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# QUALITY ASSURANCE
# PROJECT TECHNICAL MEMORANDUM
# REFUSE HIDEAWAY LANDFILL
# MIDDLETON, WISCONSIN

Revision 1

February 15, 1994

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# REFUSE HIDEAWAY LANDFILL

## QUALITY ASSURANCE
## PROJECT TECHNICAL MEMORANDUM

Revision 1
Date February 15, 1994

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## TABLE OF CONTENTS

| Section # | Section Title | Page(s) |
|---|---|---|
| | Title page with approvals | -- |
| Contents | Table of Contents | i |
| 1.0 | Introduction | 1-1 |
| 2.0 | Project Description | 2-1-5 |
| 3.0 | Project Organization | 3-1-2 |
| 4.0 | QA Objectives | 4-1-2 |
| 5.0 | Sampling Procedures | 5-1-2 |
| 6.0 | Sample Custody | 6-1 |
| 7.0 | Calibration Procedures and Frequency | 7-1-4 |
| 8.0 | Analytical Procedures | 8-1-3 |
| 9.0 | Internal QC Checks and Frequency | 9-1-9 |
| 10.0 | Data Reduction, Validation, and Reporting | 10-1-4 |
| 11.0 | Performance and Systems Audits | 11-1 |
| 12.0 | Preventive Maintenance | 12-1-4 |
| 13.0 | Specific Routine Procedures to Assess Data Precision, Accuracy, Completeness, Representativeness and Comparability | 13-1-3 |
| 14.0 | Data Documentation and Tracking Procedures | 14-1 |
| Appendix | Appendix A: Data Validation Scheme/Rationale | 1-7 |
| List | QAPTM Distribution List | 1 |
| | <u>List of Figures:</u> | |
| 3.0 | Figure 7-1 (from Work Plan): Project Organization and Personnel | 3-2 |
| | <u>List of Tables:</u> | |
| 8.0 | Table 1: Analytical Methods | 8-2-3 |
| 9.0 | Table 2: Internal QC Checks & Frequency | 9-7-9 |
| 12.0 | Table 3: Preventive Maintenance | 12-2-4 |

Note: Page numbers given as X-Y-Z, where X = Section number, Y = first applicable section page number, and Z = last applicable section page number.

## 1.0 INTRODUCTION

Quality assurance (QA) is a planned system of activities that will provide a quality product. The purpose of this QA Project Technical Memorandum (QAPTM) is to assess the quality of the historical analytical data generated for the Refuse Hideaway Landfill project.

The precision, accuracy, completeness, representativeness and comparability of environmental data produced for the Refuse Hideaway Landfill project was evaluated based on a subset of all of the environmental data collected since monitoring began. Supporting documentation was requested from the analytical laboratories involved during the course of monitoring, and the resultant data packages were validated in accordance with EPA National Functional Guidelines and EPA Region V additional guidance.

This QAPTM is written in accordance with the following established guidelines as they apply to analytical laboratory measurements:

> "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans", EPA QAMS-005/80, EPA-600/4-83-004.
>
> Statement of Work, Refuse Hideaway Landfill, March, 1993.
>
> First Revision to the RCRA Model Quality Assurance Project Plan, EPA Region V, May, 1993.
>
> "Content Requirements for Quality Assurance Project Plan," US EPA Region V, January 1989.

## 2.0 PROJECT DESCRIPTION

The Refuse Hideaway Landfill is a closed municipal, commercial, industrial landfill located in the SW 1/4, NW 1/4, section 8, T7N, R8E, Town of Middleton, Dane County, Wisconsin. The landfill operated for 14 years between 1974 and 1988. The site was closed under court order in 1988 when volatile organic chemicals (VOCs) were discovered in private wells southwest of the site. VOCs and elevated inorganic chemicals have been detected in ground water surrounding the site. The contaminated ground water extends at least 3,800 feet southwest of the landfill boundary. Methane gas has migrated off the site and standing leachate has been documented within the waste mass.

Site geology/hydrogeology includes shallow bedrock, consisting of Prairie du Chien dolomite overlying late Cambrian age sandstone, which is present north, east, and west of the site. South of the site, up to 300 feet of unconsolidated materials exist, consisting of till, glaciolacustrine, outwash, and recent alluvium deposits. Ground water occurs in the sandstone and in the glacial deposits. Ground-water flow is primarily southwest, toward the Black Earth Creek Valley.

Known contaminants in the ground water consist of VOCs, including, but not limited to, benzene, dichloroethane, trichloroethane, dichloroethylene, trichloroethylene (TCE), tetrachloroethylene (PCE), vinyl chloride, ethylbenzene, toluene, dichlorodifluoromethane, and trichlorofluoromethane.

John DeBeck, the owner and operator of the Refuse Hideaway Landfill, received a landfill license from the WDNR in 1974 to operate a 23 acre landfill. The main engineering requirement was that he maintain at least 10 feet of soil between the waste and bedrock and that he cover the waste daily. Numerous violations of the daily cover requirements are noted in the file. The site was filled from south to north, but was not operated in "phases". Therefore, the entire waste volume (approximately 1.5 million cubic yards) was exposed to leaching by rain and snow melt throughout the operating history.

On October 31, 1986, Residuals Management Technology, Inc. (RMT) submitted a closure plan for the landfill to the WDNR. Additional information was submitted for the plan on November 21, 1986. The closure plan was conditionally approved by the WDNR on April 7, 1987, pending receipt and approval of an in-field conditions report.

In 1986 and 1987, private water supply wells within a 1-mile radius of the landfill were sampled for VOCs by RMT and WDNR. No VOCs were detected in the private wells in 1986. However, in 1987, three private water supply wells, located approximately 1/2 mile to the southwest of the landfill, had measurable concentrations of VOCs. It appeared to the WDNR that the landfill was having an effect on ground water in these wells located to the southwest of the landfill.

The In-Field Conditions Report (RMT, 1988) documented the installation and sampling of 12 additional ground-water monitoring wells, one additional leachate head well, and six gas probes. Ground-water samples were collected from the new and existing monitor wells and analyzed for VOCs to determine the nature and extent of ground-water impacts. The results of the VOC analyses indicated that Chapter NR140 Wisconsin Administrative Code Enforcement Standards (ESs) were exceeded at 12 of 14 monitor wells, including wells which were apparently upgradient and downgradient. The compounds exceeding ESs included PCE, TCE, vinyl chloride, benzene, and 1,2-dichloroethane. The impacts at apparently upgradient wells indicated that the potential for radial flow from the landfill existed.

In May of 1988, the WDNR issued Special Consent Order SOD-88-02A. The Consent Order required Refuse Hideaway, Inc. to close and cap the landfill, conduct an expanded hydrogeologic investigation, and prepare the Remedial Action Report. The hydrogeologic investigation goals were to determine the degree and extent of ground-water contamination around the landfill, evaluate the local and regional ground-water flow directions, and determine the nature, persistence and likely fate of the contaminants. In addition, existing and potential health effects posed by the landfill were to be evaluated. Potential remedial actions for mitigation of the landfill's impacts on the ground water were to be identified and long-term monitoring goals were to be defined.

John DeBeck closed the landfill under court order in May, 1988. At that time, he covered the landfill in accordance with NR504.07, Wisconsin Administrative Code, and placed a 6-inch grading layer of coarse soil over the waste, followed by 2 feet of clay soils. Two and a half feet of general soil was placed over the clay and 6 inches of topsoil, seeded and mulched, finished the cap. The final cover was completed in October, 1988. In January, 1989, John DeBeck declared bankruptcy and refused to undertake additional remediation of the landfill or investigation of the degree and extent of ground-water contamination.

Therefore, in early 1989, the State of Wisconsin undertook the continued remediation and investigation of the site. Costs for this work were paid by the Environmental Fund which are monies directly appropriated by the State legislature for environmental clean-ups.

In Fall, 1989, the State began a number of actions designed to remediate the immediate problems of:

1. methane gas and leachate migration from the landfill.
2. private water supply contamination at three wells.
3. extent of ground-water contamination and possible involvement of additional private wells.

The following actions had been accomplished as of the end of 1993:

1. **Gas and leachate extraction system.** A gas and leachate extraction system is in place and operating on the landfill surface. A partial system was installed in fall, 1989 to conduct gas extraction tests that led to design of the full extraction system. The complete system consists of 13 gas/leachate extraction wells, header piping, blower, flow control systems, electrical control systems, telemetry system, a ground flare that meets all applicable air emission standards, and a leachate holding tank. Leachate is extracted from 8 of the 13 wells. The other five wells have leachate heads of less than 6 feet at the base of the wells.

2. **Long-term operation and maintenance of the gas/leachate extraction system.** A consulting firm, Terra Engineering and Construction Corporation (Terra) has been hired to operate and maintain the extraction system and landfill surface for the next 3 to 5 years. Besides actual O & M of the extraction system, they monitor gas probes surrounding the landfill for methane migration, analyze leachate samples for compliance with a wastewater permit for discharge to the Madison Metropolitan Sewerage District, ensure subcontractors (e.g leachate hauler) perform all duties, inspect the landfill cover for erosion problems, and ensure that applicable air emission standards are met.

3. **Repair of Final Cover Soils.** Several areas of the landfill cover experienced significant erosion between 1988 and 1992. In Fall, 1992 a cap repair and restoration project was undertaken. Geomembrane and

heavy riprap was installed in the areas of worst erosion, settlement cracks were repaired, an access road over the landfill surface was constructed, top soil, seed and mulch was added to areas of sparse vegetation. At this time, the landfill surface is in fairly good repair. The landfill surface will continue to be maintained through the State's O & M contract with Terra, at least until RD/RA.

4. **Private Water Supply Wells.** Three private water supply wells, serving three homes, were discovered to be contaminated with VOCs in January, 1988. The landfill owner supplied bottled water until January, 1989 at which time the State took over payment for bottled water deliveries. In Fall, 1989, testing for design of a point-of-entry (POE) water treatment system was undertaken. The system, an activated carbon filtration system manufactured by Hellenbrand Water Systems, was installed in 2 homes in April and May, 1990. The third home is no longer occupied and the water well has been shutdown. The third property (owned by Randall Swanson) is used as a business and the State continues to supply bottled water to the business.

The State maintained and tested the POE systems for two years. In Summer, 1992, ownership of the POE systems was transferred to the homeowners, who are now permanently responsible for maintenance of the system and testing of the water supply. All testing to date indicates that the filtration systems reliably produce safe, drinkable water.

6. **Testing of Private Water Supplies Within One Mile of the Landfill.** In Fall, 1989, 43 private water supply wells (serving 53 homes) were tested for the presence of VOCs. Two testing rounds were conducted, in October, 1989 and January, 1990. The tests showed that all private wells (except the 3 previously mentioned) were free of VOCs. In one of the testing rounds, toluene was detected at approximately 1 part per billion in several private wells. Laboratory contamination is believed responsible for this. Subsequent testing showed all VOCs to be below detection at all the homes.

7. **Ground-water Monitoring Study.** In Summer, 1990, the State undertook an intensive ground-water investigation to determine the degree and extent of VOC contamination. Simon Hydro-Search of Brookfield, Wisconsin performed the investigation. Twenty-seven ground-water monitoring wells were installed. There were 30 existing monitoring wells at the site, for a total of 57 monitoring wells in the study. The study

evaluated the geology, the vertical and horizontal ground-water flow, the average ground-water velocity in each geologic unit, the extent of aquifer contamination, the direction of plume movement, preliminarily evaluated four remedial actions, and made recommendations on future work at the site.

The study showed that the ground-water plume has the potential to contaminate the Deer Run Heights subdivision, located approximately 1 mile southwest of the landfill. In January, 1991, the State began monitoring private wells in the eastern portion of Deer Run Heights.

8. **Numerical Model Simulation and Assessment of Contaminant Plume Migration.** In Summer, 1991, a numerical model was performed by Simon Hydro-Search in an effort to estimate movement of the plume front downgradient of the landfill. A number of simulation scenarios were performed, resulting in a range of possible outcomes. The modeling effort provided an evaluation of the State's ground-water monitoring strategy and suggested that at least one additional monitoring well be installed in the Black Earth Creek Valley. Other conclusions and recommendations are contained in the study.

9. **On-going ground-water monitoring.** The State has established a long-term ground-water monitoring program that monitors the movement of the plume and tests private wells closest to the plume. Testing is conducted semi-annually (in May and October) on 21 monitoring wells and 12 private wells. At present, this monitoring will continue through the end of 1994. Simon Hydro-Search is under contract to perform this monitoring.

10. **Community Relations.** A community relations program was instituted at the beginning of the State's involvement with investigation and response actions at the Refuse Hideaway Landfill. Six public meetings have been held in the last 3 years. Public meetings are always announced by way of fact sheets and news releases. There currently is a mailing list of approximately 150 interested persons. In addition, 3 or 4 "technical availability sessions" have been held. These are less formal, but serve as a mechanism for interested persons to directly ask questions of WDNR staff involved in the Refuse Hideaway clean-up. A copy of each fact sheet and information sheet produced for the public are available at the WDNR.

## 3.0 PROJECT ORGANIZATION

Entities responsible for project management, field sample collection, and laboratory analysis were as follows:

**Warzyn:** Private well sample and POE system sample collection/analysis 1988-1990, landfill waste/borings collection/analysis 1989-1990

**Swanson:** private well analysis 1991-present, ground water analysis 1990-present

**Southwest Laboratory of Oklahoma:** ground water analysis for TCL semivolatiles, TCL PCB/pesticides, TAL metals, 1993.

**Midstate:** leachate sample analysis 1991-present.

**Enviroscan:** leachate sample analysis (TCLP organics) as subcontractor to Midstate, 1991-present.

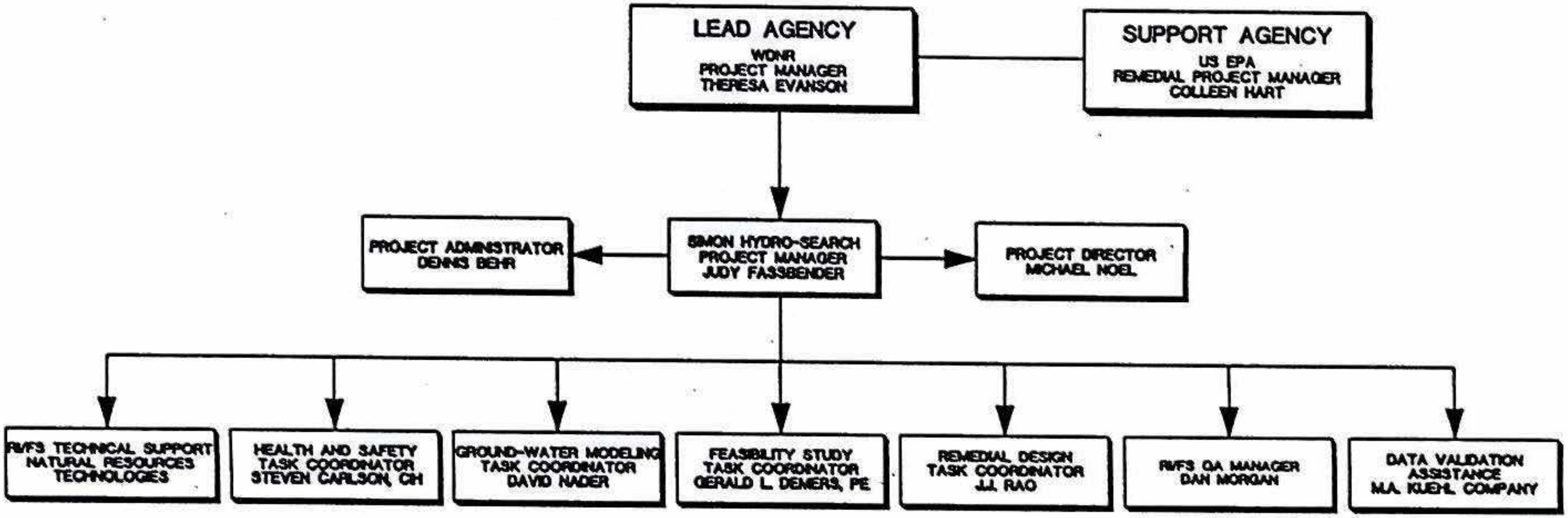
**ECRS/Terra:** Leachate sample collection 1991-present.

**Siimon Hydro-Search:** ground-water sample collection, project management 1990-present.

**Compuchem:** Waste/boring TCLP analysis as subcontractor to Warzyn, 1989-1990.

**RMT:** private well sample collection/analysis 1986-1987.

The current project organization chart for the RI/FS is presented in Figure 7-1 (attached) from the Work Plan.



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Dsgn. by:
Chk. by:
Apprv. by:

PROJECT: 301483135
DATE: 12/02/93

REFUSE HIDEAWAY LANDFILL
MIDDLETON, WISCONSIN

## PROJECT ORGANIZATION AND PERSONNEL

DRAWING NO.: 3135-1
FIGURE: 7-1

/hsi/148/flow-chart/3135-1

## 4.0 QA OBJECTIVES

The initial primary QA objective of the project was to provide data of adequate quality for DNR and the Madison Metropolitan Sewerage district (MMSD) monitoring requirements. This translates to EPA Data quality Objective (DQO) level III. DQO level III is defined as applicable to risk assessment, site characterization for nonSuperfund sites, hazardous waste/RCRA analyses and remediation monitoring. Analyses were done at DNR certified laboratories using EPA approved methods. Complete data packages with raw data and internal QC results to approximate DQO level IV in support of the designation of the site to the NPL list, were not generated at the time of sample analysis, and were compiled only recently for the purposes of site scoring for the NPL and for data validation in support of this QAPTM.

DQOs are qualitative and quantitative statements that specify the quality of the data necessary to support the client's or regulatory agency's use of the data. DQOs are based on the end use of the data to be collected, the type of decision to be made, the allowable uncertainty in the decision and the risk associated with a "wrong" decision.

Historical data needs for this project were for compliance of leachate discharge with MMSD Pretreatment Standards and RCRA regulations, and for assessment of ground water against DNR NR140 regulations. Additionally, ground water and drinking water entering neighboring impacted home were under the auspices of the Safe Drinking Water Act sampling and analytical requirements.

The purpose of compliance with the specified DQO level is to define the precision, accuracy, representativeness, comparability and completeness achieved for the sample analysis. In general, the data generated for the project should:

Be accurate in comparison to true or reference values within an accepted tolerance limit.

Be precise to within a specified degree of variability between replicate measurements.

Be representative of the source sampled.

Be comparable to analytical results obtained by other laboratories following the same DQO level and method.

Be complete in terms of the amount of valid data obtained versus all analyses requested.

These general QA objectives were fulfilled by the analytical laboratories that produced the historical data by use of their QA program that defines the specific internal QC samples to be analyzed and their acceptable limits. The limits are based on historical data collected and method validation studies conducted in-house. When not enough data was collected by the analytical laboratories to set acceptance limits, advisory limits were set using EPA or DNR data. These limits and the frequency of QC sample analyses are specified in the QAPTM.

## 5.0 SAMPLING PROCEDURES

Sample collection procedures were in accordance with those established by the Wisconsin Department of Natural Resources (DNR) as specified in the following document:

"Groundwater Sampling Procedures and Guidelines", Wisconsin Department of Natural Resources Publication WR-153-87, 1987.

Leachate samples were collected using grab techniques from the leachate collection tank. Private well samples were collected after purging and before any home water softeners or conditioners/filters. Ground-water samples were collected after purging the wells of four-well volumes, to within DNR tolerances for pH and conductivity. Purging was completed with Grundfos, Keck, or QED pumps or dedicated PVC bailers. Samples for chemical analysis were collected with the pump or bailer used for purging, or in some instances prior to 1990, with a Teflon bailer. Dedicated bailers/ QED systems in each of the monitoring wells have been used for the past four sampling events and will be utilized in the ongoing monitoring program.

Field blanks and trip blanks were collected periodically to assess field sample collection techniques. Contaminants in these blanks were antimony, methylene chloride, chloroform, bis(2-ethylhexyl)phthalate, aluminum, iron and manganese. In addition, trace levels of alpha BHC and heptachlor were reported in one field blank. The source of these contaminants is not known, but their presence did not invalidate sample data, as sample concentrations either exceeded 10 X blank level or were not detected. Field duplicate samples collected to assess field sampling precision were not widely variable, indicating acceptable field collection reproducibility.

Volatile vials received by the laboratories that contained headspace were not analyzed unless additional sample could not be obtained. Data was qualified as estimated where samples with headspace were analyzed during the data validation process. The frequency of samples noted as having headspace decreased as the sampling events progressed. Several samples were received by the laboratory at 16 degrees C and resultant data was qualified as estimated due to the temperature exceedance. Resampling was done and the samples were received within 4 +/- 2 degrees C.

Some volatile samples were received unpreserved and not analyzed within 7 days. Sample results for these samples were qualified as estimated due to a possible bias from inadequate acid preservation.

Sample aliquots for cyanide were not preserved to pH > 12, and associated sample data was qualified as estimated due to inadequate addition of NaOH in the field.

## 6.0 SAMPLE CUSTODY

A sample is legal evidence collected by the client representative of the site. In order to produce legally defensible data representative of a sample, the custody and documentation of the sample must be traceable and secure from sample collection through sample analysis and data entry. This section discusses the field and lab operations done to ensure sample and document integrity.

The trail of the sample's journey, from collection to disposal, was documented by the chain-of-custody form, that accounted for the secure location of the samples. Chain-of-custody was properly initiated in the field by the samplers.

At each laboratory, the lab itself was considered a secured area restricted to analysts only, and the chain-of-custody was considered unbroken until the sample was disposed of by the sample custodian. Intralab transfer of custody occurred when samples or sample extracts were transferred from one analyst to another, but was not recorded. Shipment of samples to subcontractor laboratories was also accomplished under custody by use of a chain-of-custody form.

## 7.0 CALIBRATION PROCEDURES AND FREQUENCY

The purpose of calibration is to verify that the analytical instrument/equipment can provide data of known and acceptable precision and accuracy. Instrument calibration was performed by the analyst in accordance with each laboratory's method and instrument SOPs each day samples were analyzed. Laboratory equipment calibration was periodically performed at prescribed intervals for balances, pipettes and thermometers which are relatively stable in performance. Field collection personnel recorded each day's pH and conductivity meter calibration to ensure accurate pH/conductivity measurements during well purging.

All instruments subject to calibration were uniquely numbered/identified so that calibration records were traced to a specific instrument. EPA and manufacturer's specific calibration protocols were followed. The source of the analytical standards used, the preparation of the standards and the documentation of the instrument calibration complied with the requirements in the EPA methods. Specific procedures followed for the project are briefly described below by instrument:

### GC/MS BNAs

- Every 12 hours the instrument was tuned and met EPA established abundance criteria for DFTPP to assure that instrument response met EPA specifications.
- Generation of five point calibration curves for all method compounds at least quarterly, or more frequently if needed. Recalibration was done when continuing calibration criteria was not met as specified in the EPA method.
- Verification of volatile system cleanliness by the analysis of at least one daily reagent blank.
- Maintenance of sample response within linear range of instrument by dilution.
- Addition of internal standards to each sample that met area count criteria of -50% to +100%.

### GC VOCs

- Generation of five point calibration curves for all analyzed compounds at least quarterly, or prior to any sample analysis as stated in the analytical method. Recalibration was done when continuing calibration criteria were not met and the compound of interest was present in the sample.

- The initial calibration curve had a Relative Standard Deviation (RSD) of ≤20% for Method 8010/8020, and ≤10% for Method 502.2 with continuing calibrations of ≤15%, and ≤20% respectively. RSDs were calculated based on guidance found in SW846, Method 8000, Section 7.4.4.2. Alternatively, the linear regression performed had a correlation coefficient greater than 0.995.
- Maintenance of sample response with linear range of instrument by dilution.
- Monitor consistency of instrument response through the analysis of a QC check standard after at least every 20 sample analyses, acceptable recovery range 60-140%.
- Demonstration of system cleanliness through the analysis of at least one daily reagent blank.

Pesticides and PCBs - GC/EC

- The initial calibration curve had an RSD of ≤20% with a continuing calibration of ≤15%. RSDs were calculated based on guidance found in SW846, Method 8000, Section 7.4.4.2.. Alternatively, the linear regression performed had a correlation coefficient greater than 0.995.
    - Generation of five point calibration curves for all analyzed compounds monthly, prior to any sample analysis, or as stated in the analytical method. Recalibration was done when continuing calibration was not met and the compound of interest was present in the sample.
    - Maintenance of sample response within linear range of instrument by dilution.

Metals - ICAP/Flame

- Analysis of at least one standard and a blank.
- Verification of system cleanliness and baseline maintenance through the analysis of a continuing calibration blank (CCB) after every ten samples.

Detected metals were less than Contract Required Detection Limit (CRDL) or laboratory reporting limit.

- Verification of instrument stability through the analysis of a continuing calibration verification (CCV) standard after every ten samples. Recovery was within 90-110%.
- Determination of instrument performance by the analysis of an interference check sample (ICSAB) at the beginning and end of each run, or twice in an 8 hour shift with limit of 80% - 120%.
- Maintenance of sample concentration within the linear range of the instrument by dilution.

AA Furnace and Cold Vapor Mercury Analyzer

- Initial and continuing calibration was recovered at 80-120% for the Cold Vapor Mercury Analyzer and 90-110% for AA.
- Verification of system cleanliness by a CCB analysis after every ten samples.
- Construction of at least a three point calibration curve for each element prior to the analysis of any sample set.
- Maintenance of sample response within linear range of instrument by dilution.

pH /conductivity meters

- Construction of a three point (2 point for pH) calibration curve prior to the analysis of any sample.
- Verification of cleanliness of the conductivity meter system through the analysis of a reagent blank.
- Verification of instrument consistency through the analysis of a conductivity standard and/or standard pH buffer after the analysis of every ten samples.

Lachat Auto Analyzer

- Construction of a three point calibration curve prior to the analysis of any sample. The initial calibration curves had an RSD of ≤20% and $r^2$ of ≥0.995.
- Monitored for the introduction of any interferents through the analysis of a reagent blank, prior to any sample analysis.
- Maintenance of sample response with the linear range by dilution.
- Verification of the consistency of instrument response through the analysis of a lab control standard (LCS) after every ten sample analyses.

## 8.0 ANALYTICAL PROCEDURES

Analytical procedures were selected by the sample collection firm in consultation with the DNR and/or MMSD and the laboratories to meet the permit or detection limits necessary. Table 1 lists the methods used for analysis of project samples.

Deviations from the stated EPA reference methods did occur. second column confirmation for 502.2/8021 analyses was not done by any of the laboratories, as they claimed to have sufficient historical data on the expected identity of project contaminants. Wider than specified retention time windows for the identification of PCB/pesticides was used, and associated sample data was considered estimated.

The laboratories involved defined the detection limit of a method as the quantity of analyte which resulted from the lowest differential between a signal caused by the analyte and that of random noise. Practical Quantitation Limits (PQLs) were defined as 5-10 times this signal, and were used by the laboratories as their reporting limit. Metals instrument detection limits (IDL) for analyses by CLP protocols were determined quarterly by spiking distilled water at a concentration 3-5 times the anticipated IDL. This solution was analyzed 7 times on three nonconsecutive days and the standard deviation calculated. The IDL was determined as 3 times this standard deviation.

PQLs for organic analytes were determined statistically at least annually for the methods listed in Table 1 using the criteria contained in <u>Federal Register</u> Vol. 49, No. 209, October 26, 1984, Appendix B to Park 136. For SW846 metals analyses, values above the method detection limit (MDL) were reported. MDLs were determined from 7 low level digested distilled water spikes. Organic analytes present in concentrations below PQLs were not reported as present in the samples analyzed for 502.2 and 8010/8020 analyses. Concentrations were reported as "less than" value (<) or "U" value. This less than or "U" value does not indicate that an analyte is <u>not</u> present in a sample, but only that its presence is at levels below PQL.

For results produced by CLP organic methods, values which were below required detection limits, but could still be quantified, were reported as estimated concentrations using a "J" qualifier. For results produced by CLP inorganic methods, values above the IDL but below the contract required detection limit (CRDL) were reported with a "B"

**TABLE 1** *REFUSE HIDEAWAY ANALYTICAL METHODS*

| ANALYTE | REFERENCE METHODS | | ANALYTE | REFERENCE METHODS | | | |
|---|---|---|---|---|---|---|---|
| **WET CHEMISTRY/ORGANICS** | | | **METALS** | | | | |
| Alkalinity | 310.1 | | Aluminum | CLP | | | 6010 |
| BOD | 405.1 | | Antimony | CLP | | 7041 | 6010 |
| COD | 410.4 | | Arsenic | CLP | | 7060 | 6010 |
| Chloride | 325.1 | | Barium | CLP | | | 6010 |
| Conductivity | 120.1 | | Beryllium | CLP | | | 6010 |
| Coliform, Total | Colilert | 9132 | Cadmium | CLP | 213.2 | 7130 | 6010 |
| Fecal Coliform | 909C | | Calcium | CLP | | | 6010 |
| Cyanide | 335.2 | CLP | Chromium, total | CLP | | 7190 | 6010 |
| Hardness | 130.2 | | Chromium, hex | | | 7196 | |
| Total Kjeldahl Nitrogen | 351.2 | | Cobalt | CLP | | | 6010 |
| Nitrate-N | 353.2 | | Copper | CLP | | 7210 | 6010 |
| pH | 150.1 | 9040 | Iron | CLP | | | 6010 |
| Oil & Grease | 413.1 | | Magnesium | CLP | | | 6010 |
| TOC | 415.1 | 9060 | Manganese | CLP | | | 6010 |
| TSS | 160.2 | | Mercury | CLP | 245.1 | 7470 | 7471 |
| Sulfate | 375.4 | | Nickel | CLP | | 7520 | 6010 |
| TCLP/ZHE Extraction | 1311 | | Potassium | CLP | | | 6010 |
| EP Toxicity Extraction | 1310 | | Selenium | CLP | | 7741 | 6010 |
| Aqueous Extraction | 3510 | 3520 | Silver | CLP | 272.2 | | 6010 |
| Solid Sample Extraction | 3540 | 3550 | Sodium | CLP | | | 6010 |
| Sample Clean-up | 3620 | 3640 | Thallium | CLP | 279.2 | 7841 | 6010 |
| Chlorinated Herbicides | 8150 | | Lead | CLP | | 7420 | 6010 |
| Pesticides/PCBs | CLP | 8080 | Vanadium | CLP | | | 6010 |
| Semivolatile Organics | CLP | 8270 | Zinc | CLP | | 7950 | 6010 |
| | | | Metal Digestion | 3005 | 3050 | 3020 | 3010 |
| Volatile Extraction | 5030 | | Volatiles | | 502.2 | 8010 | 8020 |
| | | | | | | | |
| | | | | | | | |

qualifier. Values below the IDL were qualified with a "U" code.

Actual reporting limits achievable in project samples varied based on dilution requirements, background interferences, sample concentration factors and cleanup techniques. The leachate sample, mercury, selenium, cadmium, and hexavalent chromium due to matrix interferences.

## 9.0 INTERNAL QC CHECKS AND FREQUENCY

This section describes the types of QC samples which were prepared by each laboratory and routinely analyzed with project samples to demonstrate that the lab was operating within known precision and accuracy, representativeness, completeness and comparability limits. Table 2 summarizes these QC samples and indicates their frequencies, and applicabilities. Internal control limits were updated on an ongoing basis by each laboratory, or EPA advisory limits were used where insufficient historical data was available. **Precision** was defined as the reproducibility of analytical measurements. It was a quantitative measure of the variability of a group of measurements compared to their average value, and was dependent on sampling and analytical error. The following internal QC samples measured precision:

### Lab Duplicate (LD)

A sample was split by the lab and both aliquots were analyzed separately to assess method precision. The relative percent difference (RPD) was calculated. Metals, volatiles by GC, and wet chemistry analyses utilized this QC sample.

Frequency: One per 10 samples or daily, whichever was more frequent.

Limits: Less than 20% RPD water, less than 35% RPD soil. Analyte, matrix and concentration dependent.

### Matrix Spike Duplicate (MSD)

The matrix spike duplicate was prepared by spiking two aliquots of sample with the analytes of interest or a subset of analytes and the RPD calculated between the MS/MSD pair. If the variability between the MS/MSD exceeded limits, the associated sample data case narrative or report sheet contained a note to this effect.

Frequency: One per 20 samples of a similar matrix.

Limits: method and matrix dependent.

**Accuracy** was defined as the bias of analytical measurements. Sources of bias were the sampling process, field contamination, sample preservation, handling, sample matrix, laboratory sample preparation, and analysis. The following internal QC check samples were used to assess accuracy:

Trip Blanks (TB)

Volatile organics samples are susceptible to contamination by diffusion of contaminants through the teflon septum of the sample vial. Trip blanks were prepared by the laboratories or field personnel and were shipped with the coolers to the field and then to the lab. They were analyzed to monitor possible sample contamination during shipment. If the trip blanks indicated contamination, the associated sample data was qualified as suspect. Results of trip blank analyses were reported with the corresponding sample analytical data.

Frequency: Two 40 ml. volatile vials per cooler containing volatile samples.

Limits: If lab blanks also contained same analytes, results were reported with qualification.

Field Blanks (FB)

A field blank was "pure" water used to demonstrate the absence of contamination during sampling. Deionized, distilled laboratory or grocery store purchased water was poured through sample collection equipment (bailers), placed into sample containers in the field, packaged, and shipped with the other field samples. If the field blanks indicated possible contamination of the samples depending upon the nature and extent of the contamination, the associated sample data was qualified. Sources of contamination included: Containers; sample storage facilities; field handling procedures; and sampling equipment. Results were reported with the corresponding sample analytical data.

Frequency: One per 10 field samples or daily (recommended by EPA).

Limits: Not applicable, results reported.

Method Blanks (MB)

A method blank was a volume of laboratory grade water carried through the entire analytical procedure. The volume of the blank was approximately equal to the sample volume processed. If the concentration of an analyte in the blank was above the laboratory's PQL or reporting limit, the sample with the least concentration analyte must be greater than 10 times the blank concentration, or all samples associated with the blank and less than 10 times the blank concentration were redigested or reextracted and reanalyzed. No sample values were corrected for the blank value. Analysis of the blank verified that method interferences caused by contaminants in solvents, reagents, glassware, and other sample processing hardware were known and minimal.

Results of method blanks were reported with the data for volatile organics, semivolatile organics and PCB/pesticides by CLP protocols, and were kept in the project file for other analyses.

Frequency: One per 20 samples analyzed or daily, whichever was more frequent.

Limits: Less than detection limit or less than 10 x lowest detected sample level for inorganic analytes, and less than 10 x the reporting limit/CLP Contract Required Quantitation Limit (CRQL) for the common organic laboratory contaminants: phthalates, methylene chloride, and acetone.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

To determine the accuracy of the method in the real sample matrix, two separate aliquots of a sample were spiked with the analyte or subset of analytes of interest and analyzed with the sample. The percent recovery was calculated and compared against EPA advisory limits or the laboratory's historical limits. If the percent recovery was outside of the limits in both samples, a matrix effect was suspected and the report contained a note on the matrix effect. Matrix spikes were applicable for wet chemistry and metals analyses, matrix spike duplicates were applicable to organic analysis.

<u>Frequency</u>: One per batch of 20 samples or daily, whichever was more frequent.

<u>Limits</u>: As set by EPA method and/or historical data at mean +/- 3sd.

<u>Analytical (Post Digestion Spikes) (AS)</u>

Target metals at a known concentration were added to an aliquot of the sample digest for GFAA analysis just prior to analysis to assess if matrix effects (suppression or enhancement) were present. If results were outside limits, the data report indicated that the sample exhibited a matrix effect.

<u>Frequency</u>: Every sample for GFAA analysis (CLP protocol).

<u>Limits</u>: 85-115%.

<u>Internal Standards (IS)</u>

A known concentration of organic analyte not expected in environmental samples was added to the sample extract just prior to analysis. It measured instrument performance and was used to normalize data for quantitation. Reinjection of the sample was done if results were not acceptable.

<u>Frequency</u>: Every real sample, standard and internal QC sample.

<u>Limits</u>: -50 to + 100% area counts.

<u>Surrogate Spikes (SS)</u>

Surrogates were organic analytes that also were not expected to be found in environmental samples and their behavior mimicked those of the target analyses. Samples, blanks and internal QC samples were spiked with surrogates prior to purging or extraction for GC or GC/MS analyses. Reanalysis of samples occurred if a specified number of surrogates were outside limits.

<u>Frequency</u>: Every real sample, standard and internal QC sample.

<u>Limits</u>: As contained in laboratory methods.

Laboratory Control Standards (LCS)/QC Check Standards

A standard of midpoint concentration on the curve or a known EPA reference standard/sample was analyzed to assess the accuracy of the calibration curve and the stability of the instrument response. This sample is in addition to the calibration requirements. For CLP aqueous samples, the LCS is the digested initial calibration verification solution (ICV).

Frequency: One per 20 samples or daily, whichever was more frequent.

Limits: Method and matrix dependent.

**Representativeness** was defined as the degree to which sample data accurately and precisely represented the environmental conditions. It was controlled by selecting proper sampling locations and collecting a sufficient number of samples. The following internal QC check samples were used to assess representativeness:

Field Duplicate

An assessment of field collection and homogenization techniques and/or site variability was made by calculating the RPD.

Frequency: One per 10 field samples collected (recommended by EPA).

Limits: Not established.

Valid data for 100% of all samples analyzed was the **completeness** goal of the QA program for the project. Since no specific internal QC checks measure completeness, this goal was achieved by the laboratory's following EPA reference methods without significant deviation in the sample preparation, instrument calibration, operation and analysis. Data not qualified with an R code expressed as a percentage against all project data was used to approximate completeness. Completeness achieved was 99%. Invalid data was obtained for 2,4,6-trichlorophenol, cis-1,2-dichloroethene, bis(2-chloroethyl)vinylether, 4-chloroaniline, and methylene chloride. In addition, cis-1,2-dichloroethene was not reported as an analyte in some sample reports.

**Comparability** was defined as the confidence with which one group of data can be compared with another. It was controlled by using standard sampling and approved EPA analytical techniques. The following internal QC check samples were used to assess comparability:

External Performance Evaluations

All of the labs participating in the project participated in inter-laboratory round robin studies supplied by the US EPA, Wisconsin DNR and other commercial vendors. Reports of the true values and acceptable statistical limits were received and were used to assess each lab's performance.

Frequency: At least quarterly.

Limits: Study specific.

| Table 2 | INTERNAL QC CHECKS & FREQUENCY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ANALYTE | BLANKS | | | DUPLICATES & SPIKES | | | | | | CONTROL STANDARD | |
| | TB | FB | MB* | LD | FD | MS/MSD | MS | SS | AS | IS | LCS |
| ALKALINITY | -- | -- | 1/10 | 1/10 | -- | -- | -- | -- | -- | -- | 1/10 |
| BOD | -- | -- | DAILY | 1/10 | -- | -- | -- | -- | -- | -- | 1/10 |
| COD | -- | -- | 1/10 | 1/10 | -- | -- | 1/10 | -- | -- | -- | 1/10 |
| CHLORIDE | -- | -- | 1/10 | 1/10 | -- | -- | 1/10 | -- | -- | -- | 1/10 |
| CONDUCTIVITY | -- | -- | 1/10 | 1/10 | -- | -- | -- | -- | -- | -- | 1/10 |
| COLIFORM | -- | -- | 1/10 | 1/10 | -- | -- | -- | -- | -- | -- | 1/10 |
| CYANIDE | -- | -- | 1/10 | 1/10 | -- | -- | -- | -- | -- | -- | -- |
| HARDNESS | -- | -- | 1/10 | 1/10 | -- | -- | 1/10 | -- | -- | -- | 1/10 |
| TKN | -- | -- | 1/10 | 1/10 | -- | -- | 1/10 | -- | -- | -- | 1/10 |
| NITRATE | -- | -- | 1/10 | 1/10 | -- | -- | 1/10 | -- | -- | -- | 1/10 |
| OIL & GREASE | -- | -- | 1/10 | 1/10 | -- | -- | -- | -- | -- | -- | 1/10 |
| pH | -- | -- | 1/10 | 1/10 | -- | -- | -- | -- | -- | -- | 1/10 |
| TOC | -- | -- | 1/10 | 1/10 | -- | -- | 1/10 | -- | -- | -- | 1/10 |
| TSS | -- | -- | 1/10 | 1/10 | -- | -- | -- | -- | -- | -- | 1/10 |
| SULFATE | -- | -- | 1/10 | 1/10 | -- | -- | 1/10 | -- | -- | -- | 1/10 |
| HEX CHROMIUM | -- | -- | 1/10 | 1/10 | -- | -- | 1/10 | -- | -- | -- | 1/10 |
| METALS | -- | 1/10 | 1/10 | 1/10 | 1/10 | -- | 1/10 | -- | 100% | -- | 1/10 |
| TCLP EXTRACTION | -- | -- | 1/10 | 1/20 | -- | -- | 1/20 | -- | -- | -- | -- |

| Table 2 (cont.) | TB | FB | MB* | LD | FD | MS/MSD | MS | SS | AS | IS | LCS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VOAS BY 8010/8020 | 1/C | 1/10 | DAILY | 1/20 | 1/10 | -- | 1/20 | -- | -- | 100% | -- |
| VOAS BY 502.2 | 1/C | 1/10 | DAILY | 1/20 | 1/10 | -- | 1/20 | -- | -- | 100% | -- |
| SEMIVOLATILES | -- | 1/10 | 1/20 | -- | 1/10 | 1/20 | -- | 100% | -- | 100% | 2/20 |
| PCB/PESTICIDES | -- | 1/10 | 1/20 | -- | 1/10 | 1/20 | -- | 100% | -- | -- | -- |
| HERBICIDES | -- | -- | 1/20 | -- | -- | 1/20 | -- | 100% | -- | -- | -- |
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| TABLE 2 LEGEND | |
|---|---|
| TB | TRIP BLANK |
| 1/C | ONE PER COOLER RECEIVED |
| MB | METHOD BLANK |
| LD | LAB DUPLICATE |
| MS/MSD | MATRIX SPIKE/MATRIX SPIKE DUPLICATE |
| MS | MATRIX SPIKE |
| SS | SURROGATE SPIKES ADDED |
| AS | ANALYTICAL SPIKE |
| IS | INTERNAL STANDARDS ADDED |
| LCS | LAB CONTROL STANDARD OR EPA REFERENCE STANDARD |
| FB | FIELD BLANK COLLECTED |
| FD | FIELD DUPLICATE COLLECTED |
| -- | NOT APPLICABLE |
| * OR AT LEAST DAILY, WHICHEVER IS MORE FREQUENT | |
| 100% = EVERY SAMPLE SPIKED | |

## 10.0 DATA REDUCTION, VALIDATION AND REPORTING

Data reduction was the process of compiling all pertinent results, calibration records, and QC data, to produce a report that was accurate and met the project requirements. Data validation was the process of reviewing data generated against a pre-established set of criteria to determine its validity. Data reporting was the process of producing the results in a format suitable to the DNR and ensuring that it accurately represented the results of the reduction and validation processes.

The laboratories used computerized Laboratory Information Management System (LIMS) to accomplish several data cquisition activities: laboratory sample log-in, sample result archival, sample status and tracking, and final report generation. The systems are summarized below:

- Individual laboratory identification numbers were assigned for each sample. Sample data input included field sample ID, analytical test methods required, matrix, turnaround time, collection date and holding time requirements.
- LIMS assimilated the sample data and generated backlog reports for each section of the laboratory for scheduling and prioritizing analyses. These reports identified the analytical parameters, the method, the turnaround time requested and critical holding time considerations.
- Analysts entered their completed sample analytical results into the LIMS, and supervisors reviewed and approved the results. Approval of the run removed the sample analyses from the backlog as completed and a final report was generated.
- CLP data package forms were generated through independent software systems. When the entire CLP Sample Delivery Group (SDG) was complete it was removed from the LIMS backlog.

All analytical data were generated either by computer data reduction systems (GC, GC/MS,ICAP, AA) or by manual calculation (Wet Chemistry). Manually calculated data were entered into bound logbooks or forms and into LIMS.

All extractions, sample preparation, standards preparation and instrument runs were also entered into bound logbooks. Each set of analytical data was therefore traceable to specific lots of standards, digestion or extraction dates and instrument runs. Data were generated by the analyst in one of the following ways:

- By manual computation of results directly on a data sheet or on calculation pages attached to the data sheets.
- By entering raw data into the computer for processing.
- By direct acquisition and processing of raw data by the computer.

If data were manually generated by the analyst, steps in the computation were specified, including equations used and the source of input parameters such as response factors, dilution factors, and sample weights/volumes.

If data were directly acquired by the computer from the instrument and a printout was supplied, the analyst verified that the following information could be traced to the raw data: calibration results, response factors, QC sample results and numerical values used for detection limits. Units and correct sample numbers were checked during the validation process.

Project data were validated internally during collection by each laboratory and a subset (see Appendix A) was validated independently for the RI/FS. Validation criteria used were those contained in the EPA National Functional Guidelines and EPA Region V additional guidance as detailed in the following documents:

National Functional Guidelines for Organic Data Review,
U.S. EPA CLP
Draft dated June, 1991

National Functional Guidelines for Evaluating
Inorganics Analyses, U.S. EPA CLP
Draft dated October, 1989

Region 5 Standard Operating Procedure for Validation of
CLP Inorganic Data
September, 1993

Region 5 Standard Operating Procedure for Validation of CLP Organic Data
April, 1991; revised August 25, 1993

Each discrete data package was validated independently and a Technical Memorandum generated. The data packages have been forwarded to the U.S. EPA CRL for a 10% validation.

The format and content of a data report were dependent upon project needs, such as whether or not a CLP data package, case narrative, or QA Summary was required, and DNR reporting formats. A consistent report format was not supplied between laboratories, but most reports did meet the requirements summarized below:

- All result sheets and/or a cover letter/case narrative were signed by the Laboratory Manager. This signature indicates that the data was reviewed for:
    - Completeness - results for all parameters requested were present; detection limits, units, dates, and sample descriptions were complete and correct.
    - Consistency - all parameters were reviewed for internal consistency (hexavalent chromium ≤ total chromium).
    - Sample identification number used by each laboratory and the sample identification provided to the laboratory by the sampler matched up.
    - Chemical parameters analyzed, reported values, units of measurement, analytical method used, dates prepared/extracted and analyzed.
    - Detection limit of the analytical procedure used, if undetected values were reported.
    - Data for each chemical parameter reported with consistent significant figures.
    - Explanation of any out-of-control events that affected data quality (holding times, preservatives, surrogates).

- Explanation of any data qualifiers used.

Data qualifiers added during the validation process were R and J. Estimated data were coded based on low QC check standard recoveries, low surrogate recoveries, initial and continuing calibration deviations, and low RRF responses. Low MS recoveries also were the cause of estimated data qualifiers being added. The suspected presence of water in the PID system affected the response and quantitation of cis-1,2-dichloroethene, and affected data was qualified as estimated, or unusable, depending on the severity of the effect. Sporadic cis and trans-1,3-dichloropropene, 2,4,6-trichlorophenol, bis(2-chloroethyl)vinyl ether, and 4-chloroaniline data was qualified as unusable due to low QC check standard recovery.

## 11.0 PERFORMANCE AND SYSTEMS AUDITS

Performance audits independently collect data from the QA system using performance evaluation samples and are quantitative. Results are usually expressed as falling within or outside of statistically determined acceptance limits. System audits are the review of the entire data production process and consist of on-site inspection and a review of documentation. System audits are qualitative and consist of an audit report containing any deficiencies. Data audits consist of reviewing project files for appropriate QC results and documentation from sample receipt through disposal.

The laboratories involved in the project routinely analyzed EPA blind performance evaluation (PE) samples for the Water Pollution (WP) and/or Water Supply (WS) studies. No project specific blind PE samples were analyzed during the course of the project. PE samples from the DNR were also analyzed on an ongoing basis by the laboratories located in Wisconsin as part of their annual recertification process. None of the laboratories provided data on analytes they were not certified for. None of the laboratories were under Notice of Violation from the DNR during the course of the analytical work.

Every 3 years, the Wisconsin Department of Natural Resources conducts an on site inspection of laboratories certified by the State. All Wisconsin based laboratories involved in the project have been audited at least once during the project time frame (1988-1993).

Southwest Laboratory of Oklahoma (SWOK) is currently pursuing certification from the State. SWOK undergoes annual audits as part of its participation in the Superfund Contract Laboratory Program (CLP).

No project specific on-site audits of the laboratories were conducted while samples were being analyzed.

Data audits were done by the M.A. Kuehl Company on selected project samples. The rationale for the samples selected is presented in Appendix A. A data validation technical memorandum was prepared for each data package audited. The CRL will then audit 10% of the samples in each of these validated data packages.

## 12.0 PREVENTIVE MAINTENANCE

Preventive maintenance (PM) is an organized program of actions (such as equipment cleaning, lubricating, reconditions, adjustment and/or testing) taken to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use. The purpose of PM is to increase reliability of data reported and reduce downtime. The laboratories preventive maintenance programs included the following:

- Instruments, equipment, and parts subject to wear or deterioration without proper periodic maintenance.
- Spare parts were readily available to minimize downtime, and avoid missing holding times.
- Frequency that maintenance is required and documentation that it was performed.

Implementation of the preventive maintenance program was dependent upon the specific instrument and manufacturer. This QAPTM does not designate specific PM for each instrument and equipment but lists in Table 3 the general practices that were followed by all of the labs participating in the project. Documentation was recorded in each instrument of maintenance logbook.

## TABLE 3 REFUSE HIDEAWAY LANDFILL PREVENTIVE MAINTENANCE

| INSTRUMENT | ITEM CHECKED/SERVICED | FREQUENCY |
|---|---|---|
| **Atomic Absorption Spectrophotometer** | | |
| | Burner head | Each shift |
| | Electrical | Each shift |
| | Lamps | Each shift |
| | Nebulizer | Each shift |
| | Optics | During PM Service Calls |
| | Graphite tube | As necessary |
| | Replace graphite tube | As needed |
| | Replace contact rings | As needed |
| | Replace quartz windows | As needed |
| | Clean optics | As needed |
| | Align background lamp | When changed |
| **Gas Chromatograph** | | |
| | EC (Ni-63) wipe test | Semi-annual |
| | Clean detector | monthly |
| | Change column | As needed |
| | Change glass wool plug | Weekly |
| | Clean insert | Weekly |
| | Replace septum | Daily |
| | Gas purity check | Upon receipt of new cylinders |
| | Flow controller | Semi-annually |
| | Purge and trap | As needed |
| | Change fuses | As needed |
| | Reactivate external carrier gas filter dryers | Weekly |
| | Reactivate flow controller filter dryers | Semi-annually |
| | Clean and silanize or replace glass liners on injectors | As needed or quarterly |
| | Clean Detectors a) ECD<br>b) FID, Hall | a) As needed<br>b) As needed or annually |
| | Clean Purge Vessel | As needed or monthly |
| | Replace Purge Vessel | As needed |

***TABLE 3 REFUSE HIDEAWAY LANDFILL PREVENTIVE MAINTENANCE***

| INSTRUMENT | ITEM CHECKED/SERVICED | FREQUENCY |
|---|---|---|
| | Bake Trap | As needed |
| GC (cont.) | Replace Trap | Semi-annually |
| | Replace carbon filter | Annually |
| | | |
| ICAP | Sample introduction system | Daily |
| | Replace o-rings and water filters | As required |
| | Clean optics | As needed |
| | Clean torch | As needed |
| | Change oil and dessicant | Annually |
| | Check electronics | Daily |
| | Clean, realign torch | As Required |
| | Clean nebulizer tips | Daily |
| | Clean mixing chamber | As Needed |
| | Replace pump tubing | Daily if left hooked up |
| Lachat Autoanalyzer | | |
| | Clean and dry random access sampler | Daily |
| | Clean boats and check placement | Daily |
| | Clean sensor with cotton swab | Daily |
| | Spray proportioning pump with silicone, wipe rollers | Every 50 hours, (2500 samples) |
| | Check pump waste lines | Every 50 hours, (2500 samples) |
| | Replace injection module flares | Every 500 hours, (25,000 samples) |
| | Clean unions, replace o-rings | Every 500 hours, (25,000 samples) |
| | Clean manifold fittings | Every 500 hours, (25,000 samples) |
| | Replace manifold o-rings | Every 500 hours, (25,000 samples) |
| | Rewrap coils | Every 500 hours, (25,000 samples) |
| | Clean and dry colorimeter | As needed |
| | Run "clean disk" in computer | Every 500 hours |
| Refrigerators | | |
| | Temperature checked and logged | Daily |
| Balances | | |
| | Service representative calibration | Annually |

***TABLE 3 REFUSE HIDEAWAY LANDFILL PREVENTIVE MAINTENANCE***

| INSTRUMENT | ITEM CHECKED/SERVICED | FREQUENCY |
|---|---|---|
| **Deionized/Nanopure Water** | | |
| | Conductivity Check | Daily |
| Water (cont.) | Ion exchange bed changed | Weekly |
| | Replace filters | As needed |
| GC/MS GC/MS maintenance is the same as GC with the following additions: | | |
| | Mechanical pump oil | Quarterly |
| GC/MS (cont.) | Power Con. air filter | Bi-Weekly |
| | QEM filter | Bi-Weekly |
| | Turbo pump oil | Semi-annually |
| | Water filter (if applicable) | Observe and change as needed |
| | Computer air filter | Monthly |
| | Card cage air filter | Monthly |
| | Source-clean ceramics, polish lenses | As needed |
| | Clean poles and ceramics on the poles | As needed |
| | Clean contacts on the component boards | As needed |
| | Vacuum the component boards | As needed |
| | Clean all fan screens | Weekly |
| | Vacuum outside of instrument | Weekly |
| | Clean grob and replace quartz insert | As needed |
| | Replace septum | Daily (each shift) |
| | Injection port liner checked | Daily |
| | Column maintenance | As needed |
| Infrared Spectrophotometer | | |
| | Clean cells | Daily |
| pH Meter | | |
| | Electronics checked | Daily |
| | Electrolyte changed | Checked weekly, changed when low |

## 13.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

The purpose of this section is to describe how data from the QC samples listed in Section 9.0 were treated to determine data quality. Data accuracy and precision were calculated as percent recovery or relative percent difference (RPD). Data comparability, representativeness and completeness was not calculated by the laboratories for this project.

To determine the precision of the method and/or analyst, a routine program of sample duplicate analyses was performed. There were also lab control standard/lab control standard duplicate or matrix spike/matrix spike duplicate pairs analyzed. The results of the duplicate analyses were used to calculate the relative percent difference (RPD) which is defined as the difference (range) of each duplicate set, divided by the average value (mean) of the duplicate set, times 100 percent. For duplicate results $D_1$ and $D_2$, the RPD was calculated from Equation 13-1:

$$\text{RPD \%} = (D_1 - D_2)/(D_1 + D_2) \times 200\% \qquad (13\text{-}1)$$

When the RPD is obtained for at least 20 duplicate pairs, the average RPD and the standard deviation were calculated using:

$$\overline{m} = \frac{\sum_{i=1}^{n} m_i}{n} \qquad (13\text{-}2)$$

$$Sm = \frac{\sum_{i=1}^{n} (m-\overline{m})^2}{n-1} \qquad (13\text{-}3)$$

where

$m$ = the RPD of a duplicate pair,

$\overline{m}$ = the average of the RPD values,

$Sm$ = the standard deviation of the data set of RPD values, and

$n$ = number of RPD values used.

Control limits are calculated from these data as follows:

Upper control limit = $\bar{m} + 3Sm$,

Upper warning limit = $\bar{m} + 2Sm$,

Lower warning limit = $\bar{m} - 2Sm$, and

Lower control limit = $\bar{m} - 3Sm$.

Control limits were then distributed to analysts and updated at least annually.

To determine the accuracy of an analytical method and/or analyst, a sample and blanks were routinely spiked. The results of matrix, matrix spike duplicate, and lab control standards were used to calculate the quality control parameter for accuracy evaluation, the Percent Recovery (%R).

The %R is the observed concentration, minus the sample concentration, divided by the true concentration of the spike, times 100 percent:

$$\%R = \frac{O_i - O_s}{T_i} \times 100\% \qquad (13\text{-}4)$$

where

%R = the percent recovery,

$O_i$ = the observed spiked sample or blank concentration,

$O_s$ = the unspiked sample or blank concentration, and

$T_i$ = the true concentration of the spike.

The true spike concentration is calculated from Equation 13-5:

$$T_i = \frac{\text{Spike Conc. (mg/L)} \times \text{Volume of Spike (ml)}}{\text{Volume of Sample (ml)} + \text{Volume of Spike (ml)}} \qquad (13\text{-}5)$$

When the percent recovery was obtained for at least twenty blank spike samples, the mean percent recovery and the standard deviation were calculated using the formulas:

$$\overline{\%R} = \frac{\sum_{i+1}^{n} \%R_i}{n} \qquad (13\text{-}6)$$

and

$$S_R = \frac{\sum_{i=1}^{n} (\%R_i - \overline{\%R})}{n - 1} \qquad (13\text{-}7)$$

where

$\% R_i$ = percent recovery,

$\%\overline{R}$ = Mean percent recovery,

$S_R$ = Standard deviation,

$n$ = number of results.

Control limits are calculated from these data as follows:

Upper control limit = $\%\overline{R} + 3S_R$,

Upper warning limit = $\%\overline{R} + 2S_R$,

Centerline = $\%\overline{R}$,

Lower warning limit = $\%\overline{R} - 2S_R$, and

Lower control limit = $\%\overline{R} - 3S_R$.

All control limits were calculated and distributed to analysts and updated at least annually.

## 14.0 DATA DOCUMENTATION AND TRACKING PROCEDURES

The condition of the shipping containers and sample bottles were inspected and documented upon receipt and the temperature measured and recorded (if intact ice was not present), in accordance with DNR guidelines. Samples were documented as received at an adequate temperature 2-4 C) at the laboratories. Unique lab sample numbers were then assigned to each sample for tracking purposes by each lab.

Entries into laboratory notebooks and forms included the date, and the signature or initials of the person making the entry. Sample extraction, preparation logs, and standards preparation logs were reviewed periodically by supervisors.

Error corrections were, for the most part, done in accordance with EPA NEIC guidance: laboratory documentation was made in ink, corrections to documentation were made by crossing out the error with a single line and placing the correction above it, the error line initialled and dated by the person making the correction. No error correction fluid or "white out" was evident in the documentation reviewed.

Bound logbooks with sequentially numbered pages were used for recording laboratory data. Laboratory analysts recorded and documented instrumental calibration and preventive maintenance in designated laboratory bound notebooks. These logbooks identified instrument operating parameters, settings, and performance data associated with each instrumental calibration run. Any preprinted laboratory forms contained the date(s) they applied to. Copies of applicable pages were included with the data packages as requested for the sample results validated.

# APPENDIX A

## Data Validation Scheme/Rationale
## Refuse Hideaway Landfill

## Data Validation Scheme/Rationale
## Refuse Hideaway Landfill

**Matrix: Private Well Water**

A. Volatile organic and NR140 indicator parameters (alkalinity, chloride, $NO_3$-N, sulfate, TOC, Ca, Fe, Mg, Mn, K, Na, coliform) data from the 3 residential wells currently on POE treatment systems will not be validated as the treatment remedy is already in place. Since the monitoring began, no detectable volatile contaminants have been detected in the treated water.

B. Volatile organic data from residential well samples collected within 1 mile of the landfill in 10/89 and 1/90 will be validated. The quality of this data is important in the assessment of the extent of contamination from the plume.

Lab: Warzyn
Samples: 35 [11 (10/89), 24 (1/90)]
Lab Sample Numbers: 38081-38092, 41547-41558, 41566, 41588-41599, 41602
Analyte/Method: Volatiles/502.2
Data Package Status: Submitted to DNR in 1992, validated in 1993.

C. Volatile organic data from the 1/91 sampling of 10 unimpacted private wells will be validated to provide an assessment of the data quality used to evaluate plume extent and human exposure.

Lab: Swanson
Samples: 12
Lab Sample Numbers: 5760-2,3; 6153-1-6; 6176-1-3; 6307-1
Analyte/Method: Volatiles/502.2
Data Package Status: Submitted and validated in 1993.

**Matrix: Ground water**

A. Volatile Organic and indicator (alkalinity, COD, chloride, hardness, Fe) data generated during the placement of the monitoring well screens will not be validated as the data was not used to assess the extent of contamination.

B. Two sampling rounds of the 27 newly installed wells occurred in 12/90 and 1/91. The volatile organic data from the 1/91 event will be validated as it coincided with the sampling of the 25 preexisting monitoring wells and 10 unimpacted private wells.

Lab: Swanson
Samples: 58
Lab Sample Numbers: 5659-1-12; 5670-1-8; 5693-1-7; 5760-1,4; 5712-1-11; 5742-1-7; 5759-1-6; 5775-1-5
Analyte/Method: Volatiles/8021
Data Package Status: Submitted and validated in 1993.

C. Semi-annual volatile organic analysis of samples from 21 selected monitoring wells and 6 residential wells has been conducted since January 1991 or June 1991. The data from the most recent event completed in October, 1993 will be validated as well as the data from two previous events that exhibited significant concentrations of detectable volatiles (10/2-8/92, 5/13-21/93) to compare compounds identified and assess any concentration gradients over time.

Lab: Swanson
Samples: 88 [27 (10/92), 34 (5/93), estimate 27 (11/93)]
Lab Sample Numbers: 3000-1-4; 3000-10-13; 3000-14-16,18; 3000-19,20-22; 3044-1, 5549-2,4,9,10; 5648-2,4,5-7,9,10; 5604-1-13 by EPA Method 8021

3000-7-9, 17; 3000-23-26; 3044-2,3; 5549-1,3,5,6-8; 5648-1,3,8,11 by EPA Method 502.2

Analyte/Method: Volatiles/8021, 502.2
Data Package Status: Submitted 11/93 and 1/94, validated in 1994.

D. Ground-water samples from 18 monitoring wells and 2 residential wells were collected on 5/17-19/93 and again on 10/18-22/93. These samples were analyzed by CLP protocol OLM01.8 for TCL Semivolatiles, and SOW 3/90 TAL metals. Three samples from downgradient wells impacted by volatiles were also analyzed for TCL PCB/Pesticides. Data from the 5/93 and the 10/93 events will be validated.

Lab: Southwest Laboratory of Oklahoma
Samples: 48
Lab Sample Numbers: 1379901-8; 1382301-8; 1384201; 1387201-6; 1601601-10, 1606401-09, 1617501-04.
Analyte/Method: TCL Semivolatiles/OLM01.8; PCB/Pesticides/OLM01.8; Metals/SOW 3/90
Data Package Status: Submitted 6/93 and 12/93, validated in 1993.

E. A new deep residential well installed for the Shultz home in April, 1992 was found to be contaminated by PCE and DCE and was retained in the monitoring program as deep well. Volatile organic data from this well will be validated to verify the presence of PCE and DCE.

Lab: Swanson
Samples: 2
Lab Sample Numbers: 0958-1,2; 1220-1
Analyte/Method: 502.2
Data Package Status: Submitted 1/94, validated in 1994.

**Matrix: Leachate**

Holding tank leachate has been collected and analyzed for TCLP organics and metals since 1991. Data from the most recent event in October, 1993 will be validated to determine the data quality supporting the classification of the leachate as nonhazardous. Additionally, leachate is sampled quarterly in accordance with DNR requirements and analyzed by the treatment plant for BOD, TSS and TKN. Metals, pH, CN, hexavalent chromium, and oil & grease are also quarterly analytes. As this data is not consequential to the RI, it will not be validated.

Lab: Midstate and Enviroscan as subcontractor
Samples: 1
Lab Sample Numbers: 33585
Analyte/Method: TCLP organics (VOA, Semivolatiles, pesticides, herbicides) by 1311; CN, Oil & Grease, pH, hexavalent chromium, TCLP metals: As, Ba, Cd, Cr, PB, Hg, Se, Ag; Total metals: Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Zn
Data Package Status: Submitted 11/93, validated in 1994.

**Matrix: Waste**

During the installation of gas/leachate wells, samples from the borings were tested for EP toxicity in October, 1989. In October, 1990, during additional installation, TCLP analysis was conducted. Data from this 1990 event will be validated to serve as a validated data point to define the landfill waste source. During the course of requesting data packages, it was learned that the TCLP organic data to support the results was not available from Compuchem due to a turnover in management and the resultant historical record storage chaos.

Lab: Warzyn/Compuchem
Samples: 4
Lab Sample Numbers: 1875-001, 002, 1879-001, 002
lead reanalysis: 2121-001-003

Analyte/Method: TCLP organics (VOA, Semivolatiles, pesticides, herbicides) by 1311; TCLP Metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag
Data Package Status: Metals submitted 11/93, validated in 1993.

## Matrix: Landfill Gas

Landfill gas has been collected and analyzed for the purposes of assessment of methane migration in nearby homes, flare design, destruction efficiency, and compliance with DNR NR445. As this data is not quantitative due to the lack of accurate data on actual gas volumes collected, and is not associated with the ground water remediation activity, it will not be validated.

## Matrix: Surface Water

Surface water samples were collected from Black Earth Creek in 1989 for volatile organic analysis. As the quality of the groundwater collected from the closest wells to the creek is essentially equivalent to the surface water, the surface water data will not be validated. The ground water data will be validated as described above.

## Matrix: Fish

Fish samples were collected in 1989 and analyzed for metals and selected organic contaminants. This data will not be validated as the purpose of the sampling was for public relations and as such, will not be used in the groundwater modelling or remediation activities.

**NOTE:** The requirements for the contents of the data packages for GC analyses by methods 8021 and 502.2 sent to the laboratories are attached for reference.

## Data Package Contents Requested
## Refuse Hideaway Landfill

**Analyses:** 502.2, 8021

**Supporting Documentation:**

1. Chain-of-Custody forms, including documentation of internal transfers (if internal documentation is required by lab SOP)

2. Copy of lab specific Standard Operating Procedure (SOP) for method 502.2 and 8021

3. Current MDLs and how determined, results (accuracy and precision) of initial method validation using 4 reps of QC check standard

4. Copies of lab analyst notebook pages and/or instrument logs relating to sample prep, initial and continuing standard prep and source, matrix spike and surrogate standard source and preparation and injection sequence

5. Example of how a reported result can be calculated from GC data system printout

6. Verification of sample pH <2, and date analyzed to verify compliance with holding time.

**GC Calibration:**

1. Concentrations/source and date prepared for standards used for initial calibration, rsd calculations, average RF calculation and applicability

2. Chromatograms and data system printouts for initial and continuing calibration

3. Calculation of continuing calibration response and deviation from expected response, limits used to define acceptable calibration

4. Retention time window criteria used for acceptable compound identification, explanation of deviations

**Sample Analysis:**

1. Chromatograms and data system printouts for all samples, lab blanks, QC check samples and lab QC (duplicates, spikes)
2. Surrogate spike recovery and example of how recovery is calculated from GC data system printout information
3. Internal standards area and acceptance limits (if applicable)
4. Confirmation column chromatograms and data system printouts

**QC Sample Analysis:**

1. QC check standard chromatogram, data system printout and recovery calculations, limits used for assessment
2. MS/MSD and/or lab duplicate (as required by method) chromatograms, data system printouts and calculations of recovery and RPD, limits used for assessment
3. Lab blank chromatograms, data system printouts and limits used for assessment
4. Surrogate recovery limits and how established

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