Attachment 1

WASTE ANALYSIS PLAN

Appendix B
QUALITY ASSURANCE PLAN

MIXED WASTE FACILITY
RCRA/TSCA PERMIT APPLICATION

PERMA-FIX NORTHWEST RICHLAND, INC.
RICHLAND, WASHINGTON

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1.0 INTRODUCTION

This Quality Assurance Plan describes the Perma-Fix Northwest Richland Inc. (PFNW-R) Mixed Waste Facility (MWF) quality assurance requirements for sampling and analytical laboratory work performed in support of the MWF's Waste Analysis Plan (which is Attachment 1 to Section 3 of the permit application). This Quality Assurance Plan is not applicable to contract laboratories utilized by MWF if the laboratories are accredited by the State of Washington.

1.1 Contracted Laboratories

As provided in subsection C-2a(2)(b) of Ecology's Dangerous Waste Permit Application Requirements (Publication #95-402), this Quality Assurance Plan is applicable to contracted laboratories which are not accredited by Washington State. PFNW-R may use one or more contracted laboratories to provide analytical services to support its Waste Analysis Plan. Laboratories are contracted to supply such services based on a review of their capability of providing acceptable data for the waste types handled by the MWF. This review includes an onsite surveillance of the laboratory's facility and a review of its documentation. Criteria for selecting a laboratory include:

- A license or permit issued by the applicable government authority allowing the laboratory to handle waste samples that contain both chemical and radiological components.
- Onsite analytical capacity (number and type of analytical instruments, sample preparation facilities, and utilities) to perform the required analyses, including sufficient uncommitted capacity, or a commitment to procure sufficient capacity, to handle the MWF sample load.
- Adequate technical staff, both in number and in individual qualifications (i.e., education, training, and experience).
- Demonstrated history of performing acceptable analyses, both by evidence of successful participation in an acceptable performance evaluation program, and affidavits from current and/or previous customers, if available.
- Determination that the laboratory's Quality Assurance (QA)/Quality Control (QC) program meets the applicable MWF permit and quality assurance requirements for analytical work.

1.2 Sample Types

PFNW-R collects three types of samples under this QA Plan: waste profile confirmation/treatability test, confirmatory waste characterization, and treatment standards.

The waste profile confirmation/treatability test samples are used to confirm that the waste described on the profile sheet is as expected and to evaluate the treatability of the waste. Analyses of these samples are required meet the Data Quality Requirements (DQRs) listed in Section 3.0 of this QAP.

The confirmatory waste characterization samples are used to confirm that the incoming waste is as expected. Analyses of these samples are required to meet the DQRs listed in Section 3.0 of this QAP.

Treatment standard samples are used to ensure that post-treatment waste forms have met the applicable treatment standard. Analyses of treatment standards samples are required to meet the DQRs listed in Section 3.0 if this QAP.

2.0 ORGANIZATION

The organizational structure of the MWF is shown in Figure 1.

2.1 Vice President/General Manager

The Vice President/General Manager (VP/GM) for the MWF is responsible for operation of the MWF. Reporting directly to the VP/GM are the Environmental Safety Health and Quality (ESH&QA) Manager/RSO, Maintenance Supervisor, Plant Engineer, Controller, Regulatory Compliance Officer (RCO), Waste Acceptance Specialist and the Operations Manager. The Quality Assurance (QA) Manager reports directly to the ESH&QA Manager/RSO.

2.2 ESH&QA Manager\Radiation Safety Officer

The ESH&QA Manager\RSO is responsible for developing, maintaining, and overseeing the MWF Quality Assurance Program (QAP. Reporting directly to the QA Manager are the Quality Control (QC) personnel. Responsibilities of the QA Manager include:

- Senior QA official on site
- Washington Department of Health compliance
- Facility recordkeeping (OSHA, WDOH)
- OSHA compliance
- Radiological protection

- Radiological monitoring
- Safety training

2.3 Regulatory Compliance Officer

The RCO is responsible for developing, maintaining, and implementing the MWF regulatory compliance program. Responsibilities of the RCO include:

- Facility permit compliance
- Permit maintenance
- Permit operating record oversight
- Regulatory reporting
- Facility recordkeeping (mixed waste, mixed TSCA-regulated PCB waste)
- Waste acceptance/rejection
- Regulatory training
- Regulatory interpretations

2.4 Plant Engineer

The Plant Engineer is responsible for facility engineering and maintenance support. Responsibilities of the Plant Engineer include:

- Procedures to prevent hazards
- Design and construction oversight
- Equipment repair
- Annual tank and other inspections requiring engineering expertise

2.5 Operations Manager

The Operations Manager is responsible for waste processing activities in the MWF. Reporting directly to the Operations Manager is the Mixed Waste Operations Supervisor. Responsibilities of the Operations Manager include:

- Equipment operation

- Waste acceptance/rejection
- Waste handling/preparation
- Waste sampling
- Waste treatment
- Waste packaging
- Waste tracking
- Waste shipment scheduling
- Mixed waste and mixed TSCA-regulated PCB waste manifest
- WDOH manifest
- Container/storage management
- Container management
- Weekly container/storage inspections

2.6 Waste Acceptance Specialist

The Waste Acceptance Specialist oversees the on-site laboratory and the facility technical support personnel. Responsibilities include:

- On site sampling and analysis
- Oversight of contract laboratory
- Waste acceptance/rejection
- Waste characterization/profile
- Site customer service responsibilities

2.7 Maintenance Supervisor

The Maintenance Supervisor oversees the facility maintenance department. Responsibilities include:

- Maintenance program
- Equipment repair
- Preventative maintenance (PM)
- PM tracking/scheduling

2.8 Stop Work Authority

Any MWF employee has the authority to suspend any facility operation when there is evidence of a substantive noncompliance to requirements of the MWF QA Program.

The RSO has the authority to suspend any facility operation when it presents an imminent radiological, chemical, or occupational safety hazard to employees, the public, or the environment. All stop work orders are immediately reported to on-duty facility management.

2.9 Contracted Laboratory Support

All contracted laboratories providing services to the MWF are required by contract provisions and attachments to implement a quality assurance program that complies with the requirements established in the MWF permit and QAP, unless the contract laboratory is accredited by the State of Washington.

3.0 DATA QUALITY REQUIREMENTS

The following DQRs ensure that the information supplied by PFNW-R's WAP can be used to support both operational decisions and demonstrate compliance with regulatory restrictions and standards for waste disposal and emissions.

3.1 Precision

Precision refers to the degree of agreement between duplicates expressed as Relative Percent Difference (RPD) or Relative Standard Deviation (RSD). Where RPD and RSD are calculated by the following equations:

$$RPD = \frac{|D_2 - D_1|}{\left[\frac{(D_1 + D_2)}{2}\right]} \bullet 100\%$$

Where: D_1 is the value of the first sample result

D_2 is the value of the second sample result

And $RSD = (S/X) * 100$

Where: X = arithmetic mean

S = standard deviation

Precision criteria are based on a statistical evaluation of past laboratory performance on samples of similar matrices. The initial MWF requirement for precision is ±25%. This initial value is set administratively. Once a sufficient number of duplicate analyses (20 to 30) have been performed on MWF samples, this initial value will be replaced with a performance-based one.

3.2 Accuracy

Accuracy refers to the agreement between the amount of the analyte measured by the test method and the amount actually present expressed as Percent Recovery (%R) of surrogates and matrix spikes. Where percent recoveries are calculated by the following equations:

$$Surrogate\ \%R = \frac{Q_d}{Q_a} \bullet 100\%$$

Where: Q_a is the quantity added to the sample

Q_d is the quantity recovered during analysis

$$Matrix\ Spike\%R = \frac{SSR - SR}{SA} \bullet 100\%$$

Where: SA is the amount of spike added

SR is the sample result

SSR is the spiked sample result

Like precision, accuracy criteria are based on a statistical evaluation of past laboratory performance on samples of similar matrices. The initial PFNW-R requirement for accuracy is ±25%. This initial value is set administratively. Once a sufficient number of surrogate and spike analyses (20 to 30) have been performed on PFNW-R samples, this initial value will be replaced with a performance-based one.

3.3 Completeness

Completeness is expressed as the percentage determined from the number of acceptable results compared to number of expected results. The PFNW-R requirement for completeness is 100%. Where necessary,

samples will be re-analyzed, or if insufficient sample material remains, additional samples will be collected and analyzed to meet this requirement.

3.4 Representativeness

Representativeness is the degree to which the sample data represent a characteristic of the measured population. It is a qualitative parameter most influenced by the design and effectiveness of the sampling program and the proficiency of the sampling personnel. During initial operations, PFNW-R will randomly collect a number of co-located duplicate confirmatory waste characterization and treatment standard samples to determine the precision of its sampling of these materials. Duplicate sampling of the different sample media will be included as part of the sampling personnel training. As part of the ongoing evaluation of the sampling program and the proficiency of the sampling personnel, the QA manager requests that a co-located duplicate sample be collected. At a minimum, the QAO will request sampling personnel to collect a duplicate sample of the different types of sample media every six months.

3.5. Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared with another. No numerical requirement is set for this parameter. PFNW-R requires that any contracted laboratory that is not accredited by the State of Washington follow PFNW-R specified standard techniques and report their results in appropriate units of measurement.

3.6. Limit of Quantitation

Limit of Quantitation (LOQ) is the lowest concentration to which quantitative results may be achieved, under routine laboratory conditions, given a specific degree of accuracy and precision. The LOQ is based on a statistical determination. Initial LOQs and method detection limits (MDLs) are listed in Table B-1 for solids and sludge and in Table B-2 for liquids. As data are developed on MWF samples, performance-based MDLs and associated LOQs will be established. LOQs may be established by using the EPA-recommended method of setting the limit of quantitation at a multiplier of the MDL independent of a particular analyte and matrix, or they may be established by selecting a multiplier of the MDL that accounts for a particular analyte and matrix. If the latter method is used to establish the method LOQ, data used in the determination of the MDLs and LOQs will be kept on file.

3.7. Acceptable Data

The intent of the MWF QA Program is to only accept analytical data within its established DQRs for precision, accuracy, and LOQs. After performance-based DQRs are developed and accepted by PFNW-R, data that did not meet initial DQR set in this document will be evaluated by the QA Manager for acceptance. Once performance-based values for DQRs have been established, failure to meet DQRs will be handled in accordance with paragraph 3.8.

If process modifications create ongoing changes to a generator's waste steam that impact the established performance-based DQRs, new DQRs will be generated based on analysis of the new waste material. In addition, PFNW-R may establish performance-based DQRs for any of the analytical parameters being evaluated. These new DQRs will be implemented through permit modifications. Performance-based DQRs will not supersede any specific analytical requirements set forth in WAC 173-303 (40 CFR 261-268).

3.8. Response to Missed Data Quality Requirements

Once performance-based DQRs are established and agreed to by PFNW-R, failures to meet a DQR will require the analysis of an additional aliquot of the existing sample, or a new sample of the same material, if the existing sample was consumed. Cases where the chemical condition of an individual waste shipment requires an analytical method modification or substitution outside of normally accepted and published analytical methods in order to comply with a DQR will be handled as follows:

1. PFINW-R facility management will submit to Washington State Department of Ecology (Ecology) a request for substitution of an analytical method that is equivalent to the method specifically approved for use in the MWF permit. The request shall provide data demonstrating that the proposed method is equal to or superior to the approved analytical method in terms of MDL, LOQ, accuracy, and precision.
2. If the method relates to TSCA-regulated PCB analysis, then PFNW-R will also submit a request for an analytical method substitution to the Environmental Protection Agency Region X. The request shall provide data demonstrating that the proposed method is equal to or superior to the approved analytical method in terms of MDL, LOQ, accuracy, and precision.
3. The regulatory agency notifies PFINW-R facility management in writing that the substitution of the analytical method is approved. Such approval shall not require a permit modification.

4.0 SAMPLING QUALITY CONTROL REQUIREMENTS

The following requirements apply only to confirmatory waste characterization and treatment standards samples.

4.1. Sample Containers

Waste samples are collected in containers appropriate to the matrix and analytical method. These containers are either certified clean disposable or cleaned reusable units. The vendor-supplied clean certification will provide the documentation for verifying containers meet the SW-846 cleanliness requirements. Sample containers will be stored in a secure area, away from possible chemical exposure and tampering.

4.2. Control Samples

At the start of each sampling campaign, management may require an equipment rinsate sample be collected to check on the initial cleanliness of the sampling equipment. Additional rinsate samples may be taken during sampling, whenever a non-disposable sampling tool is cleaned and used on a different generator's shipment, waste steam, or matrix. A trip blank will be prepared and carried along with the actual waste samples to detect contamination from volatile organic compounds.

4.3. Treatment/Preservative and Holding Times

Collected waste samples are treated and preserved as necessary to protect the sample. Tables B-4, B-5 and B-6 list the SW-846-recommended treatment/preservative and holding times. Table B-7 lists the sample preparation and clean-up methods. Typically, not all samples require preservation. Likewise, samples with a high concentration of the analyte or non-Land Disposal Restriction (LDR) samples may not need preserving. Placing a holding time on a sample may not always be appropriate. For example, the original PCB sample does not require a holding time; however, the laboratory-prepared extract does require a holding time. The recommended holding time and preservation for Cr^{+6} listed in Table B-5 are required for Cr^{+6} in all sample matrices unless the Cr^{+6} concentration is assumed to be represented by total Cr in the sample. Likewise, the recommended holding time and preservative for Hg is required in all sample matrices. For the laboratory-prepared organic extracts (e.g., semi-volatile, PCB, etc.), the holding times listed in Table B-6 are required to be met for each extract. PFNW-R facility management

evaluate the need for sample preservation and sample holding times and assign preservation and holding time requirements in accordance with Tables B-4, B-5, and B-6.

5.0 ANALYTICAL METHODS

Analysis of MWF samples is performed using an appropriate procedure. Table B-1 lists appropriate methods for each expected waste constituent, with its attendant LOQ, MDL, and regulatory limits. For some metals, both a Graphite Furnace Atomic Absorption (GFAA) and Inductively Coupled Argon Plasma (ICP) Atomic Emission Spectrometry method are listed. For these constituents, the ICP method is the preferred method; however, if the required DQR cannot be met due to matrix effects or other problems, the laboratory will be allowed to re-analyze the sample using the appropriate GFAA method, without specific authorization from PFNW-R. Table B-3 lists appropriate methods for fingerprint parameters.

5.1. Method Modifications

Cases may arise where standard analytical methods will have to be modified due to radiological considerations. Expected modifications will be smaller test portions, higher dilution factors, and smaller aliquots. When sampling, the required amount of sample material is collected and may be sent to the laboratory, not as one sample, but as an aggregate of smaller samples. Higher dilution factors and smaller aliquots may impact the laboratory's ability to attain the required detection limits. Complex sample matrixes and other analytical considerations may also require that the laboratory make modifications to standard methods. Before use, the laboratory will be required to develop and submit data showing the modified method will generate data that equals or exceeds the quality requirements of the standard method.

In these cases, compensating actions such as method modification or substitution will be handled as follows:

1. PFNW-R facility management will submit to Ecology a request to substitute an analytical method that is equivalent to the method approved for use in the MWF permit. The request shall provide data demonstrating that the proposed method is equal to or superior to the approved analytical method in terms of MDL, accuracy, and precision.
2. If the method relates to TSCA-regulated PCB analysis, then PFNW-R will also submit a request for an analytical method substitution to the Environmental Protection Agency Region X. The

request shall provide data demonstrating that the proposed method is equal to or superior to the approved method in terms of MDL, LOQ, accuracy, and precision.

3. The regulatory agency notifies PFNW-R facility management in writing that the substitution of the analytical method is approved. Such approval shall not require a permit modification.

Method modifications will not supersede any specific analytical requirements set forth in WAC 173-303 (40 CFR 260-268).

5.2. Analytical Batches

The contracted laboratory is required to run MWF samples as separate analytical batches to ensure that the required duplicates and matrix spikes are made using MWF samples. Matrix spikes are expected to be performed for all appropriate methods. If the spike is not performed, such as for discarded chemical products, it will be documented as part of the analytical report. At a minimum, each analytical batch will include:

Instrument standard (laboratory control sample)
Instrument blank
Method blank
Method QC sample (standard reference material or house standard carried throughout the method)
Duplicate
Matrix spike
Surrogate (as required)

The analytical batch will include the following method specific additions:

Inorganics

ICP Metals Interference Check Sample
Continuing Calibration Verification Standard
Standards Additions
Serial Dilutions

Organics

Matrix Spike Duplicate

GC/MS Tuning

GC/MS Initial Calibrations

GC/MS Continuing Calibrations

GC Initial Calibrations

GC Continuing Calibrations

Each analytical report will include a statement of the MDL and LOQ for each measured constituent. For groups of MWF samples run as one analytical batch, the MDL and LOQ need only be calculated once given the same test portion for each sample. However, if the sample portions are different, then separate MDL and LOQ values will be calculated for each sample.

5.3. Toxicity Characteristic Leaching Procedure

Toxicity Characteristic Leaching Procedure (TCLP) is used to determine if a waste possesses the characteristic of toxicity. As a screening tool, the following process may be used to determine if a TCLP analysis is required. Based on an assumption that the waste will leach out 100 percent of its Toxicity Characteristic (TC) constituents, the MWF has the waste analyzed for the total constituent concentrations. If these total concentrations are less than 20 times the TC limits, the wastes are not to be considered to have the characteristic of toxicity. If the totals are more than 20 times the TC limits, then a TCLP sample may be analyzed or the waste reprocessed. For TCLP analysis, 50g will be the smallest volume used, or "Total Analysis" will be used.

Sampling and analysis are to follow:

1) The preparative method for the toxicity characteristic is EPA, SW-846 Method 1311, Toxicity Characteristic Leaching Procedure (TCLP). To ensure that the test portion is representative of the waste, a test portion of fifty (50) grams or more is preferred. If a test portion of fifty (50) grams or more is used for the determination, then only a single extraction is required to be performed. However, if the test portion is less than fifty (50) grams, each material to be tested must be extracted in duplicate or multiple replicates so that the precision of the extraction can be determined and evaluated. A relative standard deviation of 25% or lower between extractions for the analytes must be obtained for the analytical data to be useable for waste designation. All routine and quality control data associated with the TCLP and subsequent determinative methods are required to be maintained in the MWF unit operating record.

2) Instead of performing the TCLP as described above, a material may be analyzed for the total concentration of the Toxic Characteristic (TC) constituents. For this approach, solids and sludges must undergo a digestion procedure for metals or an extraction procedure for organics. Then, based on the assumption that the analytes are 100% (totally) leachable from the waste, the resulting data are evaluated against the TC criteria allowing for the 20-fold dilution that is inherent in the TCLP extraction for solids and sludges (Note that the diluton factor does not apply for liquids.). That is, for each toxic characteristic metal and organic compound, if the analyte concentration is less than twenty (20) times the TC limits, then the waste is not considered to possess the characteristic of toxicity for that constituent. If the totals are more than twenty (20) times the TC limits, then a TCLP must be performed (or, if undergoing stabilization, the waste may be retreated before performing another screening).

6.0 CALIBRATION CONTROL REQUIREMENTS

The contracted laboratory is required to maintain its analytical instruments and systems subject to statistical evaluation against assigned control limits. These instruments or systems are calibrated:

1. At frequencies of not longer than those established by SW-846 or applicable test method, or
2. When a calibration verification analysis indicates an out-of-control condition.

6.1. Control Chart/Limits Program

The laboratory is required to maintain a control chart/limits program established by written procedure based on statistical analysis of the quality control sample results. This required documentation includes the rules used to identify out-of-control conditions and provisions for the periodic review of assigned control limits. This program may be computer-based and/or paper chart-based, as long as it is maintained in real time.

6.2. Out-of-Control Condition

The laboratory is required to take corrective action in response to identified out-of-control conditions. These actions will include stopping analysis of samples and evaluating the instrument or system operating condition. However, PFNW-R recognizes that this evaluation may not locate an identifiable problem in all cases. For example, one of every 100 quality control standard results can be statistically

expected to fall outside of ±3 standard deviations. The laboratory's process for bringing an instrument or system back into service will include the successful analysis of additional quality control standards.

6.3. Calibration Standards

If used by the laboratory, ready-made calibration standards will be required to be traceable to the National Institute of Standards and Technology, or to another recognized national or international standard, by proper certifications. Calibration standards, including stock solutions, prepared by the contracted laboratory are required to be:

1. Prepared using certified reference materials, pure elements or compounds with vendor-supplied assay, or reagent-grade or better chemicals;
2. Prepared following approved procedures by qualified personnel;
3. Documented sufficiently to demonstrate that the reference value of the source material was properly transferred to the standard; and
4. Documented to demonstrate the standard can be traced to the source material.

6.4. Blind Standards Program

Due to the physical nature of the samples that PFNW-R sends to the contracted laboratory for analysis, PFNW-R could provide only single-blind field samples. However, the contracted laboratory is required to analyze performance evaluation samples for parameter/matrix combinations submitted to the laboratory by PFNW-R. These performance evaluation samples may be from evaluation programs administered by agencies of the United States or commercial performance evaluation programs.

PFNW-R facility management requires contracted laboratories to forward copies of the reports they receive from their performance evaluation programs. PFNW-R facility management may also send the laboratory duplicate samples as an additional method of laboratory performance evaluation.

7.0 DATA REDUCTION, REPORTING, AND VALIDATION

The contract laboratory is required to reduce the raw data generated by their analytical instrument into constituent concentration in the units listed in Table B-1. The formulas used to perform each reduction will be documented. In general, data reduction from standard methods is performed by commercial software products. Commercial software is documented by name and version. If in-house generated

computer programs or applications, such as spreadsheets, are used, they will be validated by use of standard data sets.

The contracted laboratory will be required to report both the raw data, including supporting information, such as blanks and instrument standard results, and the data reduced to final form.

Since the DQR for completeness under this QAP is 100 percent, the contracted laboratory is required to initially validate the data before reporting it to PFNW-R. This process will allow for the laboratory's quickest response to a missed DQR. Once reported, this validation will be reviewed and approved. Validating organic data will include verifying the following:

1. Sample holding time was met.
2. Gas chromatograph/mass spectrometer (GC/MS) instrument performance checks were performed less than 12 hours before the analysis and that the ion abundance criterion was met.
3. Initial calibration of the instrument was performed and demonstrated that the GC/MS was producing a linear calibration curve.
4. A continuing calibration standard containing both target compounds and system monitoring compounds was analyzed less than 12 hours before the analysis and that the percent difference between the initial calibration and the continuing calibration relative response factors were within ± 25.0%.
5. Any contaminants found in the blank did not impact DQRs.
6. Surrogates were analyzed and recoveries were within the limits specified in the specific method.
7. Matrix spikes and matrix spike duplicate samples were analyzed and that the results were within the DQR.
8. Instrument and laboratory control standards and QC checks were analyzed with the sample and that the result was with the laboratory's quality control limits.

Validation of inorganic data includes verifying the following:

1. Sample holding time was met.
2. The instrument was successfully calibrated less than 24 hours before the analysis was made.
3. Initial calibration verification analysis was made immediately after the system was calibrated to verify the accuracy of the initial calibration
4. Continuing calibration verification standard was analyzed as part of the analytical batch and that the percent recovery was within limits.
5. Any contaminants found in the blank did not impact DQRs.

6. ICP Interference Check Sample was analyzed and the results were within ± 20% of the true value for the analyte included in the standard.
7. Instrument and laboratory control standards and QC checks were analyzed with the sample and that the result was within the laboratory's quality control limits.
8. A duplicate sample was prepared and analyzed, and the results were within the DQR.
9. Matrix spike sample was analyzed and that the results were within the DQR.
10. ICP serial dilution analysis, if performed, showed a percent difference of less than 10%.

7.1. Records Management

Records generated in support of the MWF waste analysis will be maintained in accordance with the facility recordkeeping requirements provided by WAC 173-303-380.

8.0 PERFORMANCE AND SYSTEM AUDITS

8.1. Day to Day Oversight

The contracted laboratory is required to notify PFNW-R as soon as practicable of any laboratory conditions that require corrective action and submit a copy of the corrective action report. Immediate notification is required to preclude the possibility of PFNW-R mismanaging waste because of laboratory error. All corrective action reports received from the contracted laboratory will be logged in by PFNW-R. PFNW-R will review the corrective action reports to verify that the corrective action identified was implemented. At the direction of facility management, PFNW-R may also evaluate the effectiveness of the implemented corrective action. All affected analytical data received from the contracted laboratory is reviewed to ensure that the data meets PFNW-R needs. The MWF tracks and evaluates reports that do have a substantive impact, such as:

1. Sample hold times exceeded
2. Lost or damaged samples
3. Analyses that do not meet performance-based DQRs
4. Poor performance on performance evaluation standards
5. Major analytical system or utility failures
6. Data reporting problems
7. Corrective action reports
8. Laboratory notifications

9. Performance evaluation sample results

Reports are tracked until closed by the contracted laboratory. The MWF QAP evaluates such reports for any action required of the MWF. Such actions may include:

1. Stopping work on specific waste steams, or shipments until the laboratory has completed its corrective action.
2. Resampling of material for re-analysis.
3. Reviewing completed waste processing.
4. Performing an unscheduled audit or surveillance of the laboratory.

8.2. On-site Audits

PFNW-R performs system audits on contract laboratories which are not accredited by the State of Washington at least once per calendar year. Audits will be performed by PFNW-R employees or contracted employees. In either case, individuals will have the following qualifications:

- Experience performing performance audits or surveillance of environmental laboratories to written laboratory QA standards and practices.
- Knowledgeable and trained in the requirements of SW-846, particularly Chapter One, and the specific QC requirements for organic and inorganic analyses.
- Knowledgeable and trained in the methods and basic chemistry behind the operation of the major analytical instruments, such as the ICP, CG/MS, and GFAA.
- Knowledgeable and trained in statistical process control as it relates to the calculation of control limits and the use of control charts, particularly in the rules that indicate an out-of-control condition.
- Knowledgeable in requirements of the MWF permit and QA plan.

System audits are performed using written checklists based on the laboratory's documented Quality Assurance Program. As a minimum, system audits will review the following:

1. The documentation of one or more MWF samples from the point the laboratory accepted custody of the sample until the validated data were submitted to PFNW-R.
2. The laboratory control chart program, including review of documentation that the control limits were maintained in real time and reviewed in house.

3. Change in key technical personnel since the last audit, including reviewing the qualifications (education, training, and experience) of new staff members.
4. Audits and reviews performed by the laboratory or by regulators.
5. Corrective actions identified by the laboratory.
6. Changes in the laboratory's major instruments, specifically documentation relating to set up and initial performance checks and maintenance;
7. Administrative and technical procedures, including any laboratory-initiated changes and updates to SW-846;
8. Laboratory's corrective action history, including the analysis of standards, to bring systems back on-line.
9. Training records of analytical staff demonstrating analytical proficiency.

Performance audits are performed using written checklists based on the laboratory's documented Quality Assurance Program. At a minimum, performance audits will observe and/or review the following:

1. Sample receipt
2. Performance of analytical methods
3. Data recording methods
4. Traceability of documentation
5. Labeling of samples and reagents
6. Sample custody
7. Control charts
8. Control of calibration standards
9. Training Records

In addition to the annual system and performance audits for laboratories not accredited by the State of Washington, PFNW-R may perform additional audits or surveillances of contracted laboratory activities whenever questions of data quality arise. Such unscheduled activities may be initiated because of situations such as laboratory corrective action reports, failures to meet data quality requirements, and changes in key technical laboratory personnel.

Figure 1. Typical Organizational Chart.

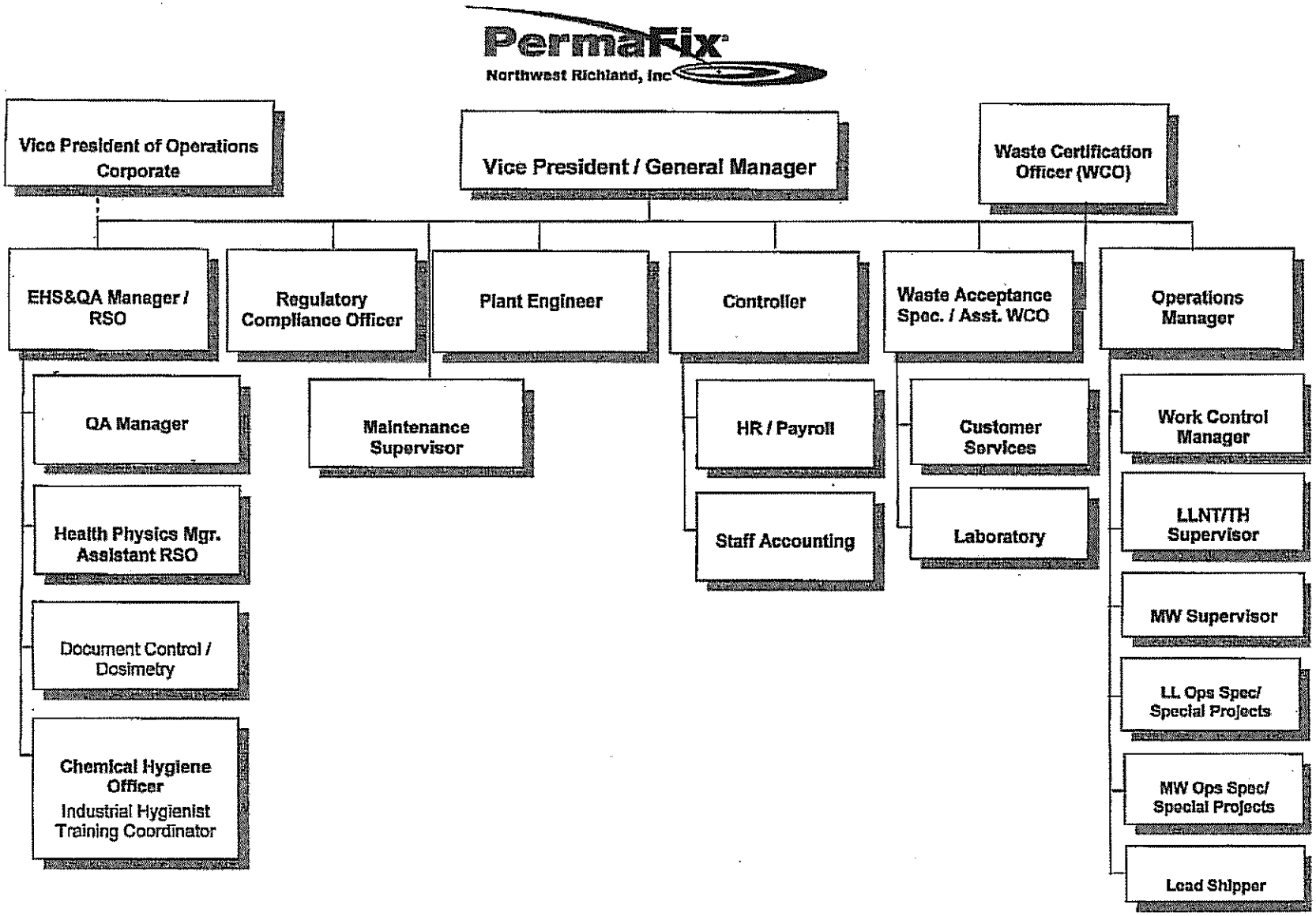

TABLE B-1a
Methods Detection Limits and Limits of Quantitation
for Determining Characteristic Hazards of Solids and Sludge

Waste Code	Constituent	Method[1]		LOQ	MDL	Action Limit
		SW-846	Description			
D004	Arsenic	7060A	AA, Graphite Furnace	13 mg/kg	0.3 mg/kg	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15 mg/kg	3 mg/kg	
D005	Barium	7080A	AA, Direct Aspiration	20 mg/kg	4 mg/kg	100 mg/l
		6010B	ICP-Atomic Emission Spectrometry	2 mg/kg	0.3 mg/kg	
D006	Cadmium	7131A	AA, Graphite Furnace	0.2 mg/kg	0.03 mg/kg	1.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	1.5 mg/kg	0.3 mg/kg	
D007	Chromium	7191	AA, Graphite Furnace	0.07 mg/kg	0.07 mg/kg	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	2 mg/kg	0.5 mg/kg	
D008	Lead	7421	AA, Graphite Furnace	0.5 mg/kg	0.1 mg/kg	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15 mg/kg	3.5 mg/kg	
D009	Mercury	7471A	Manual Cold-Vapor Technique (Solid and Semisolid)	0.3 mg/kg	0.1 mg/kg	0.2 mg/l
D010	Selenium	7740	AA, Graphite Furnace	2 mg/kg	1 mg/kg	1.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	40 mg/kg	7.5 mg/kg	
D011	Silver	7761	AA, Graphite Furnace	0.3 mg/kg	0.05 mg/kg	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	3 mg/kg	0.5 mg/kg	
D012	Endrin	8270C	Semivolatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.02 mg/l
D013	Lindane	8270C	Semivolatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.4 mg/l
D014	Methoxychlor	8270C	Semivolatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	10 mg/l

TABLE B-1a (continued)
Methods Detection Limits and Limits of Quantitation
for Determining Characteristic Hazards of Solids and Sludge

D015	Toxaphene	8270C	Semivolatile Organic Compounds by GC/MS	100 ug/kg	20 ug/kg	0.5 mg/l
D016	2,4,-D	8151A	Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation	10 ug/kg	4 ug/kg	10 mg/l
D017	2,4,5 TP (Silvex)	8151A	Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation	10 ug/kg	4 ug/kg	1.0 mg/l
D018	Benzene	8260A	Volatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	0.5 mg/l
D019	Carbon Tetrachloride	8260A	Volatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	0.5 mg/l
D020	Chlorodane	8081A	Organochlorine Pesticides by GC	100 ug/kg	20 ug/kg	0.03 mg/l
D021	Chlorobenzene	8260A	Volatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	100 mg/l
D022	Chloroform	8260A	Volatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	6.0 mg/l
D023	o-Cresol (2-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	200 mg/l
D024	m-Cresol (3-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	200 mg/l
D025	p-Cresol (3-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	200 mg/l
D026	Cresol total	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	200 mg/l
D027	p-Dichlorobenzene	8270C	Semivolatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	7.5 mg/l
D028	1,2-Dichloroethane	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.5 mg/l
D029	1,1-Dichloroethene	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/mg	0.7 mg/l
D030	2,4-Dinitrotoluene	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	0.13 mg/l

TABLE B-1a (continued) Methods Detection Limits and Limits of Quantitation for Determining Characteristic Hazards of Solids and Sludge						
D031	Heptachlor	8270C	Semivolatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.008 mg/l
D032	Hexachlorobenzene	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	0.13 mg/l
D033	Hexachlorobutadiene	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	0.5 mg/l
D034	Hexechloroethane	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	3.0 mg/l
D036	Nitrobenzene	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	2.0 mg/l
D037	Pentrachlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	3300 ug/kg	33 ug/kg	100 mg/l
D039	Tetrachloroethene	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.7 mg/l
D040	Trichloroethene	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.5 mg/l
D041	2,4,5-Trichlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	1700 ug/kg	100 ug/kg	400 mg/l
D042	2,4,6-Trichlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	2.0 mg/l
D043	Vinyl Chloride	8260A	Volatile Organic Compounds by GC/MS	2 ug/kg	0.4 ug/kg	0.2 mg/l
PCB	Aroclor	8082	Organochlorine Pesticides and PCBs	100 ug/kg	20 ug/kg	50 mg/l

[1] From Test Methods for Evaluating Solid Waste Physical/Chemical Methods (EPA/SW-846) Third Edition Update III

TABLE B-1b
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Solids and Sludge

Waste Code	Constituent	Method[1]		LOQ	MDL	Action Limit
		SW-846	Description			
D004	Arsenic	7060A	AA, Graphite Furnace	13 mg/kg	0.3 mg/kg	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15 mg/kg	3 mg/kg	
D005	Barium	7080A	AA, Direct Aspiration	20 mg/kg	4 mg/kg	100 mg/l
		6010B	ICP-Atomic Emission Spectrometry	2 mg/kg	0.3 mg/kg	
D006	Cadmium	7131A	AA, Graphite Furnace	0.2 mg/kg	0.03 mg/kg	1.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	1.5 mg/kg	0.3 mg/kg	
D007	Chromium	7191	AA, Graphite Furnace	0.07 mg/kg	0.07 mg/kg	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	2 mg/kg	0.5 mg/kg	
D008	Lead	7421	AA, Graphite Furnace	0.5 mg/kg	0.1 mg/kg	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15 mg/kg	3.5 mg/kg	
D009	Mercury	7471A	Manual Cold-Vapor Technique (Solid and Semisolid)	0.3 mg/kg	0.1 mg/kg	0.2 mg/l
D010	Selenium	7740	AA, Graphite Furnace	2 mg/kg	1 mg/kg	5.7 mg/l
		6010B	ICP-Atomic Emission Spectrometry	40 mg/kg	7.5 mg/kg	
D011	Silver	7761	AA, Graphite Furnace	0.3 mg/kg	0.05 mg/kg	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	3 mg/kg	0.5 mg/kg	
D012	Endrin	8270C	Semivolatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.13 mg/kg
D013	Lindane	8270C	Semivolatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.13 mg/kg
D014	Methoxychlor	8270C	Semivolatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.18 mg.kg

TABLE B-1b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Solids and Sludge

Waste Code	Constituent	Method[1]		LOQ	MDL	Action Limit
		SW-846	Description			
D015	Toxaphene	8270C	Semivolatile Organic Compounds by GC/MS	100 ug/kg	20 ug/kg	2.6 mg/kg
D016	2,4,-D	8151A	Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation	10 ug/kg	4 ug/kg	10 mg/kg
D017	2,4,5 TP (Silvex)	8151A	Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation	10 ug/kg	4 ug/kg	7.9 mg/kg
D018	Benzene	8260A	Volatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	10 mg/kg
D019	Carbon Tetrachloride	8260A	Volatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	6.0 mg/kg
D020	Chlorodane	8081A	Organochlorine Pesticides by GC	100 ug/kg	20 ug/kg	0.26 mg/kg
D021	Chlorobenzene	8260A	Volatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	6.0 mg/kg
D022	Chloroform	8260A	Volatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	6.0 mg/kg
D023	o-Cresol (2-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	5.6 mg/kg
D024	m-Cresol (3-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	5.6 mg/kg
D025	p-Cresol (3-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	5.6 mg/kg
D026	Cresol total	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	11.2 mg/kg
D027	p-Dichlorobenzene	8270C	Semivolatile Organic Compounds by GC/MS	1 ug/kg	0.2 ug/kg	6.0 mg/kg
D028	1,2-Dichloroethane	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	6.0 mg/kg

TABLE B-1b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Solids and Sludge

Waste Code	Constituent	Method[1]		LOQ	MDL	Action Limit
		SW-846	Description			
D029	1,1-Dichloroethene	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/mg	6.0 mg/kg
D030	2,4-Dinitrotoluene	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	140 mg/kg
D031	Heptachlor	8270C	Semivolatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	0.066 mg/kg
D032	Hexachlorobenzene	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	10 mg/kg
D033	Hexachlorobutadiene	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	5.6 mg/kg
D034	Hexechloroethane	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	30 mg/kg
D036	Nitrobenzene	8270C	Semivolatile Organic Compounds by GC/MS	330 ug/kg	33 ug/kg	14 mg/kg
D037	Pentrachlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	3300 ug/kg	33 ug/kg	7.4 mg/kg
D039	Tetrachloroethene	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	6.0 mg/kg
D040	Trichloroethene	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	6.0 mg/kg
D041	2,4,5-Trichlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	1700 ug/kg	100 ug/kg	7.4 mg/kg
D042	2,4,6-Trichlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	7.4 mg/kg
D043	Vinyl Chloride	8260A	Volatile Organic Compounds by GC/MS	2 ug/kg	0.4 ug/kg	6.0 mg/kg

TABLE B-1b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Solids and Sludge

Waste Code	Constituent	Method[1]		LOQ	MDL	Action Limit
		SW-846	Description			
PCB	Aroclor	8082	Organochlorine Pesticides and PCBs	100 ug/kg	20 ug/kg	2 mg/l
F001	Carbon Tertrachloride	8260A	Volatile Organic Compounds by GC/MS	2 ug/kg	0.4 ug/kg	6.0 mg/kg
	Methylene Chloride					30 mg/kg
	Tetrachloroethylene					6.0 mg/kg
	1,1,1-Trichloroethane					6.0 mg/kg
	Trichloroethane					6.0 mg/kg
	1,1,2-Trichloro-1,2,2-triflouroethane					30 mg/kg
	Trichlorofluoromethane					30 mg/kg
F002	Chlorobenzene	8260A	Volatile Organic Compounds by GC/MS	2 ug/kg	0.4 ug/kg	6.0 mg/kg
	o-Dichlorobenzene					6.0 mg/kg
	Methylene Chloride					30 mg/kg
	Tetrachloroethylene					6.0 mg/kg
	1,1,1-Trichloroethane					6.0 mg/kg
	1,1,2-Trichloroethane					6.0 mg/kg
	Trichloroethane					6.0 mg/kg
	1,1,2-Trichloro-1,2,2-triflouroethane					30 mg/kg
	Trichlorofluoromethane					30 mg/kg

TABLE B-1b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Solids and Sludge

Waste Code	Constituent	Method[1]		LOQ	MDL	Action Limit
		SW-846	Description			
F003	Acetone	8260A	Volatile Organic Compounds by GC/MS	20 ug/kg	6 ug/kg	160 mg/kg
	Ethyl acetate					33 mg/kg
	Methanol					0.75 mg/l
	Methyl isobutyl ketone					33 mg/kg
	Ethyl ether					160 mg/kg
	n-Butyl alcohol	8015B	Nonhalogenated Organics Using GC/FID	TBD	TBD	2.6 mg/kg
	Cyclohexanone	8315A	Determination of Carbonyl Compounds by High Performance Liquid Chromatography (HPLC)	TBD	TBD	0.75 mg/l
	Ethyl benzene	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	10 mg/kg
	Xylenes			5 ug/kg	5 ug/kg	30 mg/kg
F004	o-Cresol	8270C	Semi-volatile Organic Compounds by GC/MS	1000 ug/kg	100 ug/kg	5.6 mg/kg
	m-Cresol					5.6 mg/kg
	p-Cresol					5.6 mg/kg
	Cresyilc Acid					11.2 mg/kg
	Nitrobenzene					14 mg/kg

TABLE B-1b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Solids and Sludge

Waste Code	Constituent	Method[1]		LOQ	MDL	Action Limit
		SW-846	Description			
F005	Benzene	8260A	Volatile Organic Compounds by GC/MS	5 ug/kg	1 ug/kg	10 mg/kg
	Carbon disulfide			5 ug/kg	3 ug/kg	4.8 mg/l
	Isobutyl alcohol			300 ug/kg	1 ug/kg	170 mg/kg
	Methyl ethyl ketone			20 ug/kg	9 ug/kg	36 mg/kg
	2-Nitropropane			TBD	TBD	CMBST
	Pyridine			1000 ug/kg	100 ug/kg	16 mg/kg
	Toluene			5 ug/kg	1 ug/kg	10 mg/kg
	2-Ethoxyethanol (Ethylene Glycol)	8015B	Non-halogenated Organics Using GC/FID	TBD	TBD	CMBST

[1] From Test Methods for Evaluating Solid Waste Physical/Chemical Methods (EPA/SW-846) Third Edition Update III

TABLE B-2a
Methods Detection Limits and Limits of Quantitation for
Determining Characteristic Hazards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
D004	Arsenic	7060A	AA, Graphite Furnace	13	2.6	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	150	30	
D005	Barium	7080A	AA, Direct Aspiration	200	40	100 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15	3	
D006	Cadmium	7131A	AA, Graphite Furnace	2	0.3	1.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15	3	
D007	Chromium	7191	AA, Graphite Furnace	0.7	0.7	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15	5	
D008	Lead	7421	AA, Graphite Furnace	5	1	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	150	35	
D009	Mercury	7471A	Manual Cold-Vapor Technique (Liquids)	0.5	0.1	0.2 mg/l
D010	Selenium	7740	AA, Graphite Furnace	20	1	1.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	400	75	
D011	Silver	7761	AA, Graphite Furnace	3	0.5	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	25	5	

TABLE B-2a (continued)
Methods Detection Limits and Limits of Quantitation for
Determining Characteristic Hazards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
D012	Endrin	8270C	Semivolatile Organic Compounds by GC/MS	0.05	0.005	0.02 mg/l
D013	Lindane	8270C	Semivolatile Organic Compounds by GC/MS	0.05	0.005	0.4 mg/l
D014	Methoxychlor	8270C	Semivolatile Organic Compounds by GC/MS	0.05	0.005	10 mg/l
D015	Toxaphene	8270C	Semivolatile Organic Compounds by GC/MS	1	0.1	0.5 mg/l
D016	2,4,-D	8151A	Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation	0.5	0.1	10 mg/l
D017	2,4,5 TP (Silvex)	8151A	Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation	0.5	0.1	1.0 mg/l
D018	Benzene	8260A	Volatile Organic Compounds by GC/MS	1	0.2	0.5 mg/l
D019	Carbon Tetrachloride	8260A	Volatile Organic Compounds by GC/MS	1	0.2	0.5 mg/l
D020	Chlorodane	8081A	Organochlorine Pesticides by GC	1	0.1	0.03 mg/l
D021	Chlorobenzene	8260A	Volatile Organic Compounds by GC/MS	1	0.2	100 mg/l
D022	Chloroform	8260A	Volatile Organic Compounds by GC/MS	1	0.2	6.0 mg/l
D023	o-Cresol (2-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	10	1	200 mg/l
D024	m-Cresol (3-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	10	1	200 mg/l

TABLE B-2a (continued)
Methods Detection Limits and Limits of Quantitation for
Determining Characteristic Hazards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
D025	p-Cresol (3-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	10	1	200 mg/l
D026	Cresol total	8270C	Semivolatile Organic Compounds by GC/MS	10	1	200 mg/l
D027	p-Dichlorobenzene	8270C	Semivolatile Organic Compounds by GC/MS	1	0.2	7.5 mg/l
D028	1,2-Dichloroethane	8260A	Volatile Organic Compounds by GC/MS	5	1	0.5 mg/l
D029	1,1-Dichloroethene	8260A	Volatile Organic Compounds by GC/MS	5	1	0.7 mg/l
D030	2,4-Dinitrotoluene	8270C	Semivolatile Organic Compounds by GC/MS	10	1	0.13 mg/l
D031	Heptachlor	8270C	Semivolatile Organic Compounds by GC/MS	0.05	0.005	0.008 mg/l
D032	Hexachlorobenzene	8270C	Semivolatile Organic Compounds by GC/MS	10	1	0.13 mg/l
D033	Hexachlorobutadiene	8270C	Semivolatile Organic Compounds by GC/MS	10	1	0.5 mg/l
D034	Hexechloroethane	8270C	Semivolatile Organic Compounds by GC/MS	10	1	3.0 mg/l
D036	Nitrobenzene	8270C	Semivolatile Organic Compounds by GC/MS	10	1	2.0 mg/l

TABLE B-2a (continued)
Methods Detection Limits and Limits of Quantitation for
Determining Characteristic Hazards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
D037	Pentrachlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	50	1	100 mg/l
D039	Tetrachloroethene	8260A	Volatile Organic Compounds by GC/MS	5	1	0.7 mg/l
D040	Trichloroethene	8260A	Volatile Organic Compounds by GC/MS	5	1	0.5 mg/l
D041	2,4,5-Trichlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	50	1	400 mg/l
D042	2,4,6-Trichlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	10	1	2.0 mg/l
D043	Vinyl Chloride	8260A	Volatile Organic Compounds by GC/MS	2	0.4	0.2 mg/l
PCB	Aroclor	8082	Organochlorine Pesticides and PCBs	1	0.2	50 mg/l

[1] From Test Methods for Evaluating Solid Waste Physical/Chemical Methods (EPA/SW-846) Third Edition Update III

TABLE B-2b
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
D004	Arsenic	7060A	AA, Graphite Furnace	13	2.6	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	150	30	
D005	Barium	7080A	AA, Direct Aspiration	200	40	100 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15	3	
D006	Cadmium	7131A	AA, Graphite Furnace	2	0.3	1.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15	3	
D007	Chromium	7191	AA, Graphite Furnace	0.7	0.7	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	15	5	
D008	Lead	7421	AA, Graphite Furnace	5	1	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	150	35	
D009	Mercury	7471A	Manual Cold-Vapor Technique (Liquids)	0.5	0.1	0.2 mg/l
D010	Selenium	7740	AA, Graphite Furnace	20	1	5.7 mg/l
		6010B	ICP-Atomic Emission Spectrometry	400	75	
D011	Silver	7761	AA, Graphite Furnace	3	0.5	5.0 mg/l
		6010B	ICP-Atomic Emission Spectrometry	25	5	
D012	Endrin	8270C	Semivolatile Organic Compounds by GC/MS	0.05	0.005	0.13 mg/kg
D013	Lindane	8270C	Semivolatile Organic Compounds by GC/MS	0.05	0.005	0.13 mg/kg

TABLE B-2b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
D014	Methoxychlor	8270C	Semivolatile Organic Compounds by GC/MS	0.05	0.005	0.18 mg.kg
D015	Toxaphene	8270C	Semivolatile Organic Compounds by GC/MS	1	0.1	2.6 mg/kg
D016	2,4,-D	8151A	Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation	0.5	0.1	10 mg/kg
D017	2,4,5 TP (Silvex)	8151A	Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzylation	0.5	0.1	7.9 mg/kg
D018	Benzene	8260A	Volatile Organic Compounds by GC/MS	1	0.2	10 mg/kg
D019	Carbon Tetrachloride	8260A	Volatile Organic Compounds by GC/MS	1	0.2	6.0 mg/kg
D020	Chlorodane	8081A	Organochlorine Pesticides by GC	1	0.1	0.26 mg/kg
D021	Chlorobenzene	8260A	Volatile Organic Compounds by GC/MS	1	0.2	6.0 mg/kg
D022	Chloroform	8260A	Volatile Organic Compounds by GC/MS	1	0.2	6.0 mg/kg
D023	o-Cresol (2-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	10	1	5.6 mg/kg
D024	m-Cresol (3-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	10	1	5.6 mg/kg
D025	p-Cresol (3-Methylphenol)	8270C	Semivolatile Organic Compounds by GC/MS	10	1	5.6 mg/kg
D026	Cresol total	8270C	Semivolatile Organic Compounds by GC/MS	10	1	11.2 mg/kg

TABLE B-2b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
D027	p-Dichlorobenzene	8270C	Semivolatile Organic Compounds by GC/MS	1	0.2	6.0 mg/kg
D028	1,2-Dichloroethane	8260A	Volatile Organic Compounds by GC/MS	5	1	6.0 mg/kg
D029	1,1-Dichloroethene	8260A	Volatile Organic Compounds by GC/MS	5	1	6.0 mg/kg
D030	2,4-Dinitrotoluene	8270C	Semivolatile Organic Compounds by GC/MS	10	1	140 mg/kg
D031	Heptachlor	8270C	Semivolatile Organic Compounds by GC/MS	0.05	0.005	0.066 mg/kg
D032	Hexachlorobenzene	8270C	Semivolatile Organic Compounds by GC/MS	10	1	10 mg/kg
D033	Hexachlorobutadiene	8270C	Semivolatile Organic Compounds by GC/MS	10	1	5.6 mg/kg
D034	Hexechloroethane	8270C	Semivolatile Organic Compounds by GC/MS	10	1	30 mg/kg
D036	Nitrobenzene	8270C	Semivolatile Organic Compounds by GC/MS	10	1	14 mg/kg
D037	Pentrachlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	50	1	7.4 mg/kg
D039	Tetrachloroethene	8260A	Volatile Organic Compounds by GC/MS	5	1	6.0 mg/kg
D040	Trichloroethene	8260A	Volatile Organic Compounds by GC/MS	5	1	6.0 mg/kg
D041	2,4,5-Trichlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	50	1	7.4 mg/kg

TABLE B-2b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
D042	2,4,6-Trichlorophenol	8270C	Semivolatile Organic Compounds by GC/MS	10	1	7.4 mg/kg
D043	Vinyl Chloride	8260A	Volatile Organic Compounds by GC/MS	2	0.4	6.0 mg/kg
PCB	Aroclor	8082	Organochlorine Pesticides and PCBs	1	0.2	3 ug/l
F001	Carbon Tertrachloride	8260A	Volatile Organic Compounds by GC/MS	2	0.4	6.0 mg/kg
	Methylene Chloride					30 mg/kg
	Tetrachloroethylene					6.0 mg/kg
	1,1,1-Trichloroethane					6.0 mg/kg
	Trichloroethane					6.0 mg/kg
	1,1,2-Trichloro-1,2,2-triflouroethane					30 mg/kg
	Trichlorofluoromethane					30 mg/kg

TABLE B-2b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
F002	Chlorobenzene	8260A	Volatile Organic Compounds by GC/MS	2	0.4	6.0 mg/kg
	o-Dichlorobenzene					6.0 mg/kg
	Methylene Chloride					30 mg/kg
	Tetrachloroethylene					6.0 mg/kg
	1,1,1-Trichloroethane					6.0 mg/kg
	1,1,2-Trichloroethane					6.0 mg/kg
	Trichloroethane					6.0 mg/kg
	1,1,2-Trichloro-1,2,2-triflouroethane					30 mg/kg
	Trichlorofluoromethane					30 mg/kg
F003	Acetone	8260A	Volatile Organic Compounds by GC/MS	20	6	160 mg/kg
	Ethyl acetate					33 mg/kg
	Methanol					0.75 mg/l
	Methyl isobutyl ketone					33 mg/kg
	Ethyl ether					160 mg/kg
	n-Butyl alcohol	8015B	Nonhalogenated Organics Using GC/FID	TBD	TBD	2.6 mg/kg
	Cyclohexanone	8315A	Determination of Carbonyl Compounds by High Performance Liquid Chromatography (HPLC)	TBD	TBD	0.75 mg/l
	Ethyl benzene	8260A	Volatile Organic Compounds by GC/MS	5	1	10 mg/kg
	Xylenes			5	5	30 mg/kg

TABLE B-2b (continued)
Methods Detection Limits and Limits of Quantitation for
Verifying Treatment Standards for Liquids

Waste Code	Constituent	Method[1]		LOQ (ug/l)	MDL (ug/l)	Action Limit
		SW-846	Description			
F004	o-Cresol	8270C	Semi-volatile Organic Compounds by GC/MS	1000	100	5.6 mg/kg
	m-Cresol					5.6 mg/kg
	p-Cresol					5.6 mg/kg
	Cresyilc Acid					11.2 mg/kg
	Nitrobenzene					14 mg/kg
F005	Benzene	8260A	Volatile Organic Compounds by GC/MS	5	1	10 mg/kg
	Carbon disulfide			5	3	4.8 mg/l
	Isobutyl alcohol			300	1	170 mg/kg
	Methyl ethyl ketone			20	9	36 mg/kg
	2-Nitropropane			TBD	TBD	CMBST
	Pyridine			1000	100	16 mg/kg
	Toluene			5	1	10 mg/kg
	2-Ethoxyethanol (Ethylene Glycol)	8015B	Non-halogenated Organics Using GC/FID	TBD	TBD	CMBST

[1] From Test Methods for Evaluating Solid Waste Physical/Chemical Methods (EPA/SW-846) Third Edition Update III

TABLE B-3 Methods for Fingerprint Parameters	
Process Parameter	Method
Physical Description	ASTM D-4979, "Physical Description Screening Analysis in Waste"
pH	SW-846, Method 9045d, "Soil and Waste pH" (Note: pH not applicable to organic liquids)
Cyanides	ASTM D-5049, "Screening of Cyanides in Waste"
Sulfides	ASTM D-4978, "Screening of Reactive Sulfieds in Waste"
PCB	SW-846, Method 4020, "Screening for PCBs by Immunoassay"
Flash point	ASTM D-93-10, Pensky-Martin Closed-cup Method
Explosive Vapor (LEL)	Gas Detector "Sniffer" with capability to detect O_2, H_2S, TOX, and LEL
Specific gravity	ASTM D-5057, "Bulk Density and Apparent Specific Gravity"
Mercury	Jerom 431-X Mercury Vapor Monitor
Water Compatibility	ASTM D-5058C, "Water Compatibility"
Ignitability	SW-846, Method 1010, "Ignitability"

TABLE B-4
RECOMMENDED SAMPLE TREATMENT, PRESERVATIVES,
AND HOLDING TIMES FOR INORGANICS

Measurement	Type	Treatment	Preservative	Holding Time
Aqueous[1]	Totals		HNO_3 to pH < 2	6 months
	Dissolved	Filter on site	HNO_3 to pH < 2	6 months
	Suspended	Filter on site		6 months
Solid[1]	Total			6 months
Hexavalent Chromium	Aqueous		Store at $4^o \pm 2^o$ C[2]	24 hours
	Solid		Store at $4^o \pm 2^o$ C[2] Until analyzed	One month to extraction, 4 days after
Mercury Aqueous	Total		HNO_3 to pH < 2	28 days
	Dissolved	Filter	HNO_3 to pH < 2	28 days
Mercury Solid	Total		Store at $4^o \pm 2^o$ C[2]	28 days

[1]All except for hexavalent chromium and mercury.

[2]During shipment of samples to an off-site laboratory, this requirement will be considered met by the use of "blue ice" cold packs placed with the sample within an insulated cooler.

TABLE B-5 RECOMMENDED SAMPLE PRESERVATION AND HOLDING TIMES FOR VOLATILE ORGANICS		
Sample Matrix	Preservative	Holding Time
Concentrated Waste Samples	Cool to 4° C[1]	14 days
Aqueous Samples with no residual chlorine present	Cool to 4° C[1], adjust pH < 2 with H_2SO_4, HCl, or solid $NaHSO_4$	14 days
Aqueous Samples with residual chlorine present	Collect sample in a 125mL container containing 4 drops of 10% sodium thiosulfate solution. Swirl to mix, transfer to a 40mL VOA vial. Cool to 4° C[1], adjust pH < 2 with H_2SO_4, HCl, or solid $NaHSO_4$	14 days
Acrolein and Acrylonitrile in Aqueous samples	Adjust pH to 4-5, cool to 4° C[1]	14 days
Solid Samples	Based on individual method, see SW-846	14 days

[1]For shipment to the laboratory, this requirement will be considered met by the use of "blue ice" cold packs placed with the sample within an insulated cooler.

TABLE B-6 RECOMMENDED SAMPLE PRESERVATION AND HOLDING TIMES FOR SEMIVOLATILE ORGANICS, ORGANOCHLORINE PESTICIDES, PCB, AND HERBICIDES		
Sample Matrix	Preservative	Holding Time
Concentrated Waste Samples	None	Extracted within 14 days, analyzed within 40 extraction
Aqueous Samples with no residual chlorine present	Cool to 4° C[1]	Extracted within 7 days, analyzed within 40 extraction
Aqueous Samples with residual chlorine present	Add 3mL 10% sodium thiosulfate solution per gallon. Cool to 4° C[1]	Extracted within 7 days, analyzed within 40 extraction
Solid Samples	Cool to 4° C[1]	Extracted within 14 days, analyzed within 40 extraction

[1]For shipment to the laboratory, this requirement will be considered met by the use of "blue ice" cold packs placed with the sample within an insulated cooler.

TABLE B-7 SAMPLE PREPARATION AND CLEANUP METHODS		
Method Number	Method Title	Typical Follow-up Method
1311	Toxicity Characteristic Leaching Procedure	Metals analysis by ICP (6010B)
3005A/3010A	Metals acid digestion for ICP	Metals analysis by ICP (6010B)
3015	Metals acid digestion microwave assisted	Metals analysis by ICP (6010B)
3020A	Metals acid digestion for GFAA	Metals analysis by GFAA (7000 series)
3050B	Metals acid digestion of sediments, sludge, soils, and oils	Metals analysis by ICP (6010B)
3051	Metals acid digestion of sediments, sludge, soils, and oils microwave assisted	Metals analysis by ICP (6010B)
3510	Seperatory funnel liquid-liquid extraction	Semi-volatile organics by GC/MC (8270C)
3520	Continuous liquid-liquid extraction	Semi-volatile organics by GC/MS (8270C)
3535	Solid phase extraction	Semi-volatile organics by GC/MS(8270C)
3540/3541	Soxhlet extraction	Semi-volatile organics by GC/MS (8270C)
3550	Sonication extraction	Semi-volatile organics by GC/MS (8270C)
3580/3585	Waste dilution	Semi-volatile organics by GC/MS (8270C)
3610/3611	Alumina cleanup	Semi-volatile organics by GC/MS (8270C)
3620	Florisil cleanup	Semi-volatile organics by GC/MS(8270C)
3640	Gel-permeation cleanup	Semi-volatile organics by GC/MS (8270C)
3650	Acid-base partition cleanup	Semi-volatile organics by GC/MS (8270C)
3660	Sulfur cleanup	Semi-volatile organics by GC/MS (8270C)
3665	Sulfuric acid permanganate cleanup	Semi-volatile organics by GC/MS (8270C)
5030B	Purge and trap for aqueous samples	Semi-volatile organics by GC/MS (8770C)
5035	Closed system purge and trap for volatile organics	Volatile organics by GC/MS (8260)