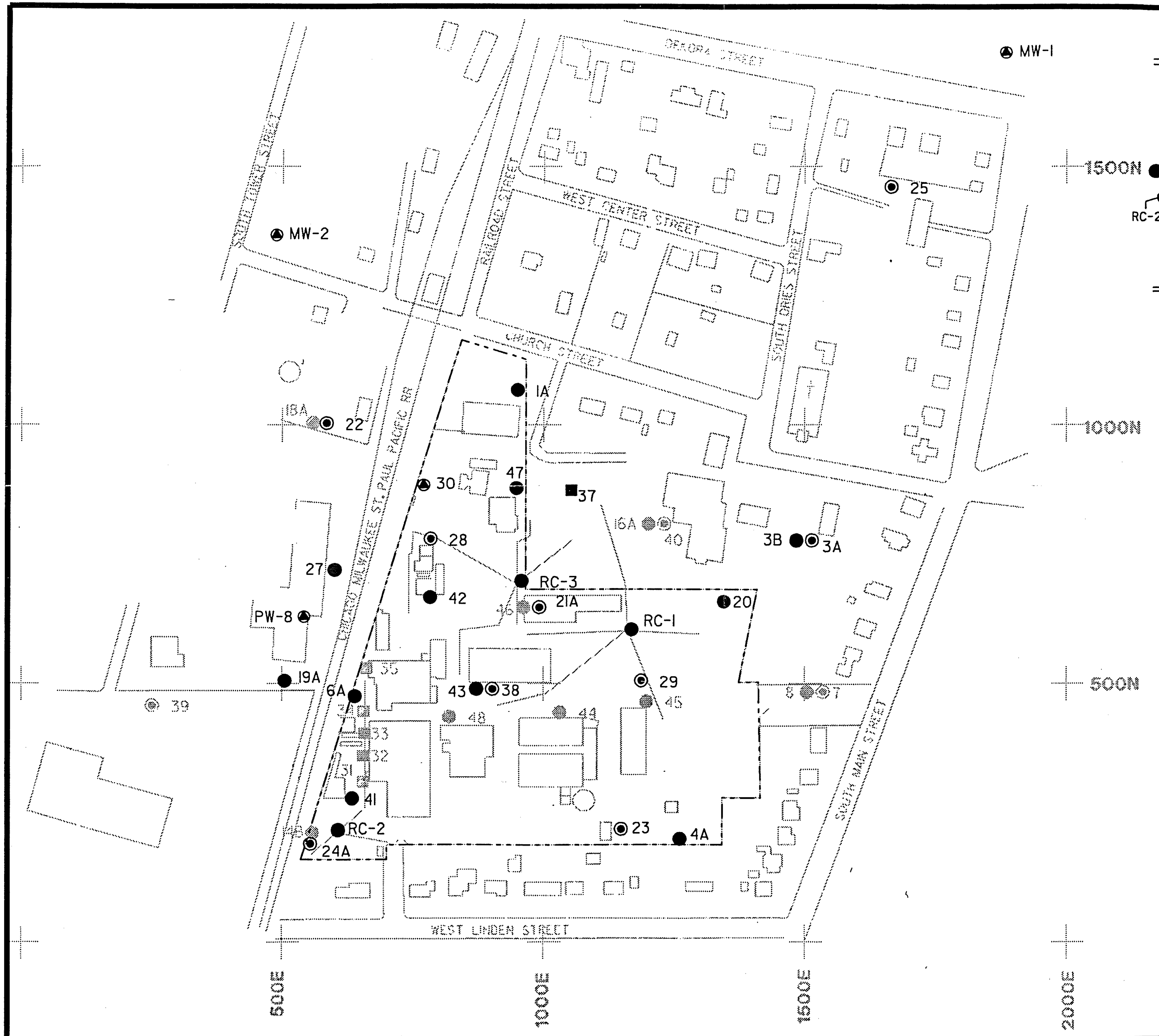
[5] Extra sample volumes will be collected to perform sample dilutions if necessary. The extra sample volumes identified as MS/MSD will be used to perform matrix spikes/matrix spike duplicates. One MS/MSD sample will be collected for every 20 or fewer investigative samples.

[6] The total number of samples includes field blanks, investigative samples, field duplicates, and extra sample volumes used for sample dilutions or as MS/MSD samples.

[7] Holding time originates from the date of sample collection.

[8] In the event that well W-47 is dry, well W-43 will be sampled.

[9] One trip blank will accompany the sample shipment and will be analyzed for Appendix IX VOCs. Trip blanks are used to assess the potential for sample contamination during sample shipment and storage. Trip blanks will be labeled "TB" and the date (month, day, year) will be included as six numerals "011493."



LEGEND

- ◉ DEEP DOLOMITE WELL
- ◉ SHALLOW DOLOMITE WELL
- ● GLACIAL OVERBURDEN WELL
- ■ GLACIAL OVERBURDEN WITHDRAWAL WELL
- ●◉ GLACIAL OVERBURDEN/SHALLOW DOLOMITE WELL NEST
- RC-2 ● RANNEY COLLECTOR

NOTES

1. BASE MAP WAS DEVELOPED FROM HATCHER-SAYRE, INC.
2. SAMPLING POINTS ARE HIGHLIGHTED.
3. PROPOSED WELL W-08A (TO REPLACE W-8) WILL ALSO BE MONITORED.
4. MUNICIPAL WELLS MW-3 AND MW-4 WILL ALSO BE MONITORED (SEE FIGURE 3-1 OF THE WORKPLAN FOR LOCATIONS).
5. POTW SAMPLING POINTS POTW-1, POTW-E, AND POTW-S WILL ALSO BE MONITORED.

0 200 400

SCALE: 1"=200'

GROUNDWATER SAMPLING POINTS

RMT INC.

Drawn By:	DJW
Approved By:	
Date: FEBRUARY, 1993	
Proj. No.:	1832.33

RMT COMPUTER AIDED DESIGN & DRAFTING

FIGURE 1-3

Levels
(1) 1,5,36-40,46-50
(2) 1-63
(3) 1-63
(4) •no ref levels•
(5) •no ref levels•
(6) •no ref levels•
(7) •no ref levels•
(8) •no ref levels•
(9) •no ref levels•
(10) •no ref levels•

Logical Names
(1) bmr
(2) bmc
(3) bdr
(4) •no ref logical•
(5) •no ref logical•
(6) •no ref logical•
(7) •no ref logical•
(8) •no ref logical•
(9) •no ref logical•
(10) •no ref logical•

Reference Files
Ref. File 1 = bmrmt.dgn
Ref. File 2 = bmclient.dgn
Ref. File 3 = border.dgn
Ref. File 4 = •no ref name•
Ref. File 5 = •no ref name•
Ref. File 6 = •no ref name•
Ref. File 7 = •no ref name•
Ref. File 8 = •no ref name•
Ref. File 9 = •no ref name•
Ref. File 10 = •no ref name•

Plot Date
Design File = sr2/1832/gwpoints.plt
User ID = project
Plot File = gwpoints.prf
Pen Table = n:\1832\table\gwpoints.tbl
Plotter = VERSATEC
Scale = 1:200.000000
Rotation = 0.000000
Plot Date = Mon Feb 15 10:22:10 1993
Levels On = 3,8,10

1.3 Additional Tasks

One new well will be installed at the site to replace existing glacial overburden well W-8, which has frequently been dry during routine monitoring. New well installation procedures are discussed in Subsection 2.4.

Aquifer testing will also be performed at the site, in order to better evaluate the relationship between CCP pumping wells, the Village municipal wells, and the Milwaukee River. Aquifer testing procedures are described in Subsection 2.5.

Section 2

SAMPLING EQUIPMENT AND PROCEDURES

2.1 Soil Sampling

2.1.1 Drilling and Sampling Procedures for Borings

Twenty-two soil borings will be drilled in the five areas of concern, as summarized in Table 1-1 and shown on Figures 1-1 and 1-2. Borings will be advanced to bedrock. The anticipated depth to bedrock is approximately 15 to 20 feet. If neither the water table nor the bedrock surface is encountered within 20 feet, the Site Coordinator and the CCP Project Coordinator will be contacted to determine how much further to drill at the specified location.

Proposed soil boring locations will be staked prior to drilling by the RMT Site Coordinator. Utility clearances for on-site boring locations will be obtained by a CCP representative from local utility companies. Proposed boring locations will be adjusted as necessary based on drill rig accessibility and the presence of underground utilities. Access permission for off-site borings has been obtained from appropriate landowners by CCP.

Soil borings will be advanced by truck-mounted drill rigs using 3.25-inch-diameter hollow-stemmed augers. Vegetable oil or Teflon® tape may be used on the drill pipe joints at the discretion of the driller. Samples for chemical analysis will be collected at 2 foot intervals (continuously) using a 2-foot-long, 3-inch-outer-diameter, split-barrel sampler (split-spoon) according to the following procedures:

- When the auger is advanced to the top of the desired sampling interval, the split-spoon will be lowered into the auger on the end of the drill rod. The split-spoon will be driven 24 inches or to refusal (i.e., more than 60 blow counts per 6 inches) using a 140-pound weight. Automated weights (hammer) may be used in lieu of free-falling weights. The number of blows required to drive each 6-inch increment will be noted by the driller and recorded by the RMT geologist. Once driven, the split-spoon will be withdrawn from the auger and removed from the rod.

- The split-spoon will be opened, and the amount of sample recovery measured. Appropriate samples for chemical analysis will be taken from the split-spoon, and the sample will be described on the WDNR boring log form (Figure 2-1).

Samples for chemical analyses will be collected using a split-spoon sampler in the following manner:

- Upon retrieval of a split-spoon sample, completely fill the appropriate glass bottles with soils for VOC, SVOC, or metals analysis using plastic or stainless-steel scoops or a clean-gloved (PVC or latex) hand. Seal, label, and tag the sample vials and place in a cooler with ice.
- At Area 5 (Churchyard) soil sampling locations, half-fill two clean, 40-mL vials with a portion of the remaining soil sample from the split-spoon sampler. Seal and label for field GC screening. Place vials in a shady area or in a vehicle out of direct sunlight. The field GC operator will be responsible for collecting screening samples from each boring.
- Place selected samples for laboratory analysis into coolers, and pack with ice.
- Complete documentation of the sample collection in the sample logbook and on the chain-of-custody forms.

The split-spoon will be decontaminated before and after each sample is collected. See Section 7 for decontamination procedures.

After sampling is completed, each boring will be backfilled with bentonite. Bentonite pellets will be used below the water table and granular bentonite will be used above the water table. If a boring is to remain open overnight prior to backfilling, soil cuttings will be mounded around the borehole to prevent surface run-off from entering it.

2.1.2 Surface Soil Sampling Procedures

The three surface soil samples to be collected at Area 4 (Logeman property) will be obtained using plastic or stainless-steel scoops, and will be placed in appropriate glass bottles for VOC and metals analysis. The samples will be sealed, tagged, handled, and documented as described in Subsection 2.1.1.

State of Wisconsin
Department of Natural Resources

Route To:
☐ Solid Waste
☐ Emergency Response
☐ Wastewater
☐ Haz. Waste
☐ Underground Tanks
☐ Water Resources
☐ Other ______________________

SOIL BORING LOG INFORMATION

Form 4400-122 7-91

Page _____ of _____

Facility/Project Name	License/Permit/Monitoring Number _ _ _ _ _ _ _	Boring Number

Boring Drilled By (Firm name and name of crew chief)	Date Drilling Started __ __ / __ __ / __ __ M M D D Y Y	Date Drilling Completed __ __ / __ __ / __ __ M M D D Y Y	Drilling Method

DNR Facility Well No. _ _ _ _	WI Unique Well No. _ _ _ _ _ _ _	Common Well Name	Final Static Water Level ______ Feet MSL	Surface Elevation ______ Feet MSL	Borehole Diameter ______ inches

Boring Location
State Plane ______________ N, ______________ E S/C/N
_____ 1/4 of _____ 1/4 of Section _____, T _____ N, R _____ E/W
Lat ___ ___ ___
Long ___ ___ ___

Local Grid Location (If applicable)
_______ Feet ☐ N ☐ S _______ Feet ☐ E ☐ W

County	DNR County Code __ __	Civil Town/City/ or Village

Sample		Blow Counts	Depth in Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
Number	Length Recovered (in)								Standard Penetration	Moisture Content	Liquid Limit	Plastic Limit	P 200	

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm

This form is authorized by Chapters 144.147 and 162, Wis. Stats. Completion of this report is mandatory. Penalties: Forfeit not less than $10 nor more than $5,000 for each violation. Fined not less than $10 or more than $100 or imprisoned not less than 30 days, or both for each violation. Each day of continued violation is a separate offense, pursuant to ss 144.99 and 162.06, Wis. Stats.

FIGURE 2-1

2.2 Groundwater Sampling

2.2.1 Monitoring and Municipal Wells

Different procedures will be followed for the different well groupings at the site (glacial, shallow dolomite, and deep dolomite), and will vary depending upon the equipment associated with each well. Specific protocol are described below.

Static Water Level Measurements

Water levels for wells 21A, 24A, 28, 29, 30, MW-1, MW-2, MW-3, and MW-4 will be taken by connecting a tire pump or other air supply to the schrader valve located beneath the pressure gauge at the top of each well head and pumping air into the line until the pressure gauge reaches a maximum reading. This reading is the point at which further supply of air will not increase the reading. Record the gauge reading.

Let X = Depth to water (in feet) (unknown)
Y = Known length of air line (in feet)
Z = Water pressure in air line, obtained from pressure gauge reading. Altitude gauge reads directly in feet of water. If gauge reads in pounds, convert to feet by multiplying by 2.31.
X = Y - Z

Distance to water = length of air line minus gauge reading (feet).

All other water levels and depths will be obtained using a water level indicator, as described in Subsection 5.1.

Well Purging Procedures

For wells without dedicated bailers or pumps, purging will be performed as follows:

- Place plastic dropcloth around the well to minimize possible contamination of sampling equipment with soil.
- Use a separate, precleaned bailer at each well. A Teflon-coated stainless-steel cable will be attached to the bailer; new polypropylene rope will also be attached to the cable.
- Calculate well volumes by subtracting the depth to water from the total depth of the well, and multiplying the difference by the cross-sectional area of the

inside diameter of the well casing. Precalculated conversion formulas may be used to determine the number of gallons that must be removed. The calculation for a well volume is as follows: depth to bottom minus depth to water times the precalculated gallons per linear foot of casing. These calculation values are as follows:

- 1 1/2-inch - 0.092 gallon per linear foot.
- 2-inch well - 0.163 gallon per linear foot.
- 3-inch well - 0.367 gallons per linear foot.
- 4-inch well - 0.653 gallon per linear foot.
- 6-inch well - 1.469 gallons per linear foot.

- Bail in such a manner as to prevent excessive amounts of agitation.

- Purge wells until stabilized pH, conductivity, and temperature readings are obtained and a minimum of four well volumes have been removed. Stabilization procedures are as follows:

1. Measure initial pH, temperature, and specific conductance.

2. Measure pH, temperature, and specific conductance after each well volume has been removed.

3. Stabilization is reached when three successive (starting with the second well volume) pH, specific conductance, and temperature measurements agree within the following limits:

pH	±0.1 pH unit
Specific conductance	±5% (temperature corrected)
Temperature	±0.5°C

- Purge municipal wells prior to sampling so that the sample is fresh well water and not water that has been in contact with plumbing, pressure tank, or a distribution system for a long period.

Purging of wells containing dedicated equipment is described in conjunction with sampling procedures.

Groundwater Sampling Procedures

Groundwater sampling will consist of the following steps:

- Water level and depth to bottom measurements
- Initial measurements of field parameters
- Well purging and stabilization procedures
- Sample collection and record keeping
- Field-filtering

Immediately after the well has been purged, the samples will be collected.

Procedures for the sampling of monitoring and municipal wells are as follows:

- Verify that sufficient vials and bottles are available for each sampling location and that each is properly labeled in accordance with Subsection 3.3.
- Prior to sample collection from municipal wells, check the area around the sampling point with an Hnu photoionization detector for possible air contamination by VOCs.
- Collect samples for VOCs and SVOCs first using the same bailer that was used for purging and a bottom-emptying device to prevent excessive amounts of agitation and aeration.
- Collect samples at municipal wells from a tap that precedes a pressure tank and any type of water treatment (e.g., a water softener). If it is not possible to collect a sample before treatment, this will be noted on the sample sheet. Aerators, filters, or other devices from the sample tap will be removed before taking a sample. If this is not possible, another similar sampling point will be chosen. If the sample must be taken from an outside tap, hoses will be removed before taking a sample.
- Run the water at municipal wells for a minimum of 10 minutes.
- Immediately fill the sample vial or bottle by allowing the water stream to strike the inner wall of the vial to minimize formation of air bubbles. At municipal wells, reduce the water flow to a thin stream. Do not rinse the sample vial. Fill the sample vial or bottle with a minimum of splashing. Fill each vial until the water forms a positive meniscus at the brim. Allow the vial to overflow slightly,

then replace the cap by gently setting it on the water meniscus. Tighten firmly, but do not overtighten.

- Insert the vial and tap lightly to check for air bubbles.
- Sample containers preservation methods (and holding times) are shown in Table 6-1.
- Collect duplicate samples and field blanks at the rate of one per every 10 or fewer samples. Trip blanks (VOCs only) will accompany each iced cooler containing VOC samples shipped to RMT Laboratories.

Procedures specific to shallow dolomite wells are as follows:

Wells 21A, 24A, 28, and 29 are equipped with dedicated submersible pumps. Evacuate well by opening the valve on the system discharge pipe in the discharge manhole at each well and evacuate each well separately by turning its respective pump controls to the "auto" position. Take samples from a sampling tap which will be flushed for 2 to 3 minutes prior to sampling. The sampling taps are located on each well head. Fill the VOA vials directly from the sampling taps.

Wells 3A, 7, 23, and 38 are equipped with dedicated bladder pumps for well evacuation and sampling. The pumps are operated by connecting a pressurized gas supply to a controller which is connected to a pressurization tube, located inside the top of each well head. Water is delivered by inflating and deflating the bladder inside of the pump. This inflation and deflation process is directed by the controller. Collect the samples in VOA vials from the sample tube which is connected to the pump as part of the dedicated equipment.

Procedures specific to deep dolomite wells (including municipal wells) are as follows:

Well W-30 does not require purging since it is constantly pumping. Collect the samples from the sampling tap located on the well head and collect directly into VOA vials.

Sample municipal wells 1, 2, 3, and 4 from sampling taps inside their respective well houses. Flush the taps with the same procedure as for W-30. Gerry Dickman of the Saukville Water Department must be notified at least 3 days in advance so that he may provide access to each facility.

> In well PW-8, a submersible pump is located at least 30 feet below the bottom of the casing for sampling purposes. This is the only practical way to sample this high-yielding dolomite well, which is 455 feet deep. Neither a bailer, peristaltic pump, or bladder pump can evacuate the volume of water required prior to sampling. Remove a minimum of three sampling hose volumes prior to sampling.

Procedures specific to glacial wells are as follows:

> Wells 6A, 19A, 20, 27, 41, 42, 43, and 47 are equipped with dedicated bladder pumps for well evacuation and sampling. Well evacuation and sampling is the same as described for shallow dolomite wells 3A, 7 (or 7A), 23, and 38.

Groundwater Field Filtration Procedures

Filtering in the field will be required for the Appendix IX metals to prevent changes due to precipitation or biological activity and to collect a more representative sample. In many cases, there may be a small amount of silt or clay in the water after purging the well. This sediment is not representative of constituents transported in groundwater flow systems. The filtering is performed in the field immediately following sample collection because even short delays may drastically change the water chemistry. Municipal well samples will not be filtered in order to access the potential exposure to receptors consuming the groundwater.

The field-filtering apparatus consists of a 12V DC battery-powered vacuum pump, sample holding container, filtering flask, porcelain Buchner funnel, Zitex spacers, and membrane filter with a 0.45-micron opening. The apparatus is assembled and the membrane filter is set in place by use of stainless-steel tweezers; the vacuum pump is then turned on and the filter checked to ensure it has seated properly in the filter tunnel. The sample is then carefully poured into the funnel (preventing excessive agitation and aeration of sample), while the vacuum pulls the sample through the filter. The filtered sample is then transferred to the appropriate sample container.

2.2.2 Ranney Collector System

The Ranney collector system does not require evacuation, but does need to be flushed for 10 to 15 minutes so that a representative sample may be collected. This is due to the use of a common pipe for discharge to the Village sewer system. The discharge pipe is inside the discharge manhole, located approximately 7 feet northeast of the northeastern corner of the groundwater pump house. The pipe without a valve attached is the Ranney system discharge pipe.

Ranney collectors 1 and 3 must be turned to the "off" position 24 hours prior to sampling so that a sufficient quantity of water is available for the flushing procedure. RC-2 will be sampled first and turned to the "off" position after samples are taken. Ranney collectors 1 and 3 will be turned to the "auto" position, one at a time, and allowed to flush for 10 to 15 minutes before the samples are collected. It is advised that the entire flushing and sampling time for Ranney collectors 1 and 3 not exceed 20 minutes each so that the collectors do not run dry before sampling has been completed. In the event that the available water in the Ranney collectors is limited, flushing times will be reduced to allow sample collection.

The VOA vials will be filled directly from the end of the discharge pipe, capped, checked for bubbles, and stored in an ice chest.

2.2.3 Publicly Owned Treatment Works (POTW)

The following protocol will be followed for sampling performed at the POTW:

- Collect POTW influent sample at the "wet well."
- Collect POTW effluent sample at the final discharge point.
- Collect POTW sludge samples.

Influent samples will be collected in the POTW's "wet well" utilizing a teflon-lined bottom discharge bailer. The bailer will be gently lowered into the well, allowing it to fill slowly to minimize agitation of water. Gently fill the VOA vials and cap. Check vials to ensure that no air bubbles have formed, and immediately place samples in ice cooler. Record collection data in the field notebook.

The effluent samples will be taken below the discharge of the final settling and aeration basin from the chlorine contact trough. The effluent samples will be taken prior to the point of chlorination to avoid possible chlorine interaction with contaminants. The VOA vials will be submerged at an angle and allowed to fill slowly. When the vials are full, they will be capped and checked to ensure that no air bubbles exist. Immediately place the vials in the ice cooler and record sampling information.

The sludge samples will be collected from the aerobic digester, the last stop before the sludge is pumped to the spreader for land application. The sampling method will be the same as that used to collect the effluent samples.

2.3 Field Quality Control Sample Collection/Preparation Procedures

Field quality control samples for soils and groundwater are collected to assess the quality of the analytical data and to evaluate sampling and analytical reproducibility (precision). Field quality control samples will consist of duplicate samples, field blanks, and trip blanks. Refer to Section 3 for the procedures to be used for labeling field quality control samples.

2.3.1 Field Duplicates

Duplicate samples, prepared by splitting a single sample between two separate containers, will be used to evaluate sampling and analytical reproducibility (precision). These samples will be collected at a rate of approximately one duplicate for every 10 or fewer environmental samples for each matrix sampled. Points where duplicate samples are to be collected will be selected by the Site Coordinator in the field to provide a range of expected contaminant concentrations. The samples will be submitted as blind duplicates to the laboratory. By selecting duplicate samples from areas free from contamination and from areas suspected or known to be contaminated, the quality assurance performance can be reviewed.

2.3.2 Field Blanks

Field (equipment) blanks will be collected and analyzed to assess procedural errors in sampling and equipment decontamination. Field blanks will be collected at a rate of at least one for every 10 or fewer groundwater samples. When dedicated or disposable sampling equipment is to be used (i.e., only one sampling point), and there is no likelihood of cross contamination, no field blanks will be collected.

2.3.3 Trip Blanks

Trip blanks will be analyzed to assess the possible cross contamination of VOCs resulting from diffusion through septa during sample shipment, as well as possible contamination during bottle preparation. Trip blanks will be prepared in the laboratory and will consist of two 40-mL (zero headspace) vials filled with laboratory-grade deionized water. The trip blanks will be transported to the site with the sample vials to be used during the investigation. Each day after collection and packaging of soil or groundwater samples, a trip blank will be included within each sample cooler of 20 samples or less for VOC analysis. The trip blanks will be entered on the Chain-of-Custody Form. If more than 20 samples for VOC analysis are collected in a day, additional trip blanks will be included and analyzed.

2.4 <u>New Well Installation Procedures</u>

The boring for the glacial replacement well (W-8A) will be drilled using 4.25-inch-I.D. HSA near the current location of W-8. The monitoring well will be constructed of 2-inch-diameter, Schedule 40 flush-threaded PVC pipe and stainless-steel screen, in accordance with Wisconsin Administrative Code NR 141 well installation procedures.

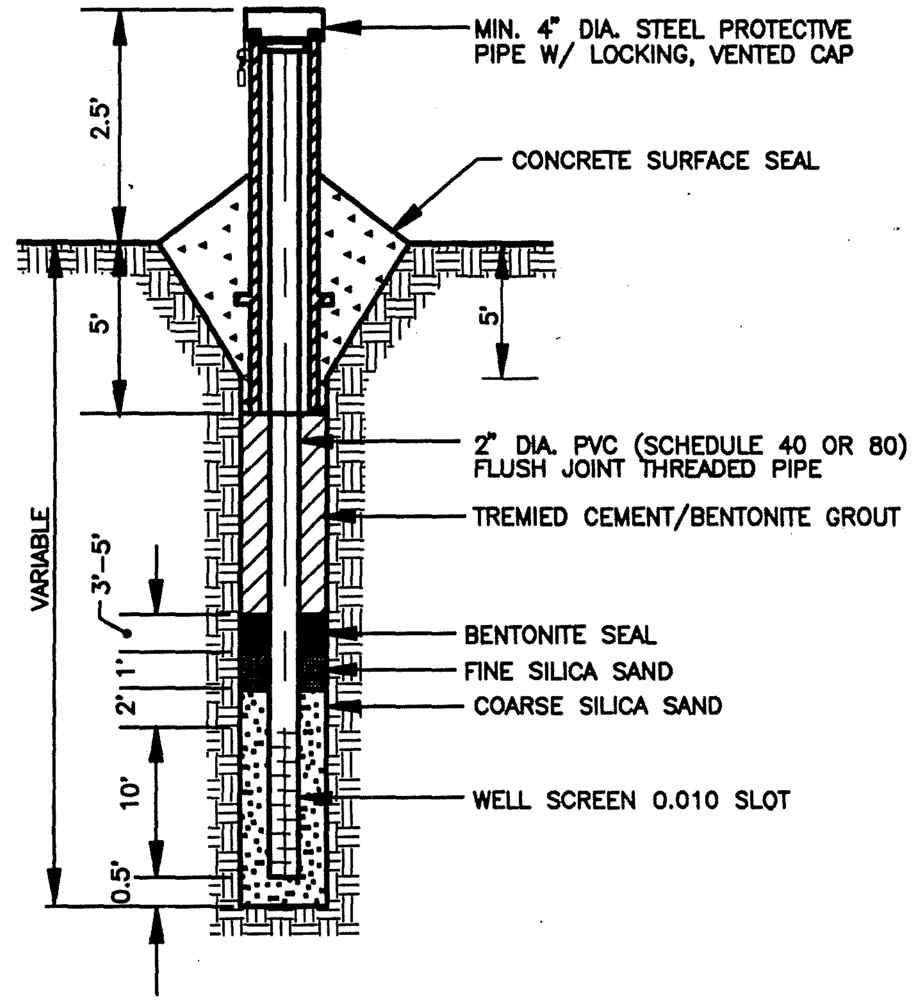
The replacement well will be similar in construction to the existing on-site wells, but the screen will be set deeper into the glacial deposits in order to ensure that the well produces water at all seasons of the year. The depth of the well screen will be determined by field personnel, based on the time of year and the estimated effects of seasonal groundwater table fluctuations. The well screen will be 10 to 15 feet long.

A generalized well construction diagram is shown on Figure 2-2. Filter sand will be added by gravity and will extend approximately 2 to 5 feet above the top of the well screen. A 2-foot clean fine sand layer will then be added by gravity. The bentonite seal will then be placed by gravity or by tremie pipe, and the remaining annular space will be filled with a cement/bentonite or bentonite grout. The riser will extend approximately 2 feet above the ground surface. The riser will be capped, and a locking protective steel casing will be cemented in place.

Well development will occur at least 12 hours after well completion and will consist of surging and purging the well with a pump or bailer. Upon completion of the purging/surging, 10 well volumes will be removed from the well (if it cannot be bailed dry) or bailed until the well produces sediment-free water. If the well can be bailed dry it will not be surged, but will be developed by slowly bailing the well dry a second time after recovery. Development will be considered complete when five wells volumes are removed. Calculation of well volume will be as specified in NR 141.21. Development water will be disposed according to the methods in Section 8.

The replacement well will be surveyed for horizontal location and elevation. The horizontal location will be measured to the nearest foot, and elevation measurements will be to the nearest 0.01 foot. The existing site grid system will be used for horizontal locations; elevations will be relative to National Geodetic Vertical Datum. Vertical elevations will include ground surface, top of PVC casing, and top of protective casing.

Existing well W-8 will be abandoned with granular bentonite or bentonite-cement grout according to NR 141 requirements.



MONITORING WELL DETAIL

NOT TO SCALE

RMT INC.

DWN. BY:	DJW
DATE:	JANUARY, 1993
PROJ.#	1832.37
FILE #	18323702

FIGURE 2-2

2.5 Aquifer Testing and Modeling Procedures

Procedures for performing the aquifer testing and flow modeling described in the Workplan are discussed in this section. The aquifer testing procedures may be modified by the Village of Saukville Water Supply Department, based on Village water requirements.

Prior to the test, background storage conditions in the dolomite aquifer must be monitored in order to adjust test results for barometric effects, rainfall, and other seasonal changes. This will require, at a minimum, the monitoring of one shallow dolomite well and one deep dolomite well beginning at least one week prior to the test and continuing throughout the testing period. All such background wells should be equipped with continuous recorders. Also, prior to the test period, the air lines on all well pumps will be checked for operational accuracy with an electric tape.

Because truly static conditions in the dolomite aquifer cannot be achieved due to the water needs of the Village and CCP, water for the Village and CCP must continue to be withdrawn from the dolomite aquifer. It is important that all pumping systems maintain a constant rate during the test.

Shallow Dolomite Aquifer Test

To conduct the shallow dolomite aquifer test, the pump in CCP well MW-21A will be turned off, and recovery will be measured in the on- and off-site shallow dolomite wells shown on Figure 2-3, including MW-21A. Shallow dolomite pumping wells W-24A, W-28, and W-29 will be turned off several days prior to the test, and water levels allowed to reach equilibrium before the test begins. It is anticipated that the test will require approximately 3 days to complete; however, if 90 percent of the prepumping water level in MW-21A is not achieved in that time period, the test will be extended. Measurements will be taken in the wells according to the schedule shown in Table 2-1, using electronic water level indicators, air line pressure gauges, chart recorders, or pressure transducers.

Plot Data

Design File = [illegible]r2/1832/points.plt
User ID = project
Plot File = points.prf
Pen Table =h:\1832\table\points.tbl
Plotter = VERSATEC
Scale = 1:200.000000
Rotation = 0.000000
Plot Date = Wed Feb 17 14:17:29 1993
Levels On = 1-19,24-42,44-56,58,60-63

Reference Files

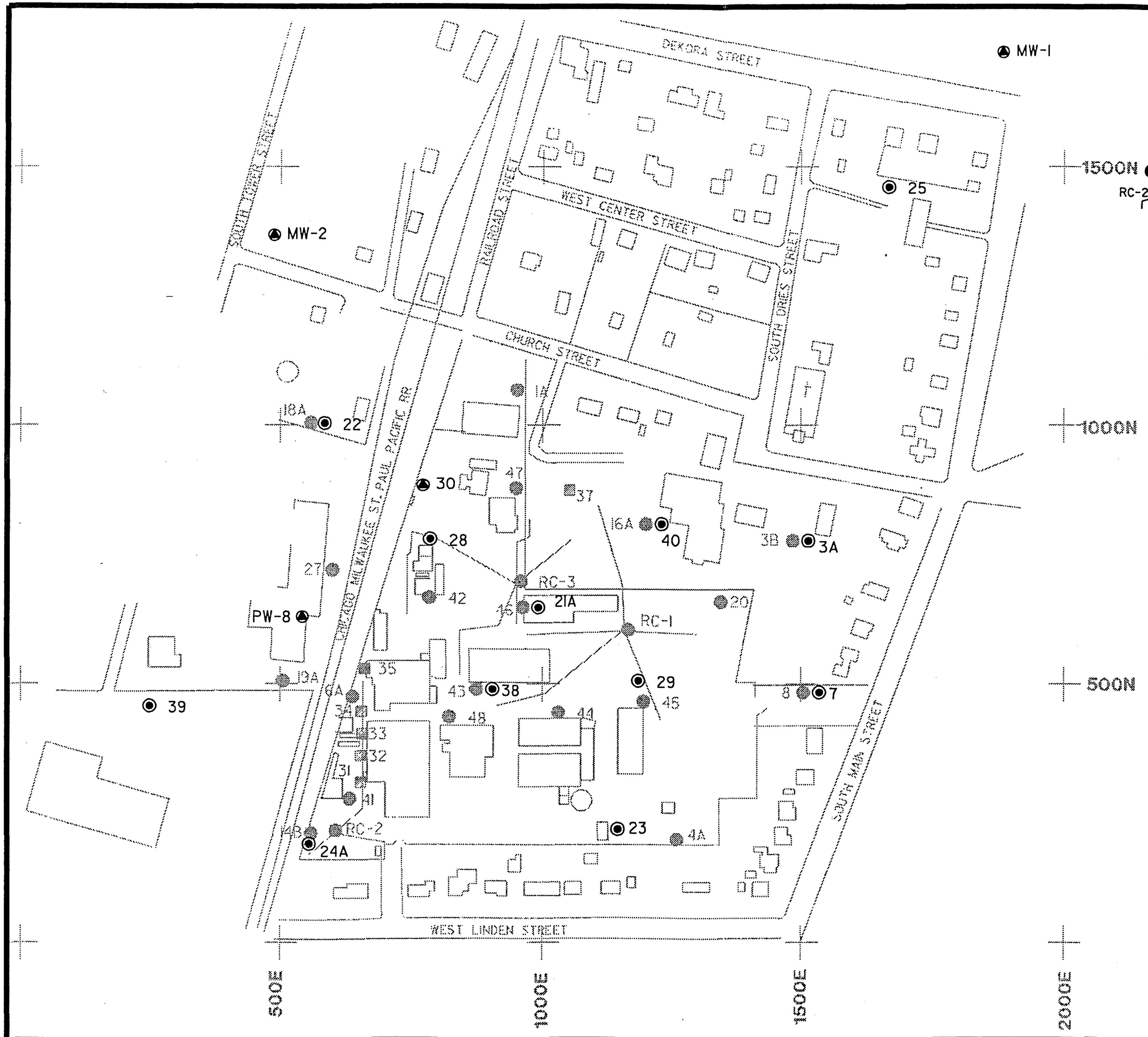
Ref. File 1= bmrmt.dgn
Ref. File 2 = bmclient.dgn
Ref. File 3 = border.dgn
Ref. File 4 = •no ref name•
Ref. File 5 = •no ref name•
Ref. File 6 = •no ref name•
Ref. File 7 = •no ref name•
Ref. File 8 = •no ref name•
Ref. File 9 = •no ref name•
Ref. File 10 = •no ref name•

Logical Names

(1) bmr
(2) bmc
(3) bdr
(4) •no ref logical•
(5) •no ref logical•
(6) •no ref logical•
(7) •no ref logical•
(8) •no ref logical•
(9) •no ref logical•
(10) •no ref logical•

Levels

(1) 1,36-40,46-50
(2) 1-63
(3) 1-63
(4) •no ref levels•
(5) •no ref levels•
(6) •no ref levels•
(7) •no ref levels•
(8) •no ref levels•
(9) •no ref levels•
(10) •no ref levels•

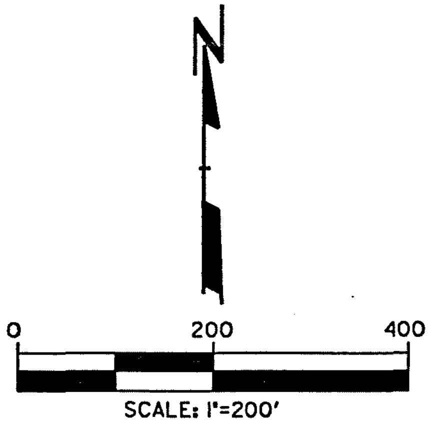


LEGEND

- ● DEEP DOLOMITE WELL
- ◉ SHALLOW DOLOMITE WELL
- ● GLACIAL OVERBURDEN WELL
- ■ GLACIAL OVERBURDEN WITHDRAWAL WELL
- ●◉ GLACIAL OVERBURDEN/SHALLOW DOLOMITE WELL NEST
- RC-2 ● RANNEY COLLECTOR

NOTES

1. BASE MAP DEVELOPED FROM HATCHER-SAYRE, INC., JANUARY, 1993.
2. SHALLOW DOLOMITE WELLS W-21A, W-24A, W-28, AND W-29 ARE WITHDRAWAL WELLS.
3. DEEP DOLOMITE WELL W-30 IS THE PRIMARY WITHDRAWAL WELL.
4. MW-1 AND MW-2 ARE MUNICIPAL WELLS.
5. THE MILWAUKEE RIVER FLOWS SOUTH APPROXIMATELY 1000 FEET EAST OF THE SITE.
6. MONITORING POINTS ARE HIGHLIGHTED.
7. MW-3 AND MW-4 WILL ALSO BE MONITORED DURING THE TEST. THE LOCATION OF THESE WELLS ARE SHOWN ON FIGURE 3-1 OF THE QAP;P.



AQUIFER TEST MONITORING POINTS

RMT INC.

Drawn By:	DJW
Approved By:	
Date:	FEBRUARY, 1993
Proj. No. :	1832.33

RMT COMPUTER AIDED DESIGN & DRAFTING

FIGURE 2-3

TABLE 2-1

SUMMARY OF AQUIFER TEST PROGRAM

Recovery Test Description	Measurement Frequency		
	Continuous[a]	Logarithmic[b]	Hourly/Daily[c]
Shallow Dolomite Aquifer (turn off MW-21A for 3 days)	MW-21A	W-28, W-29, W-38, W-40	W-3A, W-7, W-22, W-23, W-24A, W-25, W-39
Deep Dolomite Aquifer (turn off MW-1 for 2 days)	MW-1	MW-2, MW-3, MW-4, PW-8, W-30	W-3A, W-22, W-25, W-39, W-21A

NOTES:

[a] Chart recorder or pressure transducer (if possible), otherwise manual measurements will be made on a logrithmic schedule.

[b] Every minute for 0-30 minutes; every 5 minutes for 30-60 minutes; every 10 minutes for 60-120 minutes; every 15 minutes for 120-180 minutes; every 30 minutes for 180-240 minutes; hourly for 240 minutes - 1080 (12 hours); every 4 hours for 12 hours - 24 hours, twice daily until pump turned on.

[c] Hourly for first 12 hours, then follow logarithmic sequence.

Background water level readings will be obtained for all CCP monitoring wells at least 3 days prior to performance of the tests.

Deep Dolomite Aquifer Test

To conduct the deep dolomite aquifer test, the pump in Village well MW-1 will be turned off, and recovery will be measured in the on- and off-site deep dolomite wells and selected shallow dolomite wells shown on Figure 2-3, including MW-1. It is anticipated that the test will require approximately 2 days to complete; however, if 90 percent of the prepumping water level in MW-1 is not achieved in that time period, the test will be extended. Measurements will be taken in the wells according to the schedule shown in Table 2-1.

Aquifer Test Schedule

The proposed aquifer tests are expected to last a total of approximately 8 days. This schedule provides 1 day for the installation of water level recorders in background wells and 1 day for stabilization of the aquifer and any necessary yield adjustments to Village and CCP water handling procedures. In addition, 1 day is needed to organize personnel and test equipment.

Aquifer Test Analysis and Modeling

The aquifer test data will be used to construct both semi-logarithmic and logarithmic plots, depending upon the analytical method selected to interpret the data. The Jacob-Lohman method will be used for evaluating recovery data from wells MW-21A and MW-1, and the Hantush-Jacob method and Hantush Modified method will be used for analyzing recovery data from the observation wells. Other published methods may be used as appropriate. Interpretations of the aquifer test data will be based on both time-drawdown and distance-drawdown curves.

Following the determination of aquifer parameters from the tests, an optimization analysis of long-term pumping rates for water supply wells and remediation wells will be performed, in order to determine which combination of pumping rates will result in effective hydraulic capture of contaminants while minimizing drawdown in nearby water supply wells. To accomplish this objective, the aquifer parameters will be used in a flow model that predicts the combined effects of all pumping wells on the hydraulic head distribution across the aquifer.

Combinations of pumping rates for various shallow and deep dolomite wells will be evaluated for optimal capture of dissolved contaminants while minimizing drawdown effects on nearby water supply wells. The numerical flow model MODFLOW (MacDonald and Harbaugh, 1984) which can accommodate multiple layers and non-uniform aquifer properties will be used to simulate the aquifer system. Drawdowns and head levels will be computed for each simulated pumping combination. The capture zone of the on-site remediation wells will be evaluated by superimposing flowlines on maps of predicted hydraulic head values, and identifying the area over which flowlines are captured by one of the remedial pumping scenarios.

Section 3

SAMPLE CUSTODY PROCEDURES

3.1 Soil Sample Identification System

Soil samples will be identified in the field by CCP facility (Saukville = S), area of concern (1 through 5), sample location ("B" for boring; "S" for surface sample; followed by sample location number), and sample interval (for borings). Duplicate samples will be labeled with a "D" prefix, and then numbered sequentially (D01, D02). A record of the locations of duplicate samples will be kept in field notebooks. Trip blanks will be labeled with a "TB" prefix and then dated (MM/DD/YR). Matrix spike and matrix spike duplicate samples will be identified with "MS/MSD" labels and also numbered sequentially.

Field sample identification numbers will be included on Chain-of-Custody Forms. A copy of the Chain-of-Custody Form with its assigned sample numbers will be kept in the field office files and in the laboratory to help identify lost or missing samples.

Borings will be logged on Wisconsin DNR forms. Sample intervals will be labeled A, B, C, beginning with the 0- to 2-foot interval. If a sample is not obtained from a particular interval, the corresponding letter designation will be skipped so that different borings with samples from the same depth interval will have the same designation. Preselected sample intervals and designations will be as follows:

Designation	Sample Interval (feet below ground surface)
A	0 - 2
B	2 - 4
C	4 - 6
D	6 - 8
E	8 - 10
F	10 - 12
G	12 - 14
H	14 - 16

Some deviation at specific locations may be necessary due to unforeseeable circumstances.

Documentation of each boring location following installation and abandonment will be performed by inserting a labeled metal monument into an iron rod and placing it in grout at the ground surface. The completed boring locations and elevations will be surveyed to the nearest 0.1 foot by a licensed surveyor. The existing CCP coordinate system will be used to locate the borings.

3.2 Groundwater Sample Identification System

Groundwater samples collected as part of the regular monitoring program at the site will be identified by sampling point, according to the labeling system already in place. Groundwater samples collected for the contaminant characterization program will be identified by CCP facility (Saukville = S), monitoring objective well grouping (R = receptor; p = perimeter; RP = remediation progress); and well number. Duplicate samples, matrix spike/matrix spike duplicates and trip blanks will be identified as described in the previous section for soil samples. Field blanks will be labeled with the identifier "F" and numbered sequentially.

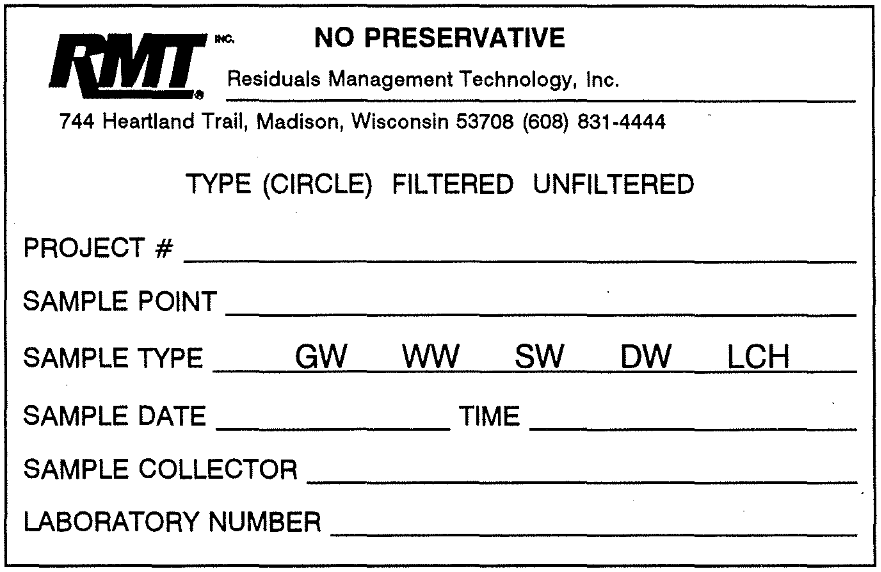
3.3 Sample Collection and Sample Tags

The following procedures will be practiced during all field activities:

- The geologist or hydrogeologist will be personally responsible for the care and custody of the samples until they are transferred or properly dispatched. The number of people handling the samples should be kept to a minimum.
- All sample bottles will be labeled and tagged with sample numbers and locations (Figure 3-1).
- Sample labels and tags will be completed for each sample using waterproof ink, unless prohibited by weather conditions. If freezing weather conditions are encountered, a logbook notation will explain that a pencil was used to fill out the sample label or tag because the ballpoint pen would not function.
- The Site Coordinator will review all field activities to determine whether proper custody procedures were followed during the fieldwork and to decide with the CCP Project Coordinator if additional samples are required.

FIGURE 3-1

EXAMPLE LABEL AND TAG FOR SOIL AND GROUNDWATER SAMPLES



RMT INC.

NO PRESERVATIVE

Residuals Management Technology, Inc.

744 Heartland Trail, Madison, Wisconsin 53708 (608) 831-4444

TYPE (CIRCLE) FILTERED UNFILTERED

PROJECT # ______________________

SAMPLE POINT ______________________

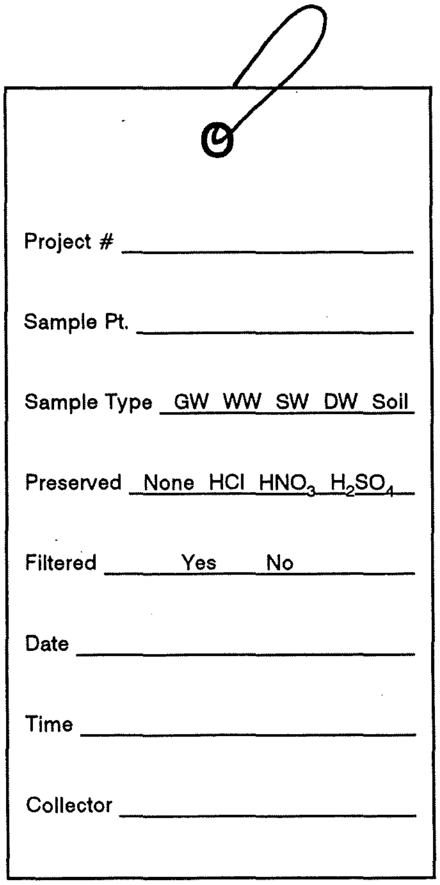
SAMPLE TYPE GW WW SW DW LCH

SAMPLE DATE ____________ TIME ____________

SAMPLE COLLECTOR ______________________

LABORATORY NUMBER ______________________

EXAMPLE - LABEL



Project # ______________

Sample Pt. ______________

Sample Type GW WW SW DW Soil

Preserved None HCl HNO_3 H_2SO_4

Filtered Yes No

Date ______________

Time ______________

Collector ______________

EXAMPLE - TAG

3.4 Field Logbooks and Documentation

The field logbook will be used to record all data-collection activities. Entries will be as detailed as possible so that personnel can reconstruct a particular site situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following information:

- Person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- Project end date

Logbook entries will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be noted. The names of visitors to the site and the purpose of their visit will also be recorded in the field logbook. Notebooks will be used to document photographs taken by recording photograph number, site conditions, and pertinent field observations. The location, sampling interval, and identification number of blind QC samples will also be recorded in the field notebook.

3.5 Transfer of Custody and Shipment Procedures

Sample possession must be traceable from the time of collection to ultimate disposal through the use of chain-of-custody procedures. Chain-of-Custody Forms must accompany all sample shipping containers in order to document the transfer of the shipping containers and samples from the field to the laboratory. The procedures to be implemented are as follows:

- Laboratory preparation of sample containers with pre-applied labels, and chain-of-custody seals on shipping containers.

- Proper labeling and tagging of each sample in the field with indelible, waterproof ink.

- Completion in the field of Chain-of-Custody Forms indicating sample identification, containers filled, sampling date, sampling time, sample collector, and sample preservation, if applicable. This information will also be noted in the field notebooks maintained on the site.

- Repacking of shipping containers with samples, Chain-of-Custody Forms, and ice packs. Each set of sample containers to be shipped together in a single shipping container will be assigned a Chain-of-Custody Form, which will travel with the shipping container.

- Sealing and shipping of containers to the appropriate laboratory. Common carriers or intermediate individuals shall be identified on the Chain-of-Custody Form, and copies of all bills-of-lading will be retained.

- Receiving and checking of shipping containers in the laboratory for broken seals or damaged sample containers. If no problems are noted, samples will be logged into the laboratory, and the Chain-of-Custody Form will be completed. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

- Inclusion of copies of the Chain-of-Custody Form with the analytical data.

- Unused sample containers will be returned to the laboratory with the Chain-of-Custody Forms.

An example Chain-of-Custody Form is shown on Figure 3-2. The form should be filled out legibly in black ink. Errors will be corrected by drawing a single line through the incorrect information and entering the correct information. All corrections will be initialed and dated by the person making the correction. This procedure applies to words or figures inserted or added to a previously recorded statement.

A checklist of information that must be included on the Chain-of-Custody Form is as follows:

RMT INC

Madison, WI 53717
744 Heartland Trail
Phone (608)831-4444
FAX (608)831-3334

Washington, DC

Santa Monica, CA

Grand Ledge, MI

Greenville, SC

F-268 (R2/88)
(Use Black Ink Only)

CHAIN OF CUSTODY RECORD

12 Sample Type: (GW, WW, SW, Soil, Other)

№ 009949

Bottles Prepared by: 1	Date/Time 2	Office Code: (State) 3
Project No. 4	Client: 5	

Container Inventory 13

Filtered (Yes/No) 14
Preserved (Code) 15
Refrigerated (Yes/No) 16

Code: A - None
B - HNO3
C - H_2SO_4
D - NaOH
E - ______

RMT Lab NO.	Yr. ___ Date	Time	Sample Station ID	Total Number Of Containers								Comments:
7	8	9	10	11								17

SAMPLER Relinquished by (Sig.) ① 6	Date/Time	Received by (Sig.) ② 18 Shipper Name & #	Date/Time	HAZARDS ASSOCIATED WITH SAMPLES 21
Relinquished by (Sig.) ③ 18	Date/Time	Received by (Sig.) ④ 18 Shipper Name & #	Date/Time	(For Lab Use Only) Receipt Temp ______ Receipt pH ______ Client P.O. Number ______ Subsequent Analysis. ______ (Check) Date Resubmitted ______
Relinquished by (Sig.) ⑤ 18	Date/Time	Received by (Sig.) ⑥ 18 Shipper Name & #	Date/Time	

Seal # 19 at chd by ○ Recvd intact by ○ Seal # 20 at chd by ○ Recvd. intact by ○

FILE # 1832.37

FIGURE 2-2

1. * **_Bottles prepared by_** - The laboratory providing the bottles must sign here.

2. **_Date / Time_** - To be filled out by the person preparing the bottles.

3. **_Office code_** - To be filled out by the person preparing the bottles.

4. **_Project no._** - To be completed by the laboratory.

5. **_Client_** - To be completed by the laboratory.

6. **_Sampler_** - The person collecting the samples must sign his/her name and print his/her name under his/her signature, and fill out the date and time the sampler relinquishes the samples to either the laboratory or shipper.

7. **_RMT laboratory no._** - This number is a unique identification number assigned by the laboratory.

8. **_Year / Date_** - The year and date the samples are collected.

9. **_Time_** - The time the sample is collected. This time **MUST** also be noted on the sample bottle.

10. **_Sample station ID_** - The location of the sample (e.g., Boring 1, Tank 17).

11. **_Total number of containers_** - Add up all of the bottles filled, and note total here.

12. **_Sample type_** - Circle sample type listed on Chain-of-Custody Form.

13. **_Container inventory_** - To be completed by the laboratory providing the bottles.

14. **_Filtered_** - Place Y (yes) or N (no) to indicate whether the (groundwater) sample in a particular bottle is filtered or not.

15. **_Preserved_** - To be completed by the laboratory.

16. **_Refrigerated_** - To be completed by the laboratory.

17. **_Comments_** - Sampler may provide additional information about a sample (e.g., odor).

18. **_Relinquished by / Received by_** - This part of the form is a record of the individuals who actually had the samples in their custody. The spaces must be used in chronological order as the Chain-of-Custody Form is transferred with the samples.

---

* The numbers of the items correspond to the numbers on the Chain-of-Custody Form (Figure 3-2).

(1) Sampler signs when relinquishing custody.
(2) Person accepting custody of samples from sampler signs.
(3) Person in (2) must sign when relinquishing custody.
(4)-(6) These are completed as necessary in the same manner as above.

Note: If commercial carriers are used, the name of the carrier, airbill number, and date and time of relinquishing is written by sample entry or field personnel and the airbill is attached to the Chain-of-Custody Form.

The final signature is that of the person receiving the samples at the laboratory.

19. ***Seal #*** - If applicable.

20. ***Seal #*** - If applicable.

21. ***Hazards associated with samples*** - This section is for field use. It can include any known or suspected hazard associated with the samples. Sample entry may add information to this section based on project manager or supervisor communication to the laboratory after samples are received. Laboratory group supervisors will use any hazard information to update and advise their analysts before work is started.

Completed Chain-of-Custody Forms will be placed in a plastic bag, sealed, and taped to the inside cover of the shipping container. After icing the samples, the coolers will be sealed, dated, and shipped to the laboratory using an overnight delivery service.

A separate sample receipt will be prepared whenever samples are split with a government agency. The receipt will be marked to indicate with whom the samples are being split. The person relinquishing the samples to the agency should request the agency representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this will be noted on the receipt and in the field notebook.

If a Chain-of-Custody Form is damaged in shipment, a written statement will be prepared by the person who collected the samples listing the samples that were recorded on the damaged form and describing when and how the samples were collected. The statement should include information contained in field logbook entries regarding the sample. This statement will be submitted to the Site Coordinator and RMT Project Coordinator for further action, as necessary.

Section 4

CALIBRATION AND PREVENTIVE MAINTENANCE PROCEDURES

Calibration procedures must be followed to maintain the accuracy of the instruments used for performing field measurements. These instruments will be calibrated prior to each use or on a scheduled, periodic basis.

Instruments used during field sampling will be examined to confirm that they are in good operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to ensure that all maintenance requirements are being observed. If any of these preliminary checks is negative, the instrument may not be functioning properly, and the back-up meter will be used. Field notes from previous sampling trips will be reviewed so that notations concerning prior equipment problems are not overlooked, and that all necessary repairs to equipment have been carried out. A spare pH electrode and two thermometers will be sent to sampling locations where measurements of pH and temperature are required, including those locations where the specific conductivity probe/thermometer is required.

Calibration and preventive maintenance procedures for various instruments to be used at the site are described below. Field instruments will include a water level indicator, a thermometer, a pH meter, a specific conductivity meter, an Hnu photoionization detector, a pressure transducer, and a portable gas chromatograph. Procedures for the portable GC are included in Attachment 2 of the QAPjP.

4.1 Water Level Indicator

The water level indicator is calibrated every 6 months by measuring the cable against a measuring tape over a known distance, to check for possible stretching of the indicator cable. Batteries are changed every 6 months.

4.2 Temperature

Temperature measurements are performed using a thermometer. The thermometers will be inspected before fieldwork begins to ensure that there is no mercury separation. The thermometers should be rechecked in the field before and after use to ensure the readings are within 1 degree of actual temperature and that the mercury is still intact; this information will be noted in the field logbook. The thermometers are calibrated biannually by immersing them in a bath of known temperature until equilibrium is reached. The thermometers are discarded if found to be more than 10 percent in error. The reference thermometer used for the bath calibration is National Bureau of Standards (NBS) traceable.

4.3 pH Meter

The pH meter will be calibrated with standard buffer solutions prior to fieldwork. In the field, the meter will be calibrated with two buffers before use. Calibration procedures and calibration frequency will be recorded in a field logbook.

pH Meter Self-Test and Checkout Procedure

1. Attach BNC shorting plug to top of meter.

2. Press the POWER key and QUICKLY press the YES key to start the self-test.

3. After code 7, a "O" will appear on the display. Press each key (the numeric digits will change and a beep will sound).

NOTE: All keys must be pressed within 10 seconds; otherwise, an error message will appear.

NOTE: To change a valve, press one of the arrow up and arrow down keys. The first digit will flash; continue scrolling until the first digit equals the correct value, and then press yes. The second digit will flash. Scroll to the correct value, and then press yes. When all digits have been changed, press yes to enter the new value.

4. After the self test, the meter will be in MEASURE mode indicated by the legend MEASURE on the display.

5. Press the mode key until pH mode indicator is displayed. Main display should read a steady 7.00 ± 0.02. Press 2nd CAL, and when the display flashes 7.00, press YES. If the display does not read 7.00, scroll until the display reads 7.00, and then press YES.

6. Press MEASURE. The main display should read 100.0 with the legend SLP in the lower display; if so, press YES. If not, scroll until the display reads 100.0 then press YES.

7. The meter advances to MEASURE, and the display should read a steady 7.00.

8. Press the mode key to enter millivolt mode. 0.0 ± .1 should be displayed.

9. Press the mode key to enter REL mV mode. 0.0 ± .1 should be displayed. Press 2nd CAL, and then press YES to enter the value 0.0. Display should read a steady 0.0.

10. After steps 1 through 6 have been successfully completed, the meter is ready for use with electrodes. Remove the shorting plug, attach the electrode, and proceed with the CALIBRATION PROCEDURE.

pH Calibration with Two Buffers

1. Connect electrode to meter.

2. Place electrode into the first buffer (7.00).

3. Press the MODE key until the pH mode indicator is displayed.

4. Press 2nd CAL. CALIBRATE will be displayed above the main readout, and the time since the last calibration will be displayed. After a few seconds, P1 will be displayed in the lower field.

5. Wait for a stable pH display (READY will be displayed in right corner of screen) and then press the up arrow or down arrow key. The first digit will start flashing. Scroll until the correct value appears in the first digit, and then press YES. The second digit will start flashing. Scroll until the correct value appears in the second digit, and then press YES. Continue in this manner until all digits have been correctly entered.

   The display remains frozen for 2 seconds. P2 is then displayed in the lower field indicating that the meter is ready for the second buffer.

6. Rinse electrode and place into the second buffer (4.01). Wait for a stable pH display, and then enter the correct value as described above.

   The electrode slope is then displayed (for a BRIEF moment, so watch carefully since this number needs to be recorded on the calibration log) in the main field with SLP in the lower field. The meter automatically advances to MEASURE mode.

7. Rinse electrode and place into sample. Record pH directly from the meter display.

pH Electrode Checkout Procedure

1. Testing electrode operation:
   a. Connect electrode to a working meter.
   b. Set function switch to absolute mV mode.
   c. Immerse electrode in fresh pH 7 buffer.
   d. Displayed value should be 0 ± 30 mV.
   e. Rinse electrode and immerse in fresh pH 4 buffer.
   f. Displayed value should be approximately 160 mV greater than in Step d.
2. If the electrode fails this procedure, return it to RMT for rejuvenation and use the back-up electrode.

The calibrations performed, standards used, and sample pH values obtained are to be recorded in the field notebook. The calibration checks should be within ±0.1 pH units. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement in the field, as necessary.

4.4 Specific Conductivity Meter

The conductivity cells of the specific conductivity meter will be cleaned and checked against known conductivity standards before fieldwork. In the field, the instrument will be checked daily with NBS traceable standards. The calibration procedure is described below as follows:

- Place the probe in conductivity calibration standard solution.
- Set temperature knob for temperature of standard solution.

- Turn to appropriate scale and set the instrument for the value of calibration standard.
- Rinse off the electrode with distilled water.
- Measure the conductivity of distilled water to be used for a field blank, making sure the temperature is set correctly for the temperature of the solution to be tested.
- If the conductivity of the blank (distilled water) is high, it must be discarded and a new blank sample must be procured.

All readings and calibrations should be recorded in the field notebook.

The only maintenance required for the conductivity meter is battery replacement. Two "D" size alkaline flashlight cells, such as Eveready E95 or equivalent, will provide 200 hours of operation. Accuracy will not be maintained if zinc-carbon "D" cells are used. Battery replacement is indicated when the redline adjustment cannot be accomplished. Replace batteries every 6 months to reduce the danger of corrosion due to leaky batteries. To replace batteries, remove the six screws from the rear plate. The battery holders are color coded. The positive (+ button) end must go on red.

When the cell test indicates low readings, the probable cause is dirty electrodes. Hard water deposits, oils, and organic matter are the most likely contaminants. For normal cleaning, soak the electrodes for 5 minutes with a locally available bathroom tile cleaning preparation such as Dow Chemical "Bathroom Cleaner"; Horizon Industries Ralley® "Tile, Porcelain, and Chrome Cleaner"; or Lysol® "Basin, Tub, and Tile Cleaner."

For stronger cleaning, a 5-minute soak in a solution made of 10 parts distilled water, 10 parts isopropyl alcohol, and 1 part HCl can be used.

Always rinse the probe after cleaning and before storage.

CAUTION: Do not touch the electrodes inside the probe. Platinum black is soft and can be scraped off.

If cleaning does not restore the probe performance, re-platinizing is required.

Re-Platinizing - Equipment required:

1. YSI #3140 Platinizing Solution, 2 fl. oz. (3% platinum chloride dissolved in 0.025% lead acetate solution)
2. YSI Model 33 or 33M S-C-T Meter
3. 50-mL glass beaker or equivalent bottle
4. Distilled water

Procedure:

1. Clean the probe using either method described above.
2. Place the cell in the beaker and add sufficient YSI #3140 solution to cover the electrodes. Do not cover the top of the probe.
3. Plug the probe into the Model 33 or 33M, and switch to the X100 scale to platinize the electrode. Move the probe slightly to obtain the highest meter reading and continue platinizing for the approximate time shown below:

Meter (μmhos/cm)	Reading (ms/M)	Time (minutes)
30,000	3,000	5
25,000	2,500	6
20,000	2,000	8
15,000	1,500	11
10,000	1,000	16

4. After the elapsed time, remove the probe and rinse in fresh water.
5. Return the solution to its container. Two ounces of solution should be sufficient for 50 treatments.

It is best to store conductivity cells in deionized water. Cells stored in water require less frequent platinization. Any cell that has been stored dry should be soaked in deionized water for 24 hours before use.

4.5 Hnu Photoionization Detector

The most accurate procedure for calibration of the instrument from a pressurized container is to connect one side of a "T" to the pressurized container of calibration gas, another side of the"T" to a rotameter, and the third side of the "T" directly to the 8-inch extension to the photoionization probe. The most convenient packages for calibration are the nontoxic analyzed gas mixtures available from Hnu Systems in pressurized containers.

Crack the valve of the pressurized container until a slight flow is indicated on the rotameter. The instrument draws in the volume of sample required for detection, and the flow in the rotameter indicates an excess of sample. Now adjust the span pot so that the instrument is reading the exact value of the calibration gas. (If the instrument span setting is changed, the instrument should be turned back to the standby position and the electronic zero should be readjusted, if necessary.) The manufacturer's operations manual for the Hnu will be taken into the field with the field team.

Section 5

FIELD MEASUREMENT PROCEDURES

Proper field analytical methods and procedures will be followed. To ensure that the analytical data gathered in the field are both valid and unbiased, the following steps will be taken:

- Field technicians will be trained in the use of each piece of equipment.
- Operating manuals will accompany each piece of equipment into the field.
- Preventive maintenance programs will be carried out on a scheduled basis (see Section 4).
- Spare components will be taken into the field in case of equipment failure or damage.
- Instruments will be calibrated on a daily basis and rechecked at various times during the day.
- Readings and calibrations will be documented.
- Daily QC checks of field notes will be performed.

The accuracy, sensitivity, and precision of the field analytical techniques are dependent upon the specifications for the instruments used, as well as the QC techniques employed during their use.

5.1 Water Levels

During groundwater monitoring, groundwater level measurements (with the exception of wells mentioned in Subsection 2.2.1) will be made using a reference point established on the well casing. The reference point will consist of an indelible mark on the highest point of the well casing.

A battery-operated water level indicator will be the primary device for water level measurements. The indicator is a self-contained, transistorized instrument equipped with a cable and sensor that activates a buzzer and a light when it comes in contact with the water. The depth to water is read from permanent 0.01-foot increment markings on the cable.

In case of instrument failure, depth to groundwater will be measured by a plopper tape, which is a bell- or cup-shaped stainless-steel weight attached to a nylon-acid, stainless-steel tape. When lowered into the well, a "plopping" or "popping" sound is made when the weight strikes the surface of the water. The depth to water can be determined by lifting and lowering the weight in short strokes, and reading the tape when the weight just strikes the water. Depth to water will be recorded to the nearest 0.01 foot. Depth to bottom measurements will be made using the stainless-steel tape with the attached plopper.

Some of the water level measurements taken during the aquifer pumping tests will be made using a pressure transducer (PST8). The PST8 is a pump and slug test monitoring system for measuring and recording water level in up to eight wells simultaneously. The end product is a data file that is compatible with commercially available aquifer analysis programs.

The PST8 switch selectable options include the following:

Recording schedule
    Logarithmic
    Delta level

Time base
    Elapsed time (t=0 at start of test)
    Clock time

Time units
    Decimal minutes
    Minutes, seconds

Starting water level
    Zero at start of test (zero datum)
    User specified (unadjusted)

The options adopted for use in these notes are a logarithmic recording interval, elapsed time in decimal minutes, and an initial water level of zero.

Field Operations

- Deploy Sensors.
    - Get the sensors into the water as soon as possible to allow maximum time for the sensor to reach thermal equilibrium.
    - Connect the extension cable to the sensor and the PST8. Make sure that the primary well is connected to PST8 connector #1.

- Set PST8 Clock (*5 Mode).
  - Turn the Off/On switch to On.
  - Set the year, day, and time in the *5 Mode.
- Set switch selectable options.
  - Logarithmic, elapsed time, decimal minutes, or zero datum are the available options.
- Enter job/sensor specific information (*4 Mode).
- View real-time readings (*6 Mode).
  - Set the "SCAN" switch to "ON."
  - Enter the *6 Mode to view the readings before starting the test.
- Start/Stop the test.
  - To start the test, switch the "RECORD" switch to "ON."
  - To stop the test, switch the "RECORD" switch to "OFF."
- View recorded data (*7 Mode).

Final Storage Workings

- Data are stored in Final Storage which is a "ring" memory. When Final Storage is full, new data write over the oldest data.
- Final Storage will store 29,900 data points

Data Retrieval

Data retrieval is the task of transferring data from the data logger to the computer. In most cases, the SM192 Storage Module will be used to retrieve data. If a field computer is on-site, data may be transferred from the datalogger directly to the computer.

5.2 Temperature

All field thermometers will be calibrated initially and semiannually against a National Bureau of Standards (NBS) certified thermometer. Field measurements of groundwater samples will be recorded to the nearest 0.5°C.

Each field thermometer will be visually inspected before each field trip and daily while in use to verify that it is not cracked and that there are no air spaces or bubbles in the mercury. Cross-checks and duplicate field analysis must agree within ±1°C.

A logbook will be maintained with each thermometer's RMT property number recorded. All calibration information, names of individuals making the calibrations, and dates will be recorded.

5.3 pH

After purging, a portion of a groundwater sample will be tested for temperature and specific conductance. A separate portion will be placed in a second container for a field pH measurement.

The pH measurements will be made electrometrically using a combination electrode, an automatic temperature compensator probe, and portable pH meter with the following specifications:

ORION MODEL 250A

pH Range	-2.00 to 19.99
Resolution	0.01/0.1
Relative accuracy	±0.02
Slope	80% to 120%
Temperature range	-5.0 to 105.0°C
Resolution	0.1°C
Relative accuracy	±1.0°C
Power requirements	One 9V alkaline batter
Environmental requirements	5 to 45°C and 5 to 85% relative humidity, non-condensing

The measurements will be recorded to the nearest 0.1 pH unit. Reference will be made to the instrument's operations manual for pH measurement procedures and instrument operation instructions.

The meter will be checked before each field trip and daily while in the field for any mechanical or electrical failures, weak batteries, and cracked or fouled electrodes. The meter and electrode also will be checked against standard buffer solutions of known pH values (e.g., 4, 7, and 10) as described in the instrument's operations manual. While in the field, the meter will be checked several times per day and every ten or fewer investigative samples using fresh buffers. In case of an apparent discrepancy in a pH measurement, the electrode will be checked with pH 7.0 buffer and recalibrated to the closest reference buffer. The sample will then be reanalyzed. Duplicate analyses will be taken once for every ten measurements and must agree within 0.1 pH unit. If measurements do not agree, the meter will be recalibrated and/or replaced as necessary. The buffer solution containers will be refilled each day from fresh stock solution.

Decontamination of the pH probe and cup will be done by rinsing each three times with distilled water. A new disposable cup will be used for each well to prevent possible cross contamination.

A logbook will be maintained and will contain the RMT property number of each pH meter. All calibrations and repairs will be noted in the logbook indicating the date, repairs made, the name of the person(s) making the repairs, calibration records, and the time used in the field for each meter.

5.4 Specific Conductivity

The specific conductivity of the water sample will be measured in the same groundwater sample used for the temperature measurement. A portable specific conductivity meter (YSI Model 33 S-C-T), wheatstone bridge type or equivalent, will be used to measure the specific conductivity of the groundwater sample.

The calibration solution concentration and composition are as follows: potassium chloride, 0.010 Molar, 1,413 micro-ohms per centimeter.

Each meter will be inspected for physical damage before each field trip and daily while in the field. Batteries and conductivity cells will be cleaned and checked daily and every ten or fewer investigative samples against known standards as described in the instrument's operations manual.

Reference will be made to the instrument's operations manual for temperature - conductivity calculations. Duplicate field measurements will be taken once for every ten samples collected. The results should agree within ± 10 umhos/cm and will be recorded in field notebooks.
A logbook will be maintained with the specific conductivity meter's RMT property numbers. All repairs, calibrations, and field time usage will be noted. The logbook will include dates, repairs made, and the name of the person(s) making the repairs.

Results will be expressed in micromhos/centimeter (μmhos/cm) corrected to 25°C, and reported to the nearest 5 units.

Probe Use:

1. Obstructions near the probe can disturb readings. At least 2 inches of clearance must be allowed for non-metallic, underwater objects. Metallic objects, such as pliers or weights, should be kept at least 6 inches from the probe.

2. Gentle agitation by raising and lowering the probe several times during a measurement ensures flow of specimen solution through the probe and improves the time response of the temperature sensor.

YSI Model 33 S-C-T Meter - Specifications

Range: 0-500, 0-5,000, 0-50,000 μmhos/cm.

Meter Accuracy:	± 2.5% max. error at 500, 5,000, and 50,000 plus probe accuracy. ± 3.0% max. error at 250, 2,500, and 25,000 plus probe accuracy.
Probe Accuracy:	± 2% of reading.
Readability:	2.5 μmhos/cm on 500 μmhos/cm range. 25 μmhos/cm on 5,000 μmhos/cm range. 250 μmhos/cm on 50,000 μmhos/cm range.

5.5 Field GC Soil Headspace

Portable gas chromatograph (GC) analysis of soil headspace using a Photovac Model 10S50 GC will be performed on each soil sample obtained from Area 5 (Churchyard). The field GC analysis will be used to characterize the presence and relative concentrations of selected VOCs (primarily BTEX) in the soil headspace on a near real-time basis. The results of the field GC analyses will be used to determine which soil samples will be submitted to the laboratory for Appendix IX VOC analysis. Standard operating procedures for the field GC are included in Attachment 2 of the QAPjP.

The gas chromatograph will be operated following the procedures set forth in the Photovac, Inc., instruction manual. Gas standards will be prepared daily by appropriate dilution of headspace over the pure solvent. Standards are prepared in gas sample bottles, using the carrier air from the GC as a diluent of the neat solvent headspace. The Photovac model 10S50 can analyze only gas-phase samples, so all standards and samples must be in the gas phase prior to injection.

Procedure

1. Inject blanks and standards as part of the GC warmup. If the standard does not give an appropriate response, reinject the standard. If the response is still low, the check syringe needle for plugging by injecting air into a VOA vial filled with water, and replacing it if plugged. If the general GC response seems very low compared to standards, replace the photoionization lamp.
2. If the standards or replicate injections are not reproducible, change the syringe needle and check the replication again.
3. Change injection port septa in the GC after every 50 to 75 injections.
4. Clean syringes after every sample by removing the plunger and exposing the syringe to the ambient air.
5. If syringe contamination is suspected, inject a sample of the carrier air. Store contaminated syringes until they can be cleaned by baking in a 100°C oven.

Documentation

- Record sample VOC concentrations from duplicate runs onto sample data sheets and store with the GC operating sheets in the GC analysis project notebook.
- Record every GC injection on the GC operations sheets with information on the injection number, injection time, injection volume, gain, and sample identification.
- Mark the GC recorder output for each day with the date, run number, and well boring number, and save for future reference.
- QC check the results in RMT's Madison office by comparing the tabulated results with the original chromatogram.

Two VOA vials are filled approximately half full with soil for each sample and are allowed to equilibrate for at least 15 minutes at ambient laboratory temperature. A headspace sample from one vial will then be extracted and analyzed on the gas chromatograph. The second vial will be held as a backup in case problems are encountered with the first sample. Gas samples are collected in gas sample bottles containing a septum port. Samples are extracted through the septum with a syringe and directly injected into the GC.

Analyses will be performed as follows:

- Start the run (series of samples) with an instrument blank and syringe blank. A standard is injected for calibration.
- Inject and analyze gas samples of the headspace vapors from soil samples. Repeat injections until the peaks of interest are on scale. If there are problems with an injection, repeat until the measurement is duplicated to within 15 percent of the previous run. Repeat all sample runs that are to be used for calculation (i.e., replicate injections of the same sample).
- Check syringe cleanliness by injecting clean air whenever there may be potential syringe contamination. If syringe contamination is found, replace the syringe needle, and clean the syringe with air and rechecked before being put back into service.
- Record GC outputs for parameters of interest on a data sheet and correct for injection volume and gain, as appropriate. Tabulate final results on a separate

sheet. Both the data sheet and final results are reviewed by a senior chemist for quality control.

- Calculate the Limits of Detection (LOD) from the detector response (in PPB-V/V-sec), the minimum area recorded by the GC (100 mV-sec), and the injection volume as follows:

$$\text{LOD, PPB} = (\text{response to standard, } \frac{(\text{PPB - V})}{\text{V - sec}}\ (0.100\ \text{V - sec})\ \ \frac{(\text{std. inj. vol. [uL]})}{(\text{sample inj. vol. [uL]})}$$

Standard preparation descriptions are given in the Table 8-1. A commercially prepared gas standard is used for vinyl chloride. All other standards are prepared by dilution of headspace over the neat solvent.

There are two aspects to calibrating the GC—calibrating the retention times recognition and calibrating the integrator response factor (i.e., the conversion factor for calculating concentration from V-sec). The response factor calibration is done at the start of each working day, using a freshly prepared standard. The standard concentrations are not stable over long time periods (e.g., hours) in the gas sample bottles due to loss through the septa and stopcocks. Therefore, the standards need to be prepared fresh for standardizing the response factor. The GC response factor changes very slowly as the lamp ages, and frequent calibration is not necessary. The GC is recalibrated if the reading for a new standard is more than 10 percent different than the prepared concentration.

Retention time calibration (i.e., making sure the GC is identifying the peaks properly) is done more frequently than response factor calibration. Retention times shift with changes in carrier gas flow rate and column temperature, both of which may drift during a day's operation. Retention time calibration is done at least every 4 hours, or more frequently if there is a question of peak identification. Retention time calibration is done using the standard prepared for that day. The same standard can be used throughout the day, since the compounds in the standard stay the same, and changes in concentrations are irrelevant for this purpose.

Section 6

SAMPLE PRESERVATION, CONTAINERS, AND HOLDING TIMES

Table 6-1 summarizes container, preservation, volume, and holding time requirements for soil and groundwater samples.

The contaminant-free sample containers (bottles) used for analyzing CLP TCL and TAL analytes for this investigation will be prepared according to the procedures specified in USEPA's "Specifications and Guidance for Obtaining Contaminant-Free Sample Containers, April 1990." It will be assumed that the bottles used for the sampling activity do not contain target organic and inorganic contaminants exceeding the levels specified in the above mentioned document. For non-CLP TCL and TAL types of analytes, bottles either should be cleaned in the same way as for the similar types of analytes or it will be negotiated with the bottle supplier(s) to clean and test the bottles for the analytes of interest to ensure that the contaminant levels of those analytes do not exceed approximately 1/3 of the required quantitation limits. Specifications for the bottles will be verified by checking the supplier's certified statement and analytical results for each bottle lot, and will be documented on continuing basis. These data will be maintained in the project evidence file and will be available if requested, for USEPA review.

In addition, the data for field blanks, rinsate blanks, and trip blanks, etc., will be monitored for contamination, and corrective actions will be taken as soon as a problem is identified. Optional corrective actions include the following: (1) discontinuing the use of a specific bottle lot; (2) contacting the bottle supplier(s) for retesting a representative bottle from a suspect lot; (3) re-sampling the suspected sample; or (4) validating the data. Data validation will take into account that the contaminants could be introduced by the laboratory (i.e., common laboratory solvents, sample handling artifacts, etc.) or could be a bottle QC problem, and will allow an informed determination to be made regarding whether the bottles and hence the data are still usable, or if other corrective actions are needed.

TABLE 6-1

SAMPLE CONTAINERS AND PRESERVATION METHODS

Sample Matrix	Parameter	Container(s)	Field Preservation Method	Holding Time
Groundwater	Appendix IX Filterable Metals	1-liter plastic bottle	Filter with 0.45-micron millipore filter; cool to 4°C, add nitric acid to pH < 2	6 months (except for mercury - 28 days)
	8240 8020 or Appendix IX Volatile Organic Chemicals	3 x 40-mL VOA vial with Teflon septum cap	Add hydrochloric acid to pH < 2, cool to 4°C	14 days
	Appendix IX Semivolatile Organic Chemicals or PCBs	2 x 1-L amber glass with Teflon-lined cap	Cool to 4°C	7 days to extraction; 40 days to analysis
Soil	Appendix IX Volatile Organic Chemicals	2 x 60-ml glass VOA vial cap	Cool to 4°C	14 days
	Appendix IX Semivolatile Organics	8-ounce wide-mouthed glass bottles (Teflon-lined lid)	Cool to 4°C	Extract within 14 days; analyze within 40 days after extraction
	Appendix IX Metals	125-ml glass (Teflon-lined lid)	Cool to 4°C, protect from light	6 month (except for mercury - 28 days)

Section 7

DECONTAMINATION PROCEDURES

7.1 Personnel

Decontamination procedures will be as follows:

- Remove protective disposable outer garments and place in disposable plastic bags at the perimeter of the decontamination zone before each departure from the decontamination zone.
- If disposable outer boots are worn, remove them first, and remove gloves second. If reusable rubber or neoprene boots are worn, wash and rinse them before leaving the contamination reduction zone.
- Wash and dry hands and all exposed surfaces before leaving the contamination reduction zone, and place used paper towels in the disposal bag.

Clean outer garments will be accessible to field personnel in an area free from potential contamination. Water, soap, and paper towels will also be kept in a clean location for both regular cleanup and emergency use.

7.2 Sample Bottles

Sample bottles will be precleaned by the manufacturer.

7.3 Drilling Equipment

The drill rig, augers, and drill rods will be steam-cleaned before startup and between borings using a high-pressure, high-temperature, hot water cleaner. Potable water from the facility (Village) water supply system will be used for decontamination. Decontamination of the drilling equipment will take place on-site near a drain or Ranney collector. Decontamination water will be discharged in this manner to the on-site collection system. At off-site locations, any decontamination water produced will be temporarily contained, and transported to the facility for disposal.

During decontamination, care will be taken to clean all work surfaces and the wheels of all vehicles. Other project-related vehicles that enter the zone will also be decontaminated.

7.4 Sampling Equipment

The 2-inch-diameter split-spoons used for borehole soil sampling will be decontaminated between each sample by the following sequential procedures: 1) a Liquinox® wash; 2) a potable water rinse; and 3) a distilled water rinse. At the end of drilling at each borehole, the split-spoons will be steam-cleaned, then washed and rinsed following the above procedures. Decontamination water from sampling equipment will be handled in the same manner as the water produced during drilling equipment decontamination.

Groundwater sampling equipment (non-dedicated pumps or bailers) will be decontaminated by thorough washing with Alconox and rinsing with deionized water. In order to minimize the possibility of cross contamination, the wells that require the use of non-dedicated equipment will be evacuated beginning with the least contaminated sampling points.

Section 8

INVESTIGATION-DERIVED WASTE DISPOSAL

The materials produced during the site investigation will be handled as follows:

- ***Drilling cuttings and excess soil from sampling***. Cuttings produced at each drilling site will be drummed. A drilling site is defined as each location where a separate setup of the drilling rig is required. At off-site locations, cuttings will be containerized if field-screening indicates the presence of VOCs.
- ***Liquids***. All well development and purging water will be discharged to the on-site collection system.
- ***Used personal protective equipment***. All used Tyvek suits, impervious or PVC overboots, latex or PVC gloves, waste paper, and other wastes will be collected, bagged, and left on-site.
- ***Investigative Samples***. Samples analyzed by RMT Laboratories will be disposed of 30 days after the results are reported by the laboratory in accordance with the laboratory's sample disposal standard operating procedure.

ATTACHMENT 2

RMT STANDARD OPERATING PROCEDURES 1.07

REVISION 0

FEBRUARY 1993

RMT STANDARD OPERATING PROCEDURE FOR PORTABLE GAS CHROMATOGRAPH ANALYSIS

REVISION 0

FEBRUARY 1993

STANDARD OPERATING PROCEDURE FOR PHOTOVAC 10S50

1. Parameters To Be Analyzed

The constituents to be analyzed by the field GC and their anticipated limits of detection are presented in Table 1. These constituents have been selected based on the previously identified constituents of concern in groundwater and soils, and on the sensitivity of the field GC to these parameters. The peak area of target contaminants will be determined for each sample. Quantitation is determined by comparing peak areas of standards to those of samples.

2 & 3. Range of Measurement and Limits of Detection

The anticipated working linear range and limits of detection are presented in Table 1. These detection limits are based on the concentration represented by the minimum recorded peak area for the GC (0.1 v-sec) at normal operating conditions. The maximum measurable concentrations for the different parameters are around 1,000 μL/L (parts per million by volume). Equivalent parameter concentrations in μg/L are also presented in Table 1. However, the μL/L (or ppm) units will be used to avoid confusion between concentration units in water and air.

4. Sample Matrix

As a means of screening soil samples for VOC contamination, the headspace over the soil sample is measured for the VOCs. Thus, the sample matrix is air that has been contacted with the sample. Headspace measurement evaluates soil concentrations indirectly by determining the parameter concentration in the air in contact with the soil (i.e., the headspace). Parameter distribution between the soil and headspace is affected by a number of soil and parameter properties, including the parameter Henry's Law constant, and soil organic and water content and consistency. Since some of these properties can vary

TABLE 1

DETECTION LIMITS FOR BTEX COMPOUNDS ANALYZED BY PORTABLE GC

	μL
Benzene	0.03
Toluene	0.03
Ethylbenzene	0.03
m,p-xylene	0.3
o-xylene	0.5

between samples, the parameter distribution between the soil and headspace can vary between samples. Headspace measurement thus does not give a direct measurement of parameter concentration in the soil, but rather gives a qualitative indication of the soil concentration.

5. Principle, Scope, and Application

Soil headspace analysis is a convenient means of screening soils for VOC contamination. In principle, VOCs contained in the soil will partition between the soil and any air in contact with the soil, with partitioning being dependent on VOC concentration in the soil as well as on several other factors (Devitt, et al., 1987). Analysis of the soil headspace can be done

in the field using a portable gas chromatograph, and can provide near real-time screening analysis of VOCs in soil. Due to the variety and variability of factors that influence VOC partitioning between the soil and air, soil gas analysis is best used for screening VOC levels rather than for quantitative analysis of the VOC content in the soil. However, measurement of the VOC concentration in the gas itself is a quantitative measurement.

Soil headspace screening is useful for locating areas of soil contamination and relative levels of contamination, for selecting samples for further laboratory analysis, and for determining the areas which should be further investigated (e.g., soil borings or monitoring well installation).

6. Interferences and Corrective Action

There are no common interferences in the analysis for the parameters analyzed under standard operating conditions. Components of gasoline coelute with di and trichloroethylene and, if gasoline is present, it is difficult to quantify di and trichloroethylene. Generally, however, gasoline and the chlorinated ethylenes are not found in the same sample. Water vapor interferes with vinyl chloride analysis, when the vinyl chloride is present at low concentrations. The detection limit of vinyl chloride in higher than if the interferences were not present. In addition, ethylbenzene and m&p-xylene peaks overlap. If both peaks are present, the peak is calculated as if it contained the constituent giving the large peak, and a note is made that both compounds were present.

Dirty apparatus can cause problems with a portable GC, since many surfaces (notably teflon) can adsorb and desorb gaseous constituents. Several precautions and cleanup steps are used to avoid such cross contamination. First standards are transported separately from the syringes, septa, etc., so that no cross contamination during transport occurs. Secondly, column and syringe blanks are run whenever contamination is suspect. Third, syringes are cleaned between each run by removing the plunger and allowing the contamination to disperse, or by purging the syringe or plunger with compressed air from the air cylinder. If syringe contamination is suspect, a syringe blank is run in which room air or compressed air is injected into the GC with the syringe in question. Syringes that remain contaminated after purging are baked overnight in a portable oven. Laboratory air contamination has not been found to be a problem.

7. Safety Precautions

Samples are contained in 40-mL VOA vials, and the analyst does not come into direct contact with the soil. If soil needs to transferred from one vial to another, or if a vial breaks, then the analyst will use normal precautions used when working with chemicals, e.g., washing hands after working with the material, not eating while handling the material, etc. All pure solvents used for making standards are likewise kept in 40-mL VOA vials, and the analyst does not come into contact with the solvents.

Standard laboratory practice precautions are taken when working with the gas cylinders used for gas supply to the GC. The cylinders are either secured to the wall by chains or, in places where no wall mountings are available, supported by a gas cylinder stand.

8. Sample Size, Collection, Preservation, and Handling.

Soil samples are collected in 40-mL VOA vials with a septum top. If the samples are analyzed in the field, the vials are filled approximately half full with soil when the sample is collected. If the samples are analyzed in the laboratory, the vials are filled completely in the field, and then a second vial is filled half full in the laboratory. The vials are then allowed to equilibrate at room temperature for at least 30 minutes. No preservatives are used in the samples. After the equilibration time, an aliquot of the headspace is removed with a syringe through the septum, and injected into the GC for analysis. Injections are repeated until the peaks of interest are on scale. The sample is discarded by either returning the vials to RMT Laboratories or by returning the soil to the sampling area. At RMT Laboratories, the vials are opened in a hood, and the VOCs are allowed to volatilize, after which the soil is discarded. After the soil has been removed from the vials, the empty vials are discarded.

9. Apparatus

The GC used is a Photovac Model 10S50 Portable Gas Chromatograph. Other sampling equipment used for the headspace analysis is listed in Table 2.

TABLE 2
PORTABLE GC FIELD EQUIPMENT CHECKLIST

EQUIPMENT	# NEEDED	CHECKOFF
INSTRUMENTS		
Photovac 10S50		
Battery Pack for Oven		
Electrical Cord for Using GC with 110 V		
Electrical Cord for Charging Battery Pack		
Electrical Cord for GC from Battery Pack		
Gas Flow Meter and Connecting Gas Lines		
Gas Tank Regulator and Connecting Lines or Internal Tank Refill Gas Line		
0.1-ppm Grade Air Tank		
GC SUPPLIES		
Plotter Pens		
Plotter Paper		
Extra UV Lamp		
White Teflon®-Coated Septa for GC		
PAPERWORK		
Field GC Logbook		
Field Notebook		
Photovac GC Instruction Manual		
SYRINGES		
10 μL		
25 μL		
100 μL		
250 μL		
1,000 μL		
Syringe Needles		
SAMPLE CONTAINERS		
VOA Vials		
1-L Gas Sample Bottles		
250-mL Gas Sample Bottles		
Green Septa for Sample Bottles		
Labels for Vials/Sample Bottles		
Standards (Pure Solvent/Gas STD)		

TABLE 2 (CONTINUED)

PORTABLE GC FIELD EQUIPMENT CHECKLIST

EQUIPMENT	# NEEDED	CHECKOFF
TOOLS		
Adjustable Wrench for Gas Cylinder		
Small Wrench for Gas Line Fittings		
Slotted Screwdriver		
Phillips Head Screwdriver		
MISCELLANEOUS		
Kim Wipes®		
Paper Hand Towels		
Markers		
Pens		
Calculator		
Knife		
Rubber Bands		
Paper Clips		
Water Bottle		

10. Routine Preventive Maintenance

The routine preventive maintenance procedures used in day-to-day operation of the GC are described in section 14 below. The procedures include running column and syringe blanks at the start of a day's operation, and when there is suspicion of syringe or instrument contamination. The injection port septa is changed after 50 to 75 injections. VOA vial blanks are run if there is suspicion of vial contamination. Vial contamination would be suspected if similar peak patterns were found in several soil samples from different areas.

The neat solvents used for preparing standards are stored and transported separately from the other GC equipment to avoid cross contamination. Septa, syringes, and the plastic portions of the gas sample bottles are stored in organic contamination-free areas.

A common analytical problem is clogging or partial clogging of the injection syringe needles. Occurrence of partial clogging is determined by running replicate samples. If the results cannot be replicated after several runs, the syringe needle is changed. Clogged syringes are detected by injecting air into a water-filled vial. If no bubbles are observed, then the needle is changed.

11. Reagents and Calibration Standards

Pure solvents are purchased from chemical supply companies. A small portion (approximately 5 mLs) of the neat liquid is placed in a 40-mL VOA vial and allowed to stand. The neat liquid volatilizes to saturate the headspace in the vial. As long as sufficient liquid is present to saturate the headspace, the volume of liquid is not important. The saturated headspace from the VOA vial is used in preparing standards for instrument calibration. A new vial is prepared when the septum on the standard vial becomes too perforated, or when the solvent volatilizes through the septum.

Calibration standards are prepared by diluting the headspace from the neat solvent vials. The volumes of headspace are injected into a 125-mL gas sample bottle and the resultant concentrations are given in Table 9-1 of the QAPjP. Chromatograms of the standard are compared with previous standard chromatograms to ensure that the standard was prepared properly.

12. Calibration Procedures

A. Standards should be prepared according to the protocol given above.

B. A standard should be run after the column blank when starting the instrument. For the most accurate results, standards should be prepared daily. The standard can be used for calibrating the instrument response factor on the first run or runs, then for peak identification for the rest of the day.

C. To calibrate the GC, do the following:

   i. Select the library to be used by pressing "USE" button and selecting the appropriate library.

   ii. Press "LIST" and "ENTER" to get a list of the compounds stored in the library.

   iii. Press "EDIT" and follow prompts to delete compounds from the library.

   iv. To enter compounds in the library, press "STORE" button and follow prompts. Instrument will ask, in order, for

      a. Peak number.
      b. Compound ID.
      c. Concentration.
      d. Limit Value (enter 0.00).

   v. Store all compounds that were run and are to be saved. If the compounds are already in the library, the peaks can be recalibrated using the "CAL" button.

   vi. Press "LIST" and "ENTER" for a printout of the library in use. The library numbers for the compounds are important for recalibrating peaks.

D. After the instrument is calibrated, a second standard should be run to verify that the first standard is reasonable. If the results differ by more than 5 percent, rerun and recalibrate (if necessary) the instrument using a different syringe or a different needle.

E. Record on the strip chart both the V-sec and ppm readings on standards that are used for calibration, so that the calibration factor the instrument is using can be calculated.

F. If there is a question on the identity of a given peak in a sample run, run a standard to determine the retention time of the compound of interest. Peak identification by the GC can be in error if the airflow rate or column temperature drift. The analyst should be familiar with the peak patterns of the compounds of interest, check to ensure that the GC is correctly identifying peaks, and check retention times against standards if there is any question.

13. Sample Preparation

Sample preparation is discussed in Section 8 above.

14 & 15. Step-by-Step Analytical Methodology

The daily operation of the GC, including routine procedures, preventive maintenance and daily quality control procedures, is described below:

A. Connect the power supply for the GC (unless using the internal battery).

B. Connect battery for column oven to the external DC input connector. Set column to desired temperature, and allow to heat for approximately 30 minutes to reach operating temperature.

C. Connect the exhaust gas lines to the gas flow meter. The left side of the flow meter measures flow through the detector and is connected to the "Detector Out" port, while the right side is connected to the needle valve on the "Aux Out" post.

D. Connect the input gas lines, turn gas flow on, adjust flow through column, and backflush to the appropriate values. The backflush flow should be set slightly higher than the column flow. If using the internal tank, fill the tank before adjusting flow. The gas flow through both the detector and backflush lines is set by the "A + B" valve at center left of front panel. The backflush flow is also controlled by the "Aux Out" needle valve. Note that the internal gas pressure should be set at 40 psi.

E. Turn instrument on (Note: gas must be flowing past detector before the lamp is turned on). The instrument will read "LAMP NOT READY. PLEASE WAIT" for a few minutes after turning the instrument on. If the lamp does not come on after several minutes, as indicated by the instrument reading "READY," turn the instrument off ("OFF", then "ENTER"), and then back on and wait for a minute. If the lamp still does not turn on, use the special Teflon® screwdriver to adjust the lamp power supply on the lamp box inside the unit. If the lamp still does not light, change the detector bulb.

F. Set daily information, using USE button. Also enter project information, if necessary, using INFO button.

G. If you are not sure of the GC's valve timing, press "TEST" then "ENTER." The GC will print out the Event timing. Event 1 should be set for an ON time of 8 (sec) and one OFF time of 10 sec. Event 1 controls the buzzer for sample injection, and the injection port sequence. Event 3 controls the backflush start time. The ON time should be 0 (sec) and the OFF time should be one-fourth to one-fifth of the retention run time of the slowest analyte of interest. The run time is set by the CYCLE button.

H. Set gain to desired value (Note: Gain defaults to 2 when instrument is turned off).

I. Change septum on injection port, if necessary (septa are good for approximately 50 injections).

J. Prepare daily injection log. All runs should be recorded on log.

K. Run a column blank (no injection) and a syringe blank.

L. Prepare appropriate standards (if necessary). Directions for standards preparation are given in Section II.

M. Run standard. Recalibrate instrument, if necessary (see Calibrating the GC in Section II-12). If possible, obtain the peak areas in V-sec as well as ppm-V, so that the instrument calibration factor (in (μL/L)/V-sec) can be determined.

N. If time, run syringe blank (an injection of room air or 0.1 air) to ensure syringe cleanliness using the syringes that will be used in day's work.

O. Run samples. Adjust injection volume until peaks of interest are on scale and preferably more than 1/4 of maximum size for chart paper. If time permits, runs should be duplicated and average values used for quantification.

P. Record sample ID, injection volume, and gain on the injection log. Also record sample ID and injection volume on chromatogram at start of run.

Q. Record results of run on calculation sheet for project. Correct GC output for injection volume (and gain if results are in mV or V-sec) to those values used for standard. When two replicate runs are made, calculate for both separately, then average results.

R. Record corrected results on results sheet for project. One copy of results sheet should be given to PM/person-in-charge, and one copy placed in the project notebook.

S. Clean syringes by removing plunger after an injection and letting plunger air.

T. If replicate runs are not satisfactory (< 10 percent difference is a suggested guideline), reinject sample. If third run is still inconsistent, replace needle on syringe, then rerun sample. Also check for syringe contamination by running a syringe blank. Check for plugged syringes by injecting air into a vial filled with water.

U. If instrument is not recognizing obvious peaks, recalibrate the known peak. If unsure of peak ID, run standard for peak identification. (Note: once the septa is punctured in the gas sample bottle, the VOCs are slowly lost from the bottle. Therefore, the standard should be used for calibrating the concentration only shortly after the standard is prepared. The standard can still be used for peak identification until the peaks disappear.)

V. Standards should be run periodically throughout the day, for peak identification (not for recalibration of concentration) and at any time there is a question on peak identification. At least three standards should be run each day.

W. Column and syringe blanks should be run periodically throughout the day, and if there is any question of syringe contamination. Column and syringe blanks are particularly important when the sample concentration is low, or if there is a sharp drop in sample concentration (< factor of 5 change in concentration).

X. Under normal operation, the maximum gain is 20, and under all conditions, the maximum injection volume is 1,000 μL.

Y. After 50 to 60 injections, change the injection septum.

Z. The instrument should always be calibrated in μL/L (ppm-V). Even when analyzing water headspace, record the results in μL/L and convert to μg/L or mg/L by hand.

AA. After last run has been completed, disconnect oven battery from instrument, then shut the power off to the instrument. After the instrument has turned off, turn off the airflow, either by closing the tank or decreasing the regulator (if using an external tank). If using the internal tank, turn off the flow by using the instrument flow control knob.

BB. At the end of a day's run, tear off the chart paper and mark the end with the date, project name and number, and, if possible, samples run.

CC. If the instrument is using the internal power supply, then it should be recharged overnight. Fill the internal gas tank in the instrument, and bring the GC to a place where there is a 110 v power supply. Plug the instrument in, turn the airflow to a very slow rate (5 to 10 mL/min), then turn the instrument on overnight. Be sure the air tank is full or has sufficient air to keep air running through the detector throughout the night.

16. Data Treatment

The Photovac measures the area under peaks for the compounds in the injected gas sample. The area, in V-sec or MV-sec, is converted to μL/L (ppm-V) in the gas phase by calibrating the instrument using a known concentration of the compound in question (with gas standards). The instrument compares areas of standards with sample peak areas to determine the concentration of the unknown. The instrument corrects for gain, but not for injection volume. The instrument's concentration output should be corrected for injection volume as follows:

$$(\textit{Actual Conc., } \mu L/L) = (\textit{Instrument Reading, } \mu L/L)\left(\frac{\textit{Injection volume of standard}}{\textit{Injection volume of sample}}\right)$$

If the reading is given in V-sec, a correction needs to be made for gain as well as injection volume, i.e.,

$$(\text{Actual Conc., } \mu L/L) = (\text{Instrument Reading, } V\text{-Sec})\left(\text{Response Factor } \frac{\mu L/L}{V\text{-sec}}\right)\left(\frac{\text{Injection volume of standard}}{\text{Injection volume of sample}}\right)\left(\frac{\text{Gain setting for standard}}{\text{Gain setting for sample}}\right)$$

where the injection volume and gain are the values for the standard at the time the instrument was calibrated.

The response factor is the conversion factor for the V-sec given by the detector at a given standard concentration, i.e.

$$\text{Response factor} = \left(\frac{\text{Standard concentration, } \mu L/L}{\text{Instrument Reading, } V\text{-sec}}\right)$$

The response factor is specific for the injection volume, gain, and detector response.

Gas measurements are commonly reported in ppm or $\mu g/m^3$. A gas phase unit of ppm is a μL/L. To avoid confusion between measurements made on different matrices (air, water, or soil) units of μL/L are used in the calculations.

17. Data Deliverables

Portable GC Results Notebooks will be prepared. The notebook will consist of the following sections:

A. Project information
B. Standards preparation and SOP for the sample handling and GC operation
C. Injection logs
D. Calculation sheets
E. Results summary sheets
F. Replicate comparison and standards results sheets
G. Chromatograms

After the fieldwork, the chromatograms are xeroxed and placed in the appropriate section. Replicates are recorded separately, and compared in a separate section of the notebook. The calculation and results summary sheets should be checked by the QC reviewer. The notebook should be comb bound and placed in the project file. The calculation and results summary sheets can be xeroxed and stored at the GC operator's desk for later reference, if appropriate.

The notebooks contain the information required to follow the results from the original chromatogram to the final results sheet. Standards are included so retention times can be checked. However, syringe or column blanks, runs that went off-scale, and other miscellaneous runs are not included. The original chromatograms are stored in the RMT Applied Chemistry Laboratory.

18. Quality Control

The degree of QA/QC for the portable GC use is dependent on the use of the results, and should be adjusted as appropriate. It should be recognized that the GC itself is a precise analytical instrument, capable of providing as consistent and reliable results as a laboratory GC, if used under optimum conditions. However, use in the field under less controlled conditions increases the analytical variation in the results. Further, and more important, soil headspace analysis is designed to be a screening method, giving approximate indicators of soil concentrations. There is inherent variability in a soil headspace measurement due to changes in the soil itself that cannot be eliminated by QC procedures during the analysis. The extent of QC should be appropriate to the end use of the results.

During field operation of the GC, the operator checked for syringe clogging or contamination, machine malfunction, and miscalibration as discussed in Sections 14 and 15. If replicate runs vary by more than 10 percent difference between the results, the sample is reanalyzed by repeating the injections until the results do replicate or the cause of the poor replication is identified.

The purpose of the QA/QC procedures can be divided into three areas, as follows:

A. Verification

Much of the verification of peak identification, syringe cleanliness, and proper operation is done during machine operation, and is discussed in Section 12, Calibration Procedures. During the QC check of the results, the following steps are needed:

i. Sample and standard peak retention times and peak patterns are compared. GC identification of the peaks is checked. Incorrect GC peak identification is noted on the chromatogram.

ii. If there is a question of peak identification that cannot be resolved by comparing sample peak retention time with that of the standard, relative retention times for the unknown and for a known compound are calculated and compared between the sample and standard.

iii. If there is still a question of peak identification after a relative retention time check, the peak is identified as the compound of interest with a note saying "Tentative Identification."

B. Data and Calculations Checks

i. All results to be reported should be recorded on the calculation sheet.

ii. The results should be corrected for injection volume and gain. Note: the Photovac automatically corrects for gain if the reports are presented in ppm, but does not correct for gain if the results are presented as V-sec.

iii. Further calculations should be recorded on the DATA CALCULATION SHEET.

iv. The corrected results should be recorded on the sample results sheet. All results should be reported as μL/L (ppm-V).

v. All data transcriptions and calculations should be checked by a QC person, unless otherwise instructed. The QC person should check the results for accuracy of transcription, and spot check the calculations. Furthermore, the QC person should compare the final results for reasonableness, based on previous results or anticipated results.

vi. A xerox of the chromatograms used for calculation should be made. The xerox facilitates QC checking and project file documentation. If duplicate injections were made, both chromatograms should be recorded. Further, if there is any uncertainty about peak identification, then the standards used for retention time calibration should be xeroxed also.

vii. The QA/QC person should initial and date each page of data calculation or results sheet checked and any corrections that are made. Corrections should be in a different color ink (e.g., blue or red) than the original.

C. Documentation

i. A portable GC project notebook should be used unless there are instructions to the contrary. The project notebook should consist of the following sections:

Section Topic

a. General Project Information
   - Include the proposed Scope of Services if available

b. Standard Operating Conditions
   - Standards preparation forms
   - Standards chromatogram

        - Calculation equations
        - Sample handling instructions (if prepared)

    c. Results Summary forms

    d. Daily Injection Log

    e. Calculation Sheets and Chromatograms

ii. While the project is active, the notebook should be kept in a 3-ring binder (unless otherwise specified).

iii. After the project is completed, the notebook should be comb bound, with a cover page, and stored in the project files. The GC operator is responsible for putting the final notebook together.

iv. The original chromatograms should be stored in the Applied Chemistry Laboratory. The chromatograms should be organized by project and date.

19. References

Devitt, D.A., R.B. Evans, W.A. Jury, T.R. Starks, B. Eklund and A. Gnolson. 1987. Soil Gas Sensing For Detection and Mapping of Volatile Organics. EPA 600/8-87-036, USEPA, Las Vegas, NV.

STANDARD OPERATING PROCEDURE

PROCEDURE TITLE: Sample Receipt, Log-In, Storage, Analysis, and Disposal

DEPARTMENT: All Departments

PROCEDURE:

A. Scope

The following steps are taken by the laboratory personnel when samples arrive in the laboratory for analysis:

- Examine case and sample seals for integrity.
- Examine samples for proper labels, preservatives, temperature, and any damage.
- Reference samples to the Chain of Custody Record (COC).
- Sign the COC (Figure 1.07-1).
- Store samples under the proper environmental conditions.
- Note sample location and condition in the appropriate log.
- Enter samples into the Laboratory Information Management System (LIMS).
- Generate a Sample Receipt Acknowledgment form (Figure 1.07-2) and send to the project manager.
- Notify supervisors of sample arrival.
- Complete an internal COC (refrigerator or solid waste log).
- Store samples in a secure area.
- Prepare work lists and schedules for sample analysis.
- Document sample preparation and analysis.
- Return or dispose of samples after analysis completion.

B. Receipt

Place samples that arrive during nonbusiness hours in designated storage refrigerators until the next business day. On weekends, commercial carriers contact the weekend laboratory personnel for a signature. Keep coolers sealed until samples can be logged in on the next business day.

Access to the laboratory is through a monitored area. All laboratory personnel are issued a security card that permits entry to the laboratory during off hours (5 p.m. to 8 a.m. during the week and all weekend). Other outside access doors to the laboratory are kept locked. Visitors sign a visitor's log and are escorted while in the laboratory. Samples remain in a secure storage area until removed for preparation or analysis.

C. Log-In

Log in samples immediately upon receipt during work hours. Log in samples that arrive during nonbusiness hours immediately the next business day.

Remove samples from the cooler and group together according to sample point. Record the temperature of a representative (unpreserved) sample from each cooler. Take care to avoid cross-contamination. Record the actual temperature for samples received from nearby sites that have not had sufficient time to cool to 4°C ±2°. Then log these samples in and place immediately in the refrigerator. For soil or no-headspace samples, record the temperature of the cooler water if there is no unpreserved water sample. Analyze the pH of all preserved samples and add preservative if not within the required range.

A COC is a written record of sample bottle possession and transference. To ensure proper tracking, this form contains the following information: bottle preparer, bottle preparation date and time, office code, project number, client name, sampler signature, laboratory number, sample collection date and time, sample station identification, number of containers, sample type, container inventory, filtering, preservative code, refrigeration, seal number, persons relinquishing and receiving samples, hazards associated with samples, and any other applicable information. If any items are not in conformance, complete a Nonconformance Memo (Figure 1.07-3) and route to the Quality Assurance (QA) officer.

Assign sample numbers and note them on the bottles and on the COC. Take care to associate the proper bottle with the proper sample number using the sample point description on the COC and bottle label. Enter the sample numbers, client information, and other applicable information on the Refrigerator Sample Tracking System log (Figure 1.07-4). Notify supervisors of any tests for which there is a short hold time to ensure analysis is completed on time.

Assign a report target date, analysis target date, and work order identification. Complete the work order using a price quote or the current price list. Enter samples into LIMS. Print checking reports daily after entry. Give the COC, work order, and checking report to the designated person who reviews the LIMS sample entry for accuracy and completeness. Print the Sample Receipt Acknowledgement form after the LIMS entry is reviewed. Note any nonconformance items on this form. Route the Sample Receipt Acknowledgement form, work order, and COC to the appropriate people. Give the checking reports to the laboratory director.

D. Storage

Place samples requiring refrigeration in the appropriate refrigerators on the proper shelves as indicated by the preservative type. Record all bottles in the correct refrigerators using the Laboratory Refrigerator Tracking Log (Figure 1.07-5). Place solid wastes not requiring refrigeration in the solid waste storage bins. Record the samples in the correct bins using the Laboratory Solid Waste Inventory (Figure 1.07-6). Refrigerators are maintained according to RMT written procedure. Return samples to the storage area at the end of a work shift.

To minimize the possibility of contamination, bag the following in leakproof, zipper bags: any sample for volatile or total petroleum hydrocarbon analysis; any sample received in 60-mL jars or 40-mL vials, when the work order is not received with the samples or is unclear; and any sample to be stored in a Volatile refrigerator. Bottles with the same sample number may be stored in the same bag.

E. Analysis

1. Documentation

Write all hand-written raw data pertaining directly or indirectly to a sample analysis in water insoluble ink. Sign and date all raw data when collected and describe the procedure conducted (e.g., sample extraction, digestion, analysis, etc.). Sign all computer-generated data if not initialed and dated by the person operating the instrument. Stray marks and numbers on raw data are not acceptable; all data must be legible and identified. All looseleaf data must contain a project number or other identification.

Put all raw data on the appropriate document (e.g., laboratory notebook, bench sheet, calibration log, etc.). Raw data cannot be put on other paper and transferred to the appropriate document. If for any reason data are not recorded on the appropriate document, the paper containing the original data must be permanently attached to the document. Attach all computer-generated or hand-generated calculation sheets to the bench sheet or cross-reference their location on the bench sheets.

Label all columns of data and define units (e.g., peak area, concentration, absorbance, weight, etc.). Label all chromatograms and instrument printouts with instrument parameters. Identify each chromatogram injection by sample number or standard and injection volume and sign and date. Label each atomic absorption spectrophotometry, inductively coupled argon plasma, or other appropriate instrument printout with the sample number or standard and sign and date. If a sample is injected automatically, one signature and date are adequate for the group of samples in that run. Record the data for the standard curve on the bench sheets with appropriate units. If a standard curve is applicable to more than one bench sheet, record the location of the data on each bench sheet. Label dilutions from stock standards with the date of dilution and the date of stock standard preparation. Record these dates on the bench sheet with the standard curve data.

Document any unusual occurrences or data that may affect the analysis. Document and explain any spillage, contamination, quality control failure, or other reasons that may necessitate rerunning a sample. Note any unique instrument identification used during the collection of raw data on the bench sheet or in the laboratory notebook. Write or attach to the raw data the actual method or procedure used if it is a modification from the current method or procedure in use in the laboratory (modifications are justified and approved by the supervisor). Document any special requests by clients.

All instruments must have an instrument standard operating procedure (SOP) and analytical run, maintenance, and calibration logs. Calibrate each instrument according to the procedure and frequency described in the instrument SOP, analytical method, or QA manual. Record the calibration and samples analyzed in the log. For nonroutine maintenance, document the defect, how and when the defect was discovered, and any remedial action taken.

2. Review

Analysts review their raw data and bench sheets, then a second analyst reviews the data for calculations and completeness. The second analyst signs and dates the raw data after the review. The group leader or supervisor also reviews the data for LIMS entry and signs and dates the raw data after the review. The supervisor reviews the LIMS report for technical significance and errors. Upon approval, the supervisor signs the final report. The QA department reviews approximately 10% of the final report for quality control criteria, completeness, QA compliance, and traceability after the supervisor approves the final report.

F. Disposal

Samples may be completely consumed during analysis, returned to the client or sampling location, stored under the required environmental conditions if reanalysis is anticipated or under ambient conditions if reanalysis is unlikely, or disposed of by the laboratory. Dispose of samples and extracts after 60 days unless otherwise specified. The laboratory director or designee determines the disposal method and time if not specified by the project manager. Some waste may be disposed of in a sanitary sewer as permitted by 40 CFR 261.3 (a) (2) (iv). Hazardous samples (general characteristic or listed in 40 CFR 261) are shipped according to 40 CFR 172.02, 03, 04, 300, and 400.

REVIEWED BY: Mark S. Wirtz
Mark S. Wirtz
Quality Assurance Officer

11/20/91
Date

APPROVED BY: Karen M. MacKenzie
Karen M. MacKenzie
Laboratory Director

11.20.91
Date

RMT INC
LABORATORIES

Madison, WI 53717
744 Heartland Trail
Phone (608) 831-4444
FAX (608) 831-7530

Washington, D.C.

Santa Monica, CA

Grand Ledge, MI
Nashville, TN

Greenville, SC
Schaumburg, IL

F-268 (R2/88)
(Use Black Ink Only)

CHAIN OF CUSTODY RECORD

Sample Type: (GW, WW, SW, Soil, Other)

№ 024086

Bottles Prepared by:	Date/Time	Office Code: (State)
Project No.	Client:	

Container Inventory

Filtered (Yes/No)
Preserved (Code)
Refrigerated (Yes/No)

Code: A - None
B - HNO3
C - H_2SO_4
D - NaOH
E - ______

RMT Lab NO.	Yr. ___ Date	Time	Sample Station ID	Total Number Of Containers								Comments:

SAMPLER Relinquished by (Sig.) ①	Date/Time	Received by (Sig.) ② Shipper Name & #	Date/Time
Relinquished by (Sig.) ③	Date/Time	Received by (Sig.) ④ Shipper Name & #	Date/Time
Relinquished by (Sig.) ⑤	Date/Time	Received by (Sig.) ⑥ Shipper Name & #	Date/Time

Seal # at'chd by ○ Recvd. intact by ○ Seal # at'chd by ○ Recvd. intact by ○

HAZARDS ASSOCIATED WITH SAMPLES

(For Lab Use Only)

Receipt Temp ______ Receipt pH ______

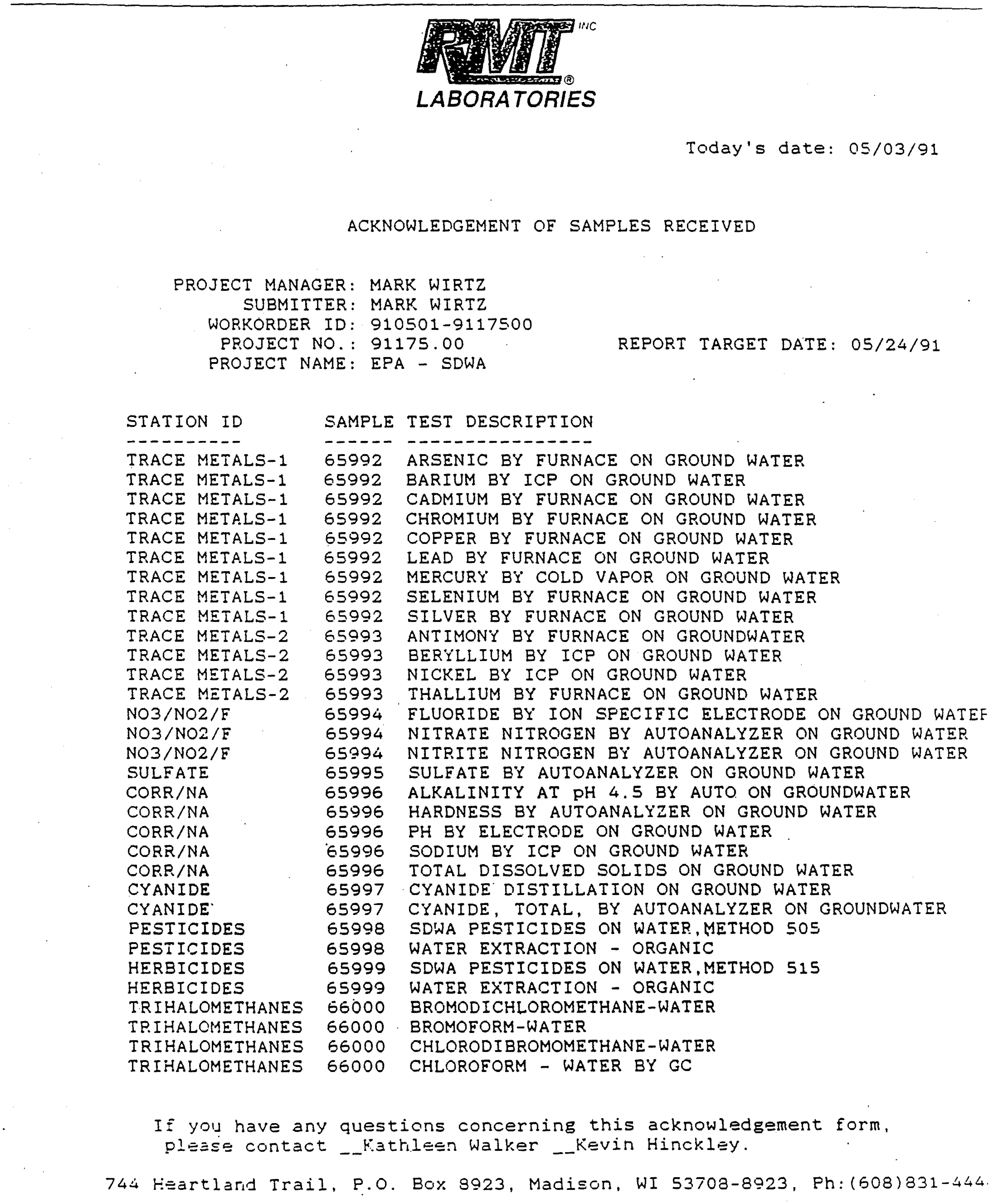
Client P.O. Number ______

Subsequent Analysis: ______ (Check)

Date Resubmitted ______

Figure 1.07-1

Figure 1.07-2



RMT INC
LABORATORIES

Today's date: 05/03/91

ACKNOWLEDGEMENT OF SAMPLES RECEIVED

PROJECT MANAGER: MARK WIRTZ
SUBMITTER: MARK WIRTZ
WORKORDER ID: 910501-9117500
PROJECT NO.: 91175.00
PROJECT NAME: EPA - SDWA

REPORT TARGET DATE: 05/24/91

STATION ID	SAMPLE	TEST DESCRIPTION
TRACE METALS-1	65992	ARSENIC BY FURNACE ON GROUND WATER
TRACE METALS-1	65992	BARIUM BY ICP ON GROUND WATER
TRACE METALS-1	65992	CADMIUM BY FURNACE ON GROUND WATER
TRACE METALS-1	65992	CHROMIUM BY FURNACE ON GROUND WATER
TRACE METALS-1	65992	COPPER BY FURNACE ON GROUND WATER
TRACE METALS-1	65992	LEAD BY FURNACE ON GROUND WATER
TRACE METALS-1	65992	MERCURY BY COLD VAPOR ON GROUND WATER
TRACE METALS-1	65992	SELENIUM BY FURNACE ON GROUND WATER
TRACE METALS-1	65992	SILVER BY FURNACE ON GROUND WATER
TRACE METALS-2	65993	ANTIMONY BY FURNACE ON GROUNDWATER
TRACE METALS-2	65993	BERYLLIUM BY ICP ON GROUND WATER
TRACE METALS-2	65993	NICKEL BY ICP ON GROUND WATER
TRACE METALS-2	65993	THALLIUM BY FURNACE ON GROUND WATER
NO3/NO2/F	65994	FLUORIDE BY ION SPECIFIC ELECTRODE ON GROUND WATEF
NO3/NO2/F	65994	NITRATE NITROGEN BY AUTOANALYZER ON GROUND WATER
NO3/NO2/F	65994	NITRITE NITROGEN BY AUTOANALYZER ON GROUND WATER
SULFATE	65995	SULFATE BY AUTOANALYZER ON GROUND WATER
CORR/NA	65996	ALKALINITY AT pH 4.5 BY AUTO ON GROUNDWATER
CORR/NA	65996	HARDNESS BY AUTOANALYZER ON GROUND WATER
CORR/NA	65996	PH BY ELECTRODE ON GROUND WATER
CORR/NA	65996	SODIUM BY ICP ON GROUND WATER
CORR/NA	65996	TOTAL DISSOLVED SOLIDS ON GROUND WATER
CYANIDE	65997	CYANIDE DISTILLATION ON GROUND WATER
CYANIDE	65997	CYANIDE, TOTAL, BY AUTOANALYZER ON GROUNDWATER
PESTICIDES	65998	SDWA PESTICIDES ON WATER,METHOD 505
PESTICIDES	65998	WATER EXTRACTION - ORGANIC
HERBICIDES	65999	SDWA PESTICIDES ON WATER,METHOD 515
HERBICIDES	65999	WATER EXTRACTION - ORGANIC
TRIHALOMETHANES	66000	BROMODICHLOROMETHANE-WATER
TRIHALOMETHANES	66000	BROMOFORM-WATER
TRIHALOMETHANES	66000	CHLORODIBROMOMETHANE-WATER
TRIHALOMETHANES	66000	CHLOROFORM - WATER BY GC

If you have any questions concerning this acknowledgement form,
please contact __Kathleen Walker __Kevin Hinckley.

744 Heartland Trail, P.O. Box 8923, Madison, WI 53708-8923, Ph:(608)831-444

Figure 1.07-3

NONCONFORMANCE AND TRACKING MEMO - SAMPLE RECEIVING

Sample No(s).: ____________________ Project Name: ____________________
____________________ Project No.: ____________________

NONCONFORMANCE [check applicable items]:

Paperwork:
_____ 1) INCOMPLETE or NO request for analysis (circle one).
_____ 2) INCOMPLETE or NO chain-of custody (circle one).
_____ 3) No filtering information supplied.

Samples:
_____ 4) Received more than three days past collection date.
_____ 5) Waters requiring pest/PCB or semivolatile organic analysis older than two days past collection date.
_____ 5) Not enough sample sent for proper analysis; low volume.
_____ 6) Bottles received broken and/or cap not intact.
_____ 7) Received without needed and/or proper refrigeration.
_____ 8) Received in improper container(s).
_____ 9) Insufficient or no preservation.
_____ 10) Parameters have passed holding time.
_____ 11) No trip blank was sent with samples, and one was needed.
_____ 12) Time and/or date not written on bottles.

Numbering:
_____ 13) ILLEGIBLE or MISSING sample label(s) (circle one).
_____ 14) Number(s) on sample(s) not the same as on paperwork.

Other:
_____ 15) Standard operating procedure not adhered to (specify). ____
____
_____ 16) Other (specify). ____________________________________
____

CORRECTIVE ACTION TAKEN [check applicable items]
_____ 1) Sample(s) processed "as is."
_____ 2) Samples "on hold" until further notice.
_____ 3) Preservative added to sample(s); see #10 above.
_____ 4) Other (specify). ____________________________________

ROUTING

Title	Initials	Date	Check if Corrected
Sample Entry	______	______	______
Group Supervisor	______	______	______
QA Coordinator	______	______	______

TRACKING
Date Received: ____________________
Time Received: before 8 8-9 9-10 10-11 11-12 12-1 1-2 after 2
Carrier: Fed Ex UPS Air Borne Client Other
Into Refrigerators: S N L into walk-in

Entered into Lims: S N L
Delays because of: work-order LIMS numbering

Figure 1.07-4

REFRIGERATOR SAMPLE TRACKING SYSTEM

DATE REC'D	CLIENT NAME	PROJECT #	SAMPLE TYPE	SAMPLE NO.'S	HNO$_3$				REFRIGERATOR LOCATION & SIZE											SW BINS	LOGGED BY:	COMMENTS
					125	250	500	1000	H_2SO_4 (Pl/Gl)				40 mL	60 mL	UNPRES.				NaOH 1.0 L			

COMMENTS: ______________________

LOCATIONS: A Unpreserved Leach Refrigerator, B Ground Water Refrigerator, C Metals Refrigerator, D TOC Refrigerator, E Organic Refrigerator (Water), F Organic Refrigerator (Soil), G WVOA Refrigerator H SVOA Refrigerator, I Walk-in Cooler.

LABORATORY REFRIGERATOR TRACKING LOG

Shelf No.	Project	Project #	Sample Numbers	Container - (type, size preservative) one type only per line entry	Checked in by (Date/ Initial)	Checked Out By	Checked In By	Checked Out By	Checked In By	Checked Out By	Checked In By	Checked Out By	Checked In By	Checked Out By	Checked In By	Final Checkout to Walk-In

96.04:LAB:378
Form #378 (10/31/89)

Figure 1.07-5

Figure 1.07-6

LABORATORY SOLID WASTE INVENTORY

Bin #:

Date	Project	Project Number	Sample Numbers	Project Manager	Container Type	Checked In By (Date/ Initial)	Checked Out By	Checked In By	Checked Out By	Checked In By	Checked Out By	Checked In By
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.
						1.	2.	3.	4.	5.	6.	7.

(96.04:LAB:LF-388)

ATTACHMENT 3

SAMPLE BOTTLE SPECIFICATION

REVISION 0

FEBRUARY 1993

SAMPLE BOTTLE SPECIFICATION

Sample Containers used are Eagle-Picher or an equivalent brand

Level 2 bottles subject to the following cleaning procedures:

Cleaning Procedure A (Glass Containers)

1. Bottles, liners, and caps are washed in laboratory-grade, non-phosphate detergent.
2. Rinsed 3 times with distilled water.
3. Rinsed with 1:1 nitric acid.
4. Rinsed 3 times with ASTM Type 1 organic-free water.
5. Oven-dried for 1 hour.
6. Rinsed with Hexane.
7. Oven-dried for 1 hour.

Cleaning Procedures B (VOA Vials)

1. Vials, septa, and caps are washed in laboratory-grade, non-phosphate detergent.
2. Rinsed 3 times with distilled water.
3. Rinsed 3 times with ASTM Type 1 organic-free water.
4. Oven-dried for 1 hour.

ATTACHMENT 4

LABORATORY PRECISION AND ACCURACY CONTROL LIMITS

REVISION

FEBRUARY 1993

ORGANIC ANALYSES - PRECISION AND ACCURACY

Analyses	Surrogates	Control Limit Requirements	Matrix Spikes	Control Limit Requirements	
				Accuracy	Precision
Volatile Organics - Aqueous Method 8240[a]	Toluene - d_8	88 - 110% recovery	1,1-Dichloroethane	61 - 145% recovery	14% RPD
	Bromofluorobenzene	86 - 115% recovery	Trichloroethene	71 - 120% recovery	14% RPD
	1,2-Dichloroethane -d_4	76 - 114% recovery	Benzene	76 - 127% recovery	11% RPD
			Toluene	76 - 125% recovery	13% RPD
			Chlorobenzene	75 - 130% recovery	13% RPD
Volatile Organics - Solid Method 8260[a]	Toluene - d_8	81 - 117% recovery	1,1-Dichloroethane	59 - 172% recovery	22% RPD
	Bromofluorobenzene	74 - 121% recovery	Trichloroethene	62 - 137% recovery	24% RPD
	1,2-Dichloroethane-d_4	70 -121% recovery	Benzene	66 - 142% recovery	21% RPD
			Toluene	59 - 139% recovery	21% RPD
			Chlorobenzene	60 - 133% recovery	21% RPD
Volatile Organics - Aqueous Method 8020	1,4-Difluorobenzene	77 - 123% recovery	Toluene	73 - 127% recovery	12% RPD
	3-Chlorotoluene (PID)	70 - 130% recovery	m-Xylene	73 - 127% recovery	18% RPD
	3-Chlorotoluene (HAL)	76 - 124% recovery	o,p-Xylene	53 - 146% recovery	18% RPD
			Ethylbenzene	71 - 128% recovery	24% RPD
			Benzene	78 - 121% recovery	9% RPD
			Chlorobenzene	82 - 118% recovery	15% RPD
			1,4-Dichlorobenzene	74 - 125% recovery	19% RPD
			1,3-Dichlorobenzene	76 - 123% recovery	20% RPD
			1,2-Dichlorobenzene	69 - 131% recovery	34% RPD
Semivolatile Organics - Solid Method 8270[a]	Nitrobenzene - d_5	23 - 120% recovery	Phenol	26 - 90% recovery	35% RPD
	2-Fluorobiphenyl	30 - 115% recovery	2-Chlorophenol	25 - 102% recovery	50% RPD
	Terphenyl-d_{14}	18 - 137% recovery	1,4-Dichlorobenzene	28 -104% recovery	27% RPD
	Phenol - d_6	24 - 113% recovery	N-Nitroso-di-n-propylamine	41 - 126% recovery	38% RPD
	2-Fluorophenol	25 - 121% recovery	1,2,4-Trichlorobenzene	38 -107% recovery	23% RPD
	2,4,6-Tribromophenol	19 - 122% recovery	4-Chloro-3-methylphenol	26 -103% recovery	33% RPD
			Acenaphthene	31 - 137% recovery	19% RPD
			4-Nitrophenol	11 - 114% recovery	50% RPD
			2,4-Dinitrotoluene	28 - 89% recovery	47% RPD
			Pentachlorophenol	17 - 109% recovery	47% RPD
			Pyrene	35 - 142% recovery	36% RPD

ORGANIC ANALYSES - PRECISION AND ACCURACY (CONTINUED)

Analyses	Surrogates	Control Limit Requirements	Matrix Spikes	Control Limit Requirements	
				Accuracy	Precision
Semivolatile Organics - Aqueous Method 8270	Nitrobenzene - d_5	35 - 14% recovery	Phenol	12 - 89% recovery	42% RPD
	2-Fluorobiphenyl	43 - 116% recovery	2-Chlorophenol	27 - 123% recovery	40% RPD
	Terphenyl-d_{14}	33 - 141% recovery	1,4-Dichlorobenzene	36 - 97% recovery	28% RPD
	Phenol-d_6	10 - 94% recovery	N-Nitroso-di-n-propylamine	41 - 116% recovery	38% RPD
	2-Fluorophenol	21 - 100% recovery	1,2,4-Trichlorobenzene	39 - 98% recovery	28% RPD
	2,4,6-Tribromophenol	100 - 123% recovery	4-chloro-3-methylphenol	23 - 97% recovery	42% RPD
			Acenaphthene	46 - 118% recovery	31% RPD
			4-Nitrophenol	10 - 80% recovery	50% RPD
			2,4-Dinitrotoluene	24 - 96% recovery	38% RPD
			Pentachlorophenol	9 - 103% recovery	50% RPD
			Pyrene	26 - 127% recovery	31% RPD
PCBs Aqueous Method 8081	Tetrachloro-m-xylene	60 - 150% recovery[b]	AR1254	50 - 150% recovery	25% RPD
	Decachlorobiphenyl	60 - 150% recovery[b]			

Laboratory control limits are updated periodically.

Notes:

[a] USEPA Contract Laboratory Program, Statement of Work for Organics Analysis, 02/88 Rev.

[b] Advisory limits only. Actual laboratory control limits are being established.

Inorganic Section
Metals–GFAA

ACCURACY CONTROL LIMITS
1992

Effective Date: April 8, 1992

LCL - UCL
(LWL - UWL)

NOTE: Control Limits of Analytes and Matrixes not listed:

GW	Control Limit	80 - 120	All Others	Control Limit	75 - 125
	Warning Limit	85 - 115		Warning Limit	80 - 120

ANALYTE	MATRIX			
	GW	GWT	WW	CMP
Arsenic	79 - 128 (87 - 120)	65 - 134 (77 - 122)	67 - 118 (76 - 110)	52 - 124 (64 - 112)
Cadmium	85 - 126 (92 - 119)	81 - 127 (89 - 120)		84 - 129 (92 - 122)
Chromium	77 - 122 (85 - 115)	73 - 119 (81 - 111)	66 - 128 (77 - 118)	
Lead	83 - 124 (90 - 117)	76 - 124 (84 - 116)	80 - 125 (87 - 118)	68 - 127 (77 - 117)
Selenium	74 - 119 (82 - 111)	59 - 115 (68 - 106)	64 - 115 (73 - 106)	60 - 110 (68 - 102)
Silver	70 - 113 (78 - 106)			
Thallium			64 - 121 (73 - 112)	

[*] Control Limit calculated using ± 25% from the Centerline.

Inorganic Section
Metals–CVAA

ACCURACY CONTROL LIMITS
1992

ANALYTE	MATRIX			
	GW	GWT	WW	CMP
Mercury	86 - 113 (90 - 109)	84 - 110 (88 - 106)	73 - 118 (80 - 111)	85 - 118 (91 - 113)

Shaded boxes containing Control Limits incorporate data from 1990.

Inorganic Section
Metals—ICP

ACCURACY CONTROL LIMITS
1992

Effective Date: April 8, 1992

LCL - UCL
(LWL - UWL)

NOTE: Control Limits of Analytes and Matrixes not listed:

GW	Control Limit	80 - 120	All Others	Control Limit	75 - 125
	Warning Limit	85 - 115		Warning Limit	80 - 120

ANALYTE	MATRIX				
	GW	GWT	WW	TCP	CMP
Aluminum			77 - 115 (84 - 109)		
Boron	84 - 128 (91 - 121)				
Barium	86 - 114 (91 - 109)	85 - 118 (91 - 112)	77 - 112 (83 - 106)	77 - 109 (82 - 104)	62 - 128 (84 - 117)
Beryllium					79 - 107 (83 - 102)
Cadmium			81 - 109 (86 - 104)	86 - 107 (89 - 103)	76 - 113 (82 - 107)
Calcium	73 - 123 (81 - 115)				
Chromium	79 - 121 (86 - 114)		76 - 111 (82 - 105)	85 - 107 (89 - 104)	75 - 119 (82 - 112)
Copper	84 - 116 (89 - 111)	86 - 116 (91 - 111)	82 - 115 (87 - 109)	87 - 109 (91 - 106)	72 - 118 (79 - 110)
Iron	83 - 120 (89 - 114)	77 - 121 (84 - 113)	74 - 123 (82 - 115)	78 - 113 (82 - 107)	
Lead			73 - 115 (80 - 108)	81 - 110 (86 - 105)	74 - 118 (81 - 110)
Magnesium	73 - 125 (81 - 116)				67 - 123 (76 - 113)
Manganese	85 - 115 (90 - 110)	83 - 116 (89 - 111)			
Molybdenum				80 - 104 (84 - 100)	
Nickel	74 - 123 (82 - 115)		77 - 116 (84 - 109)	72 - 115 (79 - 106)	74 - 118 (81 - 111)
Potassium	79 - 124 (86 - 116)				72 - 120 (80 - 112)
Silver				91 - 114 (95 - 110)	87 - 121 (93 - 115)
Sodium	74 - 122 (82 - 114)	71 - 121 (79 - 112)			77 - 114 (83 - 108)
Zinc	85 - 118 (91 - 113)	84 - 114 (89 - 109)	76 - 115 (83 - 109)	82 - 109 (86 - 104)	69 - 125 (78 - 116)
Hardness	74 - 121 (82 - 114)		66 - 127 (76 - 117)		

Shaded boxes containing Control Limits incorporate data from 1990.

Inorganic Section
Metals

PRECISION CONTROL LIMITS
1992

Effective Date: April 8, 1992

UCL
(UWL)

NOTE: Control Limits of Analytes and Matrixes not listed: Control Limit 0 - 20
Warning Limit 15

ANALYTE	MATRIX				
	GW	GWT	WW	TCP	CMP
Arsenic (GFAA)					0 - 21 (16)
Chromium (GFAA)					0 - 36 (28)
Lead (GFAA)					0 - 23 (17)
Barium	0 - 15 (11)	0 - 15 (11)	0 - 16 (13)	0 - 12 (9)	0 - 24 (19)
Cadmium				0 - 19 (14)	0 - 19 (14)
Calcium	0 - 7 (5)	0 - 9 (6)	0 - 15 (12)		0 - 18 (14)
Chromium			0 - 15 (11)	0 - 13 (9)	0 - 28 (22)
Copper					0 - 25 (20)
Hardness	0 - 8 (6)		0 - 8 (6)		
Iron	0 - 14 (10)				0 - 26 (20)
Lead				0 - 11 (8)	0 - 24 (18)
Magnesium	0 - 11 (8)				0 - 19 (14)
Manganese	0 - 12 (9)				0 - 26 (20)
Nickel					0 - 25 (19)
Potassium	0 - 12 (9)				
Sodium	0 - 8 (6)	0 - 9 (6)	0 - 13 (10)		
Zinc			0 - 12 (9)	0 - 14 (10)	0 - 22 (17)

Shaded boxes containing control limits incorporate data from 1990.

Inorganic Section
Metals

LCS CONTROL LIMITS–NON-AQUEOUS
1992

Effective Date: April 8, 1992

NOTE: Control Limit of Analytes not listed: 80 - 120%

ANALYTE	INST.	LCL	LWL	CENTERLINE	UWL	UCL
Barium	ICP	85	89	97	104	108
Beryllium*	ICP	72	79	94	109	116
Cadmium	ICP	82	86	94	102	106
Calcium	ICP	83	88	96	105	109
Chromium	ICP	81	85	93	101	105
Cobalt*	ICP	74	82	99	116	124
Copper	ICP	84	92	96	99	107
Iron	ICP	83	90	104	118	125
Lead	ICP	80	85	96	107	112
Magnesium	ICP	81	86	97	107	110
Manganese*	ICP	81	86	97	107	112
Nickel	ICP	84	87	94	102	105
Potassium	ICP	75	81	91	102	107
Silver	ICP	98	101	108	115	118
Sodium	ICP	83	88	98	107	112
Zinc	ICP	82	86	94	102	106
Arsenic	GFAA	90	94	103	112	117
Cadmium	GFAA	85	91	105	118	125
Chromium	GFAA	80	87	100	112	119
Lead	GFAA	91	96	105	114	119
Selenium	GFAA	86	92	103	114	119
Mercury	CVAA	93	95	101	106	109

* Control Limit calculated incorporating data from 1990.

Inorganic Section
Metals

LCS CONTROL LIMITS–AQUEOUS

Total Metals-ICP (GWT, Leach Ext., WW)/3010
1992

Effective Date: April 8, 1992

NOTE: Control Limit of Analytes not listed: 80 - 120%

ANALYTE	INST.	LCL	LWL	CENTERLINE	UWL	UCL
Aluminum*	ICP	79	85	96	107	113
Barium	ICP	88	92	101	110	114
Beryllium*	ICP	86	89	96	104	107
Calcium	ICP	84	89	100	111	116
Cadmium	ICP	88	92	100	107	111
Chromium	ICP	85	89	98	106	110
Copper	ICP	89	93	102	111	116
Iron	ICP	87	92	102	112	117
Lead	ICP	88	93	102	110	115
Magnesium	ICP	84	90	101	112	117
Manganese	ICP	88	93	102	112	117
Nickel	ICP	90	94	102	111	115
Potassium	ICP	76	83	96	110	117
Sodium	ICP	89	94	103	111	116
Zinc	ICP	88	92	101	109	114

* Control Limit calculated incorporating data from December, 1990.

Inorganic Section
Metals

LCS CONTROL LIMITS-AQUEOUS

Dissolved Metals-ICP GWu/3005
1992

Effective Date: April 8, 1992

NOTE: Control Limit of Analytes not listed: 80 - 120%

ANALYTE	INST.	LCL	LWL	CENTERLINE	UWL	UCL
Boron	ICP	90	97	109	122	129
Barium	ICP	95	99	107	115	119
Calcium	ICP	94	98	106	114	118
Copper*	ICP	97	101	108	114	118
Iron	ICP	90	95	105	116	121
Magnesium	ICP	89	94	105	115	120
Manganese	ICP	96	100	108	117	121
Potassium	ICP	79	86	100	113	120
Silver	ICP	93	98	108	118	123
Sodium	ICP	92	97	106	116	121
Zinc	ICP	96	101	110	119	123

* Control Limit calculated incorporating data from December, 1990.

Inorganic Section
Metals–GFAA

LCS CONTROL LIMITS–AQUEOUS
1992

Effective Date: April 8, 1992

NOTE: Control Limit of Analytes not listed: 80 - 120%

ANALYTE	INST.	LCL	LWL	CENTERLINE	UWL	UCL
Antimony	GFAA	78	85	100	115	123
Arsenic	GFAA	84	92	106	121	129
Cadmium	GFAA	87	93	106	118	124
Chromium	GFAA	81	88	101	114	121
Copper	GFAA	85	92	105	117	124
Lead	GFAA	88	94	107	120	127
Selenium	GFAA	83	91	107	122	130
Silver	GFAA	70	79	95	111	119
Thallium	GFAA	81	88	103	117	124

Inorganic Section
Metals–CVAA

LCS CONTROL LIMITS–AQUEOUS
1992

ANALYTE	INST.	LCL	LWL	CENTERLINE	UWL	UCL
Mercury	CVAA	86	91	100	108	113

APPENDIX B

RMT HEALTH AND SAFETY PLAN

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS (CONTINUED)

List of Figures

Section 1

INTRODUCTION

1.1 Background

RMT, Inc. (RMT), has been retained by Cook Composites and Polymers (CCP), to complete a site investigation at their plant located in Saukville, Wisconsin.

The site investigation includes soil sampling, well installation, and performance of a pump test. This site-specific Health and Safety Plan (HSP) focuses on investigation activities included in the Field Sampling Plan (FSP). More detailed descriptions of these activities are included in the FSP.

Field activities are scheduled to begin one to two months from USEPA/WDNR approval of the Site Investigation and Continuing Interim Corrective Measures Workplan.

1.2 Purpose

The site-specific HSP provides guidelines and procedures intended to help protect the health and safety of RMT field personnel conducting the field investigations. RMT personnel participating in the fieldwork will be required to review these guidelines and procedures before initially entering the site. Specific questions regarding the HSP should be addressed to the RMT Corporate Health and Safety Director, Christine Hansen.

A copy of the site-specific HSP will be kept at the site in the RMT support zone. It will be available for review by RMT personnel, subcontractors, and authorized visitors.

1.3 Scope

The HSP is aimed specifically at protecting workers from reasonably foreseeable health and safety hazards arising from the constituents of concern known or suspected to be present at the project site, as identified during the site investigation.

The HSP has been developed based on the requirements and guidance contained in the following regulations and guidance documents: Occupational Safety and Health

Administration (OSHA) Standards, 29 CFR 1910 and 1926, including 29 CFR 1910.120; U.S. Environmental Protection Agency (USEPA) "Standard Operating Safety Guides," June 1992; ER 385-1-92, "Safety and Occupational Health Guidance Requirements for Hazardous Waste Site RA's," August 30, 1984; NIOSH/OSHA/USCG/EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," October 1985; and RMT Corporate Health and Safety policies and procedures.

The HSP is based on information available to date and is subject to revision as new data and information on potential health and safety hazards on the site become available.

1.4 Applicability

The HSP applies to RMT personnel who participate in the field activities described in Subsection 1.1. It contains minimum requirements necessary to protect on-site personnel from physical and chemical hazards particular to this site, which have been identified as of the date of the HSP.

Employees of the subcontractor, government agencies, and authorized visitors are responsible for their own health and safety while on the site.

RMT personnel will also abide by policies and procedures included in the RMT Heath and Safety Manual. In the event of discrepancies between RMT's Manual and this site-specific HSP, the policies and procedures in the HSP will take precedence.

1.5 Organization and Coordination

The following RMT personnel are designated to carry out stated job functions related to the project:

Project Coordinator	Stacy McAnulty
Corporate Health and Safety Director	Christine Hansen
Site Health and Safety Representative	Gwen Porus

The Project Coordinator will be responsible for the overall management of field activities, monitoring performance, and promoting communication between the Health and Safety Director and the project staff.

The Health and Safety Director will provide guidance for implementing the HSP, review and audit health and safety procedures implemented during the field investigation, and revise the HSP as required, based on new information. The Corporate Health and Safety Director will also provide guidance for evaluating, planning, and implementing health and safety procedures to be used on-site.

The Site Health and Safety Representative will be on-site while the work is in progress. The Site Health and Safety Representative will have authority for implementing this HSP and for ensuring that procedures are followed by RMT site personnel. Additional RMT personnel may be designated Site Health and Safety Representatives by the Project Coordinator during different field activities. If a health and safety issue cannot be resolved by the Site Health and Safety Representative, the Site Health and Safety Representative will seek input from the Project Coordinator and the Health and Safety Director.

Section 2

FIELD PERSONNEL HEALTH AND SAFETY TRAINING AND MEDICAL SURVEILLANCE

2.1 Health and Safety Training

The training requirements in OSHA Standard 29 CFR 1910.120 are to be followed, at a minimum, by all personnel that enter the site.

Prior to the start of field activities, RMT personnel conducting or observing on-site activities will participate in the following health and safety training sessions:

- Site-specific health and safety meeting - This HSP will be reviewed, and any special procedures will be outlined.
- Health and Safety for Hazardous Waste Site Activities - This 40-hour training session includes the following elements: regulations, industrial hygiene, toxicology, respiratory protection, radiation, chemical and physical hazards, noise, temperature extremes, personal protective equipment, medical surveillance, air monitoring equipment, site control and decontamination, standard operating procedures, and confined space entry.
- An annual 8-hour refresher course will be required for field personnel who participated in the 40-hour training more than 1 year ago.

Training will be provided to additional RMT field personnel so that back-up personnel can be assigned to the site should the need arise.

Documentation of attendance in training sessions is maintained by the RMT Human Resources Department and the RMT Corporate Health and Safety Director in Madison, Wisconsin.

In addition to the formal training required, RMT on-site personnel will briefly meet each day before beginning work to discuss the tasks to be completed that day, potential health and safety hazards associated with the tasks, and any necessary precautions to be taken.

2.2 Medical Surveillance

Medical surveillance requirements contained in OSHA Standard 29 CFR 1910.134 and 29 CFR 1910.120 are to be followed, at a minimum, by all personnel that enter the site. RMT field personnel assigned to the site will receive an initial medical examination prior to performing their first field assignment, and on an annual basis thereafter. The protocol for the yearly medical examination includes the following:

- Health history
- Vital signs and physical examination screen
- Pulmonary function
- Hematology survey
- Urinalysis
- Heavy metals screen
- Blood chemistry screen (SMA-20)
- Stool for occult blood
- Vision test
- Hearing test

The initial examination includes a maximal stress treadmill exercise test with a 12-point-lead EKG and chest x-ray, in addition to the above annual tests.

RMT field personnel assigned to conduct site investigations will have passed the required medical examination before entering the project site.

Medical records of RMT personnel are kept on file at the examining physician's clinic. A certificate of medical fitness or specified work restrictions is maintained in the employee's personnel file in the Human Resources Department.

Section 3

HAZARD EVALUATION

3.1 Chemical Hazards

Organic Compounds - The primary potential chemical hazards that have been identified at the site are organic compounds. The following organic compounds have been identified as constituents of potential concern.

Chemical Name	OSHA Permissible Exposure Limit[1] in ppm	OSHA Short-Term Exposure$_2$ Limit in ppm	Ionization Potential in eV	Highest BTEX Concentration in Soil (μg/kg)	Highest Concentration in Groundwater (μg/L)
Ethylbenzene	100	125	8.76		28,000
Toluene	100	150	8.82		75,000
Xylene	100	150	8.56	16,300,000[3]	130,000
Styrene[4]	50	100	8.40		< 500
Benzene[5]	1	5	9.24		4,100

Notes:

[1] The OSHA permissible exposure limits (PEL) are for an 8-hour time-weighted average exposure (inhalation).

[2] The short-term exposure limits (STELs) are for an employee's exposure during a 15-minute time-weighted average.

[3] Measured in soils in the urethane laboratory disposal area.

[4] Carcinogen

The primary potential route of exposure for the above substances is inhalation of vapors. Secondary potential routes of exposure are skin contact with contaminated soils or liquids and accidental ingestion from contact with contaminants or contaminated articles.

3.2 Physical Hazards

3.2.1 Utilities

Overhead and underground utilities (e.g., electric, gas, telephone, water, sewer, drainage, etc.) in the area must be located by the owner (CCP) for on-site locations, and by the subcontractor for off-site locations before the start of any operations which require digging (soil boring and monitoring well installation) or moving and set-up of heavy equipment, such as the drill rig. The information regarding locations of utilities will be kept at the site by the RMT Site Health and Safety Representative.

3.2.2 Heavy Equipment and Noise

Heavy equipment such as the drill rig to be used on the site is under the control of the contractor, who is responsible for maintaining the equipment in good working order and operating it safely. Subcontract requirements for contractors operating this equipment will state that applicable OSHA and State health and safety requirements must be met by the contractor. However, RMT personnel shall not work near equipment that they judge to be unsafe because of deterioration, missing parts, obvious defects, or improper operation. The RMT Project Coordinator will be notified immediately if unsafe equipment or work practices are observed on the site.

Operation of heavy equipment in areas with steep embankments or unstable ground will be avoided if possible. If it is necessary to operate equipment in these areas, the contractor will make provisions to ensure the safety of the equipment operator and other personnel in the area.

Operating heavy equipment is also a potential source of noise during site work. RMT personnel must wear hearing protection when the noise level exceeds 85 dBA.

3.2.3 Vehicle Traffic

Trucks may be operating on roads in the area adjacent to the work zones. Field personnel must be alert to traffic and yield the right-of-way. Personnel shall notify the client if they will be working near access roads.

3.2.4 Heat Stress

The USEPA Standard Operating Safety Guides (1984) recommend that a heat stress monitoring program be implemented when employees wear impervious clothing in ambient temperatures of 70°F or above. The frequency of monitoring should increase as temperatures rise, and employees should be monitored after each work period when ambient temperatures exceed 85°F. The following monitoring program recommended by the USEPA guide shall be used by personnel when ambient temperatures exceed 70°F.

- Heart Rate (HR) shall be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats per minute. If the HR is higher, the next work period shall be shortened by 10 minutes, while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle shall be shortened by another 33 percent.

All personnel shall remain alert to the symptoms of heat stress. The general symptoms include the following:

- Heat Rash - Decreased ability to tolerate heat, chafing clothes.
- Heat Cramps - Muscle spasms and pain in the extremities and abdomen.
- Heat Exhaustion - Shallow breathing; pale, cool, moist skin; profuse sweating; dizziness and lassitude.
- Heat Stroke - Red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong rapid pulse; coma. Immediate medical assistance must be obtained.

Preventive measures for heat-stress shall include shaded rest areas and ample quantities of cool liquids for worker consumption.

3.2.5 Cold Stress

Persons working outdoors in low temperatures, especially at or below freezing, are subject to cold stress. Exposure to extreme cold for a short time causes severe injury to the surface of the body, or results in profound generalized cooling and may cause death. Areas of the body which have a high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible to injury.

Protective clothing generally does not afford protection against cold stress. In many instances, it increases susceptibility due to a reduction in wind-chill awareness and exposure to lower than perceived ambient temperatures.

Two factors influence the development of a cold stress injury—ambient temperature and the velocity of the wind. Wind-chill is used to describe the chilling effect of moving air in combination with low temperature.

As a general rule, the greatest incremental increase in wind-chill occurs when wind at a speed of 5 miles per hour (mph) increases by 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is perspiration soaked. Warm, dry clothing must be available and donned as soon as possible when these conditions are present.

Frostbite

Local injury resulting from cold temperatures is included in the generic term frostbite. Frostbite of the extremities can be categorized into the following:

- Frost nip or incipient frostbite is characterized by sudden blanching or whitening of skin.
- Superficial frostbite is characterized by skin with a waxy or white appearance which is firm to the touch; the tissue beneath the skin, however, is resilient.

To administer first aid for frostbite, bring the victim indoors, and rewarm the areas quickly in warm water. Never place frostbitten tissue in hot water, as the area will have a reduced heat awareness, and such treatment could result in burns. Give a warm drink, but not coffee, tea, or alcohol. The victim must not smoke. Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws. Elevate the injured area and protect it from further physical injury. Do not allow blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep victim warm, and summon immediate medical assistance.

- Do not rub the frostbitten area (this may cause gangrene).
- Do not use ice, snow, gasoline, or anything cold on the frostbitten area.
- Do not use heat lamps or hot water bottles to rewarm the frostbitten part.
- Do not place the frostbitten part near a hot stove.

Hypothermia

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperatures. Its symptoms are usually exhibited in five stages as follows:

- Shivering
- Apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95 degrees Fahrenheit
- Unconsciousness, glassy stare, slow pulse, and slow respiratory rate
- Freezing of the extremities
- Death

Quick rewarming is essential. Bring the person into a warm room and wrap in warm blankets or additional warm clothing.

Personnel will watch for signs of frostbite and cold exposure in themselves and team members. Field activities should be curtailed if the equivalent chill temperature (°F) (as shown on the wind-chill chart) is below zero (°F), unless the activity is of an emergency nature.

The following wind-chill chart is from the ACGIH, Threshold Limit Values for Chemical Substances in the Work Environment for 1992-1993.

TABLE 2. Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	*LITTLE DANGER* In < hr with dry skin. Maximum danger of false sense of security				*INCREASING DANGER* Danger from freezing of exposed flesh within one minute.				*GREAT DANGER* Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Section 4
AIR MONITORING

4.1 Purpose

Air monitoring is conducted to help ensure that the level of respiratory protection selected for field personnel is adequate for the different phases of the field investigation. Changes in the level of protection may be required if significant changes in airborne concentrations of contaminants occur.

Air monitoring will be required to establish background conditions or if there are noticeable odors or visual subsurface contamination. The requirements in the following sections will apply if air monitoring is required.

4.2 Parameters

Concentrations of total organic vapors and gases may be monitored using direct-reading equipment in the breathing zone during soil boring and sampling, groundwater sample collection, and during other activities reasonably expected to generate air contaminants.

4.3 Monitoring Equipment

A photoionization detector (PID) will be used as the primary instrument for routine monitoring of organic vapor concentrations. The PID measures concentrations of organic vapors in air and provides a direct readout of the organic concentrations as parts per million (ppm) equivalent to the isobutylene calibration gas. The instrument will be calibrated in the field at least twice daily, before and after use, with calibration gas.

4.4 Monitoring Schedule

If required, air monitoring using the direct-reading equipment will be conducted at the beginning of each day on the upwind side of the site to establish background concentrations in the air. The air monitoring for organic vapors and gases will be conducted in the breathing zone of the workers to determine potential exposure levels. The PID will be operated continuously, and measurements will be recorded periodically by field personnel during work at the site.

4.5 Establishing Background Levels of Air Contaminants

Background concentrations in air, as equivalent ppm of isobutylene measured with the PID, will be established prior to initiating any site activity which requires air monitoring. The background level will be re-established each time the project site is entered, at least once daily before the site is entered, and more frequently if conditions likely to affect the background level change significantly, e.g., airborne contaminants are transported into the work areas from other sources.

If background concentration levels are found to present a potential health hazard, the levels of personal protection will be adjusted to provide protection from these additional exposures.

4.6 Response to Concentrations of Air Contaminants Above Background Levels

If the PID measures significant breathing zone concentrations in the work areas of organic vapors and gases above background levels, the following general guidelines will be used by the Site Health and Safety Representative as part of the decision-making criteria for establishing the appropriate level of protection:

- Background to 2 ppm above background - Level D protection as defined in Subsection 5.1.1 will be used. Field personnel will use their experience and judgment to aid in determining whether an initial reading greater than background is "drift" on the equipment, exhaust from an engine, or is from other sources of erroneous readings. However, personnel will not be allowed to continue work in the area until the cause for the high reading has been determined. The determination must be documented in the field log book.

- 2 ppm above background to 10 ppm above background - Level C protection as defined in Subsection 5.1.2 will apply. While working in Level C protection, if the airborne concentrations measured on the PID fall below 5 ppm for at least 10 minutes, and the tasks being conducted are not reasonably expected to generate a recurrence of airborne levels exceeding 5 ppm (above background), the RMT Site Health and Safety Representative may make the decision to return to Level D protection.

- Greater than 10 ppm above background - Personnel will leave the area, and work in that area will be suspended until the concentrations return to levels less than 10 ppm above background. The RMT Site Health and Safety Representative will notify the RMT Project Coordinator and the RMT Health and Safety Director as soon as practicable to inform them of the situation. After discussion, the RMT Site Health and Safety Representative may be authorized to re-enter the site with adequate personal protection to determine if the concentration levels persist. If the levels persist, additional air sampling may be required to identify and quantify the air contaminants responsible for the excessive concentrations. The additional sampling may be through a specific direct-reading method (e.g., Drager colorimetric tubes) or a method requiring laboratory analysis (e.g., personal sampling pump and sampling media). After evaluation of these data, the Health and Safety Director may adjust the level of protection required based on the nature and extent of the airborne substances present and the degree of hazard to which on-site personnel may be exposed.

4.7 Documentation

Air monitoring readings from direct-reading instruments will be recorded in the field log books with the date, time, location, task being conducted, concentration levels, and any observations noted. Concentration levels will be recorded prior to the start of field activities (which may cause contaminants to become airborne by disturbing contaminated soil or groundwater), every 30 minutes thereafter, and whenever there is any noticeable odor.

Section 5

LEVELS OF PROTECTION

5.1 Levels of Protection for Work Activities

In general, protective clothing must be worn whenever the potential exists for employees to come in contact with or to be exposed to contaminated materials.

Work activities will be conducted under Level D or Level C protection based on the most current information available on potential health and safety hazards on the site. If Level B or Level A protection is deemed necessary, modifications of the Workplan and an extension of the fieldwork schedule may be required.

5.1.1 Level D Protection: Background to 2 ppm Above Background

Based on an evaluation of the data and information available to date, field personnel will be adequately protected from potential health hazards present using Level D protection. Hence, all fieldwork will be conducted under Level D requirements unless the PID readings indicate that organic vapor concentrations exceed 2 ppm above background.

For tasks that involve little or no potential contact with contaminants, Level D protection will apply. Level D protection for these tasks will consist of the following:

- Steel-toe work shoes
- Impervious PVC overboots

During drilling and soil sampling, Level D protection will consist of the following to protect personnel from contact with contaminated soils:

- Steel-toe work shoes
- Eye protection: safety glasses, goggles, or full-face shield
- Impervious PVC overboots
- Impervious PVC gloves

- Polylaminated Tyvek® suits if potential for contact with clothing

During on-site activities with the potential for liquid splashes of contaminants, Level D protection will consist of the following:

- Steel-toe work boots
- Hard hat
- Eye protection: safety glasses, goggles, or full-face shield
- Impervious PVC overboots
- Impervious PVC gloves
- Polylaminated Tyvek® suits

Hard hats and hearing protection must also be worn whenever working around heavy equipment.

5.1.2 Level C Protection: 2 ppm Above Background to 10 ppm Above Background

Level C requirements include the protective clothing and equipment specified for the various categories of tasks listed under Level D protection plus air-purifying respirators which must be worn when working in Level C. Air-purifying respirators with organic vapor filters will be available on-site and will be used when working in Level C. Each person required to use a respirator will be issued the type and size of respirator as determined by that person's fit test.

5.1.3 Level B Protection: Greater Than 10 ppm Above Background

Level B protection requires that a self-contained breathing apparatus be used in addition to the personal protective clothing requirements. As stated in Subsection 4.6, if air contaminant concentrations exceed 10 ppm above background, work will be stopped and personnel will leave the area until concentrations return to levels less than 10 ppm above background or until the RMT Health and Safety Director determines that Level B protection is to be implemented and the required personal protective equipment has been obtained.

5.2 Changes in Levels of Protection

The RMT Site Health and Safety Representative may authorize a change in the level of protection based on an evaluation of actual field conditions after consulting with the RMT Corporate Health and Safety Director.

New air monitoring data may reveal the presence of concentrations of organic vapors or other air contaminants above acceptable levels for the type of respiratory protection being used. If this occurs, the RMT Site Health and Safety Representative will contact the RMT Health and Safety Director to evaluate the need to modify the level of protection required in a particular area and will discuss the results of the evaluation with the RMT Project Manager. If changes in the level of protection are warranted, the RMT Site Health and Safety Representative will inform the field personnel and the RMT Project Coordinator of the changes.

5.3 Work Limitations

- No smoking, eating, or drinking will be allowed in the work zones. Smoking is prohibited on CCP property.
- All personnel and equipment leaving the work zones must be properly decontaminated prior to leaving the site.
- A minimum of two persons will be on-site during work activities in the work zones. This may be one RMT person and one subcontractor person.

Section 6

SITE CONTROL

6.1 Purpose

The purpose of site control is to minimize the transfer of contaminants from and within the project site. Two contamination control methods are 1) establishment of work zones at the project site; and 2) decontamination of field personnel and equipment.

6.2 Work Zones

To prevent the spread of contaminants during the work, exclusion zones, contamination reduction zones, and support zones, will be used.

6.2.1 Exclusion Zone

The exclusion zone is the zone where hazardous substances may be present, based on available information. During field activities at the site, the boundaries of the exclusion zone will encompass the particular areas where work is being performed. Temporary exclusion zones will also be established around drilling rigs (30- to 40-foot radius) during subsurface investigations beyond the exclusion zones. All personnel entering these zones must wear the required protective equipment.

6.2.2 Decontamination Zone

The decontamination zone is a transition zone between contaminated and clean zones and serves as a buffer to reduce the possibility of the clean zone becoming contaminated.

Decontamination of field personnel and equipment will be done at each sampling site. Field personnel will wear the required personal protection while working in the decontamination zone. Protective equipment worn in the decontamination zone will be removed according to the procedures presented in Subsection 6.3.

6.2.3 Support Zone

The support zone is a noncontaminated or clean area. Support equipment (clean protective equipment, supplies, etc.) will be located in this zone, which will include the RMT field vehicle. Normal work clothing is appropriate in this zone.

The location of the support zone and any support facilities will be determined based on the following factors:

- Wind direction - preferably the support zone should be located upwind of the exclusion zone.
- Accessibility
- Support services - electric power supply, roads, drinking water, etc.

6.3 Decontamination Procedures

6.3.1 Field Personnel

Decontamination procedures will be as follows:

- Protective outer garments will be removed and placed in disposable plastic bags at the perimeter of the decontamination zone before leaving the decontamination zone.
- Boots will be removed first, then Tyvek® suits, and then outer gloves.
- For Level C work, respirators will then be removed, and spent cartridges or canisters will be removed to clean the facepiece. The inner gloves will then be removed.
- Field personnel will wash and dry their hands before leaving the contamination reduction zone, and used paper towels will be placed in the disposal bag.
- The plastic bags containing waste materials will be bagged and disposed off-site.

Clean outer garments will be kept accessible to field personnel in an area free from potential contamination. Water, soap, and paper towels will be kept in a clean location for both regular cleanup and emergency use.

Potable water for decontamination purposes will be brought to the site by the drilling contractor and stored in appropriate portable containers.

6.3.2 Sampling and Drilling Equipment

Sampling equipment used in the field will be decontaminated following the procedures specified in Section 7 of the FSP.

Section 7
CONTINGENCY PLAN

7.1 Purpose

This contingency plan provides the emergency information needed should there be a sudden, life- or health- threatening situation during work activities.

The provisions of the contingency plan are to be implemented immediately in the event of a fire, explosion, or accident which could threaten human health or the environment.

7.2 Emergency Contacts

Emergency contacts and telephone numbers for use in emergency situations occurring during field activities are as follows:

•	Fire Police	911 911
•	Hospital - St. Mary's Hospital - Ozaukee 743 North Montgomery Street Port Washington, WI (Hospital will be relocated to Mequon after 12/93)	414-284-5511
•	RMT, Inc., Office Madison, Wisconsin	608-831-4444
	Project Director - Jim Rickun	(w)608-831-1989 ext. 128 (h)608-274-2921
	Project Coordinator - Stacy McAnulty	(w)608-831-1989 ext. 195 (h)608-221-8062
	Corporate Health and Safety Director Christine Hansen	(w)608-831-1989 ext. 297 (h)608-241-5655
	WDNR Representative - Jill Fermanich	(w)608-266-5741
	USEPA Representative - Robert Smith	(w)312-886-7568
	RMT Site Coordinator - Gwen Porus	(w)608-831-1989 ext. 354 (h)608-251-1442
	CCP Office - Craig Bostwick	(w)414-284-5541 ext. 289

A map showing the site location and route to the hospital is included as Attachment 1. Directions to the hospital from the site are as follows: Turn right (east) on Route 33 in Saukville and follow 33 to I43. Get on I43 going north and continue to Port Washington exit. Take that exit and go south. Turn right at 2nd hospital sign, then go 2 1/2 blocks to St. Mary's.

7.3 Emergency Procedures

If an emergency situation develops at the site, the discoverer will take the following course of action:

- Notify the proper emergency services (fire, ambulance, police, etc.) for assistance.
- Notify any other affected personnel at the site.
- Contact RMT and the client contact to inform them of the incident as soon as possible.
- Prepare a summary report of the incident for RMT and the client contact as soon as possible after the incident.

7.4 Emergency Equipment

Emergency equipment that will be on-site with the RMT field personnel will include the following:

- First aid kit
- Clean water for emergency wash

Section 8

RECORD KEEPING

8.1 Training Attendance

Copies of each RMT employee's certificate of completion of the 40-hour Health and Safety Training for Hazardous Waste Sites and the 8-hour refresher course are maintained in the RMT Human Resources Department in the employee's personnel file. Each employee retains the original certificates issued.

8.2 Respirator Fit Test

Copies of respirator fit testing forms containing the RMT employee's name, test protocol used, respirator tested, and fit test results are distributed as follows:

- 1 copy to the employee
- 1 copy to employee's personnel file
- Signed original filed with the RMT Health and Safety Director

8.3 Medical Certification

The Dean Clinic, 1313 Fish Hatchery Road, Madison, Wisconsin, maintains each RMT employee's medical testing records. A certification of medical fitness to wear a respirator and perform required job functions, and any work restrictions is sent by the physician to the RMT Human Resources Department and is kept in the employee's personnel file.

8.4 Air Monitoring Results

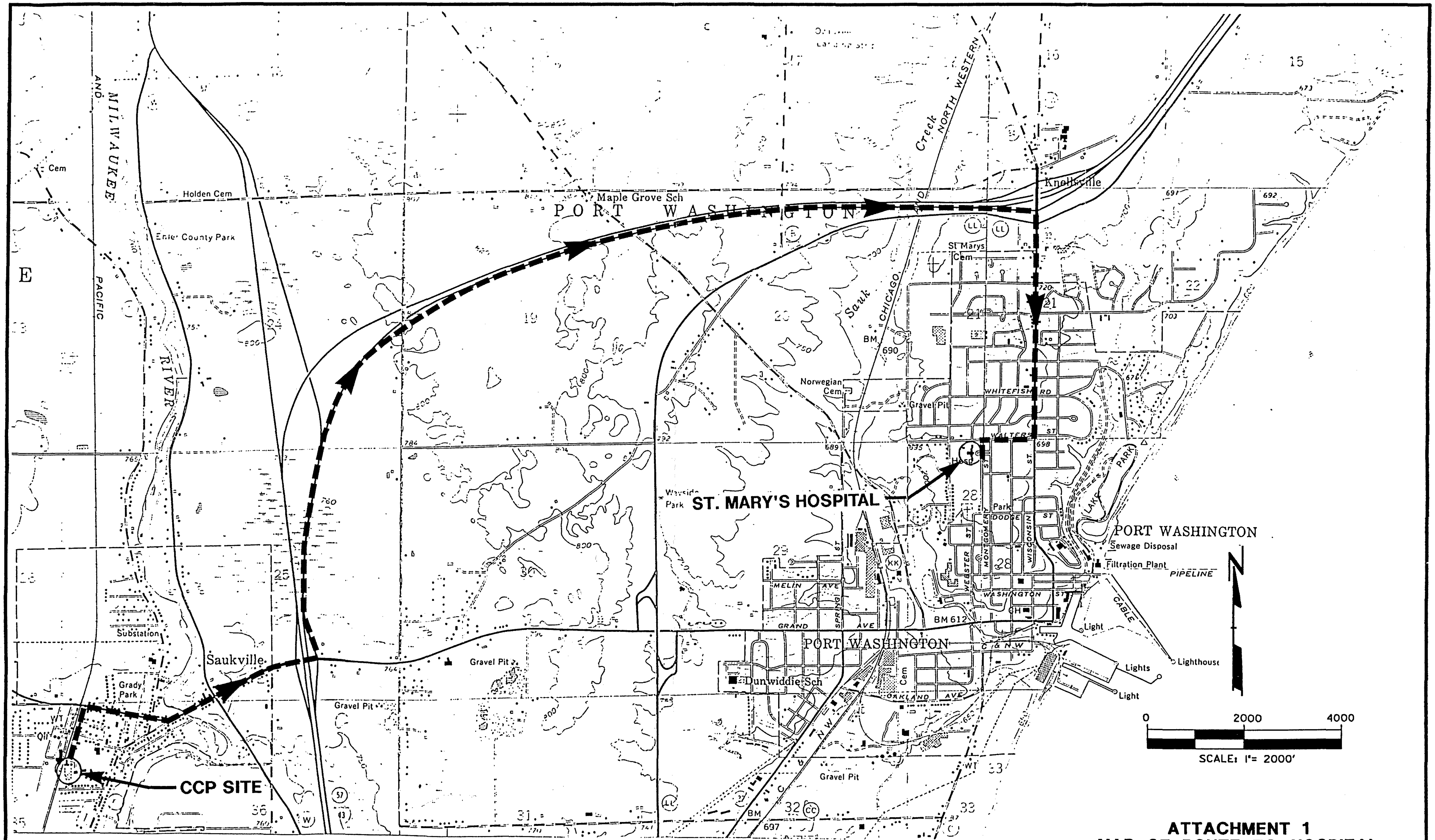
Airborne contaminant concentration levels obtained using the PID or other direct-reading monitors will be recorded in the field log book by the person making the readings. The date, time, location, work task being performed, concentration level measured, and any other observations will be noted.

8.5 Site Entry Log

Access to the site will be documented in a site entry log noting the person's name, company or agency affiliation, date, time entered the site, and time exited the site. The RMT Site Coordinator will be responsible for maintaining the log.

ATTACHMENT I

MAP OF ROUTE TO HOSPITAL



ATTACHMENT 1
MAP OF ROUTE TO HOSPITAL

SOURCE: PORT WASHINGTON EAST AND PORT WASHINGTON WEST, WISCONSIN 7.5 MINUTE USGS QUADRANGLES.

RMT INC.

Drawn By: DJW
Approved By:
Date: JANUARY, 1993
Proj. No.: 1832.37

ser ID = project
lot File = hospital.pr
lot Date = Mon Feb 3:02:09 1993
en Table = \plot\tabl def.tbl