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REVISED
GROUND-WATER MONITORING PLAN

FF/NN LANDFILL
RIPON, WISCONSIN

February 20, 2003

Prepared For:

FF/NN Landfill PRP Group

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1.0 INTRODUCTION

The FF/NN Landfill is located on South Koro Road in the Town of Ripon, Wisconsin (Figure 1-1). A Remedial Investigation was conducted for the FF/NN Landfill in Ripon, WI, in 1993-1994, and the results of this investigation can be found in *Remedial Investigation Report, FF/NN Landfill* dated August 19, 1994. *Remedial Action Monitoring Plans*, dated January 26, 1996 were prepared for the site, including a *Monitoring Program Plan, Quality Assurance Project Plan* and a *Health and Safety Plan for Ground-Water Monitoring During the Remedial Action.* These Remedial Action Monitoring Plans were implemented beginning in 1996, and have continued since that time.

Historically, the VOC impacts originating from the landfill had been limited to monitoring wells within the landfill boundaries or immediately downgradient. In October 2001, vinyl chloride was detected in two private drinking water wells located downgradient of the landfill. In response to these detections, an alternative source of water was provided to the affected homes and an additional investigation was undertaken to define the extent of vinyl chloride impacts. More frequent monitoring of existing wells has also occurred during the past year in order to address the concerns related to vinyl chloride detections. As of February 2003, the following has occurred:

* The extent of the vinyl chloride plume has been defined horizontally and vertically through installation of three deep monitoring wells and extensive groundwater sampling of existing monitoring and private drinking water wells.

* The public water supply was connected to the two affected homes, as well as a third home.

An evaluation of additional long-term remedies has also been requested by the WDNR for the vinyl chloride plume. A Focused Feasibility Study (FFS) work plan was submitted for comments to the WDNR on January 8, 2003. The final FFS will address the range of remedies available and their overall effectiveness for this site.

The purpose of this *Revised Groundwater Monitoring Plan* is to request from the WDNR a modification to the approved 1996 *Monitoring Program Plan*, taking into account the changes at the site that have occurred since that time. This *Plan* is more comprehensive in scope than all previous plans in order to provide additional data from which to evaluate remedies for the vinyl chloride-impacted groundwater. It is anticipated that this *Plan* will be revised appropriately for a long-term monitoring program once the additional data has been evaluated. Any future changes will be submitted for approval to the WDNR based on historical monitoring results.

2.0 HISTORICAL GROUND-WATER MONITORING PROGRAM

2.1 Well Inventory

Table 2-1 shows the existing monitoring wells (water table wells and piezometers) for the FF/NN Landfill. Table 2-2 shows the regularly monitored private drinking water wells along with private wells that have been sampled as part of the recent vinyl chloride investigation. Figure 2-1 shows the locations of these wells. The *December 2002 Status Report*, issued by GeoTrans, Inc. to the WDNR on January 27, 2003, provides recent analytical results for these wells.

As part of the extensive vinyl chloride investigation conducted in 2002, monitoring wells were organized into four stratigraphic groups to provide a method by which to delineate contamination at depth and laterally in the aquifer. The fourth column on Table 2-1 identifies the stratigraphic group to which each monitoring well belongs.

2.2 Historical Sampling

The 1996 *Monitoring Program Plan* included sampling of the following eleven monitoring wells: MW-101, MW-102, MW-103, P-103, MW-104, P-104, P-106, MW-107, P-107, P-107D and MW-108. MW-112 was added to the sampling list later in 1996. In 1999, MW-102, P-103, P-104 and P-108 were removed from the semiannual sampling program with WDNR approval. The routine groundwater monitoring schedule through the Fall of 2001 was as follows:

- Eight monitoring wells were sampled semi-annually. These wells included MW-101, MW-103, MW-104, P-106, MW-107, P-107, P-107D and MW-112.

- Seven private wells were sampled annually. These wells included Altnau, Baneck, Gaastra, Hadel, Miller, Rohde and Weiss.

2.3 Recent Results

The historical results for all monitoring and private wells are found in Appendix A. Figures 2-2, 2-3, 2-4 and 2-5 show the lateral delineation of vinyl chloride impacts for each stratigraphic unit

using 2002 analytical results (for some wells, the most recent data is from February 2002). The three maps can be used together to show vertical delineation of impacts as well.

3.0 REVISED GROUNDWATER MONITORING PLAN

3.1 Parameters Proposed for Analysis

3.1.1 Contaminants of Concern

The contaminants of concern (COC) at this site are chlorinated solvents and their breakdown products. Therefore, samples will be analyzed for volatile organic compounds (VOC). VOC samples from monitoring wells will be analyzed using EPA method SW846 8260B. Samples from drinking water wells will be analyzed using EPA method 524.2.

3.1.2 Natural Attenuation Parameters

One of the groundwater remedies considered in the forthcoming FFS is Monitored Natural Attenuation (MNA). Groundwater monitoring programs at sites utilizing MNA as a remedy generally sample for natural attenuation parameters. Table 3-1 provides a list of the parameters commonly used when performing MNA. Specifically, these parameters provide information about the geochemical environment and help to determine whether natural attenuation is occurring (WDNR, 2002 and EPA, 1998).

Included on Table 3-1 is the relevance of each parameter and whether it is appropriate for the FF/NN Landfill. The final column indicates the recommendation by GeoTrans of which parameters will be analyzed. This recommendation is based on local groundwater characteristics, groundwater sampling methods in place at the site and the relevance of the parameter for evaluating MNA at the landfill.

For those wells to be proposed for natural attenuation parameter sampling (Section 3.2), the following parameters will be analyzed:

Dissolved Oxygen (DO)	Specific Conductance
Iron II	Sulfate
Nitrate	Temperature
Oxidation Reduction Potential (ORP)	Total Organic Carbon (TOC)
pH	

DO, specific conductance, temperature, ORP and pH will be measured in the field using a water quality meter (generally a YSI 600). Measurements will be taken with the probe placed in the well.

Iron II will be measured in the field using a Hach field test kit (model 1R-18C). Nitrate, sulfate and TOC will be analyzed in the lab using methods EPA 353.2, EPA 300.0 and EPA 6010B, respectively.

3.2 Wells Proposed for Sampling and Sampling Frequency

3.2.1 Monitoring Wells Proposed for Sampling

Table 3-2 shows all wells at the site, describes the position of each well relative to the landfill and indicates whether the well had exceedances of groundwater standards for VOCs in 2002. The final two columns indicate which wells will be sampled for VOCs and which wells will be sampled for natural attenuation parameters. As can be seen, 15 wells will be sampled for VOCs, natural attenuation parameters or both. These wells will be sampled on a semi-annual basis.

3.2.2 Private Drinking Water Wells Proposed for Sampling

The 1996 *Monitoring Program Plan* for the landfill called for annual sampling of the Altnau, Baneck, Gaastra, Hadel, Miller, Rohde and Weiss private drinking water wells. The Ehster well was installed in November 2000 and was first sampled in October 2001 at the request of the PRPs and WDNR.

The Altnau, Ehster and Miller residences were connected to the water main in November 2002. The Ehster well was converted to a monitoring well (P-114) on January 29, 2003. The Altnau and Miller wells were abandoned in January 2003.

Based on the most recent delineation of vinyl chloride impacts in groundwater, the Gaastra, Baneck and Rohde wells are not within or downgradient of the vinyl chloride plume. Therefore, it is proposed that these wells return to an annual monitoring schedule with sampling to occur during the May event.

The Weiss well is the only well directly downgradient of the vinyl chloride plume and the Hadel well is near the western edge of the plume. These two wells will be monitored for VOCs on a quarterly basis for four quarters. In addition, well P-113B will also be monitored quarterly for four quarters for VOCs as it serves as a sentinel well for homes downgradient of its location. After four quarters of monitoring have been completed, the Hadel and Weiss wells and P-113B will be monitored semi-annually if no VOCs are detected above the NR140 standards.

3.3 Other Monitoring Activities

3.3.1 Groundwater Elevation Measurement

Measurements of both shallow and deep groundwater elevations during 2002 did not demonstrate steady state conditions, most likely due to the pumping by Northeast Asphalt in early 2002. To provide a comprehensive picture of the hydrogeological environment near the site, groundwater elevation measurements will be taken quarterly for four quarters and semi-annually, thereafter.

3.3.2 Hydrogeological Characterization of the Sandstone Aquifer

The 1994 RI evaluated the hydraulic conductivity of the aquifers beneath the landfill through the use of slug tests. However, only one of the wells installed at that time is screened in the sandstone, and it is actually screened at the base of the unit extending partly into the underlying quartzite and granite. Therefore, the hydraulic conductivity measurement from that well is representative of the basal sandstone unit.

Aquifer testing will occur in 2003 in the two newly-installed upper sandstone wells (P-111D and P-113B) to provide hydraulic conductivity values for the aquifer unit in which the vinyl chloride is primarily traveling. The testing will consist of slug tests using pressure transducers for data recording.

3.3.3 Leachate Wells

Per an August 7, 2002 letter from Jennie Pelczar of the WDNR, leachate wells must be sampled annually. During recent sampling events, only well LC-2 had sufficient water for sample collection, with both LC-1 and LC-3 being dry. Well LC-2 will be sampled annually. If wells LC-1 or LC-3 should have sufficient water for sample collection, they will be included in this annual schedule. LC-2 is scheduled to be sampled annually in May.

3.3.4 Landfill Cap Inspection

A landfill cap inspection will be conducted semi-annually to ensure that the integrity of the cap is maintained. The inspection will observe the type and extent of vegetation, any erosion due to overland flow and any impacts due to wildlife (burrows, deer trails, etc.). The inspection will be conducted in May and November.

3.3.5 Landfill Gas Monitoring

Landfill gas monitoring will be conducted semi-annually. Monitoring will occur at the 12 gas vents located within the landfill as well as at the nine water table wells in the vicinity of the landfill. Monitoring is scheduled to occur in May and November.

3.4 Field Methods

Field procedures and sample handling procedures are contained in the 1996 *Monitoring Program Plan*. These procedures will continue to be used at the site. Sampling procedures for the field measurements of natural attenuation parameters (iron II, DO and ORP) are found in Appendix B.

3.4.1 Sample Storage and Analysis

Ground water samples collected will be immediately placed on ice and sent to a Wisconsin-certified laboratory.

3.4.2 Quality Assurance/Quality Control (QA/QC)

Sample quality control will consist of collecting one duplicate sample per 10 samples per sampling event to evaluate analytical reproducibility. One trip blank per sampling event will be analyzed for VOCs.

The 1996 *Remedial Action Project Plans* included a *Quality Assurance Project Plan, Monitoring for Remedial Action* which included a quality assurance plan for analytical procedures for IEA Laboratories. IEA was subsequently replaced by NET (currently known as TestAmerica). Beginning in the fall of 2001, Northern Lake Service (NLS) was used for laboratory analysis for samples from the FF/NN Landfill because NLS could achieve a detection limit less than the Enforcement Standard for vinyl chloride, 0.20 parts per billion, while TestAmerica could not. The Quality Assurance Plan prepared by NLS is found in Appendix C.

4.0 REPORTING AND EVALUATION OF DATA

4.1 Reporting of Groundwater Monitoring Results

A status report will be submitted to the WDNR after each semi-annual sampling event. This report will include a description of field activities along with a summary of laboratory analytical results, groundwater elevations, field measurements and any significant observations. The report will also contain any actions recommended to be taken by the PRPs as well as a description of the next regularly scheduled sampling activities.

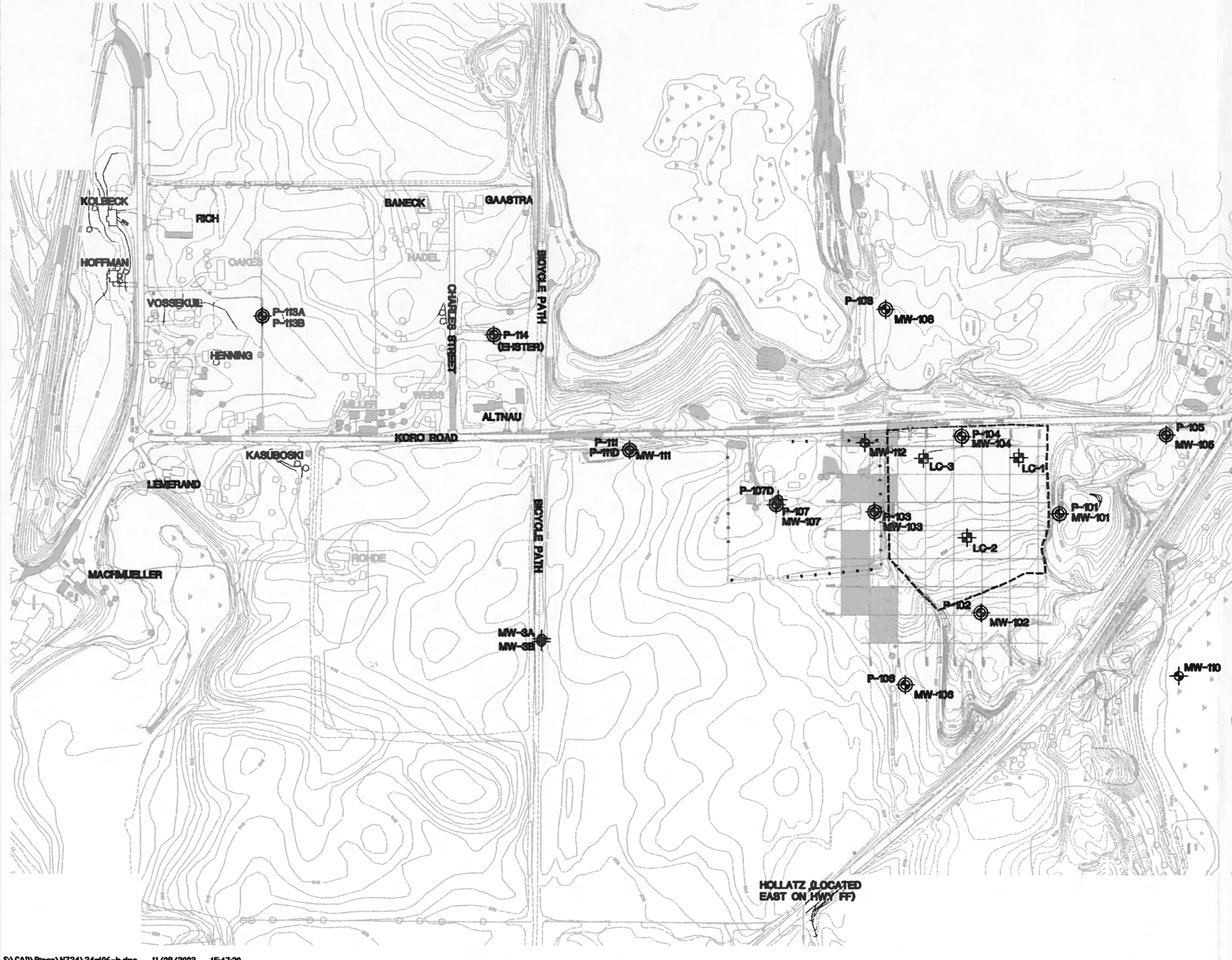
The lab results for the private homes will be forwarded to the WDNR within 10 days of GeoTrans receiving them from the lab. Historically, the WDNR has prepared and distributed letters to the residents regarding their private well analytical results. The PRPs request that the WDNR continue to transmit these letters.

5.0 REFERENCES

Wisconsin Department of Natural Resources, 2002. *Understanding Chlorinated Hydrocarbon Behavior in Groundwater: Investigation, Assessment and Limitations of Monitored Natural Attenuation* (Draft issued in December 2002). Publication RR-699.

US EPA, 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water*. EPA/600/R-98/128.

FIGURES



EXPLANATION

P-104 / MW-104 — MONITOR WELL, PIEZOMETER LOCATION, DESIGNATION

LC-2 — LEACHATE HEAD WELL LOCATION, DESIGNATION

— — — OUTLINE OF CLOSED LANDFILL

N

SCALE

0 700

Feet

FF/NN LANDFILL
RIPON, WISCONSIN

MONITORING AND PRIVATE WELL LOCATIONS

DATE:	4/30/02
DESIGNED:	GLD
CHECKED:	GLD
APPROVED:	GLD
DRAWN:	HJW
PROJ.:	N734

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Figure 2-1

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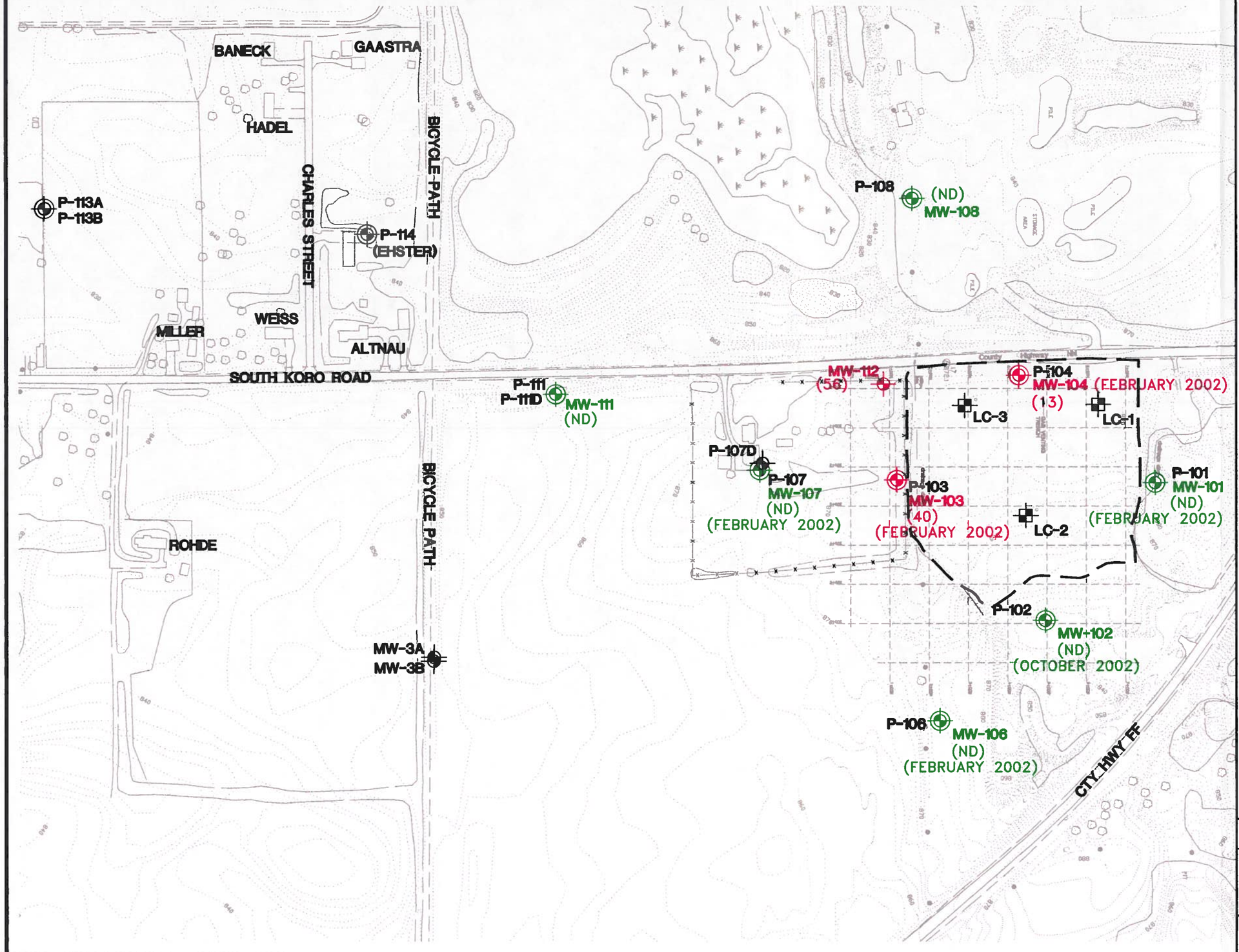

EXPLANATION

P-104 / MW-104	MONITOR WELL, PIEZOMETER LOCATION, DESIGNATION
LC-2	LEACHATE HEAD WELL LOCATION, DESIGNATION
— — —	OUTLINE OF CLOSED LANDFILL
(56)	CONCENTRATION OF VINYL CHLORIDE (ug/L)
(ND)	VINYL CHLORIDE NOT DETECTED

NOTE: ALL CONCENTRATIONS ARE THE MOST RECENT SAMPLE RESULTS FOR THE WELL. THIS IS DECEMBER 2002 UNLESS OTHERWISE INDICATED.

N

SCALE

0 500

Feet

RIPON FF/NN LANDFILL
RIPON, WISCONSIN

DELINEATION OF VINYL CHLORIDE IMPACTS - WATER TABLE WELLS DECEMBER 2002

DATE:	2/14/03
DESIGNED:	HWY
CHECKED:	HWY
APPROVED:	GLD
DRAWN:	HJW
PROJ.:	N734

GeoTrans, Inc.

Figure 2-2

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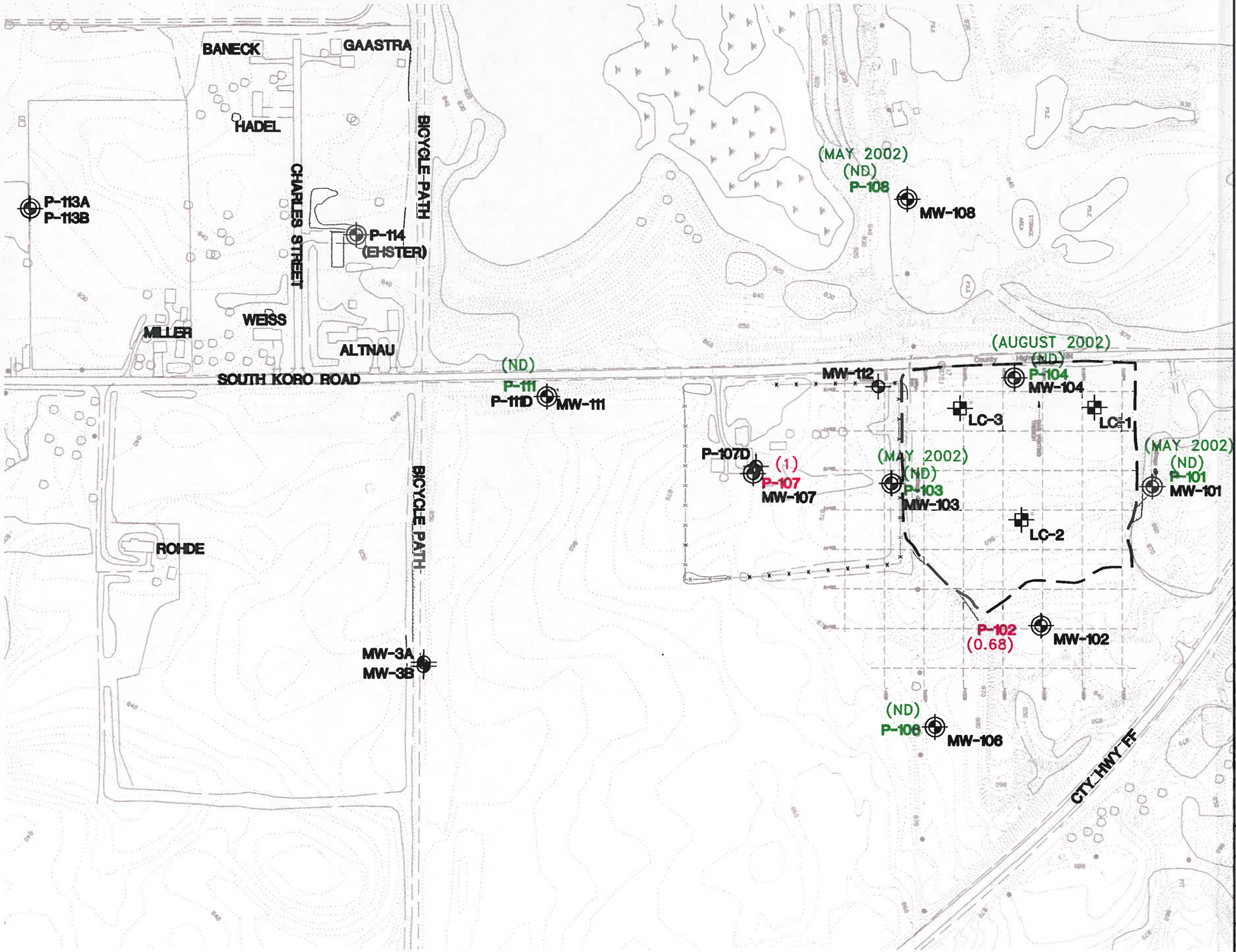

EXPLANATION

P-104 / MW-104	MONITOR WELL, PIEZOMETER LOCATION, DESIGNATION
LC-2	LEACHATE HEAD WELL LOCATION, DESIGNATION
— — —	OUTLINE OF CLOSED LANDFILL
(0.68)	CONCENTRATION OF VINYL CHLORIDE (ug/L)
(ND)	VINYL CHLORIDE NOT DETECTED

NOTE: ALL CONCENTRATIONS ARE THE MOST RECENT SAMPLE RESULTS FOR THE WELL. THIS IS DECEMBER 2002 UNLESS OTHERWISE INDICATED.

N

SCALE

0 500

Feet

RIPON FF/NN LANDFILL
RIPON, WISCONSIN

DELINEATION OF VINYL CHLORIDE IMPACTS - DEEPER UNCONSOLIDATED WELLS DECEMBER 2002

DATE:	2/14/03
DESIGNED:	HWY
CHECKED:	HWY
APPROVED:	GLD
DRAWN:	HJW
PROJ.:	N734

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Figure 2-3

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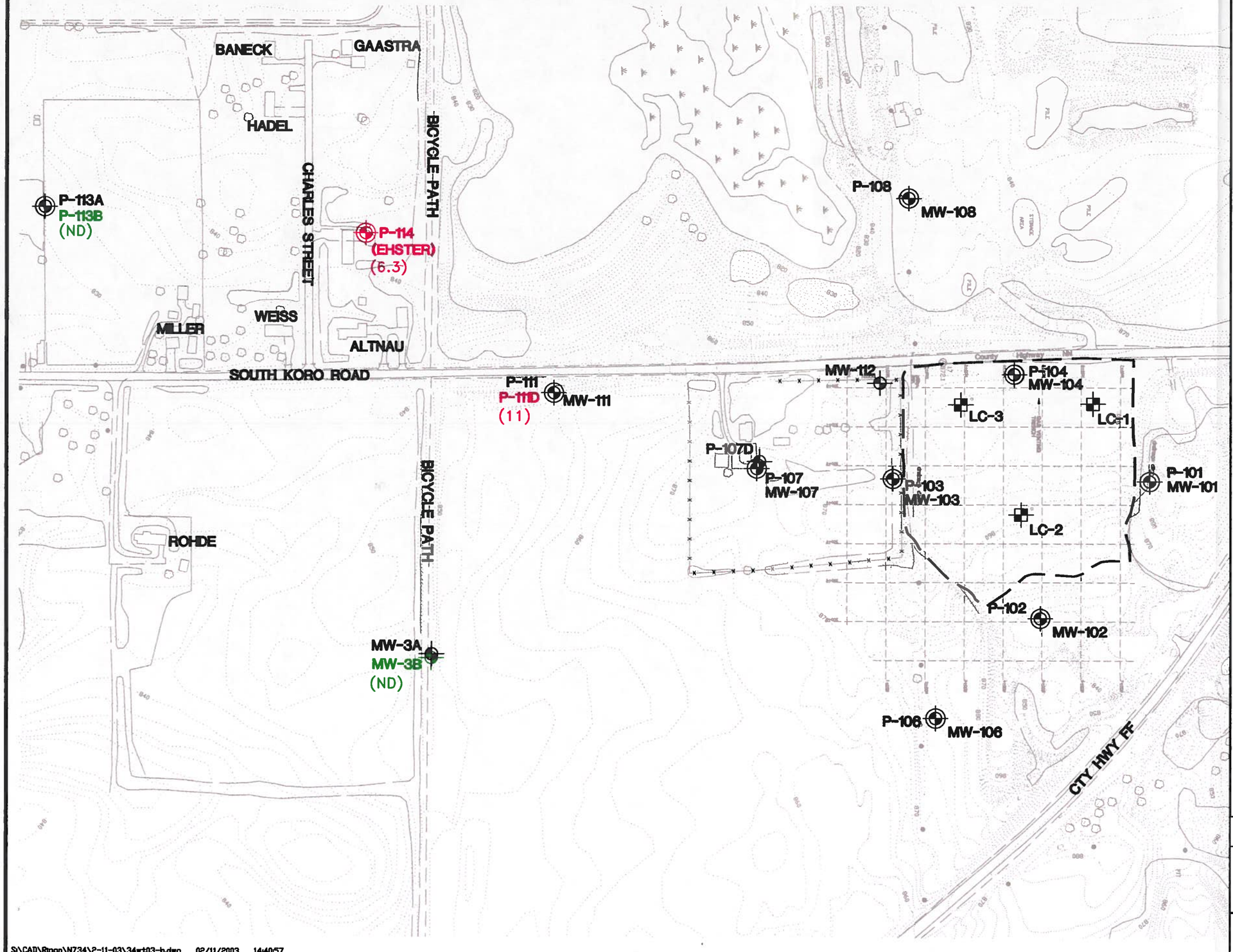

EXPLANATION

- P-104 / MW-104 — MONITOR WELL, PIEZOMETER LOCATION, DESIGNATION
- LC-2 — LEACHATE HEAD WELL LOCATION, DESIGNATION
- — — — OUTLINE OF CLOSED LANDFILL
- (6.3) — CONCENTRATION OF VINYL CHLORIDE (ug/L)
- (ND) — VINYL CHLORIDE NOT DETECTED

N

SCALE

0 500

Feet

RIPON FF/NN LANDFILL
RIPON, WISCONSIN

DELINEATION OF VINYL CHLORIDE IMPACTS - UPPER SANDSTONE WELLS DECEMBER 2002

DATE:	2/14/03
DESIGNED:	HWY
CHECKED:	HWY
APPROVED:	GLD
DRAWN:	HJW
PROJ.:	N734

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Figure 2-4

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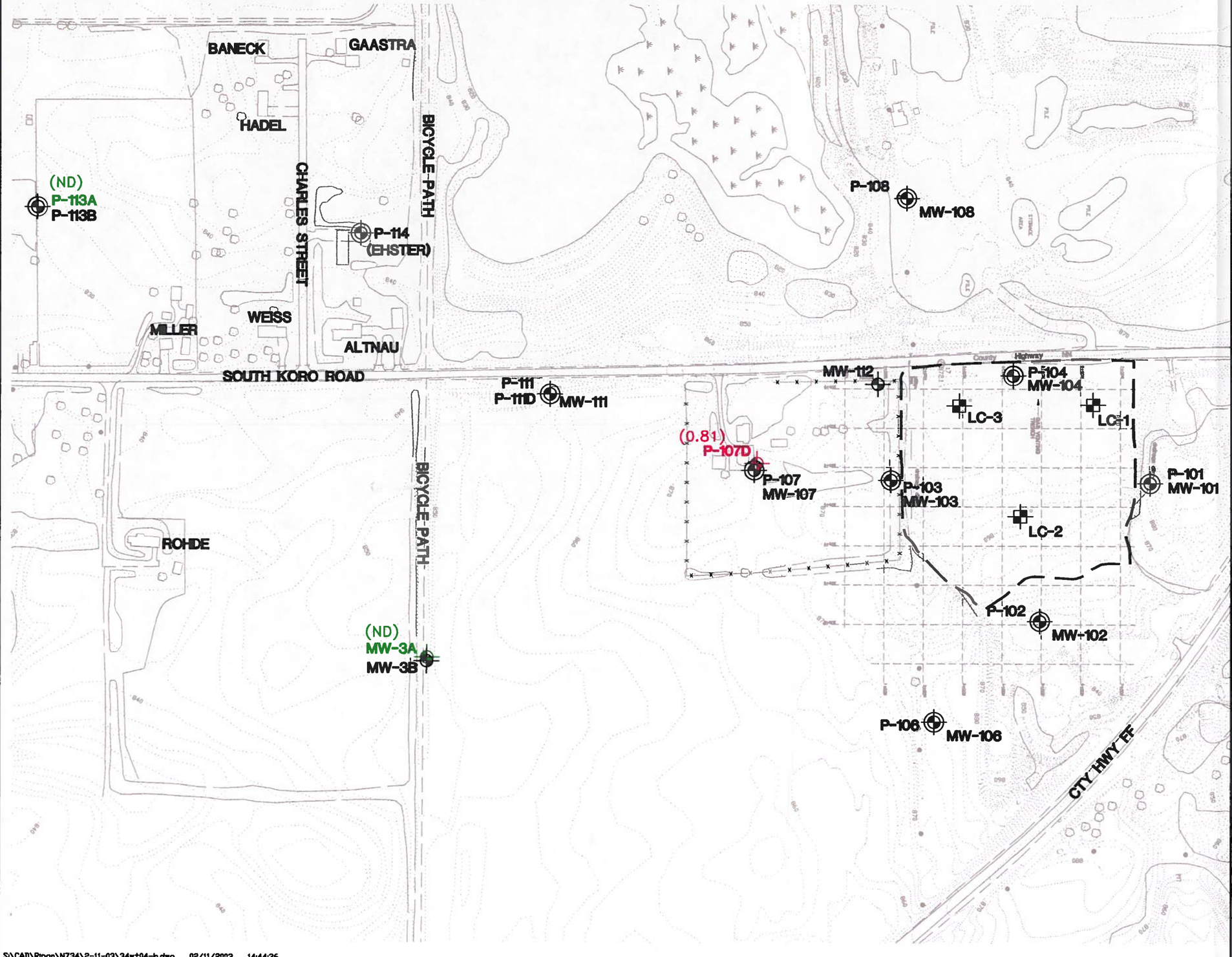

EXPLANATION

- P-104 / MW-104 — MONITOR WELL, PIEZOMETER LOCATION, DESIGNATION
- LC-2 — LEACHATE HEAD WELL LOCATION, DESIGNATION
- — — — OUTLINE OF CLOSED LANDFILL
- (0.81) — CONCENTRATION OF VINYL CHLORIDE (ug/L)
- (ND) — VINYL CHLORIDE NOT DETECTED

N

SCALE

0 500

Feet

RIPON FF/NN LANDFILL
RIPON, WISCONSIN

DELINEATION OF VINYL CHLORIDE IMPACTS - BASAL SANDSTONE WELLS DECEMBER 2002

DATE:	2/14/03
DESIGNED:	HWY
CHECKED:	HWY
APPROVED:	GLD
DRAWN:	HJW
PROJ.:	N734

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Figure 2-5

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TABLES

Table 2-1: Inventory of Monitoring Wells
FF/NN Landfill, Ripon, WI

Water Table Wells	TOC Elev	Well Screen Elev	Stratigraphic Group
MW-101	884.8	820.4	Water Table
MW-102	843.05	818.9	Water Table
MW-103	872.42	818.7	Water Table
MW-104	875.15	819.3	Water Table
MW-106	878.9	821.0	Water Table
MW-107	871.78	816.5	Water Table
MW-108	845.25	814.9	Water Table
MW-111	856.46	812.3	Water Table
MW-112	874.55	814.1	Water Table

Piezometers	TOC Elev	Well Screen Elev	Stratigraphic Group
P-101	885.26	790.0	Deeper Unconsolidated
P-102	842.99	781.3	Deeper Unconsolidated
P-103	872.92	789.9	Deeper Unconsolidated
P-104	875.48	782.0	Deeper Unconsolidated
P-106	878.91	791.7	Deeper Unconsolidated
P-107	871.38	785.6	Deeper Unconsolidated
P-107D	871.98	544.0	Basal Sandstone/Granite
P-108	845.61	783.5	Deeper Unconsolidated
P-111	856.13	774.2	Deeper Unconsolidated
P-111D	855.79	704.0	Upper Sandstone
P-113A	833.09	507.8	Basal Sandstone/Granite
P-113B	833.1	634.2	Upper Sandstone
P-114 (Ehster)			Upper Sandstone
WPL MW-3A	850.77	570.0	Basal Sandstone/Granite
WPL MW-3B	851.04	665.0	Upper Sandstone

Leachate Wells	TOC Elev
LC-1	873.15
LC-2	866.05
LC-3	877.34

Table 2-2: Inventory of Private Drinking Water Wells
FF/NN Landfill, Ripon, WI

Wells Previously Monitored on an Annual Basis

Altnau	N8798 S. Koro Rd	
Baneck	W14298 Charles St	
Ehster	W14271 Charles St	(monitored beginning 10/01)
Gaastra	W14297 Charles St	
Hadel	W14292 Charles St	
Miller	N8756 S. Koro Rd	
Rohde	N8745 S. Koro Rd	
Weiss	N8778 S. Koro Rd	

Additional Wells Sampled for 2002 Vinyl Chloride Investigation

Fude	N9005 S. Koro Rd.
Henning	W14255 S. Koro Rd
Hoffman	W14274 S. Koro Rd
Hollatz	N8789 CTH FF
Kolbek	W14294 S. Koro Rd
Kasuboski	N8711 S. Koro Rd
Lemerand	N8705 S. Koro Rd
Oakes	W14273 S. Koro Rd
Rich	W14293 S. Koro Rd
Sauer	N8980 S. Koro Rd.
Machmueller	N8679 S. Koro Rd
Vossekuil	W14265 S. Koro Rd

Table 3-1 Natural Attenuation (Geochemical) Parameters
FF/NN Landfill
Ripon, WI

	Reason for taking	How taken *	Concerns in Sample Collection	Recommend?
Chloride	To verify water is coming from same aquifer; final breakdown product	In plastic bottle (lab procedure)	Additional concentrations (in ppb) not discernable above background levels	No - we know where water is coming from
Dissolved Oxygen (DO)	To determine if environment is aerobic	Downhole with meter	Grundfos pumps, where used, may be aerating water during purge process	**Yes**
Ethane	Is a breakdown product of chlorinated ethanes	In 40mL vials (lab procedure)	Sample may get aerated during sampling process, off-gassing ethene	No (no chlorinated ethanes at site)
Ethene	Is a breakdown product of chlorinated ethenes	In 40mL vials (lab procedure)	Sample may get aerated during sampling process, off-gassing ethene	No - Dec 02 samples all non-detect
Hydrogen	Useful for when other methods for determining redox environment are ineffective	Closed system sampling (bubble strip sampling - lab analysis)	Sampling equipment expensive and difficult to use, and process is time-consuming	No - Expensive and time-consuming. Not necessary unless other methods of determining redox are ineffective
Iron II	Defines the redox environment -- Vinyl chloride may be oxidized in iron-reducing environment	Field test kit	Sampling method may oxidize iron to iron III	**Yes**
Manganese II	Can serve as an electron donor for reductive dechlorination	Field test kit	Sampling method may change valence state of manganese	No - High background levels may be too high for field test kit
Methane	Indicates the most reduced groundwater conditions.	In 40mL vials (lab procedure)	Sample may get aerated during sampling process, off-gassing methene	No - Dec 02 samples were mostly non-detect; detects were very low levels
Nitrate	Nitrate suppresses reductive dechlorination	In plastic bottle (lab procedure)	None	**Yes**
Oxidation Reduction Potential (ORP)	A measure of redox environment	Downhole with meter	Grundfos pumps, where used, may be aerating water during purge process	**Yes**
pH	Always taken when groundwater sampling	Downhole with meter	None	**Yes**
Specific Conductance	Always taken when groundwater sampling	Downhole with meter	None	**Yes**
Sulfate	Concentrations indicates redox environment is not sulfur-reducing	In plastic bottle (lab procedure)	None	**Yes**
Sulfide	Indicates significantly reduced environment	In plastic bottle (lab procedure)	Sulfide may get oxidized or precipitated during sampling	No - Dec 02 samples all non-detect
Temperature	Always taken when groundwater sampling	Downhole with meter	None	**Yes**
TOC	Measures organic carbon available which may serve as cometabolic food source or as competition for chlorinated solvents	In plastic bottle (lab procedure)	None	**Yes**

*** Sample methods noted in text of groundwater monitoring plan**

Table 3-2: Well Summary for Revised Groundwater Monitoring Program
FF/NN Landfill
Ripon, WI

Stratigraphic Grouping	Well ID	Location Relative to Landfill	VOC exceedances in 2002?	Comments	Sampling Parameters	
					VOCs	Natural Attenuation
Water Table (25-65 ft bgs)	MW-101	Upgradient	No	To be used for background levels		✓
	MW-102	Side gradient	No			
	MW-103	Down gradient	Yes	Has parent & breakdown products	✓	✓
	MW-104	Within landfill	Yes	Characterizes environment within waste boundary	✓	✓
	MW-106	Side gradient	No			
	MW-107	Down gradient	Yes	Only has TCE; nested with two wells with vinyl chloride	✓	✓
	MW-108	Side gradient	No			
	MW-111	Down gradient	No			
	MW-112	Down gradient	Yes		✓	
Deeper Unconsolidated (62-95 ft bgs)	P-101	Upgradient	No	To be used for background levels		✓
	P-102	Side gradient	Yes		✓	
	P-103	Down gradient	No	Nested with well having parent & breakdown products		✓
	P-104	Beneath landfill	Yes**			
	P-106	Side gradient	Yes		✓	
	P-107	Down gradient	Yes	In centerline of plume	✓	✓
	P-108	Side gradient	No			
	P-111	Down gradient	No	In centerline of plume	✓	✓
Upper Sandstone (152-199 ft bgs)	MW-3B	Down gradient	No	Screened in pertinent sandstone unit	✓	✓
	P-111D	Down gradient	Yes	In centerline of plume	✓	✓
	P-113B	Down gradient	No	Downgradient of centerline of plume	✓	✓
	P-114 (Ehster)	Down gradient	Yes	In centerline of plume	✓	✓
Basal Sandstone* (281-328 ft bgs)	MW-3A	Down gradient	No	Screened in pertinent sandstone unit	✓	✓
	P-107D	Down gradient	Yes	In centerline of plume	✓	✓
	P-113A	Down gradient	No	Downgradient of centerline of plume	✓	✓

* P-107D is partially screened in granite/quartzite

** Chloromethane was detected once in Feb 02 and never detected again. This was the only VOC exceedance (a PAL).

APPENDIX A

HISTORICAL GROUNDWATER RESULTS

Table 2 - VOC Sampling Results for Groundwater
FF/NN Landfill, Ripon, WI

Sampling Point:	Collection Date:	Parameters																																
		Benzene	Bromomethane	2-Butanone (MEK)	sec-Butylbenzene	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	1,4-dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-dichloroethane	1,1-Dichloroethene	cis-1,2-dichloroethene	trans-1,2-Dichloroethene	1,2-dichloropropane	Ethylbenzene	Isopropylbenzene	Methylene chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	1,2,4-Trichlorobenzene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl Chloride	Total Xylenes	MTBE	Isopropyl Ether
MW-3A	04/04/2002			NA																														
	05/22/2002			NA																														
	08/20/02																																	
	12/05/02																																	
MW-3B	04/04/2002			NA																			0.38						0.31				
	05/22/2002			NA																		NA												
	08/20/2002																					NA												
	12/05/2002																																	
MW-101	Oct-93																				0.7 J												
	Apr-94																				0.6J												
	May-96																				0.6J												
	Oct-96								0.89 J												0.72 J												
	May-97																																	
	Oct-97																				0.7												
	4/98*																																	
	Oct-98																																	
	Apr-99																																	
	Oct-99																				0.7												
	May-00																				0.32												
	Oct-00																				0.38												
	01-May																				0.28												
	10/11/2001																																	
	02/05/2002			NA							0.19										0.32	NA			0.16								
	05/21/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/19/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/5/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-101	Oct-93																																	
	Apr-94																						0.5J											
	02/05/2002			NA																		NA												
	05/22/2002			NA																		NA												

Table 2 - VOC Sampling Results for Groundwater
FF/NN Landfill, Ripon, WI

Sampling Point:	Collection Date:	Parameters																													
		Benzene	Bromomethane	2-Butanone (MEK)	sec-Butylbenzene	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	1,4-dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-dichloroethane	1,1-Dichloroethene	cis-1,2-dichloroethene	trans-1,2-Dichloroethene	1,2-dichloropropane	Ethylbenzene	Isopropylbenzene	Methylene chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	1,2,4-Trichlorobenzene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl Chloride	Total Xylenes	MTBE	Isopropyl Ether
MW-102	10/26/1993																														
	04/11/1994																						3								
	05/08/1996																						0.4J								
	10/30/1996								0.99 J												0.30 J										
	05/12/1997																														
	10/26/1997																														
	04/13/1998														0.46																
	10/11/2001																														
	5/21/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/19/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/5/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-102	10/26/1993																														
	04/11/1994																														
	10/11/2001																														
	05/21/2002			NA																		NA						[0.33]			
	08/20/2002																					NA						0.62			
	12/04/2002																											0.68			
MW-103	10/27/1993														410													75			
	04/11/1994														1100													440			
	4/1/1994 Dup														970													410			
	May-96					7J									740	9J									10J			170			
	5/1/1996 Dup					8J			9J						840	10J									11J			180			
	Oct-96	3.3				8.1 J	1.9		1.1	0.76 J		0.99 J		0.30 J	520 E	5	1.9								4.7			98 E			
	May-97	4.3				8.5	2.7			0.98		1.2	0.52	0.75	790	4.7	1.6								5.6			230		0.27	
	Oct-97	4.2				7.9	2.4			1.4		0.89	0.38		550J	5.2	1.5					3.1			6.6			220J		0.38	0.57
	4/98*																														
	Oct-98	2				5.7									260	3.3									5.8			45			
	Apr-99	1.4				4.7									150	2.4									3.9			47			
	Oct-99					5.2									170	2.6									2.4			48			
	May-00	1.8				6.5									170	3.4									4.1			60			
	Oct-00	1.6				6.9	3.1			0.84		0.33			130	4.5	0.75								6.6			78			
	May-01	1.2				5.7	1.5			0.92					94	3.4	0.54			2.6L		1.1			4.5			46			
	10/11/2001	1.1		80		2.6	0.62			0.54					25	2.7				6.4L			0.8					15			
	02/04/2002	1.8		NA		6.4	1.1			0.81		0.36			71	5.5	0.53			0.28	0.13	NA	0.72		3.1			40			0.3
	5/21/2002*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/19/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/5/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2 - VOC Sampling Results for Groundwater
FF/NN Landfill, Ripon, WI

		Parameters																															
Sampling Point:	Collection Date:	Benzene	Bromomethane	2-Butanone (MEK)	sec-Butylbenzene	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	1,4-dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-dichloroethane	1,1-Dichloroethene	cis-1,2-dichloroethene	trans-1,2-Dichloroethene	1,2-dichloropropane	Ethylbenzene	Isopropylbenzene	Methylene chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	1,2,4-Trichlorobenzene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl Chloride	Total Xylenes	MTBE	Isopropyl Ether
P-103	10/27/1993																																
	04/12/1994																																
	05/09/1996														0.1J								0.1J						0.1J				
	10/31/1996								0.84 J																								
	05/13/1997																																
	10/27/1997																																
	04/13/1998																																
	02/04/2002			NA																		NA											
	05/21/2002			NA											[0.54]							NA											
MW-104	10/27/1993	2				2				2					1 JB								31										
	04/19/1994	1				1				1					10										0.8J				6				
	05/09/1996	6				5	1		0.3J			0.2 J			6	0.3 J		0.1J					0.2 J		0.5J				10				
	10/30/1996	0.64 J				1.1	0.34 J		0.46 J						3.6	0.22 J		0.80 J							0.31 J				4.3	0.77 J			
	05/12/1997	4.8				4.5	1.5			0.91					1.1														4.5		0.32		
	10/27/1997	0.63				1.3				0.85					7.3														18				
	04/13/1998	1.2													74	0.67							0.46		3.5				17				
	10/13/1998	1.7								0.76					3.3														15	4.1			
	04/07/1999	3.2				1.4									6.6										0.71				6.1				
	10/27/1999	3.5				5.4				0.92					4.5														2.8				
	05/02/2000	3				5.7				1.5					0.7								0.13						1.1				
	10/30/2000	2				6.2				1.6					2.6								0.12		0.33				29				
	May-01	2.5				5.6				2	0.47				7				0.26	0.51L		0.81	0.13		0.66				8.6				
	10/11/2001	3.1				9.5				2.3				0.85	2					0.39L			0.1				0.14		2.2				
	02/05/2002	2.7		NA	0.16	8				2	0.19				5.1				0.23			NA	0.17		0.73				13				
	5/21/2002*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/19/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/5/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-104	10/27/1994																																
	04/19/1994																																
	05/09/1996																																
	10/30/1996								0.20 J																								
	05/12/1997																																
	10/27/1997																																
	04/13/1998																																
	10/11/2001																			0.52L													
	02/05/2002	0.18		NA					0.85													NA											
	05/21/2002			NA																		NA											
	08/20/2002																					NA											

Table 2 - VOC Sampling Results for Groundwater
FF/NN Landfill, Ripon, WI

Sampling Point:	Collection Date:	Parameters																														
		Benzene	Bromomethane	2-Butanone (MEK)	sec-Butylbenzene	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	1,4-dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-dichloroethane	1,1-Dichloroethene	cis-1,2-dichloroethene	trans-1,2-Dichloroethene	1,2-dichloropropane	Ethylbenzene	Isopropylbenzene	Methylene chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	1,2,4-Trichlorobenzene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl Chloride	Total Xylenes	MTBE	Isopropyl Ether
MW-105	10/26/1993																															
	04/13/1994																															
	Well aband.																															
P-105	10/26/1994																															
	04/13/1994																															
	Well aband.																															
MW-106	Oct-93																															
	Apr-94																						11									
	02/04/02			NA																		NA	0.25								
	05/21/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/19/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/5/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
P-106	Oct-93																								0.61							
	Apr-94																								0.81							
	May-96														0.2 J										0.81							
	Oct-96								0.62J																0.22 J							
	May-97																								0.65							
	Oct-97																								0.67							
	Apr-98																								0.61							
	Oct-98																								0.71							
	Apr-99																								0.58							
	Oct-99																								0.61							
	May-00																								0.56							
	Oct-00																								0.6							
	May-01																								0.56							
	10/11/2001																								0.39							
	02/05/2002			NA																		NA			0.6							
	02/05/2002 Dup			NA																		NA			0.6							
	05/22/2002			NA																		NA			0.49							
	05/22/2002Dup			NA																		NA			[0.47]							
	08/20/2002																					NA			[0.43]							
	12/04/2002																								0.53							

Table 2 - VOC Sampling Results for Groundwater
FF/NN Landfill, Ripon, WI

		Parameters																													
Sampling Point:	Collection Date:	Benzene	Bromomethane	2-Butanone (MEK)	sec-Butylbenzene	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	1,4-dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-dichloroethane	1,1-Dichloroethene	cis-1,2-dichloroethene	trans-1,2-Dichloroethene	1,2-dichloropropane	Ethylbenzene	Isopropylbenzene	Methylene chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	1,2,4-Trichlorobenzene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl Chloride	Total Xylenes	MTBE	Isopropyl Ether
MW-107	10/27/1993																								2						
	04/12/1994																								2						
	05/09/1996																								2						
	10/21/1996								0.80 J																2.2						
	05/13/1997										0.9														2.6						
	10/27/1997										0.7														2						
	04/14/1998																								2.1						
	10/13/98*																								NA						
	04/06/1999																								1.8						
	10/27/1999																								1.1						
	05/02/2000																								1.6						
	10/31/2000																								1.2						
	05/31/2001										0.47									0.57L					1.8						
	10/11/2001																								0.87						
	02/04/2002			NA							0.35											NA			1.4						
	05/21/2002*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/19/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/5/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2 - VOC Sampling Results for Groundwater
FF/NN Landfill, Ripon, WI

		Parameters																												
Sampling Point:	Collection Date:	Benzene	Bromomethane	2-Butanone (MEK)	sec-Butylbenzene	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	1,4-dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-dichloroethane	1,1-Dichloroethene	cis-1,2-dichloroethene	trans-1,2-Dichloroethene	1,2-dichloropropane	Ethylbenzene	Isopropylbenzene	Methylene chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	1,2,4-Trichlorobenzene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl Chloride	Total Xylenes	MTBE	Isopropyl Ether
P-107	10/27/1993														4														6			
	04/12/1994														2								0.7J						3			
	4/12/1994 Dup														2								0.7J						3			
	05/09/1996	0.1 J					0.2 J								2								0.1 J		0.1 J				2			
	10/23/1996						0.19		0.79 J						1.9														2.3			
	10/23/96 DUP						0.21		0.49 J						2.1														2.7			
	05/14/1997														1.3														2			
	5/14/97 Dup														1.1														1.7			
	10/27/1997														2.2														2.6			
	10/27/97 DUP														1.8														2.3			
	04/14/1998														2.3														2.2			
	4/14/98 Dup														2.3														2.4			
	10/14/1998														2.1									0.2					1.5			
	10/14/98 DUP														2.4														1.7			
	04/06/1999														1.5														0.58			
	10/27/1999														1.8																	
	10/27/99 DUP														1.8																	
	05/02/2000														1.5														1.2			
	5/02/00 Dup														1.6														1.2			
	10/31/2000														1.4																	
	10/31/00 DUP														1.4																	
	05/09/2001														0.96					0.52L		0.72			1.8				0.85			
	5/9/2001 Dup														0.97					0.49L		0.79							0.86			
	10/11/2001														1.6														1.7			
	10/11/01DUP														1.5														1.7			
	02/04/2002			NA											1.6							NA							1.2			
	05/21/2002			NA											1.8							NA							1.5			
	5/21/02DUP			NA											1.7							NA							1.4			
	08/20/2002														0.84							NA							[0.54]			
	12/04/2002														1.3														1			

Table 2 - VOC Sampling Results for Groundwater
FF/NN Landfill, Ripon, WI

Sampling Point:	Collection Date:	Parameters																														
		Benzene	Bromomethane	2-Butanone (MEK)	sec-Butylbenzene	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	1,4-dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-dichloroethane	1,1-Dichloroethene	cis-1,2-dichloroethene	trans-1,2-Dichloroethene	1,2-dichloropropane	Ethylbenzene	Isopropylbenzene	Methylene chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	1,2,4-Trichlorobenzene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl Chloride	Total Xylenes	MTBE	Isopropyl Ether
P-107D	10/27/1993														2B														6			
	04/13/1994																															
	05/09/1996	0.1J							0.3J						0.2J								0.3J						0.6J			
	10/23/1996								0.44 J																				3.9			
	05/14/1997														0.49														2.4			
	10/27/1997														1.7														5.1			
	04/14/1998														1														4.1			
	10/14/1998																												2.2			
	04/06/1999														0.34														0.87			
	10/27/1999																												1.7			
	05/02/2000																												1.3			
	10/31/2000														0.64																	
	01/05/2001		0.33												1.5					0.44L		0.72B							5.6			
	10/11/2001														2.2														10			
	02/04/2002			NA											1.2							NA			0.17				3.9			
	02/04/2002 Dup														1.2														3.9			
	05/21/2002			NA											1.1							NA							3.3			
	08/20/2002														1.1							NA							3.1			
	12/04/2002														0.75														0.81			
MW-108	10/18/1993																						11									
	04/13/1994																						2									
	05/08/1996														0.2 J								0.2 J									
	10/23/1996								0.85 J																							
	05/12/1997																															
	10/27/1997																															
	04/14/1998																															
	10/11/2001																			0.34L												
	05/21/2002*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/19/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/05/2002																															
P-108	10/25/1993																															
	10/25/1993 Dup																															
	04/13/1994																															
	4/13/1994 Dup																															
	10/11/2001																			0.32L												
	02/05/2002			NA																		NA										
	05/21/2002			NA																		NA										

Table 2 - VOC Sampling Results for Groundwater
FF/NN Landfill, Ripon, WI

		Parameters																														
Sampling Point:	Collection Date:	Benzene	Bromomethane	2-Butanone (MEK)	sec-Butylbenzene	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	1,4-dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-dichloroethane	1,1-Dichloroethene	cis-1,2-dichloroethene	trans-1,2-Dichloroethene	1,2-dichloropropane	Ethylbenzene	Isopropylbenzene	Methylene chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	1,2,4-Trichlorobenzene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl Chloride	Total Xylenes	MTBE	Isopropyl Ether
P-109	10/21/1993																															
	04/13/1994																															
	Well aband.																															
MW-110	10/19/1993																															
	04/13/1994																						6									
	Well aband.																															
MW-111	04/19/1994																															
	10/11/2001																			0.30L												
	05/21/2002*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	08/19/2002																					NA										
	12/05/2002																															
P-111	04/19/1994																						2									
	10/11/2001																															
	02/05/2002			NA																		NA										
	05/22/2002			NA																		NA										
	08/19/2002																					NA										
	08/19/2002 Dup																					NA										
	12/05/2002																															
	12/05/2002 Dup																															
P-111D	04/04/2002														0.6								0.3						13			
	05/22/2002			NA											[0.59]							NA							15			
	08/19/2002														[0.37]							NA							12			
	12/05/2002														[0.42]														11			

Table 2 - VOC Sampling Results for Groundwater
FF/NN Landfill, Ripon, WI

		Parameters																														
Sampling Point:	Collection Date:	Benzene	Bromomethane	2-Butanone (MEK)	sec-Butylbenzene	Chlorobenzene	Chloroethane	Chloroform	Chloromethane	1,4-dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-dichloroethane	1,1-Dichloroethene	cis-1,2-dichloroethene	trans-1,2-Dichloroethene	1,2-dichloropropane	Ethylbenzene	Isopropylbenzene	Methylene chloride	Tetrachloroethene	Tetrahydrofuran	Toluene	1,2,4-Trichlorobenzene	Trichloroethene	Trichlorofluoromethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl Chloride	Total Xylenes	MTBE	Isopropyl Ether
MW-112	11/27/1996	0.61					2 J								59	1 J									31				15			
	11/27/1996 Dup	0.71					2 J								58	1 J									41				16			
	05/12/1997	0.59				0.27									5.4														2.2			
	10/26/1997	0.5				0.29									1.3																	
	04/13/1998	0.69					1.4								57	1.3									1.9				12			
	10/13/1998	0.76													80										1.2				25			
	04/06/1999	0.72					1.4								40	0.56									1.7				7.9			
	10/27/1999														7.6										1							
	05/02/2000	0.46													3.4										0.39							
	10/30/2000					0.37									5.6										0.37							
	05/09/2001	0.42				0.42									3.5														0.98			
	10/11/2001	0.36				0.39	0.53								27										0.83				3.7			
	02/04/2002	0.23		NA		0.48									0.49							NA										
	05/21/2002*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8/19/2002 *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12/04/2002														150										[2.7]				56			
P-113A	09/12/2002							[0.37]															[1.0]									
	12/03/2002																															
P-113B	09/11/2002 #							J										[0.41]					6.6						2.6			
	12/03/2002																															
WDNR NR140	PAL	0.5	1	90	NE	NE	80	0.6	0.3	15	200	85	0.5	0.7	7	20	0.5	140	NE	0.5	0.5	10	200	14	0.5	NE	96		0.02	1000	12	NE
	ES	5	10	460	NE	NE	400	6	3	75	1000	850	5	7	70	100	5	700	NE	5	5	50	1000	70	5	NE	480		0.2	10000	60	NE

Results in µg/L

B = analyte found in method blank as well as sample
E = exceeds calibration range
J = estimated value
L = Lab Artifact
NE = None Established
NA= Not Analyzed

PAL = Preventive Action Limit
ES = Enforcement Standard
Underline indicates exceeds NR 140 PAL
Bolding indicates exceeds NR 140 ES
Blank = Not detected
[ ] = indicates detection below LOQ (limit of quantitation)

* Not sampled due to insufficient water for sample collection
# this sample had detections of bromodichloromethane at 0.59 ppb and dibromochloromethane at 0.35 ppb,

Table 3 - Groundwater Sampling Results for Private Drinking Water Wells
FF/NN Landfill, Ripon, WI

Private Well ID	Sampling Date	Parameters: VOC's: Carbon disulfide *	Methyl ethyl ketone *	Chloromethane	cis-1,2-Dichloroethene	Napthalene	Toluene	Vinyl Chloride	Inorganic: Alkalinity	COD	Chloride	Hardness
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L
Regularly Monitored Wells												
Altnau [1]	10/09/2001	NA	NA					**0.96**	NA	NA	NA	NA
	02/05/2002	NA	NA					**0.48**	270	2.8	18	320
	05/22/2002	NA	NA					**0.97**	280		13	300
	08/21/2002-influent	NA						**1.2**	300	ND	15	320
	08/21/2002-post filter	0.97							NR	NR	NR	NR
	November 2002	Home connected to public water supply. Well to be abandoned.										
Baneck [1]	05/09/2001	NA	NA						NA	NA	NA	NA
	11/19/2001 [2]	NA	NA						NA	NA	NA	NA
	02/05/2002	NA	NA						280	3.2		280
	05/22/2002	NA	NA						300			290
	5/22/2002 Dup	NA	NA						300			290
	08/19/2002								300	[3.0]	ND	290
	12/03/2002								NA	NA	NA	NA
Ehster	11/19/2001 [2]	NA	NA		0.93			**7**	NA	NA	NA	NA
	02/05/2002	NA	NA		0.85			**5.5**	300	3.7	24	340
	05/22/2002	NA	NA		1.2			**6.2**	320		22	330
	08/21/2002-influent [4]	NA			0.93			**5.4**	NA	NA	NA	NA
	08/21/2002-post strip	NA	[2.1]			[0.65]			NR	NR	NR	NR
	08/21/2002-post filter								NR	NR	NR	NR
	12/03/2002				1.3		[0.40]	**6.3**	NA	NA	NA	NA
Gaastra [1]	05/09/2001	NA	NA						NA	NA	NA	NA
	11/19/2001 [2]	NA	NA						NA	NA	NA	NA
	02/05/2002	NA	NA						290			280
	05/22/2002	NA	NA						290			270
	08/19/2002			[0.24]					300	ND	ND	280
	12/03/2002								NA	NA	NA	NA

Table 3 - Groundwater Sampling Results for Private Drinking Water Wells
FF/NN Landfill, Ripon, WI

		Parameters										
		VOC's							Inorganic			
Private Well ID	Sampling Date	Carbon disulfide *	Methyl ethyl ketone *	Chloromethane	cis-1,2-Dichloroethene	Napthalene	Toluene	Vinyl Chloride	Alkalinity	COD	Chloride	Hardness
Hadel [1]	10/09/2001	NA	NA						NA	NA	NA	NA
	11/19/2001 [2,3]	NA	NA						NA	NA	NA	NA
	02/05/2002	NA	NA						290			280
	05/22/2002	NA	NA						300			280
	08/19/2002	[0.24]							290	ND	ND	280
	08/19/2002 Dup								290	ND	ND	290
	12/03/2002								NA	NA	NA	NA
	12/03/2002 Dup								NA	NA	NA	NA
Miller [1]	05/09/2001	NA	NA						NA	NA	NA	NA
	05/09/01 Dup	NA	NA						NA	NA	NA	NA
	11/19/2001 [2]	NA	NA						NA	NA	NA	NA
	11/19/2001 Dup	NA	NA						NA	NA	NA	NA
	02/05/2002	NA	NA						280	3.7	5.2	290
	05/22/2002	NA	NA						290			290
	08/20/2002								290			290
	November 2002	Home connected to public water supply. Well to be abandoned.										
Rohde [1]	10/09/2001	NA	NA						NA	NA	NA	NA
	11/19/2001 [2]	NA	NA						NA	NA	NA	NA
	02/04/2002	NA	NA						290			300
	05/22/2002	NA	NA						290			290
	08/20/2002								300			290
Weiss [1]	10/09/2001	NA	NA						NA	NA	NA	NA
	10/09/01 Dup	NA	NA						NA	NA	NA	NA
	11/19/2001 [2]	NA	NA						NA	NA	NA	NA
	02/05/2002	NA	NA						280	4.6		270
	05/22/2002	NA	NA						290			280
	08/19/2002			[0.20]					290			280
	12/03/2002											
Wells Not on Regular Monitoring Schedule												
Fude	02/05/2002	NA	NA						240			
Hoffman	02/05/2002	NA	NA						290			290
Hollatz	02/05/2002	NA	NA						290			300
Henning	02/05/2002	NA	NA						280		10	350

Table 3 - Groundwater Sampling Results for Private Drinking Water Wells
FF/NN Landfill, Ripon, WI

		Parameters										
		VOC's							Inorganic			
Private Well ID	Sampling Date	Carbon disulfide *	Methyl ethyl ketone *	Chloromethane	cis-1,2-Dichloroethene	Napthalene	Toluene	Vinyl Chloride	Alkalinity	COD	Chloride	Hardness
Kasuboski	02/05/2002	NA	NA						290		8.4	330
	05/22/2002	NA	NA						310		8.5	340
Kolbeck	02/05/2002	NA	NA						280		5.7	320
Lemerand	02/05/2002	NA	NA						300		13	370
	05/22/2002	NA	NA						300		12	370
Machmueller	02/05/2002	NA	NA						300	2.8	23	350
	05/23/2002	NA	NA						290		19	330
	05/23/2002 Dup	NA	NA						300		18	340
Oakes	02/05/2002	NA	NA						300			310
	05/23/2002	NA	NA						300			310
	5/23/2002 Dup	NA	NA									
	08/20/2002		[0.70]						300			320
Rich	02/05/2002	NA	NA						290	3.2		2.5
Sauer	02/05/2002	NA	NA						250	2.8		260
Vossekuil	02/05/2002	NA	NA						300	3.2	41	360
	05/22/2002	NA	NA						330		46	370
	08/21/2002			[0.19]					310			360
WDNR NR140	PAL	200	90	0.3	7	8		0.02	NS	NS	125	NS
	ES	1000	460	3	70	40		0.2	NS	NS	250	NS

Blank = not detected
NA = not analyzed
NR = not required to analyze
PAL = Preventive Action Limit
ES = Enforcement Standard
[ ] = detected at less than quantitation limit

Underline values indicate PAL exceedance
Bold values indicate ES exceedance

* Began analyzing using method 542.2 with August 2002 event

[1] Monitoring began in 1993. See prior report submittals to WDNR for results prior to 2001.

[2] Methylene Chloride was detected in 11/19/01 samples and is assumed to be a laboratory artifact

[3] 1,1,1-Trichloroethane was detected at 0.18 ppb in Hadel well on 11-19-01

[4] Lab didn't analyze indicator parameter samples before hold time expired.

APPENDIX B

FIELD SAMPLING PROCEDURES – IRON II, DO & ORP

PROCEDURES FOR FIELD MEASUREMENT OF IRON II, DISSOLVED OXYGEN AND OXYGEN REDUCTION POTENTIAL

Iron II

Iron II is measured in the field using a Hach Test Kit for ferrous iron (model IR-18C). After groundwater samples are collected for lab analysis, a sample is collected for the iron test. The sample is collected with minimal agitation of the water to prevent oxidation of any iron II. The sample is analyzed as shown on the following pages taken from the operations manual provided with the test kit.

Dissolved Oxygen and Oxygen-Reduction Potential

Dissolved oxygen (DO) and oxygen-reduction potential (ORP) are measured in the field using a water quality meter. Following are the procedures for this measurement process:

1. Purge three casing volumes of groundwater from monitoring well
2. Collect groundwater samples for lab analysis and iron II field measurement
3. Insert water quality meter sonde into well down to the screen interval (in basal sandstone wells, probe is extended downhole to extent of cable which is approximately 200 feet).
4. Allow probes to stabilize. Once readings have stabilized, DO and ORP can be recorded.
5. pH, temperature and conductivity may also be recorded using this method.

The water quality meter is rented for each monitoring event; thus, the make and model may change. Historically, the YSI 600XL has been used for DO and ORP field measurement.

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ap/dp rev1 2/99 te/dk 8/97 2ed

Iron, Ferrous, Test Kit

2007-00

1,10 Phenanthroline Iron Reagent Method

• Trousse d'analyse fer ferreux

Méthode réactif fer 1, 10 Phéanthroline

• Eisen, 2wertig Test Kit

1,10 Phenanthrolin-Eisenreagenz Methode

• Kit de análisis para hierro ferroso

Método reactivo de fenatrolina de hierro 1,10

0.0 – 10.0 mg/L
• Mod. IR-18C
• # 26672-00

- To ensure accurate results, read carefully before proceeding.
- Pour obtenir des résultats exacts, lire attentivement le mode d'emploi avant d'utiliser la trousse.
- Um genaue Ergebnisse zu gewährleisten, lesen Sie das Folgende bitte aufmerksam durch, bevor Sie fortfahren.
- Para obtener resultados precisos, lea detenidamente las instrucciones antes de proceder al análisis.

WARNING

Handling chemical samples, standards, and reagents can be dangerous. Review the Material Safety Data Sheets before handling any chemicals.

ATTENTION

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les fiches de données de sécurité des produits avant de manipuler tout produit chimique.

WARNUNG

Die Handhabung chemischer Proben, Standards und Reagenzien kann gefährlich sein. Bitte gehen Sie die Materialsicherheitsdatenblätter durch, bevor Sie Chemikalien handhaben.

ADVERTENCIA

El manejo de sustancias químicas, patrones y reactivos, puede resultar peligroso. Lea las fichas de informaciones de seguridad de materiales antes de manipular cualquier producto químico.

Testinformationen

ırtikel zwischen den Tests. Verunreinigung kann die
ıen. Reinigen Sie sie mit einem nicht scharfen Detergent oder
e zum Beispiel Isopropylalkohol. Verwenden Sie für das
knen ein weiches Tuch. Verwenden Sie bei den
apierhandtücher oder Tissue-Papier, da dieses sie zerkratzen
ıberem Wasser (vorzugsweise entsalztes Wasser).

chen vor dem Test gründlich mit dem Probenwasser.

ere zur Öffnung der Plastik-Pulverkissen.

n zu erzielen, sollte die Genauigkeit der Reagenzien für jede
verden. Bereiten Sie eine Eisen-II Stammlösung
n Sie 0,702 Gramm Eisen-II Ammoniumsulfat, hexahydrat,
ı Wasser lösen. 3,00 mL dieser Lösung werden mit 100 mL
innt, so dass eine 3,0 mg/L Standardlösung entsteht. Diese
r vor Gebrauch angesetzt. Arbeiten Sie, unter Benutzung
iner Wasserprobe, gemäß den Anweisungen für den

ın e información general sobre el análisis

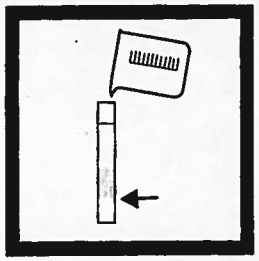
e laboratorio entre los análisis. La contaminación puede
mpiar con un detergente no abrasivo o con un solvente como
Jtilizar un paño suave para limpiar o secar. No utilizar ni
ɔapel para limpiar los tubos de plastico para no rayarlos.
(preferentemente agua desionizada).

; para colorimetría abundantemente con la muestra de agua
sis.

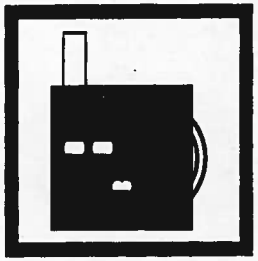
tes para abrir las cápsulas de plástico.

) difficiles, la precisión del reactivo debe ser verificada cada
ı un nuevo lote. Preparar una solución de reserva de hierro
lisolviendo 0,702 gs. de sulfato de amonio ferroso,
de agua desionizada. Diluya 3,00 mL de esta solución en
zada para hacer una solución estándar de 3,00 mg/L. Esta
diatamente antes de usarla. Siga las instrucciones de la
empleando esta solución en vez de una muestra de agua.

Procedure • Technique • Verfahren • Procédure



1. Fill a viewing tube to the first (5-mL) line with sample water. This is the blank.
   - Remplir un tube colorimétrique jusqu'au premier trait (5 mL) avec l'échantillon d'eau. Ceci est le blanc.
   - Füllen Sie ein Prüfröhrchen bis zur ersten (5 mL) Linie mit Probenwasser. Dieses ist die Blindprobe.
   - Llene un tubo para colorimetría hasta la primera marca (5 mL) con la muestra de agua. Esto constituye el blanco.



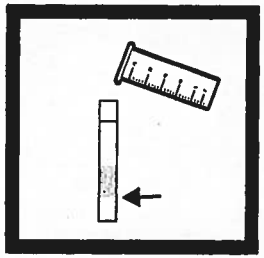
2. Place this tube in the top left opening of the color comparator.
   - Placer ce tube dans l'ouverture supérieure gauche du comparateur.
   - Stellen Sie dieses Röhrchen in die obere linke Öffnung des Farbkomparators.
   - Coloque este tubo en la abertura superior izquierda del comparador.

3. Fill the measuring vial to the 25-mL mark with sample water.
   - Remplir le tube de mesure jusqu'au trait 25 mL avec l'échantillon d'eau.
   - Füllen Sie das Messröhrchen bis zur 25 mL Markierung mit dem Probenwasser.
   - Llene el frasco medidor hasta la marca de 25 mL con el agua de la muestra.

4. Add the contents of one Ferrous Iron Reagent Powder Pillow to the measuring vial.
   - Ajouter le contenu d'une gélule de réactif du fer ferreux au tube de mesure.
   - Geben Sie den Inhalt eines Eisen(II)-Reagenz-Pulverkissens in das Messröhrchen.
   - Agregue el contenido de una cápsula del Reactivo para Hierro Ferroso al frasco medidor.

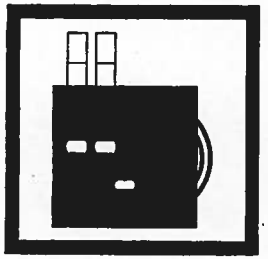
5. Swirl to mix. An orange color will develop if ferrous iron is present. Allow three minutes for full color development.

- Agiter pour mélanger. En présence de fer ferreux, une coloration orange se développe. Attendre le développement complet de la coloration.
- Schwenken Sie zum Vermischen. Ist Eisen(II) vorhanden, entwickelt sich eine orange Färbung. Warten Sie drei Minuten, bis sich die Farbe vollständig ausgebildet hat.
- Agite para mezclar. Se formará un color anaranjado en presencia de hierro ferroso. Deje pasar tres minutos para que el color se desarrolle completamente.



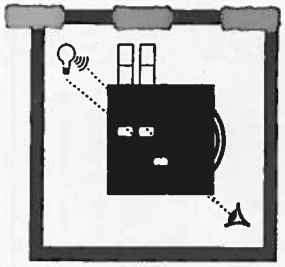
6. Fill another viewing tube to the first (5-mL) mark with the prepared sample.

- Remplir un autre tube jusqu'au premier trait (5 mL) avec l'échantillon préparé.
- Füllen Sie ein weiteres Prüfröhrchen bis zur ersten (5 mL-) Linie mit der vorbereiteten Probe.
- Llene otro tubo para colorimetría hasta la marca de 5mL con la muestra preparada en los puntos 4 y 5.



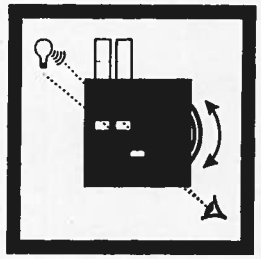
7. Place the second tube in the top right opening of the color comparator.

- Placer le second tube dans l'ouverture supérieure droite du comparateur.
- Setzen Sie das zweite Röhrchen in die obere rechte Öffnung des Farbkomparators.
- Coloque el segundo tubo en la abertura superior derecha del comparador.



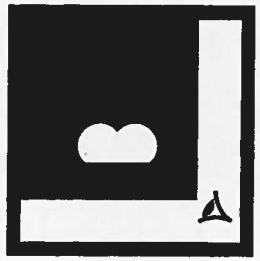
8. Hold comparator up to a light source such as the sky, a window or a lamp. Look through the openings in front.

- Tenir le comparateur face à une surface uniformément éclairée (ciel, lampe, fenêtre) et regarder par les ouvertures de la face antérieure du comparateur.
- Halten Sie den Komparator gegen eine Lichtquelle wie zum Beispiel den Himmel, ein Fenster oder eine Lampe. Sehen Sie durch die Öffnungen vorn.
- Lleve el comparador hasta una fuente de luz, tal como el cielo, una ventana o una lámpara. Mire a través de las aberturas frontales del comparador.



9. Rotate the color disc until the color matches in the two openings.

- Tourner le disque jusqu'à égalité des teintes dans les deux ouvertures.
- Drehen Sie die Farbscheibe, bis die Farbe in den beiden Öffnungen übereinstimmt.
- Haga girar el disco de color hasta que el color coincida en ambas aberturas.



10. Read the mg/L ferrous iron in the scale window.

- Lire la concentration du fer ferreux en mg/L dans la fenêtre de l'échelle.
- Lesen Sie die mg/L Eisen(II) im Skalenfenster ab.
- Lea la concentración de hierro ferroso en mg/L en la ventanilla graduada.

APPENDIX C

NORTHERN LAKE SERVICES – QUALITY ASSURANCE PLAN

The State of Wisconsin

DEPARTMENT OF NATURAL RESOURCES

Hereby grants

Wisconsin Certification under NR 149

under the provisions of ch. NR 149, Wisconsin Administrative Code to:

Northern Lake Service Inc
400 North Lake Ave
Crandon, WI 545201286

Laboratory ID Number: **721026460**

Issued Date: **September 1, 2002**

Expiration Date: **August 31, 2003**

for the following test categories:

* Oxygen Utilization
  - Biochemical Oxygen Demand
  - Carbonaceous BOD
* Nitrogen
  - Ammonia as N
  - Nitrite as N
  - Nitrate as N
  - Nitrate + Nitrite as N
  - Total Kjeldahl Nitrogen
* Phosphorus
  - Orthophosphate
  - Total Phosphorus
* Physical
  - Oil and Grease (HEM)
  - Total Dissolved Solids
  - Total Solids
  - Total Suspended Solids
  - Total Vol. Suspend Solids
  - Total Volatile Solids
* General I
  - Alkalinity/Acidity
  - Bromide
  - Chlorophyll a
  - Color
  - Hardness
  - Silica
  - Silicate
  - Sulfite
  - Surfactants
* General II
  - Chloride
* General II
  - Cyanide
  - Chemical Oxygen Demand
  - Fluoride
  - Total Phenolic Compounds
  - Sulfide
  - Sulfate
* General III
  - EP Toxicity
  - Ignitability
  - Total Releasable Cyanide
  - Reactivity
  - Total Releasable Sulfide
  - SPLP
  - TCLP
  - Total Organic Carbon
* Metals I
  - Silver
  - Aluminum
  - Arsenic
  - Boron
  - Barium
  - Beryllium
  - Calcium
  - Cadmium
  - Cobalt
  - Chromium (Total)
  - Copper
  - Iron
  - Chromium (Hexavalent)
  - Mercury
* Metals I
  - Potassium
  - Magnesium
  - Manganese
  - Molybdenum
  - Sodium
  - Nickel
  - Lead
  - Antimony
  - Selenium
  - Tin
  - Strontium
  - Thallium
  - Vanadium
  - Zinc
* Metals II
  - Lithium
  - Titanium
* Organics; Purgeable
  - Purgeable Aromatics
  - Purgeable Halocarbons
  - Volatile Organics (VOCs)
* Semivolatiles by GC/MS
  - Base/Neutral/Acid Extract
* Liquid Chromatography
  - PAHs by LC
* Pesticides
  - Nitrogen Pesticides
  - Organophosphorus Pests.
  - Triazines and Metabolites
* Petroleum Hydrocarbons
* Petroleum Hydrocarbons
  - Diesel Range Organics
  - Gasoline Range Organics
  - Petroleum VOCs
* Organics; Organochlorine
  - PCBs
  - Organochlorine Pesticides
* Safe Drinking Water
  - Arsenic
  - Barium
  - Beryllium
  - Cadmium
  - Chl. Hydrocarbon (GC/MS)
  - Cyanide
  - Chl. Pesticides by GC
  - Chl. Pesticides by GC/MS
  - Chromium
  - Copper
  - EDB and DBCP
  - EDB/DBCP Microextraction
  - Fluoride
  - Mercury
  - Nitrate + Nitrite
  - Sodium
  - Nickel
  - Nitrite
  - Nitrate
  - Antimony
  - Selenium
  - Sulfate
  - Thallium
  - Total Trihalomethanes
  - Volatile Organics
  - N/P Pesticides by GC/MS
  - PAHs by GC/MS
  - Lead
  - Phthalates by GC/MS

David Webb

Chief, Environmental Science Service

Darrell Bazzell

Secretary

Certification or registration by the State of Wisconsin is not an endorsemet or guartantee of the validity of data generated by this laboratory. This certificate is valid unless revoked or suspended and supersedes all previous certificates.

NORTHERN LAKE SERVICE, INC.

Analytical Laboratory and Environmental Services

400 North Lake Avenue • Crandon, WI 54520-1298
Tel: (715) 478-2777 • Fax: (715) 478-3060

NORTHERN LAKE SERVICE PERFORMANCE EVALUATION STUDIES

Commercial labs in Wisconsin are required to analyze blind samples for many parameters under various programs each year to meet laboratory certification requirements. These are samples of known concentrations of analytes that are unknown to the analyst. The lab's results are compared to the known values, either in-house or by Wisconsin's lab certification authority. Because these samples are made available through either public or private sources as concentrates in sealed glass ampules, lab people generally refer to the results as "ampule results". They are also called "PE (performance evaluation) results" or "reference sample results".

At Northern Lake Service, we take full advantage of any available QC ampules. We not only run the reference sample on the primary instrument used for that test program, but *also on any other redundant instrument that might be used to analyze for that parameter* should the primary instrument for that program go down, or to satisfy the requirements of a different program. For example, we use one of our four purge-and-trap GC/MSs almost exclusively for the drinking water program. This program tends to have tighter control limits than the wastewater program, but we might also analyze the SDWA VOC ampule on one or more of the other three instruments for additional QC documentation for those instruments. In fact, many times we will also run this ampule by a GC/Hall, PID instrument, even though we seldom use this instrument for current programs.

The accompanying table lists the various QC ampule studies we have participated in for the five-year period of 1998 through 2002. The data includes *all* the blind ampule results produced during that time, not just the information required for submittal to satisfy regulatory program requirements.

A 1996 study by IAETL (the International Association of Environmental Testing Laboratories) indicated that any lab scoring 95% or higher *on just the most recently submitted* ampule results was in the top echelon for producing quality data. The cumulative average of all NLS ampule results over the past seven years is 99%. During 2002, our record was 99.6%.

We feel that few, if any, other environmental labs can claim a similar long-term quality record.

Revised 02/04/03

NORTHERN LAKE SERVICE PROFICIENCY TESTING 1998 - 2002

	INORGANICS		%	ORGANICS		%	TOTALS		% WITHIN
STUDY I. D.	ACCEPTABLE	TOTAL		ACCEPTABLE	TOTAL		ACCEPTABLE	TOTAL	LIMITS
WW/98-A	67	70		118	119		185	189	
WSLH/98-1	66	70		132	134		198	204	
EPAWSO40	43	47		99	99		142	146	
EPAWPO39	66	66		99	99		165	165	
DW/98-1	60	63		132	134		192	197	
DW/98-2	64	64		81	81		145	145	
WW/98B	72	74		130	134		202	208	
EPAWSO41	41	43		99	99		140	142	
WW/98-C	69	71		128	135		197	206	
EPAWPO40	67	69		98	99		165	168	
DW/98-3	67	61		132	132		199	193	
1998	**682**	**698**	**98%**	**1248**	**1265**	**99%**	**1930**	**1963**	**98%**
WSLH/99-1	69	72		145	146		214	218	
WW/99-A	71	72		145	145		216	217	
DW/99-1	59	61		106	106		165	167	
WSLH-APG/991	29	32		142	142		171	174	
DW/99-2	58	63		133	133		191	196	
WW/99-B	66	72		148	149		214	221	
DW/99-3	61	62		81	81		142	143	
WW99/C	69	71		124	125		193	196	
1999	**482**	**505**	**95%**	**1024**	**1027**	**100%**	**1506**	**1532**	**98%**
WW/00-A	72	73		123	124		195	197	
DW/00-1	108	108		67	67		175	175	
WLSH/00-1	73	73		117	117		190	190	
WSLH-APG/00-1	31	34		190	190		221	224	
WW/00-B	73	74		94	94		167	168	
ERA/DMRQA001	70	71		0	0		70	71	
APG/DMR-QA-20	42	43		0	0		42	43	
WW/00-C	74	74		124	124		198	198	
DW/00-2	73	75		112	112		185	187	
2000	**616**	**625**	**99%**	**827**	**828**	**100%**	**1443**	**1453**	**99%**
WW/01-A	73	73		123	123		196	196	
DW/01-1	71	71		112	112		183	183	
APG/WS-01	59	62		184	188		243	250	
WSLH-APG/01-1	78	83		192	193		270	276	
WW/01-B	70	72		106	107		176	179	
WW/01-C	72	72		119	122		191	194	
DW/01-2	84	84		72	72		156	156	
DW/01-3	69	69		107	107		176	176	
2001	**576**	**586**	**98%**	**1015**	**1024**	**99%**	**1591**	**1610**	**99%**
WSLH-APG/02-1	53	55		88	88		141	143	
APG/WS-02	61	61		96	96		157	157	
DW/02-1	63	63		114	114		177	177	
WW/02-A	82	82		139	139		221	221	
ERA Pests	0	0		26	26		26	26	
DW/02-2	64	64		198	199		262	263	
WW/02-B	70	70		113	114		183	184	
APG/DMR-QA22	43	43		0	0		43	43	
APG/DMR-QA/QC	42	42		0	0		42	42	
DW/02-3	63	65		260	260		323	325	
WW/02-C	77	78		160	160		237	238	
2002	**618**	**623**	**99%**	**1194**	**1196**	**100%**	**1812**	**1819**	**100%**
FIVE YEAR RECORD	**2974**	**3037**	**98% INORGANICS**	**5308**	**5340**	**99% ORGANICS**	**8282**	**8377**	**99% ALL RESULTS**

IMPORTANT CONSIDERATIONS WHEN CHOOSING A LABORATORY

How long has the lab been in operation? This question has several ramifications. It takes considerable time, capital expense, dedicated personnel and effort to develop a quality service culture and full-service facility. Labs that have been in business for less than five to ten years are probably "farming out" many tests because it takes a number of profitable years to accumulate the expensive instruments to do state-of-the-art analyses in-house. Or, they may be using obsolete equipment picked up at bankruptcy sales. Or, perhaps they are leasing instrumentation, in which case, their commitment to protect their investments by producing a good product over the long term need not be as deep. ***NLS has been in business for over 28 years. We started out small and developed expertise one step at a time. We own all of our equipment and dedicate a considerable portion of our earnings each year to replacement with the most up-to-date technology. We plan to be here long into the future.***

Has the lab ever had financial problems? Ask the prospective lab about past reorganizations, bankruptcies, acquisitions, divestitures, and changes in ownership. Bigger isn't necessarily better. In fact historically, the large "network" labs and national, multi-facility labs have been common visitors to the bankruptcy courts. Many are constantly buying a lab here, selling a lab there, or closing a facility because they had failed to make the necessary capital decisions to replace older instrumentation, or because of data quality failures or certification problems. Typically, their main concern is cash flow rather than data quality. Eventually, the majority of the "biggies" have ended up in some sort of reorganization, which usually leaves their clients and/or suppliers on the disappointing end of a business agreement. ***NLS is a medium size lab: we're big enough to have redundancy in our instruments and analysts, and to support a full-time QA Officer and client services staff, and small enough to treat each client on a personal basis. We need only to support overhead expenses of a single facility. We have excellent credit, but no current long-term debt. We own, outright, all of our 27 major instruments. We have been financially stable during our 28 - year history, and plan to stay that way.***

What's in a name? Ask a prospective lab about its name history. If it changed its formal name, even slightly, over the past decade, ask why and be wary. Has it changed ownership over the past decade or two? Has it gone through a bankruptcy or reorganization? Is it hiding from a certification problem, a messy lawsuit, or had other reputation problems that the new name hides? Will it be around, under the same management a few years from now? If not, how will your back data be supported? ***Northern Lake Service has been our one and only name since inception. We are a second generation, family owned business. We don't do much lake management work any more, but to our clients, Northern Lake Service or NLS has meant quality, dependability, stability, and value for all of our 28 years. We hope we never need to change our name for any reason .... and, we plan to be around for another 28 years.***

What is the prospective lab's quality history? Ask to see recent audit reports by both DNR auditors and independent client auditors (if available). Talk to these auditors "off the record" if they are willing, about the prospective lab's performance. Ask to see results of the past four or five EPA ampule studies. Half the certified labs will have acceptable results on 92% or more of their tests; one out of ten labs will score better than 96% on a regular basis. ***NLS averages 99% on QC ampules and regularly achieves 100%. We have always had good rapport within the regulatory community.***

What do the prospective lab's clients think of the lab? Ask the prospective lab for a list of *clients having analytical needs similar to yours* and have been using the prospective lab's services for at least four or five years. Inquire about overall service satisfaction: dependability of data, electronic deliverables, returning phone calls, frequency of errors and how the lab handled them, and occurrences of regulatory agencies questioning data and how the lab responded. ***NLS has numerous long-term clients in each testing program category that would be happy to discuss our services with a prospective client.***

Does the lab boast an ultra-fast turn-around time? A good lab can generally produce good results on a typical parameter list in five to twelve working days. Samples with extended lists can take three or four weeks to turn around due to additional complexity. But, since interferences are common on at least ten percent of the tests on a complex wastewater sample, for example, re-testing is often necessary to meet QC requirements and produce conclusive results. It also takes time for data validation by department supervisors and a client services chemist to make sure the data package is accurate and complete. "Quick turns" can usually be accomplished in one to a few days, but only at the expense of interrupting regular runs and schedules; hence the price premiums on these samples. Many labs that guarantee short turn-times are mere number factories, running samples through test procedure only once regardless of QC failures. They may or may not flag the failed data; in either case the client is getting fast, but not definitive results. ***At NLS we assume our clients want the best data. If a particular matrix requires two, three, or four runs before QC limits are met for a particular test, we will keep running the sample, if necessary, using alternate, approved procedures, until we can produce a credible, court-proof result, usually at our expense. This takes additional time and precludes a guaranteed turn-time, but our clients are paying us for dependable data, and that sometimes takes a little longer.***

05/2002

NORTHERN LAKE SERVICE, INC.
QUALITY ASSURANCE/QUALITY CONTROL
MANUAL

This manual documents the methods and procedures used by Northern Lake Service (NLS) to comply with NR149 Wisconsin Administrative Code. Methods are taken from authoritative sources with some modifications recommended by instrument manufacturers to increase analytical performance and ease of instrument operation.

This QA/QC manual is updated annually.

Approved By:

Northern Lake Service, Inc
400 North Lake Avenue
Crandon, Wisconsin 54520
715/ 478-2777

President

Lab Manager

QA Officer

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GENERAL INFORMATION

Northern Lake Service began operations in 1974 to provide analytical and consulting support for Wisconsin's Inland Lake Renewal Program. Under that program NLS conducted comprehensive lake studies requiring collection, analysis, and interpretation of groundwater and surface water samples along with hydrological and biological investigations to determine water quality and lake management alternatives for about 30 Wisconsin lakes. It was under this program that our reputation for analytical expertise and accurate results became recognized and grew.

NLS has continued to provide new environmental services in response to client needs. Procedures and methods are chosen or developed to provide the most accurate and precise information in the most efficient and timely manner. Consequently, our ever-expanding list of satisfied clients includes various industries, landfills, municipal waste treatment plants, public water utilities, government agencies, and private parties.

Our modern laboratory is equipped with state-of-the-art instrumentation for analyzing drinking water, groundwater, process water, wastewater, soil, sediments, and tissue for inorganic, organic, and physical constituents. We are certified as an environmental laboratory in the state of Wisconsin for Drinking Water and Wastewater analyses. In addition, NLS is one of the few labs in Wisconsin to become certified under the Safe Drinking Water Act (SDWA), and by our request, one of the first to undergo the comprehensive lab audit required under this certification program.

While much of our effort is committed to providing analytical lab services, we also offer a variety of field services. Our groundwater sampling service, which utilizes an efficient in-line field filtering procedure to insure the collection of representative samples, has set the standard for producing reliable groundwater data and has become our primary field service.

The NLS staff take particular pride in producing objective, reliable, accurate, and precise environmental data. Praise and satisfaction, both from our clients and from the regulatory agencies, provide the chief driving force at Northern Lake Service. We strive to grow both in technology and client-base without losing the level of personal service and efficiency associated with being small.

NLS has developed a program of QA and QC procedures that provide our clients with defensible, cost effective and timely results. Management creates a culture of integrity, continuous improvement in knowledge and equipment, and reliable client service. A key part of this culture is providing employees with educational resources for training, keeping current on technological and regulatory changes. As a result, employees are empowered to make decisions that not only meet, but exceed our client's expectations.

RESUMES OF KEY PERSONNEL

RONALD K. KRUEGER, Founder and Chairman of the Board

Ron Krueger founded Northern Lake Service in 1974 and while less involved in day to day operations he provides valuable oversight of numerous management issues. He also remains active in various NLS field activities, developing and refining sampling procedures and programs to meet clients' needs.

Ron's environmental experience spans over 36 years and includes: conducting biological and chemical surveys and coordination of waste disposal programs in the paper industry: drainage basin surveys and administration of aquatic nuisance control programs in Wisconsin Department of Natural Resource's Lake Michigan District; lake management consultation and field investigation for over 30 lake districts while at NLS. He served as president and chairman of the Board of NLS for 26 years.

Ron holds a B.S. in biology and general science from the University of Wisconsin-Stevens Point. He is a member of the American Water Well Association and the Wisconsin Ground Water Association.

RONALD T. KRUEGER (R.T.), President and Chief Executive Officer

R.T. provides management of day to day company operations, working with supervisors, QC, Marketing, LIMS and Client Services to assure client needs are met.

R.T. has over 21 years of experience in environmental analysis and field sample collection. He has developed a variety of technical skills, working as a field technician, inorganic analyst, groundwater monitoring crew chief, limnologist and Laboratory Manager position at NLS prior to becoming president.

He has a B.S. in Biology and Earth Sciences from the University of Wisconsin Stevens Point. R.T. is a member of the Wisconsin Groundwater Association.

STEVEN L. MLEJNEK, Laboratory Manager

Steve Mlejnek provides direct coordination of laboratory operations, both organic and inorganic at Northern Lake Service. With the department supervisors, Steve oversees routine analysis and the training of laboratory personnel. He is also involved as the technical liaison with clients and regulatory agencies.

Steve has experience in the analysis of volatile organic analyses. The analyses are performed by gas chromatograph/mass spectrometry on a Varian Saturn III GC/MS system. Steve also provides analytical and troubleshooting help for other volatile organic methods including EPA methods 8260, 8021, and petroleum methods. He has over 11 years of experience in environmental analysis.

Steve graduated from the University of Wisconsin - Stevens Point with a B.S. in Natural Science. He attended Varian Instrument's "Environmental Applications of GC/MS" course and Tekmar Instrument's "Purge and Trap Users School".

MALCOLM C. GROSS, Sales/Marketing Director

Mal Gross has over 28 years of experience in sales and marketing of technical products and services, about twelve of those in the environmental laboratory and consulting field. He currently provides overall direction of sales/marketing for NLS, including long term strategic planning input and short / long-term sales promotion.

He also provides liaison with clients, subcontractors and industry trade groups. Mal is primarily responsible for bids, quotations and contracts for analytical services, and provides project management and review for selected projects.

Mal graduated with honors from the University of Wisconsin –Green Bay, with a B.S. in General Management. He has about 30 college credits in science and math, and has completed some graduate work in Business Administration. He has also attended many seminars and programs in environmental subjects.

Mal is a member of the Federation of Environmental Technologists, Water Environment Federation, Wisconsin Laboratory Association, Wisconsin Ground Water Association, American Water Well Association, Central States Water Environment Association, American Water Resources Association and the Wisconsin Wastewater Operators Association.

W. JOSEPH NOSEK, Jr., Quality Assurance Officer

Joe Nosek oversees the NLS quality assurance program and the Continuous Quality Improvement Program, which he instituted at NLS. Joe also monitors data quality and adherence to Standard Operating Procedures (SOP's). He interacts with regulatory agencies and is generally responsible for maintaining current laboratory certification by those agencies.

Joe graduated from the University of Minnesota at Duluth with a B.S. in Earth Sciences. He has completed courses in quality assurance from the National Bureau of Standards and the Association of Official Analytical Chemists, and Good Laboratory Practices from the Society of Quality Assurance. He is a member of the American Society of Testing and Materials and the American Society for Quality from which he has earned the Certified Quality Auditor Certificate. Joe has over 16 years of experience in quality assurance with environmental laboratories.

TRACY HUBER, Client Service Representative

Tracy Huber has over 10 years of experience at Northern Lake Service interacting directly with clients. Tracy is actively involved in all laboratory – client communications, subcontractor management, project initiation and progress, and assists in quotations. Prior to joining the Client Service Department she supervised the Sample Receiving and Shipping departments. Tracy has an Administrative Assistant Associates Degree from Nicolet College. She has also attended seminars covering a variety of Office Management and Client Service Representative skills.

ANDREW J. OSTROWSKI, Environmental Scientist/Client Services

Andy Ostrowski performs many client service activities, such as quotations, data package review, project management and subcontractor liaison. He also has over 11 years of field sampling experience and provides general oversight of those services at NLS.

Andy holds a B.S. in Water-Resources, Chemistry and Soil Science from the University of Wisconsin-Stevens Point. He has also attended WGWA seminars and has completed OSHA's required 40-hour HazWaste Site Training. Andy is a member of the Wisconsin Ground Water Association.

DAWN M. DREHER, Office Coordinator / Purchasing Agent

Dawn coordinates the day-to-day operations of the Northern Lake Service office, including scheduling, communications, invoicing, accounts receivable, accounts payable, and filing. Dawn also conducts and monitors the corporate purchasing functions for the evaluation, purchase, and receipt of all laboratory and field supplies. She has 19 years of office experience and administration, with 10 of those years served at NLS. Dawn has completed several office operations and administration seminars and is a member of the American Purchasing Society.

CHRIS GESKE, LIMS Manager

Chris Geske manages the programming, operation and maintenance of the NLS Laboratory Information Management System. He also oversees the operation and maintenance of instrument data systems and networks.

Chris works closely with the Laboratory Manager and the Quality Assurance Officer, as well as with laboratory staff. He attended the Milwaukee School of Engineering and has an Associate degree in electronics from North Central Wisconsin Technical College.

THOMAS R. PRIEBE, Inorganic Supervisor

Tom Priebe provides supervision of the Inorganics department including metals and wet chemistry parameters. His background also allows Tom to specialize in troubleshooting analytical interferences in complex waste matrices.

He has experience with a large waste disposal company, as well as with the WDNR where he was involved with field sampling, analysis, and maintenance.

Tom holds a B.S. degree in Water Chemistry from the University of Wisconsin - Stevens Point, and has completed the 40 hours training in Health, Safety & Management of Hazardous Materials per 29 CFR 1910.120. He has over 11 years of experience.

JERRY BOCK, Semi-Volatiles Supervisor

Jerry Bock provides supervision of the organics department including gas chromatography for semi-volatile organics and pesticides/PCBs. He has a strong background in organic chemistry and over 21 years of analytical chemistry experience.

Jerry has a B.S. in Medical Technology from the University of Wisconsin-Eau Claire. He has also attended Hewlett-Packard courses in gas chromatography techniques.

RUSS A. WOLFF, Team Leader/Chemist - Volatiles Department

Russ Wolff conducts analyses for volatile organic compounds by gas chromatography and gas chromatography/mass spectrometry. He has over 8 years of analytical experience working with various purge and trap systems in areas of Gasoline Range Organics/Petroleum Volatile Organic Compounds, and Volatile Organic Compounds. Russ holds a B.S. degree in Chemistry from Northland College - Ashland.

CRAIG S. CASELTON, Chemist - Organic Department

Craig Caselton conducts analyses for Pesticides and PCBs by gas chromatography. He has over 6 years of analytical experience working with various purge and trap systems for the GRO/PVOC compounds as well as Pesticides and PCBs. Craig holds a B.S. degree in Water Chemistry from the University of Wisconsin - Stevens Point.

DOUGLAS M. JENNINGS, Chemist-Inorganics Department

Doug Jennings has 19 years of experience in the analysis of environmental samples for metals. He currently analyzes various matrices for metals, using AA-flame, AA-graphite furnace, AA/AF-cold vapor and ICP techniques. Doug graduated from Central Michigan University with a B.S. in Chemistry/Biology. His experience includes analysis of samples from USDOD and USDOE programs under CLP and GLP requirements.

DATA CONFIDENTIALITY

The results of all analyses are confidential. Data are only released to the client, or to an agent of the client if NLS has received prior written authorization from the client. Unless the data has been subpoenaed by a court action, state and federal officials may only receive copies of this data from the client or with their permission from NLS.

LAB AND FIELD SECURITY

Lab equipment, field equipment, reagents, empty sample bottles, and filled samples bottles are all items which potentially can become contaminated either maliciously or inadvertently. These items remain in secure custody to insure the legal credibility of analytical results.

Sample Custody in the Field

There are two categories of custody for samples that are collected at various locations and analyzed at Northern Lake Service. The first category includes samples that are collected by Northern Lake Service personnel in whose custody the samples remain until they are received and logged into the database at the lab. The second category of custody occurs when a client collects a sample or set of samples and either makes personal delivery or ships the sample(s) to the laboratory using a public or private courier.

To insure a secure custody of samples collected by NLS personnel, the following policy is followed by NLS field staff during sampling and transportation of samples to the lab:

> The names or initials of NLS field personnel are listed on data sheets or field data records. NLS personnel insure that secure custody is maintained by keeping all items either under lock and key or under the direct surveillance of at least one NLS field investigator at all times while in the field. This means that vehicles, buildings, motel rooms, or other locations in which sampling equipment and samples are stored or transported are securely locked whenever unattended by NLS personnel. Whenever the conditions of this policy are not met, a written report explaining the circumstances of non-compliance is required. If the samples had been left in someone else's custody for a period of time, the times and names are recorded. If samples could not or inadvertently were not securely locked up in the absences of NLS personnel, the circumstances will be recorded. Any comments regarding evidence of tampering or whether the attending NLS personnel suspect that the samples may have been tampered with are recorded. This report is signed by all NLS personnel present on that sampling trip and attached to the data to which it pertains in NLS files.

Northern Lake Service assumes no responsibility for sample custody prior to delivery at the lab except when NLS personnel have conducted the sampling and transporting. NLS does provide a chain of custody form for its clients. NLS makes no claims regarding the legal propriety of this form; it was designed to be efficient and minimize paperwork, and to identify all sample custodians. A signature is required by each custodian who is likely to have primary interest in the samples. Transporters are identified only by company name or agency.

Section V of the NLS chain of custody form is completed by NLS personnel when the sample(s) arrive(s) at the lab. A copy is returned to the client with the final data reports for the samples to which it pertains.

Sample Custody in the Laboratory

Once samples are delivered to the laboratory, sample custody is secure by virtue of the fact that no unauthorized persons are allowed in the laboratory. Visitors and service personnel are allowed only under the supervision of NLS personnel. The computerized database is self-contained on the premises. The computer system does not allow anyone to log-in without the proper user-ID and password.

All access doors to NLS are locked at all times when the premises are vacated. All lab reagents, sample bottles, and lab equipment are stored on the premises. Only full time employees are allowed unsupervised access to the laboratory. Lab security is an important consideration whenever new employees are hired. A special secured area within the sample walk-in cooler is provided with locks for clients requiring strict chain of custody and locked storage.

REFERENCES OF METHODOLOGY

All Northern Lake Service analytical, quality control, and preservation methodologies are taken from the following sources:

1. American Public Health Association, et. al. Standard Methods for the Examination of Water and Wastewater. 16th - 20th Editions. American Public Health Association. Washington, D.C.

2. American Society of Testing and Materials, 1995-1999. Annual Book of ASTM Standards - Water and EnvironmentalTechnology, Section 11, volume 11.01 - 11.05; ASTM, Philadelphia, PA.

3. American Society of Agronomy, et. al. 1982. Methods of Soil Analysis Part 2 - Chemical and Microbiological Properties. 2nd Edition. Edited by A.L. Page, R.H. Miller, D.R. Keeney. Soil Science Society of American. Madison, Wisconsin.

4. Code of Federal Regulations, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act. Final Rule; Title 40, Part 136. Government Printing Office. Washington D.C.

5. Code of Federal Regulations, National Primary Drinking Water Regulations. Final Rule; Title 40, Part 141. Government Printing Office. Washington D.C.

6. Perkin-Elmer. Analytical Methods for Atomic Absorption. 1982 and Updates. Perkin-Elmer Corporation.

7. Technicon Industrial Systems. Technicon Autoanalyzer II Operation Manual. Technicon Instrument Corporation. Tarrytown, New York.

8. United States Environmental Protection Agency, Methods for the Determination of Metals in Environmental Samples. June, 1992. EPA/600/4-91/010. Supplement 1, May, 1994. EPA/600/R-91/111.

9. United States Environmental Protection Agency. Handbook for Analytical Quality Control in Water and Wastewater Laboratories. March, 1979. EPA-600/4-79-019. Revised 1983.

10. United States Environmental Protection Agency. Methods for the Chemical Analysis of Water and Wastes. March, 1983. EPA-600-4-79-020. Government Printing Office. Washington, D.C.

11. United States Environmental Protection Agency. Methods for Organic Analyses of Municipal and Industrial Wastewater. July 1982. EPA-600/4-82-057. Government Printing Office. Washington, D.C.

12. United States Environmental Protection Agency. Test Methods for Evaluating Solid Waste. July, 1982. SW-846. Third Edition and Updates I, II, III and IIIA. Government Printing Office. Washington, D.C.

13. United States Environmental Protection Agency. Methods for the Determination of Organic Compounds in Drinking Water. December 1988. EPA-600/4-88-039, plus Supplements 1 & 2.

14. United States Environmental Protection Agency. Technical Notes on Drinking Water. October 1994. EPA/600/4-94/173.

15. Varian Techtron Pty. LTD. Analytical Methods for Flame Spectroscopy. Varian Techtron, Springvale, Australia.

16. Varian Techtron Pty. LTD. Analytical Methods for Graphite Tube Atomizer. Varian Techtron. Mulgrave Victoria, Australia.

17. United States Environmental Protection Agency. Methods for the Determination of Inorganic Substances in Environmental Samples. August, 1993. EPA-600/R-93/100.

REPORTING DATA

Significant Digits

All results are reported to two significant digits, unless otherwise specified.

Rounding

Digits 6, 7, 8, & 9 are rounded up; 1, 2, 3, & 4 are rounded down. 5's are rounded to the nearest even number; e.g., 4.25 = 4.2; 4.35 = 4.4.

Percent Solids

All Percent Solids results are reported on a Dry Weight basis, unless otherwise specified.

LABORATORY CHEMICALS AND GASES

High quality results are a function of the reagents used. In general, most reagents are of "Analytical Regent Grade" quality or better. All preservative chemicals meet a minimum quality of ACS analytical grade. All laboratory water used in the analytical methods is reagent grade and appropriate for the specific test. All acids used in graphite furnace analysis are of J.T. Baker Instra-Analyzed quality or better. Acetylene used in atomic absorption is the purified form. Nitrous oxide is U.S. P. grade. Air for atomic absorption analysis is filtered to remove particulates and passed through silica gel to remove moisture prior to its introduction into the atomic absorption spectrophotometers. All chromatography gasses meet a minimum purity of 99.99%.

Standards are purchased or made up by NLS staff. Chemicals used to make standards are of primary standard grade. If purchased, standards are obtained from a reputable supplier. All reagents are dated, and appropriate shelf lives are recorded. Reagents are discarded prior to their expiration date. Matrix modifiers meet ACS Grade. Matrix modifiers for graphite furnace analysis may be extracted with ADPC/MIBK to remove trace metal contaminants. GC gasses are purified using moisture, carbon, and oxygen traps when necessary.

IN-HOUSE BOTTLE CHECK PROCEDURE

New Bottles:

Northern Lake Service utilizes an in-house bottle check procedure to rule out the sample container as a source of contamination. Upon receipt of new sample bottles, each box is given a lot number. Lot numbers are assigned by size of bottle and type of preservative to be used. A random sampling is then pulled from each lot of bottles. These bottles are given a sample number and logged into the database for specific parameters each bottle is used for during analysis. The appropriate preservative along with reagent water is added to each bottle. These samples are then analyzed according to EPA protocol and holding times. If a lot is proven to be contaminated, the whole lot may either be rinsed in the appropriate manner to remove the contamination, not used for that contaminated parameter, or are returned to the manufacturer.

SAMPLE PRESERVATIVE AND HOLDING TIMES

Sample preservation methods are taken from the following sources:

Wisconsin Administrative Code, NR 219, Table F, November 1996, Number 491; Wastewater; and NR 809.725, Tables F, G, and H, October, 1997, No. 502; Drinking Water.

American Public Health Association, et. al., 1995. Standard Methods for the Examination of Water and Wastewater. 20th Edition. American Public Health Association. Washington, D.C.

Storage at low temperature (1 - 4 degrees C) is perhaps the best way to preserve most samples until they can be analyzed. Chemical preservatives are used only when they are shown not to interfere with the analysis being conducted. When used, preservatives are added to the sample bottle initially, so that all sample portions are preserved as soon as collected.

The sample preservative must be chosen with due regard to the determinations to be made. A method of preservation may be hindered when applied to suspended matter.

Methods of preservation are generally intended to retard biological action, retard hydrolysis of chemical compounds and complexes, or reduce volatility of constituents.

Preservation methods are limited to pH control, chemical addition, refrigeration, and freezing. Table I contains holding times and preservation techniques currently employed by Northern Lake Service.

ANALYTICAL RECORDS

The following records are maintained for a minimum of five years by Northern Lake Service:

1. Sample logbook.
2. Sample raw data processed so that any sample may be traced back to the analyst, date collected, date analyzed, method used, raw data, calculations, results and final report.
3. Quality control data for spikes, duplicates, reagent blanks, reference samples, calibration standards, and known standards.
4. Quality control records for precision and accuracy.
5. Instrument maintenance records.
6. Sample preservation checks of in-coming samples.
7. Status of samples on arrival.
8. Log books, bench sheets, and method demonstration.
9. Chain-of-custody.
10. If NLS does the sampling, the following records are kept on file:
    - A. Preservation used.
    - B. Sampling technique.
    - C. Whether sample was equal volume, time-proportionate or composited-proportionate to flow.
    - D. Whether groundwater samples were field filtered, and the pore size diameter of the filter, (i.e., 0.45 um).
    - E. Any unusual circumstances which may affect result interpretation.
    - F. Field sample results.
    - G. Calibration curves for field instruments, standard conditions, and appropriate maintenance.
    - H. Location and time of sampling.
    - I. Name of sampler.

Analytical methods for the analysis of groundwater, surface water, industrial and municipal wastewater's comply with Wisconsin Statutes NR101, NR140, NR149, NR180, NR181, NR204, NR214, NR219, NR508. NOTE: This section does not address NR 809 Wisconsin Safe Drinking Water statute.

METHODS AND DETECTION LIMITS

In order to insure accurate and consistent results, Northern Lake Service uses methods that have been studied and proven to be reliable by the USEPA. Detection limits used by Northern Lake Service are updated frequently. Detection limits are derived by conducting a replicate analysis with a minimum of seven samples. These samples are spiked and diluted to the proper volume. The samples are digested/extracted (where applicable) and analyzed as if they were an actual sample. The average response and standard deviation is calculated and the method detection limit is calculated as the product of the student t-value times the standard deviation of the test using a 99% confidence level. The reported limit of detection (LOD) is generally the same of these calculated method detection limits (MDLs). The (MDL) detection limits and methods used for each parameter are shown in Table 2. The limit of quantitation (LOQ) for analytical methods, which is the level above which quantitative results may be obtained with a specific degree of confidence, is mathematically defined as equal to 10 times the standard deviation of the results obtained from the MDL analyses. The LOQ is approximately equal to 3.3 times the MDL value.

GENERAL QUALITY CONTROL

Quality assurance in the laboratory has come to mean many things. To some, it is merely equated with such factors as:

1. Adequately trained and experienced personnel.
2. Good physical facilities and equipment.
3. Certified reagents and standards.
4. Frequent servicing and calibration of instruments.
5. Use of replicate and known-addition analysis.

While all of these are important, none in itself assures reliability of laboratory data. A good analytical quality control program consists of three factors:

1. Using only methods that have been studied collaboratively and found acceptable (this generally implies "Standard Methods," EPA, etc.).

2. Routinely analyzing control samples regularly during runs on which unknown samples are being analyzed.

3. Confirming the ability of a laboratory to produce acceptable results by requiring analysis of reference samples several times a year.

Additional considerations which supplement those above, may be designated as internal or statistical quality control, (i.e., control chart trends) as well as external quality control, proficiency testing, or laboratory evaluation.

In the following discussion, internal quality control is emphasized. It is based on a system developed for the control of general production processes and product quality although the same concepts are adapted readily to laboratory operations.

LABORATORY QUALITY CONTROL LIMITS

In industrial applications, control limits are recommended for each product, each machine, and each operator. In the laboratory environment, the parameter of interest, the instrument, and the operator are analogous system variables. However, environmental laboratories routinely have to contend with a variable that has no industrial counterpart - the true concentration level of the parameter of interest, which may vary considerably among samples. Unfortunately, the statistics that work well in industrial applications are sensitive to the variability in true concentration that is found in environmental analysis. This variability in true concentration means that there are no expected values for randomly selected samples, so that the accuracy of testing methodology must be evaluated indirectly through the recovery of known standards and spikes. As a result, it is somewhat difficult to apply industrial quality control techniques to the environmental laboratory.

Accuracy Control Limits

Accuracy is defined as the ability to obtain a result with minimal deviation from the actual amount. Control limits for accuracy are calculated after running a minimum of thirty analyses on spiked samples. The accuracy of the analysis is recorded as percent recovery. Percent recovery (P) can be calculated using the following equation:

$$P = \frac{\text{(observed result - background)}}{\text{(amount of spike)}} \times 100\%$$

After collecting a minimum of thirty data points for percent recovery, the average percent recovery (P_a) is calculated using the following equation:

$$P_a = \frac{\Sigma P}{\text{(number of points)}}$$

The standard deviation (P_s) is calculated using the following equation:

$$(P_s) = \sqrt{[\Sigma (X_i - X_{avg.})^2 \ / \ (n-1)]} \qquad \text{where n = number of points}$$

The warning and control limits are calculated using the following equations:

Upper Control Limit = UCL = $P_a + 3(P_s)$
Upper Warning Limit = UWL = $P_a + 2(P_s)$
Lower Warning Limit = LWL = $P_a - 2(P_s)$
Lower Control Limit = LCL = $P_a - 3(P_s)$

During a typical analytical run, one out of ten samples are spiked and analyzed. If the recovery of these samples is out of control, the spiked samples are usually diluted to counteract any matrix effect and reanalyzed until the spiked sample is in control.

Precision Control Limits

Precision is defined as the ability to obtain the same result every time a sample is analyzed. Control limits for precision are calculated after a minimum of thirty analyses on duplicate samples. The precision of the analysis is recorded as the difference in the results of the duplicate samples. The duplicate difference is calculated using the following equation:

$$D = \left|(\text{Result of 1st Analysis}) - (\text{Result of 2nd Analysis})\right|$$

Precision of the analysis can also be recorded as percent difference in the results of the duplicate samples. Percent difference ($D_{\%}$) is calculated using the following equation:

$$D_{\%} = \frac{(\text{Result of 1st Analysis}) - (\text{Result of 2nd Analysis})}{(\text{Result of 1st Analysis}) + (\text{Result of 2nd Analysis})} \times 200\%$$

Because the characteristics of precision for samples with a low concentration of analyte as compared to samples with a high concentration of analyte are different, control limits for individual analytes are divided into three ranges of concentrations. Samples with a low concentration of analyte must meet the control limits for the low concentration range. Samples with a high concentration of analyte must meet the control limits for the high concentration range. There is also an intermediate range of analyte concentration. The following is an example of this:

Range 1: 0 - 20 mg/L Maximum Duplicate Difference = 1 mg/L
Range 2: 21 - 40 mg/L Maximum Duplicate Difference = 2 mg/L
Range 3: 41 - 100 mg/L Maximum Duplicate Difference = 3 mg/L

After collecting a minimum of thirty data points for duplicate difference, the average duplicate difference (D_a) for a particular range can be calculated using the following equation:

$$D_a = \frac{\Sigma D}{(\text{number of points})}$$

where D = duplicate difference

The standard deviation (D_s) is calculated using the following equation:

$$(D_s) = \sqrt{[\Sigma (X_i - X_{avg.})^2 \ / \ (n-1)]}$$

where n = number of points

The warning and control limits for a particular concentration range are calculated using the following equations:

$$\text{Upper Control Limit} = UCL = D_a + 3(D_s)$$
$$\text{Upper Warning Limit} = UWL = D_a + 2(D_s)$$
$$\text{Lower Warning Limit} = LWL = D_a - 2(D_s)$$
$$\text{Lower Control Limit} = LCL = D_a - 3(D_s)$$

During an analytical run, one out of ten samples are run in duplicate. Many of these duplicate analysis involve the spiking of the samples to provide a non-zero result. If the difference between the duplicate analyses is out of control, the last ten samples are reanalyzed in an attempt to bring the system under control.

Sample Matrix

Since accuracy and precision data is more likely to vary with sample matrix, control limits have been established for the different matrices. There are separate control limits for clean, solid, and waste matrices.

Control Charts and Benchsheets

Accuracy and precision data can be best observed on a control chart. A control chart is a graphical representation of the data. An example of a control chart can be seen in Figure 1. This is a plot of Range 1 duplicate data and accuracy data for (Nitrate + Nitrite) analyzed by EPA method 353.2 (clean matrix).

When benchsheets are printed for an individual parameter, the control limits for that parameter are printed on the first page. Therefore, the analyst knows immediately if a spike or duplicate analysis is out of control.

Computer-Aided Data Entry and Limit Calculation

To assist in the tracking and entry of quality control data, customized computer programs are incorporated into the quality assurance program. Individual analytes are assigned a test code specific to Northern Lake Service requirements. All quality control data make reference to these testcodes. After the completion of every analytical run, the quality control data for that run is entered into the database. Results that exceed control limits are flagged immediately, and the sample batch is reanalyzed. Control limits are automatically recalculated annually. Only those parameters with a minimum of thirty data points are recalculated. All data and past control limits are stored in the new database for ten years.

FIELD SAMPLING QUALITY CONTROL

In addition to laboratory quality control, NLS has standardized field sampling techniques and field quality control. Each time our field sampling crew conducts groundwater sampling, a field equipment check is performed to determine cross contamination between wells.

NLS has devised the following procedure:

1. All equipment is triple rinsed with reagent-grade water. NOTE: This is the standard cleanup procedure between well samples.
2. 500 ml of reagent-grade water is run through the Geofilter pump and filter holder which contain a 0.45 um membrane filter to flush and remove any residual COD, TOC, MBAS, or other trace analytes.
3. An appropriate volume of water is placed in the bailer, filtered through the Geofilter filtering system, and collected into new bottles containing the proper preservatives. These samples are then iced.
4. Appropriate field analyses are run and recorded immediately after sample collection. Examples are conductivity, pH, and temperature.
5. Date, time, weather conditions, etc. are recorded for each sample collected.
6. The field equipment check is logged into the database when received at the lab with all the parameters to be performed on the corresponding samples. This is done to insure there is no possibility of cross-contamination.
7. All meters for field analysis are standardized prior to and after sample collection. Both the pH and conductivity meters are calibrated before sample collection and at four-hour intervals.

Field determination for odor, color, and turbidity on water samples might be expected to vary from observer to observer on the same sample. In an attempt to reduce this variability and produce the most definitive and repeatable results, the terminology shown in Table 3 will be used for these determinations by NLS personnel in the field. All records acquired during field sample collection are kept for a minimum of three years.

ANALYTICAL EQUIPMENT

Northern Lake Service always strives to utilize the most modern equipment available in the environmental analysis field. Many hours of evaluation and testing go into any equipment purchase. The following is a list of analytical equipment used at Northern Lake Service:

1. Technicon Auto Analyzer II.
2. Lachat QuikChem AE Automated Ion Analyzer .
3. Varian Atomic Absorption Spectrometer AA-1475.
4. Perkin Elmer Zeeman Atomic Absorption Spectrometers 4100ZL (two).
5. Thermo Jarrell Ash AtomScan 25 ICP.
6. Thermo Jarrell Ash ICAP 61E Trace Analyzer.
7. Sartorius Analtyical Balance.
8. Mettler – Toledo AT200 Analytical Balance.
9. Spectronic Genesys 2 Spectrometer.
10. Blue-M Magni-Whirl Constant Temperature Water Bath (two).
11. American Scientific Products Model DX-38 Drying Oven (three).
12. Thermolyne Model 6000 Laboratory Muffle Furnace.
13. Technicon BD-20/40 Digestion Block and Controller.

14. Orion Model 820 Oxygen Meter.
15. Fisher-Accumet AR40 Dissolved Oxygen Meter.
16. Hach Ratio/XR Turbidimeter.
17. Orion Specific Ion Electrode Meter Model 920A Fluoride, pH/temperature, redox, single/double junction electrodes.
18. Precision Scientific Inc. Steam Bath.
19. Baxter S/P Brand Ultrasonic Cleaners (two).
20. Hewlett Packard 5890 Gas Chromatograph with two Electronic Capture Detectors (PCBs/Pesticides).
21. Hewlett Packard 5890A Gas Chromatograph with two Nitrogen/ Phosphorus Detectors (N/P Pesticides).
22. Hewlett Packard 5890 Series II Gas Chromatograph with two Flame Ionization Detectors (DRO).
23. Varian 3400 Gas Chromatograph with Flame Ionization Detector Photo-Ionization Detector (GRO/PVOC).
24. Varian 3400-CX Gas Chromatograph with Flame Ionization Detector and Photo-Ionization Detector. (GRO/PVOC).
25. Varian 3400 Gas Chromatograph with Flame Ionization Detector (Methanol).
26. Varian 3300 Gas Chromatograph with Photo-Ionization Detector (PVOC).
27. Varian Saturn II GC / Mass Spectrometer (VOC).
28. Varian Saturn III GC / Mass Spectrometer (Drinking Water VOC).
29. Varian Saturn 2000 GC/Mass Spectrometer (VOC).
30. Varian Saturn 2000R GC/Mass Spectrometer (VOC).
31. Tekmar LSC 2000 Purge and Trap with ALS 2016 16-position autosampler (four).
32. Tekmar LSC 3000 Purge and Trap with ALS 2016 16-position autosampler (four).
33. Hewlett Packard High Performance Liquid Chromatograph with 1046A Fluorescence Detector 1040 Diode Array (PAH). Detector , 1050 Autosampler, 1050 Quaternary Pump.
34. Hewlett Packard 3365 Dos Chemstation Software (GC Operating System).
35. Hewlett Packard 3D Win Chemstation for HPLC Software (HPLC Operating System).
36. Hewlett-Packard 5890 Series II Plus Gas Chromatograph/Mass Spectrometer - Series 5972 (Semivolatiles).
37. Lab-Crest MIDI Distillation system.
38. Ohmicron model RPA-1 Spectrophotometer.
39. Lachat Quik Chem Model 8000 Atomic Fluorescence Mercury Analyzer.
40. ABC Gel Permeation Chromatography (GPC) System.
41. Environmental Express "Hot Block" Metals Digestion Block and Controller.
42. Lachat "Astro" Total Organic Carbon Analyzer.
43. Hewlett Packard 5890 Series II+ Gas Chromatograph with Nitrogen/ Phosphorus and Electronic Capture Detectors (PCBs/Pesticides).
44. Bran + Luebbe AutoAnalyzer 3 (Cyanide, Ammonia, Total Kjeldahl Nitrogen).
45. Dionex DX-500 Ion Chromatograph (Anion analyses, Bromide, Chloride, Sulfate).
46. Thermo-Orion Model 960/940 Autotitrator with AS3000 AutoSampler (Alkalinity, Fluoride).
47. Varian Saturn 2100 D GC/MS with CP 8400 AutoSampler (Drinking Water Semi-Volatiles).
48. Leeman Labs' Hydra AF Gold Plus Atomic Fluorescence Analyzer (Ultra-low level Mercury in the 0.05 ppt range).

INSTRUMENT CALIBRATION

Instruments are calibrated or the calibration is verified on the day of analysis. A blank and a minimum of three or more calibration standards is generally used to calibrate every instrument. Some methods allow the use of a continuing calibration check standard to assure the calibration from the previous day is still intact, in which case, the recovery of the check standard must fall within predetermined limits. If this check standard does not meet the limits, the instrument must be recalibrated using a blank and generally at least three calibration standards. The following are summaries of the calibration procedures for all instruments:

1. Furnace Atomic Absorption analysis on Varian AA Furnace:
   All standard calibration curves consist of a blank and a minimum of three standards. All samples are analyzed in duplicate. Spikes are analyzed at a ration of 1 in every 10 samples. A continuing calibration blank (CCB) and a continuing calibration verification (CCV) check sample are reanalyzed after every tenth sample (maximum).

2. Flameless Atomic Absorption for Hg on Varian AA Furnace:
   All standard calibration curves consist of the following: A blank and standards at (0.05; 0.10; 0.2; 0.5; and 1.0)

Samples are spiked at a ratio of 1 in every 10 samples; different dilutions are acceptable.

3. Metals by Thermo Jarrel Ash ICP model Atomscan 25:
   All standard calibration curves consist of a blank and one calibration standard. All curves are determined within the linear dynamic range of the instrument for each element. All samples are scanned a minimum of three times per element. Duplicate and spikes are analyzed at a ratio of 1 in every 10 samples.

4. Metals by Thermo Jarrel Ash – Trace ICP:
   All standard calibration curves consist of a blank and one calibration standard. All curves are determined within the linear dynamic range of the instrument for each element. All samples are scanned a minimum of two times per element. Duplicate and spikes are analyzed at a ratio of 1 in every 10 samples.

5. Metals by Perkin Elmer Zeeman Atomic Absorption Furnace model 4100ZL:
   All standard calibration curves consist of a blank and a minimum of three standards run in duplicate. All samples are analyzed in duplicate. Spikes are analyzed at a ratio of 1 in every 10 samples.

6. Mercury by Lachat Model 8000 Quik Chem atomic Fluorescence Mercury Analyzer:
   All standard calibration curves consist of a blank and 5 standards. Duplicate spikes are analyzed 1 in every 10 samples. Continuing calibration verifications and blanks are analyzed every 10 samples.

7. Wet chemistry determined on the Technicon AA II & III; and the Lachat Autoanalyzer:
   All standard calibration curves consist of a blank and a minimum of three calibration standards run in duplicate. Duplicates and spikes are analyzed at a ratio of 1 in every 10 samples.

8. Ion Chromatography anions are determined using the Dionex DX-500 Ion Chromatograph system:
   All standard calibration curves consist of a minimum of four calibration standards run in duplicate. Duplicates, spikes, continuing calibration verification and a blank are analyzed at a ratio of 1 in every 10 samples.

9. Wet chemistry determined on Spectronic Genesys 2 and Bausch & Lomb Spec 88 spectrophotometers:
   All standard calibration curves consist of a blank and a minimum of three standards. Duplicates and spikes are analyzed at a ratio of 1 in every 10 samples.

10. Conductivity meter:
    Meter standardized using 0.010 Molar solution of Potassium Chloride at 718 Micromhos/cm @ 25° C.

11. pH meter:
    Calibrated using a pH 7.00 buffer and one other buffer to bracket the expected sample pH range. The calibration of the meter is verified after every 20th sample and at the end of the pH run. If standards differ by greater than 0.05 pH units from the true concentration, the meter is recalibrated and samples are reanalyzed. A certified pH verification check sample is analyzed with every set of samples.

12. Titrations:
    Titration analysis for alkalinity, fluoride and calcium using an autotitrator and autosampler consists of a titrated blank and a 100 mg/L standard as CaCO3, followed by the samples. Duplicates and spikes are analyzed at a ratio of 1 in every 10 samples.

13. Gasoline Range Organics and PVOCs analyzed on the Varian 3400 and 3400-CX, Gas Chromatograph:
    Standard curves consist of a blank and six calibration standards. A continuing calibration is utilized on these instruments for GRO and PVOCs. After the instruments have been initially calibrated, the curves can be used until the check standard recoveries are out of the 80-120% range. Duplicates and spikes are analyzed at a ratio of 1 in every 10 samples. Check standards are analyzed at a minimum of 1 in every 20 samples.

14. Diesel Range Organics run on HP5890A GC:
    Standard curves consist of a blank and five calibration standards. A continuing calibration is utilized on this instrument for DRO. After the instrument has been initially calibrated, the curve can be used until the check standard recoveries are out of the 80-120% range. Duplicates, Spikes and Check Standards are analyzed every 20 samples.

15. Polynuclear Aromatic Hydrocarbons (PAHs) run on HP-1050 High Performance Liquid Chromatograph (HPLC):
Standard curves consist of primarily a blank and six calibration standards with five compounds having a seventh standard. A continuing calibration is the middle (1.0 ppm) calibration standard for all compounds with a run log ratio of 1 in 20 or more frequent. After the instrument has been initially calibrated, the curve can be used until the check standard recoveries are out of the 85%-115% range. Sample sets have spike / duplicates at a ratio of 1 set of spike / duplicates per 20 samples including also a set of matrix spike / duplicates per 20 samples

16. PCBs and Pesticides run on HP5890 GC:
Standard curves consist of a blank and five calibration standards. A continuing calibration is utilized on this instrument. After the instrument has been initially calibrated, the curve can be used until the check standard recoveries are out of the 85 - 115 % range. Duplicates and spikes are analyzed at a ratio of one in every 20 samples. Check standards are analyzed at a minimum of one in every ten samples.

17. Safe Drinking Water Act analysis of VOCs run on the Varian Saturn GC/MS:
The standard curve consists of a blank and six calibration standards. A continuing calibration is utilized on this instrument. After the instrument has been initially calibrated, the curve can be used as long as check standard recoveries meet the accuracy criteria of ± 30%. Check standard frequency is 1 per every 12 hours of analytical time. Additional QC includes one sensitivity standard and one lab fortified blank per every 12-hour batch.

18. VOCs run on Varian Saturn II & Saturn 2000 GC/MSs:
Standard curves consist of a blank and six calibration standards. A continuing calibration is utilized on this instrument. After the instrument has been initially calibrated, the curve can be used until the check standard recoveries are out of the 80-120% range. Duplicates and spikes are analyzed at a minimum of 1 in every 10 samples.

19. Semi-Volatiles analyzed on the Hewlett-Packard GC/MS:
Standard curves consist of a blank and six calibration standards. A continuing calibration is utilized on this instrument. After the instrument has been initially calibrated, and prior to analysis, the initial calibration curve must meet the following requirements: The 13 CCC compounds must have a percent RSD <30%; and SPCC compounds must have an RF > 0.05. Remaining compounds should have an RSD < 15 % or use a "Higher Order" curve. If the daily Continuing Calibration does not meet the specifications for any of the CCCs and SPCCs, then recalibration may be needed. The CCAL specifications are: 1: CCCs < 20 % difference from ICAL RF and ...2) SPCC > 0.05 RF. The instrument must pass the DFTPP tune specifications given in the method every 12 hours. Duplicate and spike a minimum of 1 in every 10 samples. A total of six surrogates are used for semi-volatiles analyses (three apply to the acid extraction and three apply to the basic extraction).

Calculations performed by NLS staff to reduce raw data into final form are performed by the analyst, and checked by a peer-reviewer). The lab manager periodically spot-checks rough data calculations. The department supervisors review the final report data prior to the data being released in the final reports.

PREVENTATIVE MAINTENANCE

Refrigerators are monitored daily for temperature; the temperature is kept at 1-4 degrees C. The large walk-in refrigerator is continually monitored by computerized sensors and is alarmed to the homes of computer operations staff. The BOD-5 incubator is kept at 20 ± 1 degrees C, and temperature is monitored daily. Glucose / Glutamic acid checks are analyzed daily for BOD. Blanks for BOD should have a depletion drop of <0.20 mg/L. If depletion exceeds 0.20 mg/L, BOD bottles, storage bottles, and dilution water beakers are washed with concentrated chromic acid and rinsed six times with reagent-grade water.

Analytical balances are cleaned frequently and serviced and calibrated annually by E&B Scale. Balances are checked with class S weights when they are used.

Scheduled maintenance is performed on all analytical equipment. Maintenance procedures for individual instruments are performed according to instructions in the specific owner and operation manual for that piece of equipment. Conductivity, pH, and specific ion electrodes are rinsed with reagent grade water after each use. Probes are also cleaned according to cleaning procedure in operation manuals. Records outlining daily measurements are kept for a minimum of three years. The following list outlines the type of measurements recorded:

1. Sample storage refrigeration temperatures.
2. Standards storage refrigeration temperatures.
3. Laboratory oven temperatures.
4. Laboratory digestion block temperatures.
5. Standardization of pH and conductivity meters.
6. Water bath systems temperatures.
7. Turbidity Meter calibration.
8. Conductivity of reagent grade water.
9. Standardization of field meters.
10. pH of preserved samples.
11. Calibration of laboratory thermometers.
12. Sample extraction data and procedures.
13. Sources and lot numbers of standards used.
14. Maintenance logs for all analytical instruments.
15. Analytical instrument run logs.
16. Records of computer archived raw data.
17. Room temperatures for TCLP/SPLP leaching tests.

LABORATORY INFORMATION MANAGEMENT SYSTEM

In order to efficiently manage the large amount of data produced by an analytical laboratory, Northern Lake Service uses an ARL Revolution 6x6 server operating under the SCO Unix V5.0.2 operating system and an Oracle database Version 7.x. The ALR Revolution 6x6 is a 6 CPU-Pentium Pro 200 mhz server using Raid Level 1 and 5 for file storage. The Raid file storage allows the database to continue to operate during a hard drive failure. Additional backup steps are taken by automatically archiving all database files to DAT tapes nightly. A secondary server is on standby in case of a full hardware failure on the main server. All database access is password protected.

The versatility of the Unix operating system and the Oracle database allows us to conform to the various needs of our customers. Data can be transferred to the customer via disk or email. Data formats can be adjusted so the data may be imported into various types of software. NLS has developed and delivered numerous custom formats to fulfill the needs of our clients.

The database is used in almost every step of the analytical process. After receiving a project from a customer at the laboratory, the samples are logged into the database. The corresponding customer information and analytical parameters to perform on the samples are entered into the database. Sample labels and log-in reports are automatically printed and optionally FAXed to clients. The analysts can then print benchsheets for the individual tests to perform. After completing the analytical run, the analyst enters all results and corresponding quality control information into the database. A list of completed projects is automatically printed every morning. The final reports are then printed for these projects, reviewed, and sent to the client. Quality control limits for all parameters can be calculated on command and are generally recalculated annually. Results for every project are stored in the computer for a minimum of ten years after the receipt of samples. A number of reports can also be run to help in the scheduling process. All customer data is backed up every night onto a tape drive.

ANALYSIS OF QUALITY CONTROL SAMPLES

Laboratory Certification

Northern Lake Service participates in the Wisconsin Laboratory Certification and Registration Program. NLS is currently enrolled and certified through two NVLAP Certified Provider-Performance Evaluation Programs: the Water Supply and the Water Pollution Programs. The Wisconsin Department of Natural Resources grants certification depending on the results of these programs as well as its own WSLH performance evaluation sample program. Certified laboratories must comply with the rules and regulations established in NR149 and 219. Reciprocal laboratory certification has been granted to NLS in the State of Michigan for drinking water analyses.

Performance Evaluation Samples (Reference Samples)

Wisconsin certified laboratories are required to analyze reference samples for each test category in which they wish to be certified. In order to be certified for a test category, the reference sample results must meet the acceptable limits established by the provider. If certification of a test category depends on more than one analyte, the laboratory must have 80% of the results within acceptable limits. For test categories in which reference samples are not required, the laboratory must demonstrate acceptable precision and accuracy based on replicate and spiked sample analysis. Table 4 displays the test categories in which Northern Lake Service is certified.

Blind Standards

Wisconsin certification also requires the analysis of blind standards. Blind standards are administered by the NLS QA Officer and are analyzed a minimum of three times per year. The known amount of analytes and the acceptable ranges are shipped to the QA Officer along with the blind standard ampules. If the result of any test category is not within the acceptable range, corrective action must be taken and the standard must be reanalyzed until the corrective action proves to be successful.

SAFE DRINKING WATER ACT

This section outlines QA/QC required for certification under the Safe Drinking Water Act (SDWA). Wisconsin has addressed the necessary requirements under the Wisconsin administrative code NR809. Except where noted, this section only addresses SDWA protocol.

Sample Handling Procedures for Drinking Water

A chain-of-custody form accompanies all drinking water samples. All such samples are collected in bottles provided by NLS. These bottles come from a certified bottle check lot, and contain the proper preservatives as listed in Table 1. When a sample is received at NLS, whether collected by a client or by NLS staff, it is logged into the Laboratory Database Management Program. When all analyses are complete, a data report is printed, reviewed by the laboratory management, then sent to the client. Completed samples may be discarded by NLS staff three weeks after the final analytical report is mailed to the client .

Sample Collection, Handling, and Preservation procedure:

The sample tap must be representative of the potable water system. The water tap is sampled after maintaining a steady flow for two to three minutes to clear the service line with the exception of copper and/or lead sampling which must a "first draw" sample from a tap not used for a period of at least six hours prior to collection. The sample is taken prior to, or bypassing, any water purification or water softening devices, if possible. The tap must be free of aerator, strainer, and hose attachments. Samples are preserved according to Table 1. Analyses are then completed prior to maximum holding times. When maximum holding times cannot be met, the sample is discarded and a new sample collected. If a Safe Drinking Water Act sample exceeds the maximum contaminant level for a primary drinking water standard parameter, this occurrence is formally communicated to the client.

Safe Drinking Water Methodology

Table 5 contains the approved methodology for drinking water parameters.

TABLE I
SUMMARY OF SPECIAL SAMPLING OR HANDLING REQUIREMENTS

TEST NAME	CONTAINER TYPE	SIZE (ml)	PRESERVATION	REGULATORY HOLDING TIME
Acidity	P,G	100	Refrigerate	14 days
Alkalinity	P,G	200	Refrigerate	14 days
BOD-5	P,G	1000	Refrigerate	48 hrs
Boron	P,G	100	*6	6 months
Bromide	P,G	100	None required	28 days
Carbon, tot. Organic	P,G	250	*4	28 days
Carbon dioxide	P,G	40	None required	Immediately
COD	P,G	100	*4	28 days
Chloride	P,G	30	None required	28 days
Chlorine, Residual	P,G	500	None required	Immediately
Chlorophyll	P,G	500	*2	28 days
Color	P,G	500	Refrigerate	48 hrs
Conductivity	P,G	500	Refrigerate	28 days
Cyanide, tot.	P,G	250	*3	14 days
Fluoride	P	300	None required	28 days
Grease & Oil	G	1000	*10	28 days
Hardness	P,G	100	*6	6 mos
Iodine	P,G	500	None required	Immediately
Metals, except mercury	P(A),G(A)	500	*5, *6	6 mos
Chromium, Hexavalent	P(A),G(A)	300	Refrigerate	24 hrs
Mercury	P(A),G(A)	500	*6	28 days
Mercury, Low-level	G (A)	250	*14	28 days
Nitrogen, Ammonia	P,G	60	*1	28 days
Nitrogen, Nitrite	P,G	100	Refrigerate	48 hrs
Nitrogen, Nitrate	P,G	100	Refrigerate	48 hrs
Nitrogen, N02+N03	P,G	60	*4	28 days
Nitrogen, TKN	P,G	500	*4	28 days
Odor	G	500	None required	48 hrs
Phenols, (4AAP)	G only	500	*4	28 days
Purgeables, purge & trap	G(C)	40	*9	14 days
Pesticides-GC	G(D)	1000	Refrigerate	E7-A40
Nitrotoluenes	G(D)	1000	Refrigerate	E7-A40
PAHs	G(D)	1000	Refrigerate	E7-A40
Chlorinated Hydrocarbons	G(D)	1000	Refrigerate	E7-A40
DRO (water)	G(D)	1000	*11	E7-A40
DRO (soil)	G(D)	25 g	Refrigerate	E10-A40
GRO (soil)	G(D)	25 g	*12	14 days
GRO (water)	G(D)	40	*13	14 days
Oxygen, dis. (electrode)	G(E)	300	None required	Immediately
pH	P,G	50	None required	2 hrs
Phosphorus, elemental	G	100	Refrigerate	48 hrs
Phosphorus, orthophosphate	P,G	100	*15	48 hrs
Phosphorus, total	P,G	100	*4	28 days
Salinity	G(F)	240	None required	Immediately
Silica	P	50	Refrigerate	28 days
Solids	P,G	250	Refrigerate	7 days
Sulfate	P,G	50	Refrigerate	28 days
Sulfide	P,G	300	*8	7 days
Temperature	P,G	500	None required.	Immediately

Key for Table I - "Sampling and Handling Requirements"

Refrigerate = storage at 4 ° C, in darkness.
P = plastic
G = glass
G(A) = glass, acid rinsed or QA/QC checked
G(B) = glass, borosilicate
G(C) = glass, VOC vial
G(D) = glass, teflon lined cap
G(E) = glass, BOD bottle
G(F) = glass, wax seal
G(S) = glass, rinsed with organic solvents.

E7-A40 = extraction in 7 days, analysis in 40 days.
E10-A40 = extraction in 10 days, analysis in 40 days.
*1 = Analyze immediately, or refrigerate and add H2SO4 to pH < 2.
*2 = Filter ASAP and store in dark freezer, analyze within 3 weeks.
*3 = Add NaOH to pH > 12, refrigerate, store in dark.
*4 = Add H2SO4 to pH < 2, refrigerate .
*5 = Dissolved metals need to be filtered immediately, prior to preservation .
*6 = Add HNO3 to pH < 2, refrigerate .
*7 = Analyze as soon as possible, refrigerate, or freeze at 20° C .
*8 = Refrigerate, add 4 drops 2N zinc acetate/100 ml and 10 tablets of NaOH .
*9 = Refrigerate, add 100 mg ascorbic acid if residual Cl present add 1:1 HCL to pH< 2.
*10 = Add HCl to pH < 2, refrigerate.
*11 = Add 5 mLs of 50% HCl, refrigerate.
*12 = Add 25 mLs of P&T Methanol to 25 grams of soil, refrigerate.
*13 = Add (0.5) mLs of 50% HCl, refrigerate.
*14 = Add (2.5) mLs of concentrated HCl, refrigerate.
*15 = Filter immediately (0.45 micron), refrigerate at 4°C

TABLE 2
DETECTION LIMITS AND CORRESPONDING METHODS
(Subject to Updates, Dilutional Adjustments and Sample Matrices)

Parameter	Method Detection Limit		Method
Alkalinity (Buret)	2.5	mg/L	EPA 310.1, 310.2, SM 2320B
Alkalinity (Autotitrater)	1.1	mg/L	EPA 310.2
B.O.D. (5 days)	2.0	mg/L	SM 5210B
Chloride	5.0	mg/L	EPA 300.0
Chromium (Hexavalent)	3.6	ug/L	EPA 7196
C.O.D.	2.6	mg/L	EPA 410.1, SM 5220B
Color (APHA)	5.0	C.P.U.	EPA 110.2
Conductivity	1.0	umhos/cm	EPA 120.1
Cyanide	0.0027	mg/L	EPA 335.4
Cyanide (weak acid)	0.0027	mg/L	EPA 335.4
Dissolved Oxygen	0.5	mg/L	EPA 360.1
Fluoride	0.05	mg/L	EPA 340.2, 4500F-C
Hardness (tot. as CaCO3)	2.5/2.0	mg/L	EPA 130.2, 200.7,6010
Nitrogen, Ammonia	0.025	mg/L	EPA 350.1
Nitrogen, Kjeldahl	0.104	mg/L	EPA 351.2
Nitrogen, Nitrite	0.003	mg/L	SM4500 NO_2B
Nitrogen, Nitrate + Nitrite	0.075	mg/L	EPA 353.1, 353.2
Oil & Grease (n-Hexane)	1.06	mg/L	EPA 1664
pH	1	su	EPA 150.1, 9045
Phenol (Distillation 4AAP)	0.05	mg/L	EPA 9065
Phosphorus Total, Dissolved	0.007	mg/L	EPA 365.2, SM 4500P-E
Residue-Total (TS)	2.0	mg/L	EPA 160.3
Residue-Filterable (TDS)	2.0	mg/L	EPA 160.1
Residue-Nonfilterable, (TSS)	1.0	mg/L	EPA 160.2
Residue-Volatile Dissolved, (DVS)	2.0	mg/L	EPA 160.4
Residue-Volatile Total (TVS)	2.0	mg/L	EPA 160.4
Residue-Volatile Suspended, (SVS)	5.0	mg/L	EPA 160.4
Solids-Organic	0.1	%DWB	EPA 160.3
Solids-Percent	0.1	%DWB	EPA 160.3
Sulfate	5.0	mg/L	EPA 300.0
Sulfide	2.0	mg/L	EPA 376.1, SM 4500S^2-E
Total Organic Carbon	0.540	mg/L	EPA 415.1, SM 9060
Turbidity	0.5	NTU	EPA 180.1
Furnace AA Metals (Undigested)			
Antimony	1.69	ug/L	EPA 204.2, 704.1, 3113B
Arsenic	2.64	ug/L	EPA 206.2, 7060, 3113B
Beryllium	0.39	ug/L	EPA 210.2, 7091, 3113B
Cadmium	0.118	ug/L	EPA 213.2, 7131, 3113B
Chromium	0.308	ug/L	EPA 218.2, 7191, 3113B
Copper (SDWA)	12.8	ug/L	EPA 220.1, 7210
Copper	0.398	ug/L	EPA 220.2, 7211, 3113B
Lead	0.546	ug/L	EPA 239.2, 7421, 3113B
Selenium	2.50	ug/L	EPA 270.2, 7740, 3113B
Silver	0.102	ug/L	EPA 272.2, 7761, 3113B
Thallium	1.44	ug/L	EPA 279.2, 7841, 200.9
Mercury, Cold Vapor (Soil)	0.110	mg/Kg	EPA 245.1, 7470, 3112B
Mercury, Standard-Level	50	ng/L	EPA 245.7/163/M
Mercury, Low-Level	15	ng/L	EPA 245.7/163/M
Mercury, Ultra low-level	1.1	ng/L	EPA 245.7/163/M

TABLE 2 CONTINUED: Methods and Detection Limits

Metals by ICP (Undigested)	Method Detection Limit		Method
Aluminum	0.0317	mg/L	EPA 200.7, 6010, 3120B
Barium	0.005	mg/L	EPA 200.7, 6010, 3120B
Beryllium	0.006	mg/L	EPA 200.7, 6010, 3120B
Boron	0.152	mg/L	EPA 200.7, 6010, 3120B
Cadmium	0.0036	mg/L	EPA 200.7, 6010, 3120B
Calcium	0.30	mg/L	EPA 200.7, 6010, 3120B
Chromium	0.0094	mg/L	EPA 200.7, 6010, 3120B
Cobalt	0.0076	mg/L	EPA 200.7, 6010, 3120B
Copper	0.0041	mg/L	EPA 200.7, 6010, 3120B
Iron	0.045	mg/L	EPA 200.7, 6010, 3120B
Lead	0.0878	mg/L	EPA 200.7, 6010, 3120B
Lithium	0.0022	mg/L	EPA 200.7, 6010, 3120B
Magnesium	0.30	mg/L	EPA 200.7, 6010, 3120B
Manganese	0.0029	mg/L	EPA 200.7, 6010, 3120B
Molybdenum	0.0267	mg/L	EPA 200.7, 6010, 3120B
Nickel	0.0187	mg/L	EPA 200.7, 6010, 3120B
Potassium	0.211	mg/L	EPA 200.7, 6010, 3120B
Silver	0.0027	mg/L	EPA 200.7, 6010, 3120B
Sodium	0.033	mg/L	EPA 200.7, 6010, 3120B
Strontium	0.0010	mg/L	EPA 200.7, 6010, 3120B
Thallium	0.0952	mg/L	EPA 200.7, 6010, 3120B
Tin	0.026	mg/L	EPA 200.7, 6010, 3120B
Titanium	0.0133	mg/L	EPA 200.7, 6010, 3120B
Vanadium	0.0047	mg/L	EPA 200.7, 6010, 3120B
Zinc	0.012	mg/L	EPA 200.7, 6010, 3120B
Metals by Trace ICP (Undigested)			
Aluminum	0.0031	mg/L	EPA 200.7, 6010, 3120B
Antimony	1.85	ug/L	EPA 200.7, 6010,3120B
Arsenic	2.65	ug/L	EPA 200.7, 6010, 3120B
Barium	5.0	ug/L	EPA 200.7, 6010, 3120B
Beryllium	0.17	ug/L	EPA 200.7, 6010, 3120B
Boron	50	ug/L	EPA 200.7, 6010, 3120B
Cadmium	0.226	ug/L	EPA 200.7, 6010, 3120B
Calcium	0.30	mg/L	EPA 200.7, 6010, 3120B
Chromium	0.440	ug/L	EPA 200.7, 6010, 3120B
Cobalt	0.320	ug/L	EPA 200.7, 6010, 3120B
Copper	2.67	ug/L	EPA 200.7, 6010, 3120B
Iron	0.005	mg/L	EPA 200.7, 6010, 3120B
Lead	0.921	ug/L	EPA 200.7, 6010, 3120B
Magnesium	0.30	mg/L	EPA 200.7, 6010, 3120B
Manganese	2.0	ug/L	EPA 200.7, 6010, 3120B
Molybdenum	3.33	ug/L	EPA 200.7, 6010, 3120B
Nickel	0.710	ug/L	EPA 200.7, 6010, 3120B
Selenium	2.6	ug/L	EPA 200.7, 6010, 3120B
Silver	0.472	ug/L	EPA 200.7, 6010, 3120B
Sodium	0.020	mg/L	EPA 200.7, 6010, 3120B
Thallium	2.53	ug/L	EPA 200.7, 6010, 3120B
Vanadium	1.33	ug/L	EPA 200.7, 6010, 3120B
Zinc	10.0	ug/L	EPA 200.7, 6010, 3120B

TABLE 2 CONTINUED: Methods and Detection Limits

VOCs by EPA SW-846, Method 8260, Varian Saturn 2000R (GC/MS)

Parameter	(Water 5 mL)	
Benzene	0.119	ug/L
Bromobenzene	0.117	ug/L
Bromochloromethane	0.158	ug/L
Bromodichloromethane	0.179	ug/L
Bromoform	0.143	ug/L
Bromomethane	0.608	ug/L
n-Butylbenzene	0.131	ug/L
sec-Butylbenzene / 1,3-Dichlorobenzene	0.118	ug/L
tert-Butylbenzene	0.117	ug/L
Carbon Tetrachloride	0.103	ug/L
Chlorobenzene	0.115	ug/L
Chloroethane	1.145	ug/L
Chloroform	0.149	ug/L
Chloromethane	0.15	ug/L
2-Chlorotoluene	0.234	ug/L
4-Chlorotoluene	0.145	ug/L
Dibromochloromethane	0.152	ug/L
1,2-Dibromo-3-Chloropropane (DBCP)	0.225	ug/L
Ethylene Dibromide (1,2-Dibromoethane)	0.143	ug/L
Dibromomethane	0.188	ug/L
1,2-Dichlorobenzene	0.113	ug/L
1,3-Dichlorobenzene	0.37	ug/L
1,4-Dichlorobenzene	0.247	ug/L
Dichlorodifluoromethane	0.176	ug/L
1,1-Dichloroethane	0.639	ug/L
1,2-Dichloroethane	0.151	ug/L
1,1-Dichloroethene	0.134	ug/L
cis-1,2-Dichloroethene	0.279	ug/L
trans-1,2-Dichloroethene	0.13	ug/L
1,2-Dichloropropane	0.314	ug/L
1,3-Dichloropropane	0.127	ug/L
2,2-Dichloropropane	0.119	ug/L
1,1-Dichloropropene	0.135	ug/L
cis-1,3-Dichloropropene	0.149	ug/L
trans-1,3-Dichloropropene	0.122	ug/L
Ethylbenzene	0.184	ug/L
Hexachlorobutadiene	0.195	ug/L
Isopropylbenzene	0.143	ug/L
p-Isopropyltoluene	0.137	ug/L
Methylene Chloride	0.236	ug/L
Naphthalene	0.37	ug/L
n-Propylbenzene	0.243	ug/L
Ortho-xylene	0.209	ug/L
Styrene	0.131	ug/L
1,1,1,2-Tetrachloroethane	0.125	ug/L
1,1,2,2-Tetrachloroethane	0.176	ug/L
Tetrachloroethene	0.103	ug/L
Toluene	0.174	ug/L
1,2,3-Trichlorobenzene	0.198	ug/L
1,2,4-Trichlorobenzene	0.174	ug/L
1,1,1-Trichloroethane	0.167	ug/L

TABLE 2 CONTINUED: Methods and Detection Limits

VOCs by EPA SW-846, Method 8260, Varian Saturn 2000R (GC/MS) - Continued

Parameter	(Water 5 mL)	
1,1,2-Trichloroethane	0.252	ug/L
Trichloroethene	0.128	ug/L
Trichlorofluoromethane	0.144	ug/L
1,2,3-Trichloropropane	0.253	ug/L
1,2,4-Trimethylbenzene	0.111	ug/L
1,3,5-Trimethylbenzene	0.1	ug/L
Vinyl Chloride	0.175	ug/L
meta,para-Xylene	0.35	ug/L
MTBE	0.189	ug/L
Acteone	5.5	ug/L
Iodomethane	.134	ug/L
Carbon disulfide	.155	ug/L
Acrylonitrile	.443	ug/L
Acrolein	1.852	ug/L
Vinyl acetate	1.886	ug/L
Methyl ethyl ketone	.857	ug/L
2-Chloroethyl vinyl ether	.197	ug/L
4-methyl-2-pentanone	.459	ug/L
2-Hexanone	.407	ug/L
Tetrahydrofuran	.403	ug/L
2,3-Dichloro-1-propene	.141	ug/L
Trans 1,4-dichloro-2butene	.441	ug/L
Allyl chloride	.271	ug/L
Chloroprene	.257	ug/L
Methacrylonitrile	.33	ug/L
Methyl methacrylate	.318	ug/L
Ethyl methacrylate	.181	ug/L
Acetonitrile	2.427	ug/L
Hexane	.158	ug/L
Propionitrile	2.249	ug/L
Isobutanol	5.399	ug/L
Heptane	.124	ug/L
Octane	.313	ug/L
Cis-1,4-Dichloro-2-butene	.557	ug/L
1,3-Butadiene	.191	ug/L
Dichlorofluoromethane	.259	ug/L
Ether	.45	ug/L
1,1,2-Trichlorotrifluoroethane	.261	ug/L
Dichloroacetonitrile	1.112	ug/L
4,4-Dimethyl-2-Pentanone	.665	ug/L
Isopropyl Ether	.195	ug/L
Ethyl Acetate	1.044	ug/L
Cyclohexanone	9.11	ug/L
Isopropyl Alcohol	3.772	ug/L

VOCs by GC/MS EPA Method 524.2 (Drinking Water) Saturn 2000R

Parameter	(Water 5 mL)	
Benzene	0.066	ug/L
Bromobenzene	0.077	ug/L
Bromochloromethane	0.062	ug/L
Bromodichloromethane	0.132	ug/L
Bromoform	0.168	ug/L
Bromomethane	0.358	ug/L
n-Butylbenzene	0.095	ug/L
sec-Butylbenzene	0.099	ug/L
tert-Butylbenzene	0.08	ug/L
Carbon Tetrachloride	0.087	ug/L
Chlorobenzene	0.086	ug/L
Chloroethane	0.283	ug/L
Chloroform	0.117	ug/L
Chloromethane	0.159	ug/L
2-Chlorotoluene	0.059	ug/L
4-Chlorotoluene	0.84	ug/L
Dibromochloromethane	0.101	ug/L
1,2-Dibromo-3-Chloropropane	0.082	ug/L
Ethylene Dibromide (1,2-Dibromoethane)	0.052	ug/L
Dibromomethane	0.059	ug/L
1,2-Dichlorobenzene	0.063	ug/L
1,3-Dichlorobenzene	0.056	ug/L
1,4-Dichlorobenzene	0.074	ug/L
Dichlorodifluoromethane	0.102	ug/L
1,1-Dichloroethane	0.061	ug/L
1,2-Dichloroethane	0.064	ug/L
1,1-Dichloroethene	0.094	ug/L
cis-1,2-Dichloroethene	0.08	ug/L
trans-1,2-Dichloroethene	0.099	ug/L
1,2-Dichloropropane	0.109	ug/L
1,3-Dichloropropane	0.066	ug/L
2,2-Dichloropropane	0.091	ug/L
1,1-Dichloropropene	0.06	ug/L
cis-1,3-Dichloropropene	0.074	ug/L
trans-1,3-Dichloropropene	0.051	ug/L
Ethylbenzene	0.081	ug/L
Hexachlorobutadiene	0.144	ug/L
Isopropylbenzene	0.082	ug/L
p-Isopropyltoluene	0.104	ug/L
Methylene Chloride	0.269	ug/L
Naphthalene	0.105	ug/L
n-Propylbenzene	0.078	ug/L
Nitrobenzene	1.189	ug/L
ortho-xylene/ Styrene	0.07	ug/L
1,1,1,2-Tetrachloroethane	0.056	ug/L
1,1,2,2-Tetrachloroethane	0.143	ug/L
Tetrachloroethene	0.09	ug/L
Toluene	0.084	ug/L
1,2,3-Trichlorobenzene	0.127	ug/L
1,2,4-Trichlorobenzene	0.109	ug/L
1,1,1-Trichloroethane	0.058	ug/L
1,1,2-Trichloroethane	0.073	ug/L
Trichloroethene	0.083	ug/L
Trichlorofluoromethane	0.087	ug/L

TABLE 2 CONTINUED: Methods and Detection Limits

VOCs by GC/MS EPA Method 524.2 (Drinking Water) Saturn 2000R - Continued

Parameter	(Water 5 mL)	
1,2,3-Trichloropropane	0.077	ug/L
1,2,4-Trimethylbenzene	0.077	ug/L
1,3,5-Trimethylbenzene	0.065	ug/L
Vinyl Chloride	0.13	ug/L
meta,para-Xylene	0.145	ug/L
MTBE	0.058	ug/L

VOCs by GC/MS EPA Method 8260, 624 - Saturn 2 (Water and Methanol Preserved Soils)

Parameter	(Water 5 mL)		(Soil)	
Benzene	0.288	ug/L	11	ug/Kg
Bromobenzene	0.147	ug/L	10.9	ug/Kg
Bromochloromethane	0.359	ug/L	11.6	ug/Kg
Bromodichloromethane	0.316	ug/L	10.8	ug/Kg
Bromoform	0.292	ug/L	14.8	ug/Kg
Bromomethane	0.347	ug/L	21.3	ug/Kg
n-Butylbenzene	0.279	ug/L	10.7	ug/Kg
sec-Butylbenzene	0.322	ug/L	10.2	ug/Kg
tert-Butylbenzene	0.165	ug/L	13.3	ug/Kg
Carbon Tetrachloride	0.273	ug/L	10.2	ug/Kg
Chlorobenzene	0.26	ug/L	11.6	ug/Kg
Chloroethane	1.448	ug/L	59.84	ug/Kg
Chloroform	0.296	ug/L	10.9	ug/Kg
Chloromethane	0.288	ug/L	22.9	ug/Kg
2-Chlorotoluene	0.291	ug/L	13.2	ug/Kg
4-Chlorotoluene	0.219	ug/L	11.6	ug/Kg
Dibromochloromethane	0.264	ug/L	12.8	ug/Kg
1,2-Dibromo-3-Chloropropane	0.306	ug/L	24.4	ug/Kg
Ethylene Dibromide (1,2-Dibromoethane)	0.257	ug/L	14.1	ug/Kg
Dibromomethane	0.306	ug/L	14.6	ug/Kg
1,2-Dichlorobenzene	0.287	ug/L	10.9	ug/Kg
1,3-Dichlorobenzene	0.289	ug/L	12.2	ug/Kg
1,4-Dichlorobenzene	0.261	ug/L	12.9	ug/Kg
Dichlorodifluoromethane	0.338	ug/L	10.8	ug/Kg
1,1-Dichloroethane	0.231	ug/L	11.5	ug/Kg
1,2-Dichloroethane	0.335	ug/L	12.5	ug/Kg
1,1-Dichloroethene	0.287	ug/L	10.4	ug/Kg
cis-1,2-Dichloroethene	0.278	ug/L	12.2	ug/Kg
trans-1,2-Dichloroethene	0.293	ug/L	10.2	ug/Kg
1,2-Dichloropropane	0.334	ug/L	11.7	ug/Kg
1,3-Dichloropropane	0.328	ug/L	14.4	ug/Kg
2,2-Dichloropropane	0.283	ug/L	16.2	ug/Kg
1,1-Dichloropropene	0.293	ug/L	10.9	ug/Kg
cis-1,3-Dichloropropene	0.318	ug/L	10	ug/Kg
trans-1,3-Dichloropropene	0.344	ug/L	14.2	ug/Kg
Ethylbenzene	0.279	ug/L	12.43	ug/Kg
Hexachlorobutadiene	0.365	ug/L	16.7	ug/Kg
Isopropylbenzene	0.279	ug/L	10.9	ug/Kg
p-Isopropyltoluene	0.314	ug/L	10.9	ug/Kg
Methylene Chloride	0.562	ug/L	15.5	ug/Kg
Naphthalene	0.293	ug/L	21.5	ug/Kg

TABLE 2 CONTINUED: Methods and Detection Limits

VOCs by EPA SW-846, Method 8260, 624 - Saturn 2 (Water and Methanol Preserved Soils) - Continued

Parameter	(Water 5 mL)		(Soil in Methanol)	
n-Propylbenzene	0.247	ug/L	10.8	ug/Kg
ortho-Xylene	0.262	ug/L	14.4	ug/Kg
Styrene	0.245	ug/L	11.3	ug/Kg
1,1,1,2-Tetrachloroethane	0.299	ug/L	10.8	ug/Kg
Tetrachloroethene	0.252	ug/L	11.7	ug/Kg
Toluene	0.358	ug/L	11.9	ug/Kg
1,2,3-Trichlorobenzene	0.263	ug/L	12.8	ug/Kg
1,2,4-Trichlorobenzene	0.358	ug/L	10.8	ug/Kg
1,1,1-Trichloroethane	0.309	ug/L	10.1	ug/Kg
1,1,2-Trichloroethane	0.404	ug/L	19.1	ug/Kg
Trichloroethene	0.292	ug/L	10.1	ug/Kg
Trichlorofluoromethane	0.278	ug/L	10	ug/Kg
1,2,3-Trichloropropane	0.343	ug/L	17.4	ug/Kg
1,2,4-Trimethylbenzene	0.232	ug/L	11.2	ug/Kg
1,3,5-Trimethylbenzene	0.299	ug/L	11.2	ug/Kg
Vinyl Chloride	0.11	ug/L	13.1	ug/Kg
meta/para-xylene	0.494	ug/L	26.3	ug/Kg
Acetone (Reporting Limit)	2.69	ug/L	550	ug/Kg
MTBE	0.332	ug/L	17.9	ug/Kg
Iodomethane	.399	ug/L	11.9	ug/Kg
Carbon disulfide	.289	ug/L	12.4	ug/Kg
Acrolein	2.135	ug/L	371.9	ug/Kg
Acrylonitrile	0.701	ug/L	57.4	ug/Kg
Vinyl acetate	1.247	ug/L	133	ug/Kg
Methyl ethyl ketone	0.646	ug/L	45.6	ug/Kg
2-Chloroethyl vinyl ether	0.426	ug/L	13.9	ug/Kg
4-methyl-2-pentanone	0.767	ug/L	76.9	ug/Kg
2-Hexanone	0.639	ug/L	124	ug/Kg
Tetrahydrofuran	0.704	ug/L	53.9	ug/Kg
2,3-Dichloro-1-propene	0.334	ug/L	12.4	ug/Kg
Trans 1,4-dichloro 2-butene	0.524	ug/L	44.3	ug/Kg
Allyl chloride	0.295	ug/L	26.3	ug/Kg
Chloroprene	0.31	ug/L	12.2	ug/Kg
Methacrylonitrile	0.686	ug/L	47.1	ug/Kg
Methyl methacrylate	0.629	ug/L	65.9	ug/Kg
Ethyl methacrylate	0.53	ug/L	39.9	ug/Kg
Acetronitrile	3.292	ug/L	260	ug/Kg
Hexane	0.315	ug/L	12.1	ug/Kg
Propionitrile	25.071	ug/L	189	ug/Kg
Isobutanol	4.141	ug/L	325	ug/Kg
Heptane	0.323	ug/L	10.8	ug/Kg
Octane	0.361	ug/L	11.2	ug/Kg
Cis-1,4-Dichloro-2-butene	0.358	ug/L	20.6	ug/Kg
1,3-Butadiene	0.228	ug/L	27	ug/Kg
Dichlorofluoromethane	0.274	ug/L	46.9	ug/Kg
Ether	0.801	ug/L	24.8	ug/Kg
1,1,2-Trichlorotrifluoroethane	0.268	ug/L	10.4	ug/Kg
Dichloroacetonitrile	1.499	ug/L	13.4	ug/Kg
4,4-Dimethyl-2-pentanone	1.411	ug/L	93	ug/Kg
Isopropyl ether	.354	ug/L	19.7	ug/Kg
Ethyl acetate	3.62	ug/L	196	ug/Kg

TABLE 2 CONTINUED: Methods and Detection Limits

VOCs by EPA SW-846, Method 8260, - Saturn 2 (Water and Methanol Preserved Soils) - Continued

Parameter	(Water 5 mL)	(Soil in Methanol)
1,1,2,2-Tetracloroethane	.314 ug/L	NA
Cyclohexanone	2.978 ug/L	230 ug/Kg
Isopropyl Alcohol	7.086 ug/L	NA

VOCs by GC/MS EPA Method 8260, - Saturn 2000 (Water and Methanol Preserved Soils)

Parameter	(Water 5 mL)	(Soil)
Benzene	0.24 ug/L	14.9 ug/Kg
Bromobenzene	0.191 ug/L	16.9 ug/Kg
Bromochloromethane	0.245 ug/L	21.8 ug/Kg
Bromodichloromethane	0.143 ug/L	14.6 ug/Kg
Bromoform	0.166 ug/L	19.3 ug/Kg
Bromomethane	0.38 ug/L	200 ug/Kg
n-Butylbenzene	0.174 ug/L	21.5 ug/Kg
sec-Butylbenzene	0.183 ug/L	21.3 ug/Kg
tert-Butylbenzene	0.14 ug/L	11.6 ug/Kg
Carbon Tetrachloride	0.291 ug/L	21.4 ug/Kg
Chlorobenzene	0.105 ug/L	11.1 ug/Kg
Chloroethane	1.82 ug/L	200 ug/Kg
Chloroform	0.244 ug/L	20.4 ug/Kg
Chloromethane	0.193 ug/L	13.6 ug/Kg
2-Chlorotoluene	0.106 ug/L	10.6 ug/Kg
4-Chlorotoluene	0.164 ug/L	23.3 ug/Kg
Dibromochloromethane	0.273 ug/L	18 ug/Kg
1,2-Dibromo-3-Chloropropane	0.347 ug/L	23.8 ug/Kg
Ethylene Dibromide (1,2-Dibromoethane)	0.178 ug/L	18.9 ug/Kg
Dibromomethane	0.176 ug/L	21.3 ug/Kg
1,2-Dichlorobenzene	0.191 ug/L	18.9 ug/Kg
1,3-Dichlorobenzene	0.139 ug/L	14 ug/Kg
1,4-Dichlorobenzene	0.125 ug/L	17.3 ug/Kg
Dichlorodifluoromethane	0.293 ug/L	13.5 ug/Kg
1,1-Dichloroethane	0.235 ug/L	18.6 ug/Kg
1,2-Dichloroethane	0.175 ug/L	20.6 ug/Kg
1,1-Dichloroethene	0.332 ug/L	21.4 ug/Kg
cis-1,2-Dichloroethene	0.202 ug/L	16 ug/Kg
trans-1,3-Dichloroethene	0.378 ug/L	23.9 ug/Kg
1,2-Dichloropropane	0.25 ug/L	11.9 ug/Kg
1,3-Dichloropropane	0.177 ug/L	14.9 ug/Kg
2,2-Dichloropropane	0.33 ug/L	18.6 ug/Kg
1,1-Dichloropropene	0.241 ug/L	13.9 ug/Kg
cis-1,3-Dichloropropene	0.171 ug/L	15.2 ug/Kg
trans-1,3-Dichloropropene	0.167 ug/L	15.4 ug/Kg
Ethylbenzene	0.135 ug/L	20.4 ug/Kg
Hexachlorobutadiene	0.143 ug/L	22.7 ug/Kg
Isopropylbenzene	0.239 ug/L	19.6 ug/Kg
p-Isopropyltoluene	0.112 ug/L	21.4 ug/Kg
Methylene Chloride	0.237 ug/L	13.7 ug/Kg
Naphthalene	0.303 ug/L	24.9 ug/Kg

TABLE 2 CONTINUED: Methods and Detection Limits

VOCs by EPA SW-846, Method 8260, - Saturn 2000 (Water and Methanol Preserved Soils) - Continued

Parameter	(Water 5 mL)		(Soil in Methanol)	
n-Propylbenzene	0.174	ug/L	15.4	ug/Kg
ortho-Xylene	0.145	ug/L	22.5	ug/Kg
Styrene	0.122	ug/L	18.6	ug/Kg
1,1,1,2-Tetrachloroethane	0.198	ug/L	15.3	ug/Kg
1,1,2,2-Tetrachloroethane	0.2322	ug/L	10.6	ug/Kg
Tetrachloroethene	0.164	ug/L	21.8	ug/Kg
Toluene	0.192	ug/L	21.3	ug/Kg
1,2,3-Trichlorobenzene	0.24	ug/L	19.7	ug/Kg
1,2,4-Trichlorobenzene	0.193	ug/L	23	ug/Kg
1,1,1-Trichloroethane	0.255	ug/L	11.5	ug/Kg
1,1,2-Trichloroethane	0.231	ug/L	23.8	ug/Kg
Trichloroethene	0.165	ug/L	23.2	ug/Kg
Trichlorofluoromethane	0.347	ug/L	16.2	ug/Kg
1,2,3-Tricholoropropane	0.267	ug/L	15.6	ug/Kg
1,2,4-Trimethylbenzene	0.147	ug/L	19.7	ug/Kg
1,3,5-Trimethylbenzene	0.142	ug/L	11.3	ug/Kg
Vinyl Chloride	0.197	ug/L	17.4	ug/Kg
meta/para-xylene	0.381	ug/L	39.4	ug/Kg
MTBE	0.203	ug/L	13.9	ug/Kg
Acetone (Reporting Limit)	.981	ug/L	550	ug/Kg
Iodomethane	0.438	ug/L	11.8	ug/Kg
Carbon disulfide	0.277	ug/L	14.9	ug/Kg
Acrylonitrile	0.403	ug/L	36.6	ug/Kg
Acrolein	01.696	ug/L	52.2	ug/Kg
Vinyl acetate	0.49	ug/L	32.5	ug/Kg
Methyl ethyl ketone	0.502	ug/L	47.1	ug/Kg
2-Chloroethyl vinyl ether	0.444	ug/L	24.4	ug/Kg
4-methyl-2-pentanone	0.314	ug/L	36.5	ug/Kg
2-Hexanone	0.295	ug/L	38.1	ug/Kg
Tetrahydrofuran	0.435	ug/L	36	ug/Kg
2,3-Dichloro-1-propene	0.22	ug/L	10.8	ug/Kg
Trans-1,4-dichloro-2-butene	0.455	ug/L	37.4	ug/Kg
Allyl chloride	0.315	ug/L	17.4	ug/Kg
Chloropropene	0.23	ug/L	16.4	ug/Kg
Methacrylonitrile	0.498	ug/L	25.6	ug/Kg
Methyl methacrylate	0.425	ug/L	39.7	ug/Kg
Ethyl methacrylate	0.173	ug/L	10.9	ug/Kg
Acetonitrile	1.917	ug/L	104.8	ug/Kg
Hexane	0.253	ug/L	10.9	ug/Kg
Propionitrile	3.141	ug/L	171	ug/Kg
Isobutanol	2.335	ug/L	240	ug/Kg
Heptane	0.152	ug/L	20.1	ug/Kg
Octane	0.255	ug/L	24.7	ug/Kg
Cis-1,4-Dichloro-2-butene	0.292	ug/L	14.6	ug/Kg
1,3-Butadiene	0.197	ug/L	15.6	ug/Kg
Dichlorofluoromethane	0.268	ug/L	16.4	ug/Kg
Ether	0.647	ug/L	41.1	ug/Kg
1,1,2-Trichlorotrifluoroethane	0.297	ug/L	19.6	ug/Kg
Dichloroacetonitrile	1.444	ug/L	96.1	ug/Kg
4,4-Dimethyl-2-Pentanone	.65	ug/L	95	ug/Kg
Isopropyl Ether	0.224	ug/L	16	ug/Kg
Ethyl Acetate	1.141	ug/L	158.1	ug/Kg

TABLE 2 CONTINUED: Methods and Detection Limits

VOCs by EPA SW-846, Method 8260, - Saturn 2000 (Water and Methanol Preserved Soils) - Continued

Parameter	(Water 5 mL)	(Soil in Methanol)
Cyclohexanone	2.14 ug/L	555.7 ug/Kg
Isopropyl Alcohol	3.435 ug/L	204.5 ug/Kg

VOCs by GC/MS EPA Method 524.2 (Drinking Water) Saturn 3

Parameter	(Water 5 mL)
Benzene	0.157 ug/L
Bromobenzene	0.196 ug/L
Bromochloromethane	0.183 ug/L
Bromodichloromethane	0.128 ug/L
Bromoform	0.149 ug/L
Bromomethane	0.214 ug/L
n-Butylbenzene	0.207 ug/L
sec-Butylbenzene	0.163 ug/L
tert-Butylbenzene	0.155 ug/L
Carbon Tetrachloride	0.152 ug/L
Chlorobenzene	0.162 ug/L
Chloroethane	0.326 ug/L
Chloroform	0.212 ug/L
Chloromethane	0.16 ug/L
2-Chlorotoluene	0.184 ug/L
4-Chlorotoluene	0.182 ug/L
Dibromochloromethane	0.144 ug/L
1,2-Dibromo-3-Chloropropane	0.145 ug/L
1,2-Dibromoethane	0.127 ug/L
Dibromomethane	0.119 ug/L
1,2-Dichlorobenzene	0.209 ug/L
1,3-Dichlorobenzene	0.233 ug/L
1,4-Dichlorobenzene	0.157 ug/L
Dichlorodifluoromethane	0.133 ug/L
1,1-Dichloroethane	0.168 ug/L
1,2-Dichloroethane	0.222 ug/L
1,1-Dichloroethene	0.127 ug/L
cis-1,2-Dichloroethene	0.143 ug/L
trans-1,2-Dichloroethene	0.177 ug/L
1,2-Dichloropropane	0.151 ug/L
1,3-Dichloropropane	0.14 ug/L
2,2-Dichloroproprane	0.225 ug/L
1,1-Dichloropropene	0.144 ug/L
cis-1,3-Dichloropropene	0.161 ug/L
trans-1,3-Dichloropropene	0.136 ug/L
Ethylbenzene	0.18 ug/L
Hexachlorobutadiene	0.265 ug/L
Isopropylbenzene	0.159 ug/L
p-Isopropyltoluene	0.202 ug/L
Methylene Chloride	0.182 ug/L
Naphthalene	0.181 ug/L
Nitrobenzene	4.529 ug/L
n-Propylbenzene	0.163 ug/L
Styrene	0.187 ug/L
ortho-xylene	0.113 ug/L

TABLE 2 CONTINUED: Methods and Detection Limits

VOCs by GC/MS EPA Method 524.2 (Drinking Water) Saturn 3

Parameter	(Water 5 mL)
1,1,1,2-Tetrachloroethane	0.163 ug/L
1,1,2,2-Tetrachloroethane	0.188 ug/L
Tetrachloroethene	0.135 ug/L
Toluene	0.151 ug/L
1,2,3-Trichlorobenzene	0.214 ug/L
1,2,4-Trichlorobenzene	0.209 ug/L
1,1,1,-Trichloroethane	0.12 ug/L
1,1,2-Trichloroethane	0.136 ug/L
Trichloroethene	0.151 ug/L
Trichlorofluoromethane	0.105 ug/L
1,2,3-Trichloropropane	0.147 ug/L
1,2,4-Trimethylbenzene	0.175 ug/L
1,3,5-Trimethylbenzene	0.197 ug/L
Vinyl Chloride	0.136 ug/L
meta/para-xylene	0.276 ug/L
MTBE	0.108 ug/L

PVOCs by EPA 8020M

Parameter	(Water 5 mL)	(Methanol Preserved Soil)
tert-Butylmethyl ether	0.616 ug/L	13.1 ug/Kg
Benzene	0.614 ug/L	13.9 ug/Kg
Toluene	0.638 ug/L	14.0 ug/Kg
Ethyl Benzene	0.626 ug/L	12.7 ug/Kg
Meta/Para-xylene	1.469 ug/L	36.6 ug/Kg
O-xylene	0.623 ug/L	20.3 ug/Kg
1,3,5-Trimethylbenzene	0.665 ug/L	13.3 ug/Kg
1,2,4-Trimethylbenzene	0.647 ug/L	24.6 ug/Kg
Naphthalene	0.618 ug/L	13.0 ug/Kg

Gasoline Range Organics by Wisconsin GRO Method

Parameter	(Water)	(Methanol Preserved Soil)
GRO	0.0097 mg/L (5 mL sample)	0.218 mg/Kg (25 g sample)

Diesel Range Organics by Wisconsin DRO Method

DRO	0.10 mg/L (1000 mL sample)	10 mg/Kg (25 g sample)

Organochlorine Pesticides by EPA 8081

Parameter	(Water 1000ml)	(Soil)
Aldrin	0.00361 ug/L	0.487 ug/Kg
Alpha-BHC	0.00277 ug/L	0.280 ug/Kg
Beta-BHC	0.00448 ug/L	0.529 ug/Kg
Delta-BHC	0.00307 ug/L	0.255 ug/Kg
Gamma-BHC	0.00323 ug/L	0.374 ug/Kg
Alpha Chlordane	0.00336 ug/L	0.382 ug/Kg
Gamma Chlordane	0.00340 ug/L	0.384 ug/Kg
4,4'-DDD	0.00346 ug/L	0.414 ug/Kg
4,4'-DDE	0.00391 ug/L	0.450 ug/Kg
4,4'-DDT	0.00523 ug/L	0.643 ug/Kg
Dieldrin	0.00354 ug/L	0.377 ug/Kg
Endosulfan I	0.00328 ug/L	0.518 ug/Kg
Endosulfan II	0.00352 ug/L	0.402 ug/Kg
Endosulfan Sulfate	0.00347 ug/L	0.332 ug/Kg
Endrin	0.00331 ug/L	0.332 ug/Kg
Endrin Aldehyde	0.00357 ug/L	0.485 ug/Kg
Endrin Ketone	0.00350 ug/L	0.405 ug/Kg
Heptachlor	0.00642 ug/L	0.439 ug/Kg
Heptachlor Epoxide	0.00309 ug/L	0.423 ug/Kg
Methoxychlor	0.01045 ug/L	0.779 ug/Kg
Ethyl Parathion	0.040 ug/L	NA ug/Kg
Methyl Parathion	0.040 ug/L	NA ug/Kg
Toxaphene	0.2829 ug/L	53 ug/Kg
Technical BHC	0.10 ug/L	3.31 ug/Kg

Polychlorinated Biphenyls (PCB) by EPA 8082

Parameter	(Water 1000 mL)	(Soil)
Aroclor 1016 PCB	0.0538 ug/L	5.58 ug/Kg
Aroclor 1221 PCB	0.0831 ug/L	14.31 ug/Kg
Aroclor 1232 PCB	0.0257 ug/L	2.66 ug/Kg
Aroclor 1242 PCB	0.0640 ug/L	3.94 ug/Kg
Aroclor 1248 PCB	0.0395 ug/L	5.09 ug/Kg
Aroclor 1254 PCB	0.0272 ug/L	2.54 ug/Kg
Aroclor 1260 PCB	0.0421 ug/L	4.55 ug/Kg

Nitrogen/Phosphorus Pesticides by EPA Method 8141A

Parameter	(Water 1000 mL)	(Soil)
Acetochlor	0.0662 ug/L	8.611 ug/Kg
Alachlor	0.1124 ug/L	5.83 ug/Kg
Atrazine	0.0596 ug/L	4.26 ug/Kg
Desethylatrazine	0.0327 ug/L	4.655 ug/Kg
Desisopropylatrazine	0.0575 ug/L	17.82 ug/Kg
Butylate	0.0331 ug/L	4.13 ug/Kg
Chlorpyrifos	0.0486 ug/L	6.673 ug/Kg
Cyanazine	0.0412 ug/L	3.038 ug/Kg
Dimethenamid	0.0905 ug/L	8.711 ug/Kg

Nitrogen/Phosphorus Pesticides by EPA Method 8141A (Continued)

Parameter	(Water 1000 mL)	(Soil)
EPTC	0.0333 ug/L	4.431 ug/Kg
Malathion	0.0468 ug/L	6.772 ug/Kg
Metolachlor	0.2798 ug/L	21.108 ug/Kg
Metribuzin	0.0499 ug/L	3.866 ug/Kg
Pendimethalin	0.0551 ug/L	8.972 ug/Kg
Prometon	0.0546 ug/L	8.042 ug/Kg
Propazine	0.0521 ug/L	3.587 ug/Kg
Simazine	0.1024 ug/L	10.064 ug/Kg
Trifluralin	0.0566 ug/L	4.211 ug/Kg
Ethyl Parathion	0.0618 ug/L	NA
Methyl Parathion	0.0438 ug/L	NA

Polynuclear Aromatic Hydrocarbons by EPA Method 8310 - HPLC

Parameter	(Water 1000 mL)
Acenaphthene	0.0216 ug/L
Acenaphthylene	0.0817 ug/L
Anthracene	0.0261 ug/L
Benzo[a] anthracene	0.0189 ug/L
Benzo [a] pyrene	0.0175 ug/L
Benzo [b] fluoranthene	0.0199 ug/L
Benzo [g, h, i] perylene	0.0214 ug/L
Benzo [k] fluoranthene	0.0179 ug/L
Chrysene	0.0175 ug/L
Dibenzo [a,h] anthracene	0.0506 ug/L
Fluoranthene	0.0120 ug/L
Fluorene	0.0221 ug/L
Indeno [1,2,3-cd] pyrene	0.0216 ug/L
Methyl-1-naphthalene	0.0196 ug/L
Methyl-2-naphthalene	0.0365 ug/L
Naphthalene	0.0128 ug/L
Phenanthrene	0.0299 ug/L
Pyrene	0.0133 ug/L

Semi-Volatile Organic Compounds by EPA Method 8270C

Parameter	(Water 1000 mL)	(Soil)
Acenaphthene	0.6683 ug/L	15.1 ug/Kg
Acenaphthylene	1.29 ug/L	16.4 ug/Kg
Acetophenone	0.8852 ug/L	17.7 ug/Kg
2-Acetylaminofluorene	0.7787 ug/L	17.6 ug/Kg
4-Aminobiphenyl	0.67 ug/L	32 ug/Kg
Aniline	1.3480 ug/L	22.8 ug/Kg
Anthracene	0.4101 ug/L	14 ug/Kg
Aramite-A	1.2696 ug/L	16.4 ug/Kg
Aramite-B	1.2623 ug/L	25.3 ug/Kg
Benzidine	0.6093 ug/L	14.3 ug/Kg
Benzo [a] anthracene	0.4282 ug/L	18 ug/Kg
Benzo [a] pyrene	0.4242 ug/L	14.7 ug/Kg
Benzo [b] fluoranthene	0.5635 ug/L	13.9 ug/Kg

TABLE 2 CONTINUED: Methods and Detection Limits

Semi-Volatile Organic Compounds by EPA Method 8270C - (Continued)

Parameter	(Water 1000 mL)	(Soil)
Benzo [g,h,i,] perylene	0.91 ug/L	17.8 ug/Kg
Benzo [k] fluoranthene	0.9044 ug/L	22.1 ug/Kg
Benzoic Acid	0.88 ug/L	NA
Benzyl Alcohol	0.7788 ug/L	30.8 ug/Kg
Bis (2-chloroethyl) ether	0.8059 ug/L	25.9 ug/Kg
4-Bromophenyl-phenyl ether	0.6273 ug/L	16.4 ug/Kg
Butylbenzylphthalate	1.6651 ug/L	26.2 ug/Kg
4-Chloro-3-methylphenol	1.2060 ug/L	18.9 ug/Kg
4-Chloroaniline	1.0438 ug/L	27.5 ug/Kg
Chlorobenzilate	1.0543 ug/L	18.6 ug/Kg
1-Chloronaphthalene	0.9534 ug/L	17.1 ug/Kg
2-Chloronaphthalene	1.35 ug/L	17.7 ug/Kg
2-Chlorophenol	0.8977 ug/L	21.6 ug/Kg
4-Chlorophenyl-phenyl ether	0.5075 ug/L	13.9 ug/Kg
Chrysene	1.1588 ug/L	14.8 ug/Kg
Cis-Isosafrole	0.6778 ug/L	17.1 ug/Kg
Cis-Diallate	0.8229 ug/L	20.9 ug/Kg
Trans-Diallate	1.5279 ug/L	45.5 ug/Kg
Di-n-butylphthalate	0.5771 ug/L	20.1 ug/Kg
Di-n-octylphthalate	1.0423 ug/L	24.4 ug/Kg
Dibenzo [a,h] anthracene	0.5566 ug/L	17.1 ug/Kg
Dibenzo [a,j] acridine	1.0569 ug/L	NA
Dibenzofuran	1.32 ug/L	14.7 ug/Kg
1,2-Dichlorobenzene	0.4979 ug/L	26.9 ug/Kg
1,3-Dichlorobenzene	0.5304 ug/L	30.1 ug/Kg
1,4-Dichlorobenzene	0.5302 ug/L	27.5 ug/Kg
3,3'-Dichlorobenzidine	0.7677 ug/L	75 ug/Kg
2,4-Dichlorophenol	1.1443 ug/L	23.9 ug/Kg
2,6-Dichlorophenol	1.150 ug/L	18.5 ug/Kg
Diethylphthalate	1.4 ug/L	15.4 ug/Kg
Dimethoate	0.7694 ug/L	300 ug/Kg
3,3'-Dimethylbenzidine	0.47 ug/L	43 ug/Kg
7,12-Dimethylbenzo-a-anthracene	0.4215 ug/L	17.3 ug/Kg
2,4-Dimethylphenol	1.6097 ug/L	37.3 ug/Kg
Dimethylphthalate	0.9411 ug/L	16.8 ug/Kg
4,6-Dinitro-2-methylphenol	0.4713 ug/L	63.3 ug/Kg
1,3-Dinitrobenzene	0.6327 ug/L	30 ug/Kg
2,4-Dinitrophenol	0.6198 ug/L	170 ug/Kg
2,4-Dinitrotoluene	0.6372 ug/L	22.3 ug/Kg
2,6-Dinitrotoluene	0.6138 ug/L	20 ug/Kg
Diphenylamine/n-Nitrosodiphenlamine	1.43 ug/L	36.4 ug/Kg
Azobenzene	0.9746 ug/L	11.6 ug/Kg
Disulfoton	0.6016 ug/L	26.6 ug/Kg
Ethyl Methanesulfonate	0.6004 ug/L	15.6 ug/Kg
Ethyl Parathion	0.8648 ug/L	21.1 ug/Kg
Fluoranthene	0.4163 ug/L	15 ug/Kg
Fluorene	0.6085 ug/L	18.2 ug/Kg
Hexachorobenzene	0.4494 ug/L	15 ug/Kg
Hexachorobutadiene	0.4924 ug/L	18.2 ug/Kg
Hexachlorocyclopentadiene	1.06 ug/L	40.1 ug/Kg
Hexachoroethane	0.8294 ug/L	23.5 ug/Kg
Hexachloropropene	0.4507 ug/L	20.1 ug/Kg

TABLE 2 CONTINUED: Methods and Detection Limits

Semi-Volatile Organic Compounds by EPA Method 8270C - (Continued)

Parameter	(Water 1000 mL)	(Soil)
Indeno [1,2,3-cd] pyrene	0.5432 ug/L	20.6 ug/Kg
Isodrin	0.4933 ug/L	19 ug/Kg
Isophorone	1.0423 ug/L	17 ug/Kg
Methapyrilene	1.0232 ug/L	300 ug/Kg
Methyl methanesulfonate	0.8536 ug/L	28.4 ug/Kg
2-Methylnaphthalene	0.7646 ug/L	19 ug/Kg
Methyl Parathion	0.6692 ug/L	19 ug/Kg
2-Methylphenol	1.2085 ug/L	28.9 ug/Kg
3 & 4-Methylphenol	1.2667 ug/L	40.7 ug/Kg
N-nitroso-di-n-propylamine	1.0458 ug/L	14.7 ug/Kg
N-nitrosodi-n-butylamine	1.0484 ug/L	18 ug/Kg
N-nitrosodimethylamine	1.3638 ug/L	30.6 ug/Kg
N-nitrosopiperidine	1.1541 ug/L	17.1 ug/Kg
Naphthalene	0.7347 ug/L	18.2 ug/Kg
1-Naphthylamine	4.58 ug/L	29 ug/Kg
2-Naphthylamine	3.0 ug/L	29 ug/Kg
2-Nitroaniline	0.7813 ug/L	19.6 ug/Kg
3-Nitroaniline	0.8742 ug/L	18.4 ug/Kg
4-Nitroaniline	0.8731 ug/L	14.1 ug/Kg
Nitrobenzene	0.9987 ug/L	27.2 ug/Kg
2-Nitrophenol	1.6058 ug/L	20.3 ug/Kg
4-Nitrophenol	0.43 ug/L	40.1 ug/Kg
4-Nitroquinoline-1-oxide	8.21 ug/L	300 ug/Kg
Pentachlorobenzene	0.5356 ug/L	14 ug/Kg
Pentachloronitrobenzene	1.2972 ug/L	17.4 ug/Kg
Pentachlorophenol	0.7511 ug/L	42.6 ug/Kg
Phenacetin	0.9794 ug/L	25.2 ug/Kg
Phenanthrene	0.4097 ug/L	15 ug/Kg
Phenol	0.5071 ug/L	42 ug/Kg
Phorate	0.7579 ug/L	18.3 ug/Kg
2-Picoline	0.9632 ug/L	19 ug/Kg
Pronamide	0.7701 ug/L	19.1 ug/Kg
Pyrene	0.975 ug/L	39 ug/Kg
Pyridine	0.7707 ug/L	288 ug/Kg
Safrole	0 .8026 ug/L	17.7 ug/Kg
Sulfotepp	0.4802 ug/L	17.3 ug/Kg
1,2,4,5-Tetrachlorobenzene	0.7090 ug/L	15.1 ug/Kg
2,3,4,6-Tetrachlorophenol	0.6168 ug/L	53.8 ug/Kg
Thionazin	0.9648 ug/L	23.1 ug/Kg
1,2,4-Trichlorobenzene	0.5216 ug/L	20.8 ug/Kg
2,4,5-Trichlorophenol	1.0415 ug/L	18.6 ug/Kg
2,4,6-Trichlorophenol	0.7904 ug/L	17.3 ug/Kg
a,a-Dimethylphenethylamine	0.5726 ug/L	300 ug/Kg
Bis(2-chloroethoxy)methane	1.0846 ug/L	18.3 ug/Kg
Bis(2-ethylhexyl)phthalate	1.1305 ug/L	31 ug/Kg
Bis(2-chloroisopropyl)ether	0.8701 ug/L	19.4 ug/Kg
3-Methylchloranthrene	0.4518 ug/L	15 ug/Kg
n-Nitrosodiethylamine	1.1064 ug/L	25.8 ug/Kg
n-Nitrosomethylethylamine	1.2889 ug/L	34.1 ug/Kg
n-Ntirosomorpholine	0.8194 ug/L	13.4 ug/Kg
n-Nitrosopyrrolidine	1.2462 ug/L	24.9 ug/Kg
1,4-Naphthoquinone	4.94 ug/L	55.0 ug/Kg

TABLE 2 CONTINUED: Methods and Detection Limits

Semi-Volatile Organic Compounds by EPA Method 8270C - (Continued)

Parameter	(Water 1000 mL)	(Soil)
5-nitro-o-toluidine	0.7212 ug/L	17.3 ug/Kg
o-Toluidine	1.5285 ug/L	19.3 ug/Kg
p-(Dimethylamino)azobenzene	1.0674 ug/L	23.4 ug/Kg
p-Phenylenediamine	30 ug/L	300 ug/Kg
o-o-o-Triethyl phosphorothioate	0 .9878 ug/L	24.7 ug/Kg
1,3,5-Trinitrobenzene	0.5091 ug/L	19.8 ug/Kg
1,2-Dinitrobenzene	0.4629 ug/L	15.4 ug/Kg
1,4-Dinitrobenzene	0.8325 ug/L	19.9 ug/Kg

Semi-Volatile Organic Compounds by GC/MS Method 525.2 (Drinking Water)

Parameter	(Water)
2,4-Dinitrotoluene	0.1 ug/L
2,6-Dinitrotoluene	0.2 ug/L
4,4[1]-DDE	0.042 ug/L
Acetochlor	0.1 ug/L
Alachlor	0.1 ug/L
Aldrin	0.1 ug/L
Alpha Chlordane	0.1 ug/L
Atrazine	0.1 ug/L
Benzo[a]pyrene	0.051 ug/L
Bix(2-ethyhexyl)adipate	0.6 ug/L
Bix(2-ethylhexyl)phthalate	0.6 ug/L
Butachlor	0.1 ug/L
Desethylatrazine	0.2 ug/L
Desisopropylatrazine	0.2 ug/L
Dieldrin	0.1 ug/L
EPTAM	0.1 ug/L
Endrin	0.1 ug/L
Gamma Chlordane	0.1 ug/L
Gamma-BHC	0.025 ug/L
Heptachlor	0.04 ug/L
Heptachlor Epoxide	0.044 ug/L
Hexachlorobenzene	0.1 ug/L
Hexachlorocyclopentadiene	0.1 ug/L
Methoxychlor	0.1 ug/L
Metolachlor	0.1 ug/L
Metribuzin	0.1 ug/L
Molinate	0.045 ug/L
Propachlor	0.1 ug/L
Simazine	0.07 ug/L
Terbacil	0.1 ug/L

EDB / DBCP by GC Method 504.1 (Drinking Water)

EDB or DBCP	0.01 ug/L

Multi-Component Pesticides and PCBs by GC Method 505 (Drinking Water)

Total Chlordane	0.40 ug/L
Total Toxaphene	0.47 ug/L
Total PCBs	0.20 ug/L

**Detection limits may be subject to change due to ongoing MDL studies, Dilutional Adjustments, or Sample Matrices .

TABLE 3 - FIELD SAMPLE CHARACTERISTICS

ODOR

Observe immediately upon collection.

intensity:

not detected (ND)
slight (slt.)
moderate (mod.)
strong

description:

musty
sulfide
smokey
oily
sour
sweet
putrid
pulpy
mineral
other (specify)

COLOR

Observe filtered sample immediately after filtering, prior to preservation.

intensity:

not detected (ND)
light (lt.)
medium (med.)
dark (dk.)

description:

reddish brown (red br.)
yellow
gray
amber
green
salmon
purple
red
tan or natural
other (specify)

TABLE 3 - FIELD SAMPLE CHARACTERISTICS
(Continued)

TURBIDITY

Observe filter after about 0.3 to 0.5 liters are filtered.

quantity:

not detected (ND)
slight
moderate (mod.)
extreme

texture:

very fine - slimy feel, no observable particles, clay.
fine - floury feel, no observable particles, silt.
medium (med.) - fine gritty feel, tiny observable particles, very fine sand.
coarse - definite sandy feel; fine, medium, coarse sand.
mixed texture (mxd.tx.) - mixture of above.

color:

state color

TABLE 4 - CERTIFICATION PARAMETERS

Category	Analyte
Oxygen Utilization	Biological Oxygen Demand
	Carbonaceous Biochemical Oxygen Demand
Nitrogen	Ammonia
	Nitrate
	Nitrite
	Nitrate + Nitrite
	Total Kjeldahl
Phosphorus	Orthophosphate
	Total Phosphorus
Physical	Total Solids
	Total Dissolved Solids
	Total Volatile Solids
	Total Volatile Suspended Solids
	Total Suspended Solids
	Oil and Grease (HEM)
General I	Alkalinity/Acidity
	Bromide
	Chlorophyll a
	Color
	Hardness
	Silica
	Silicate
	Sulfite
	Surfactants
General II	Chemical Oxygen Demand
	Chloride
	Cyanide
	Fluoride
	Sulfate
	Sulfide
	Total Phenolic Compounds
General III	EP Toxicity
	Ignitability
	Toxicity Characteristic Leaching Procedure
	Synthetic Precipitation Leaching Procedure
	Total Releasable Cyanide
	Total Releasable Sulfide
	Reactivity
	Total Organic Carbon

TABLE 4 - CERTIFICATION PARAMETERS **(Continued)**

Category	Analyte		
Metals I	Aluminum	Iron	Strontium
	Antimony	Lead	Thallium
	Arsenic	Magnesium	Tin
	Barium	Manganese	Vanadium
	Beryllium	Mercury	Zinc
	Boron	Molybdenum	Hexavalent Chromium
	Cadmium	Nickel	
	Calcium	Potassium	
	Chromium	Selenium	
	Cobalt	Silver	
	Copper	Sodium	
Metals II	Lithium	Titanium	
Organics; Purgeable	Purgeable Aromatics by Gas Chromatography or GC/MS Purgeable Halocarbons by Gas Chromatography or GC/MS Volatile Organics by Gas Chromatography or GC/MS		
Semivolatiles by GC/MS	Base / Neutral /Acid Extractables		
Liquid Chromatography	Polynuclear Aromatic Hydrocarbons (PAHs) by HPLC		
Pesticides by GC	Nitrogen Pesticides, Organophosphorus Pesticides and Triazine Pesticides and Metabolites		
Petroleum Hydrocarbons	Diesel Range Organics, Gasoline Range Organics, and Petroleum Volatile Organic Compounds.		
Organics; Organochlorine Compounds	Polychlorinated Biphenyls (PCBs) and Organochlorine Pesticides		
Safe Drinking Water; Metals	Arsenic	Antimony	Barium
	Beryllium	Cadmium	Chromium
	Copper	Cyanide	Lead
	Mercury	Nickel	Selenium
	Sodium	Thallium	
Safe Drinking Water; Inorganics	Fluoride	Nitrite	Nitrate
	Sulfate		Nitrate + Nitrite
Safe Drinking Water; Organics	Volatile Organic Compounds Total Trihalomethanes Ethylene Dibromide (EDB) and Dibromochloropropane (DBCP) Chlorinated Hydrocarbons by GC/MS Chlorinated Pesticides by GC Chlorinated Pesticides by GC/MS Nitrogen/Phosphorus Pesticides by GC/MS Polynuclear Aromatic Hydrocarbons (PAHs) by GC/MS Phthalates by GC/MS		
Safe Drinking Water; Bacteria	Total Coliform Bacteria, e.Coli Bacteria (Colilert and Colisure - Presence/Absence Tests)		

TABLE 5
SAFE DRINKING WATER METHODS

Primary Inorganic Contaminants	Method
Antimony	SM 3113 B
Arsenic	EPA 200.7, SM 3113B
Barium	EPA 200.7, SM 3113B
Beryllium	EPA 200.7, SM 3113B
Cadmium	EPA 200.7, SM 3113 B
Copper	EPA 200.7, SM 3120 B
Chromium	EPA 200.7, SM 3113B
Cyanide	EPA 335.4
Fluoride	EPA 300.0, SM 4500F-C
Lead	SM 3113B
Mercury	EPA 245.2, 245.7, SM 3112B
Nickel	EPA 200.7, SM 3113B
Nitrate	EPA 300.0, EPA 353.2
Nitrite	SM 4500NO_2B, EPA 300.0
Selenium	SM 3113B
Sulfate	EPA 300.0, 375.2
Thallium	EPA 200.9
Turbidity	EPA 180.1

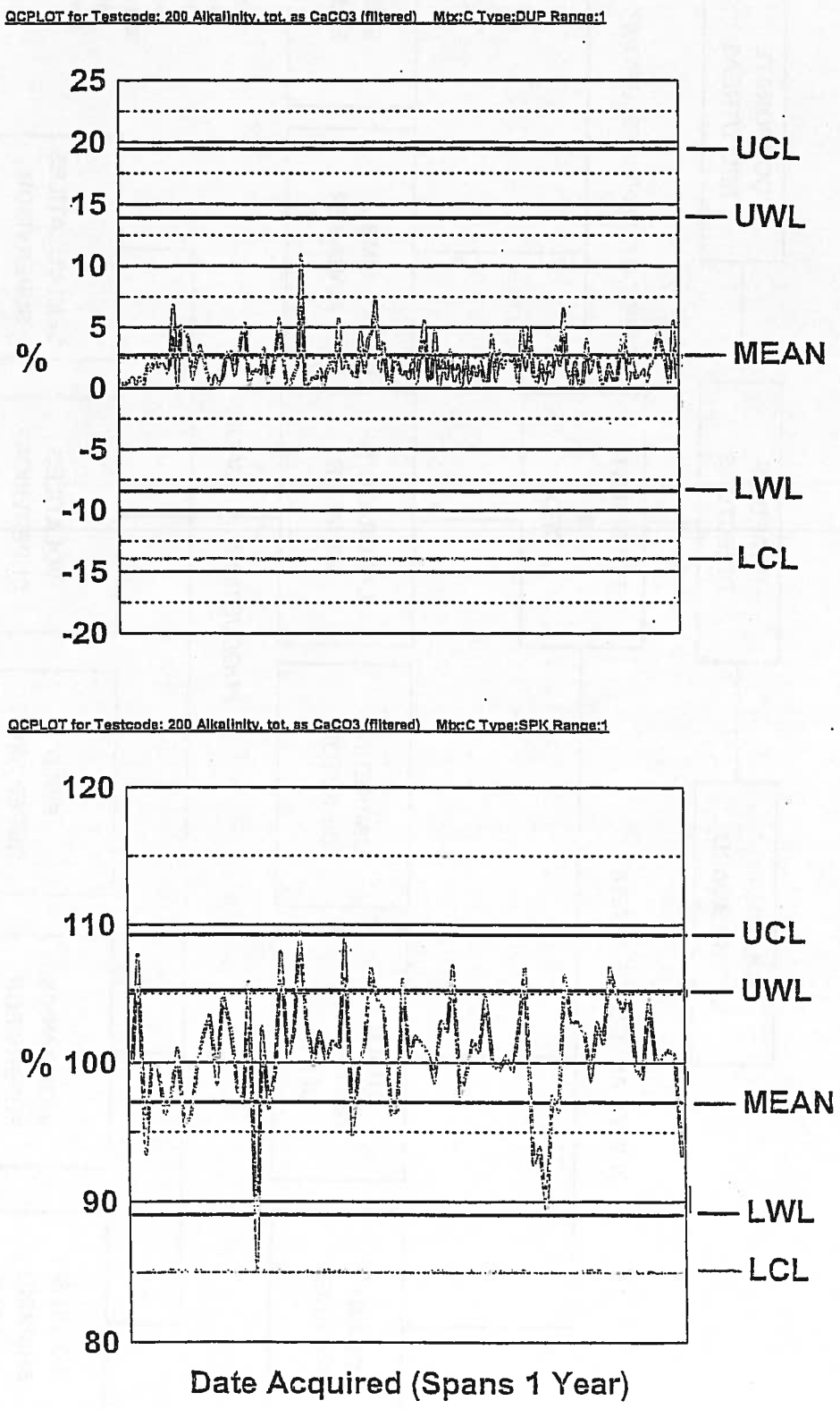
Secondary Inorganic Contaminants	Method
Alkalinity	SM 2320B
Aluminum, total	EPA 200.7
Calcium	EPA 200.7, SM 3500Ca-D
Chloride	EPA 300.0, SM 4500Cl-D
Color	SM 2120B
Conductivity	SM 2510B
Coliform Bacteria	SM 9223 (Colilert)
Free Chlorine Residual	Standard Methods (17ed) 4500-Cl
Foaming Agents	5540C
Iron, total	EPA 200.7, SM 3120B
Manganese, total	EPA 200.7, SM 3120B
Odor	FIELD
Orthophosphate	SM 4500P-E
pH	EPA 150.1
Silica	SM 4500Si-D
Sodium, total	EPA 200.7
Silver, total	EPA 200.7, SM 3120B
Temperature	SM 2550B
Total Filterable Residue (TDS)	SM2540C
Turbidity	EPA 180.1, SM 2130B
Zinc, total	EPA200.7

TABLE 5
SAFE DRINKING WATER METHODS
(Continued)

Organic Contaminants Regulated Parameters	Method
Alachlor	EPA 505, 508.1, 525.2
Aldicarb	EPA 531.1
Aldicarb sulfone	EPA 531.1
Aldicarb Sulfoxide	EPA 531.1
Atrazine	EPA 505, 507, 508.1, 525.2
Benzo(a)pyrene	EPA 550, 550.1, 525.2
Carbofuran	EPA 531.1, 6610
Chlordane	EPA 505, 508, 508.1, 525.2
Dalapon	EPA 515.1, 552.1
Dibromochloropropane (DBCP)	EPA 504 .1, 551
Di(2-ethylhexyl)adipate	EPA 506, 525.2
Di(2-ethylhexyl)phthalate	EPA 506, 525.2
Dinoseb	EPA 515.1, 515.2, 555
Diquat	EPA 549
2,4-D	EPA 515.1, 515.2, 555
Endothall	EPA 548 .1
Endrin	EPA 505, 508, 508.1, 525.2
Ethylene Dibromide (EDB)	EPA 504 .1, 551
Glyphosate	EPA 547, 6651
Heptachlor	EPA 505, 508, 508.1, 525.2
Heptachlor Epoxide	EPA 505, 508, 508.1, 525. 2
Hexachlorobenzene	EPA 505, 508, 508.1, 525.2
Hexachlorocyclopentadiene	EPA 505, 508, 508.1, 525.2
Lindane	EPA 505, 508, 508.1, 525.2
Methoxychlor	EPA 505, 508, 508.1, 525.2
Oxamyl	EPA 531.1, 6610
Picloram	EPA 515.1, 515.2, 555
Polychlorinated Biphenyls	EPA 505, 508, 508A
Pentachlorophenol	EPA 515.1, 515.2, 525.2, 555
Simazine	EPA 505, 507, 508.1, 525.2
Toxaphene	EPA 505, 508, 525.2
Total Trihalomethanes (TTHM)	EPA 502.2, 524.2, 551
2,3,7,8-TCDD (Dioxin)	EPA 1613A
2,4,5-TP	EPA 515.1, 515.2, 555
Volatile Organic Chemicals (VOCs)	EPA 502.1, 524.2

Organic Contaminants Unregulated Parameters	Method
Aldrin	EPA 505, 508, 508.1, 525.2
Butachlor	EPA 507, 525.2
Carbaryl	EPA 531.1, 6610
Dicamba	EPA 515.1, 515.2, 555
Dieldrin	EPA 505, 508, 508.1, 525.2
3-Hydroxycarbofuran	EPA 531.1, 6610
Methomyl	EPA 531.1, 6610
Metolachlor	EPA 507, 508.1, 525.2
Metribuzin	EPA 507, 508.1, 525.2
Propachlor	EPA 508, 508.1, 525.2

Figure 1
Quality Control Charts - Example



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