WASHINGTON STATE DEPARTMENT OF ECOLOGY NUCLEAR WASTE PROGRAM

Guidance for Preparing Waste Sampling and Analysis Documents and QA/QC Requirements at Nuclear Waste Sites

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List of Acronyms

Acronym	Definition
ALARA	As Low As Reasonably Achievable
ASTM	American Society for Testing and Materials
BDAT	Best Demonstrated Available Technology
CAP	Corrective Action Plan
CFR	Code of Federal Regulations
COLIWASA	Composite Liquid Waste Sampler
DQO	Data Quality Objectives
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HASQARD	Hanford Analytical Services Quality Assurance Requirements Document
LCS	Laboratory Control Sample
LDR	Land Disposal Restrictions
MARLAP	Multi-Agency Radiological Laboratory Analytical Protocols
MDL	Method Detection Limit
MSDS	Material Safety Data Sheet
MTCA	Model Toxics Control Act
NQA-1	Nuclear Quality Assurance Level 1
NDE	Nondestructive Examination
NELAP	National Environmental Laboratory Accreditation
NWP	Washington State Department of Ecology, Nuclear Waste Program
PAC	Performance and Acceptance Criteria Process
PE	Performance Evaluation
PER	Performance Evaluation System
PCB	Polychlorinated Biphenyl
ppm	Parts Per Million
QA	Quality Assurance
QAPP	Quality Assurance Project Plans
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SW-846	Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, U.S. Environmental Protection Agency
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
TSD	Treatment, Storage, or Disposal
UHCs	Underlying Hazardous Constituents
USDOE	United States Department of Ecology
WAC	Washington Administrative Code
WAP	Waste Analysis Plan
WTP	Waste Treatment and Immobilization Plant

Disclaimer

The information in this document is intended solely as guidance to assist in the preparation of documents to meet regulatory compliance requirements. It is never intended and cannot be used to create any rights, substantive or procedural, enforceable by any party in litigation with the state of Washington in the United States. The Washington State Department of Ecology, Nuclear Waste Program reserves the right to act at variance with the guidance and to change it at any time with or without public notice. For example, when the U.S. Environmental Protection Agency (EPA) issues new rules concerning the definition of hazardous waste, holding times, or when Ecology changes applicable state regulations and requirements, the contents of this guidance may change in conformance with new federal and state regulations. Any new rules or requirements will supersede those discussed in this document.

Executive Summary

Introduction

This guidance document applies to Hanford and non-Hanford work. It is intended to be used in preparing documents for environmental work performed under Ecology's Nuclear Waste Program (NWP) regulatory oversight. The guidance brings together information and points to appropriate sources of information that may be consulted for detailed requirements and standards that meet regulatory and permitting mandates at nuclear waste sites. This will ensure consistent standards and criteria in preparing documents used for similar environmental work by the regulated community. Oversight by a chemist or other technically qualified staff is required in using this guidance.

Although the Hanford Analytical Services Quality Assurance Requirements Document (HASQARD) is the primary document "designed to meet the needs of the Hanford Site for maintaining a consistent level of quality" for analytical work performed by the United States Department of Energy (USDOE) contractors and other commercial analytical operations, this guidance document provides the pertinent requirements and standards not covered by HASQARD. Because overlaps may not be completely avoided, efforts were made to minimize duplication in those aspects that HASQARD covers for Hanford work. However, as pointed out in HASQARD, attention should be given to where Washington State permitting and regulatory requirements in this document differ from HASQARD.

Nuclear Quality Assurance Level 1 (NQA-1) quality standards apply to work performed at Waste Treatment and Immobilization Plant (WTP). Washington State regulatory requirements not addressed by NQA-1 standards should be obtained from Washington Administrative Code (WAC) 178-303 and as relevantly covered by this guidance document. Other non-Hanford work not guided by HASQARD should strictly follow this guidance document. The NWP can assist in obtaining any other details not covered by this guidance document.

This guidance document primarily covers preparing the documents listed below. The guidance may also be used in preparing other documents that require oversight or approval by the NWP:

1. Waste Analysis Plan (WAP).
2. Sampling Analysis Plan (SAP).
3. Quality Assurance/Quality Control (QA/QC).

Waste Analysis Plan

Waste Analysis Plans document the processes used to obtain sufficient information on the characteristics of the waste to ensure safe waste treatment, storage, and disposal in an appropriate manner. Because a WAP is a facility-specific plan, Ecology requires the facility to follow the guidance outlined in this document and use the checklist crosswalk to ensure that all the requirements are addressed in their WAP preparation. The guidance provides:

- Flexible opportunities to propose what will be acceptable information for safe and effective waste management at the facilities.
- Compliance with regulatory requirements such as land disposal restrictions (LDR).
- Conformance with any applicable permit conditions.

The NWP regulates mixed waste and hazardous waste. The radioactive component of mixed waste poses unique challenges in obtaining information that fulfill the purposes of a WAP. The emphasis on nuclear radiation safety and avoiding unnecessary exposure to radioactivity requires using strategies that involve As Low As Reasonably Achievable (ALARA) principles when sampling and testing of the waste are inevitable.

The use of process knowledge to describe acceptable knowledge of the waste is highly recommended whenever possible to eliminate redundant or unnecessary testing of the waste. Knowledge as defined by WAC 173-303-040 is:

> *". . . sufficient information about a waste to reliably substitute for direct testing of the waste. To be sufficient and reliable, the 'knowledge' used must provide information necessary to manage the waste in accordance with the requirements of this chapter."*

In some cases, however, both waste process knowledge, sampling, and laboratory measurements may be necessary to describe the waste characteristics for safe treatment, storage, and disposal.

Regardless of the facility, the WAP must contain information to meet the requirements of Washington State Dangerous Waste Regulations and Resource Conservation and Recovery Act (RCRA) regulations. The following elements are the most essential parts of a WAP:

- Facility description.
- Hazardous waste determination and waste classification.
- Waste acceptance and confirmation processes.
- Special requirements including land disposal restrictions (LDR) and off-site facilities.
- Performance evaluation process.
- Waste analysis parameters.
- QA/QC.
- Sampling strategies and procedures.
- Testing and analytical methods.
- Records.

Sampling and Analysis Plan (SAP)

The first step in sampling and analysis is to establish the scope of sampling and data usage. Data Quality Objectives (DQO) and Quality Assurance Project Plans (QAPP) are examples of the planning process for sampling and analysis. The SAP is project specific and gives prescriptive details for obtaining representative samples of the waste. It outlines analytical tests and associated data assessment, with the primary purpose of identifying or verifying the chemical and physical characteristics of a waste.

Standards for SAPs can be obtained from 40 Code of Federal Regulations (CFR) 261, U.S. Environmental Protection Agency (EPA) SW-846, and WAC 173-303-110. Other reference documents describing a detailed sampling and analysis plan include HASQARD, National Environmental Laboratory Accreditation (NELAP) standard document, multi-agency radiological laboratory analytical protocols (MARLAP) sampling and testing approaches, and Ecology's Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. The essential parts of an SAP include:

- Documented DQO process to establish data needs and requirements.
- Statistical sampling procedures that will obtain representative samples.
- Handling of samples (including chain of custody, transportation, storage, and disposal of samples at the end of the analysis).
- QA/QC.
- Laboratory testing and measurements and re-testing basis.
- Test reports and data transmission methods.

Quality Assurance/Quality Control (QA/QC)

Specific program objectives and project needs dictate the extent of the QA/QC program. USEPA SW-846 and WAC 173-303-300 contain the general regulatory requirements for QA/QC. The primary goal of QA programs is to ensure that environmental projects and decisions are based on defensible data that meet the type and quality of their intended use. QC is a set of statistically-based criteria intended to evaluate and control the quality of measurements. The basic standards of requirements for QA/QC include:

- Quality objectives for obtaining defensible data.
- Sampling process design and procedures.
- Analytical methods, quality control.
- Data reduction, data verification and validation, data quality assessment.
- Data management and reporting.
- Record keeping requirements.
- Training requirements for personnel carrying out various aspects of the sampling and measurements.

Documents prepared to meet Ecology's requirements must follow the processes outlined in Ecology's *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*, EPA's *Guidance on Systematic Planning using the Data Quality Objectives Process* (QA/G-4), and EPA's *Guidance for Quality Assurance Project Plans* (QA/G-5).

1. Waste Analysis Plan

1.1 Introduction

The Waste Analysis Plan (WAP) provides processes to obtain acceptable information on the chemical, biological, and physical characteristics of the waste managed to meet the requirements of Washington Administrative Code (WAC) 173-303-300. It documents the waste acceptance process, sampling methodologies, analytical techniques, and overall processes that are undertaken for waste accepted for storage and treatment. A WAP is facility-specific.

This guidance provides open opportunities for each facility to propose what will be acceptable information of their waste characteristics. Safe waste management, regulatory compliance, and permit conditions conformance are the drivers for the facility that proposes the WAP. Each treatment, storage, and disposal (TSD) facility or dangerous waste management unit will have unique requirements to meet Dangerous Waste Regulations and Resource Conservation and Recovery Act (RCRA) regulatory requirements. This guidance document is intended for each facility to use the checklist as a crosswalk in addressing the requirements of their facility-specific WAP.

The Washington State Department of Ecology’s Nuclear Waste Program (NWP) regulates mixed waste and hazardous waste sites throughout the state. The United States Department of Energy's Hanford site is the major cleanup challenge that NWP regulates. Non-Hanford sites regulated by NWP include:

- The low-level radioactive waste disposal facility leased by US Ecology.
- French nuclear fuels fabricator, AREVA NP Inc.
- Energy Northwest.
- Waste treatment facility Perma-Fix Northwest Richland, Inc.
- Mixed wastes at the Puget Sound Naval Shipyard complex.

Because NWP focuses on keeping people and the environment safe from the dangers of mixed radioactive waste and chemically hazardous waste, NWP ensures that the criteria for waste handling and disposal are carried out as set by the state laws and regulations.

The preparation of a facility’s WAP and subsequent waste analyses must meet the NWP’s safety philosophy and criteria. The sampling and analysis strategies, therefore, will line up with the principles of ALARA, “as low as reasonably achievable.” In keeping with the ALARA principles, therefore, it will not be out of place for knowledge, as defined in WAC 173-303-040, to be obtained through the use of process knowledge, material safety data sheets (MSDS), history of the waste, or other credible sources whenever possible, in order to eliminate redundant or unnecessary testing of the waste.

However, in accordance with the regulations, inaccurate or incomplete waste analysis information provided by the generator is not a defense for noncompliance by the Permittee with the waste management requirements and conditions in the Permit. (See WAC 173-303 and the land disposal restrictions in 40 CFR Part 268). Both waste process knowledge and sampling and laboratory measurements may be necessary to describe the waste characteristics for safe treatment, storage, and disposal. A chemist's or other technically qualified personnel involvement in using this document to guide permit writers or other users is required for successful implementation of the regulatory and permitting requirements in this document.

Sampling data and other information will be reviewed to ensure that such data and information meet requirements in WAC 173-303-300 and WAC 173-303-806(4)(a)(iii). This guidance will aid in reviewing the facility's unit-specific WAP for completeness. The guidance will include updated information provided by Ecology headquarters and will be revised and updated as necessary. The most current revision of this guidance must be used to develop a WAP this is enforceable and supports safe and compliant management of wastes.

1.2 Regulatory Drivers

Federal and Washington State regulatory drivers that require WAP can be found in 40 CFR 264.13, 40 CFR 265.13, 40 CFR 268 and Washington State regulations such as WAC 173-303-040, WAC 173-303-140, WAC 173-303-300, WAC 173-303-380, and WAC 173-303-400.

1.3 WAP Essential Elements

The WAP must contain information to meet the requirements of Washington State Dangerous Waste regulations and EPA RCRA regulations. The elements of a WAP are:

- Facility/Unit description.
- Hazardous waste determination and waste classification.
- Waste acceptance and confirmation processes.
- Special requirements including LDR and off-site facilities.
- Waste analysis parameters and their rationales.
- QA/QC.
- Sampling strategies and procedures.
- Testing and analytical methods.
- Records.

1.3.1 Facility/Unit Description

The facility/unit description section of the WAP contains descriptions of:

- The structures used for storing waste.
- Wastes managed in the facility.
- The processes that generate and treat wastes.
- The waste characteristics.
- The hazardous waste management units and practices such as unit compatibility (see Table 1.2) that ensures safe storage and management of the waste.

The information from unit descriptions is then used through the rest of the WAP in:

- Selecting waste analysis parameters.
- Waste acceptance process.
- Sampling and testing methods.
- Screening and re-evaluation frequencies.

Although the Part A of the Permit gives detailed information about the waste, the restating of the summary of the waste characteristics, for example, helps in writing a technically sound WAP. It may be helpful to cross-reference sections of the Permit that contain pertinent information, such as the Processing Section, to the WAP when it is being prepared.

1.3.1.1 Description of Unit Processing Area

The unit processing area of the facility should be well documented in the WAP, describing the facility's waste management capabilities, which include:

- Storing.
- Receiving.
- Opening containers.
- Sampling.
- Physical/chemical screening.
- Sorting.
- Treating.
- Repackaging.
- Certification.
- Shipping dangerous waste for treatment and/or disposal offsite.

1.3.1.2 Process Descriptions

This section of the WAP describes the processes being carried out in the unit, such as:

- Deactivation (neutralization of corrosives, cementing, absorption of liquids, and controlled reaction of reactive waste).
- Stabilization (cementing, absorption, and micro- and macro-encapsulation).
- Amalgamation.
- Other processes such as volume reduction of waste (i.e., supercompaction).
- Repackaging of waste.
- Processing of waste destined for disposal in an offsite facility.

When treatment standards are expressed as a concentration, the Hanford Facility is required to test certain mixed wastes to ensure that the waste or treatment residues are in compliance with applicable LDR requirements. Such testing is performed according to the frequency specified in the WAP. (See 40 CFR 268.7[b] and WAC 173-303-140.)

1.3.2 Identification and Classification of Waste

The identity of the waste is the common name of the waste, a profile number, or the chemical name of the waste used to describe it in the facility. Each waste stream or waste type at the facility must have a unique name for easy identification. The waste generating process in permitted onsite units should be described in the WAP as discussed in Section 1.3.1.2. It is important to specify the rationale (such as listed waste) for the hazardous waste designation. Information on the chemical and physical characteristics of the waste that would help safe sampling, treatment, storage, or disposal of the waste should also be provided.

The description of waste can be in terms of waste types such as:

- Containerized liquids/free liquids.
- Pressurized gas cylinders and aerosol cans.
- Munitions/explosives (to be evaluated on a case-by-case basis).
- Bulk sodium metal.
- Labpack liquids.
- Solids/debris.
- Sludges/soils.

Unless otherwise prohibited by the WAP, the waste could exhibit the characteristics of ignitable, toxic, corrosive, and/or reactive in addition to being mixed and dangerous waste. Process knowledge, field screening, or sampling and analysis are used, as appropriate, to characterize the waste materials. Field screening and sampling occur in accordance with the WAP and at the point of waste generation or at the location where the waste materials are stored.

Biological waste received from generators could consist of animal remains that were used for experiments. This type of waste is analyzed using nondestructive examination (NDE) or visual examination.

A list of dangerous and/or mixed waste that is **not** accepted for treatment and/or storage in the unit should also be specified. Examples of waste that are not accepted in an example specific unit processing area may include:

- Bulk liquid waste in tankers.
- Bulk solids in trucks or roll-off boxes.
- Shock-sensitive waste.
- Class IV oxidizer waste.
- Infectious waste.

1.3.2.1 Dangerous Waste Numbers

The RCRA Permit Form, Addendum A, Part A, should identify the dangerous waste numbers, quantities, and process design capacity. Table 1.1 is an example of dangerous waste codes.

There are various sources of information for waste designation, including manufacturer's product information, MSDS, laboratory analysis, and reference material such as Registry of Toxic Effects of Chemical Substances. Waste can also be characterized in accordance with the requirements of 40 CFR 761.

Waste knowledge must be sufficient to determine the waste stream designation and to manage the waste in accordance with unit-specific waste acceptance criteria. The minimum level of knowledge consists of the quantitative data of the constituents that are used to designate and assign dangerous waste code. The data provide knowledge that addresses any operational parameters necessary for proper management of the waste.

Table 1-1: Designation for Waste Types Example

<table>
<tr><th>Number</th><th colspan="2">Description of Waste</th><th>References</th></tr>
<tr><td>D001</td><td colspan="2">Ignitability characteristic waste contains substance(s) that can ignite, cause fire through friction, oxidizer, or ignitable compressed gas. E.g., 20% Benzene and 80% Toluene.</td><td>WAC 173-303-090(5)</td></tr>
<tr><td>D002</td><td colspan="2">Corrosivity characteristic waste contains substance(s) that have pH <2 or >12.5 or corrodes steel greater than 6.35mm. E.g., Corrosive sodium hydroxide waste with pH = 13.4.</td><td>WAC 173-303-090(6)</td></tr>
<tr><td>D003</td><td colspan="2">Reactivity characteristic waste contains substance(s) that are unstable and readily undergo violent reaction, react violently with water, or generate toxic gases vapors, or fumes on reacting with water, capable to detonate or explode under heat or at normal temperature and pressure. E.g. Stockpile of sodium metal.</td><td>WAC 173-303-090(7)</td></tr>
<tr><td rowspan="5">D004
through
D043</td><td colspan="2">Toxicity characteristic waste</td><td rowspan="5">WAC 173-303-090(8)</td></tr>
<tr><td>D004</td><td>Waste contains arsenic (e.g., Latex Carpet Cement 0504 Weldwood).</td></tr>
<tr><td>D009</td><td>Waste contains mercury (e.g., waste containing mercury-based thermometers).</td></tr>
<tr><td>D035</td><td>Waste contains methyl ethyl ketone. (e.g., Scotch-Seal 800 Industrial Sealant).</td></tr>
<tr><td>D019</td><td>Waste contains carbon tetrachloride (e.g., ion exchange solvent).</td></tr>
</table>

Table 1.1: Designation for Waste Types Example Continued

Number	Description of Waste		References
WSC2		Corrosivity characteristic waste contains solid or semi-solid substance(s) that has pH <2 or >12.5.	WAC 173-303-090(6) WAC 173-303-104
WT01	Other toxicity waste codes apply	State-specific toxic waste containing extremely hazardous waste >1.0% equivalent concentration (e.g., Mobilgrease 28).	WAC 173-303-100 and 104
WT02	Other toxicity waste codes apply	State-specific toxic waste containing dangerous waste >0.001% but <1.0% equivalent concentration (e.g., Epoxy 300 Parts A and B).	WAC 173-303-100 and 104
WP01	Other listed waste codes apply	State-specific persistent dangerous waste halogenated organic compounds waste containing extremely hazardous waste (e.g., Dow Corning® 730 Solvent Resistant Sealant).	WAC 173-303-100 and 104
WP02	Other listed waste codes apply	State-specific persistent dangerous waste halogenated organic compounds waste containing dangerous waste (e.g., halogenated oil, using Ethane, 1,2-dichloro as example).	WAC 173-303-100 and 104
WP03	Other listed waste codes apply	State-specific persistent dangerous waste polycyclic aromatic hydrocarbon waste containing extremely hazardous waste (e.g., ZL-22A Zyglo Penetrant).	WAC 173-303-100 and 104
P numbers	Discarded chemical products Listed waste.		WAC 173-303-9903
	P006	Waste contains aluminum phosphide	
	P010	Waste contains arsenic acid	
	P015	Waste contains beryllium powder	
	P023	Waste contains chloroacetyladehyde	
	P028	Waste contains benzyl chloride	

Table 1.1: Designation for Waste Types Example Continued

Number	Description of Waste		References
U numbers	Chemical products Listed waste		WAC 173-303-9903
	U019	Benzene	
	U151	Mercury	
	U169	Nitrobenzene	
	U211	Carbon tetrachloride	
F numbers	Substances from nonspecific sources		WAC 173-303-9904
	F001	Spent halogenated solvents used in degreasing –-tetrachloroethylene, trichloroethylene, methylene chloride, carbon tetrachloride, chlorinated fluorocarbons (e.g., 100% Tricholoethylene used in degreasing).	
	F003	Spent nonhalogenated solvents – xylene, acetone, ethyl acetate, ethylbenzene, ethyl ether, methyl isobutyl ketone, methanol, or blends of these solvents (e.g. A spent blend of 80% ethyl acetate and 20% xylene).	
	F005	Spent nonhalogenated solvents containing: Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above nonhalogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures (e.g., 70% Diesel & 30% Toluene Mix).	
WPCB	Discarded transformers, capacitors or brushings containing polychlorinated biphenyls (PCBs) at concentrations of 2 parts per million (ppm) or higher and wastes generated from salvaging, rebuilding, or discarding of transformers, capacitors, or brushings containing PCBs at 2ppm or higher concentrations (e.g., A waste containing 5% PCBs).		WAC 173-303-9904

1.3.3 Waste acceptance and confirmation processes

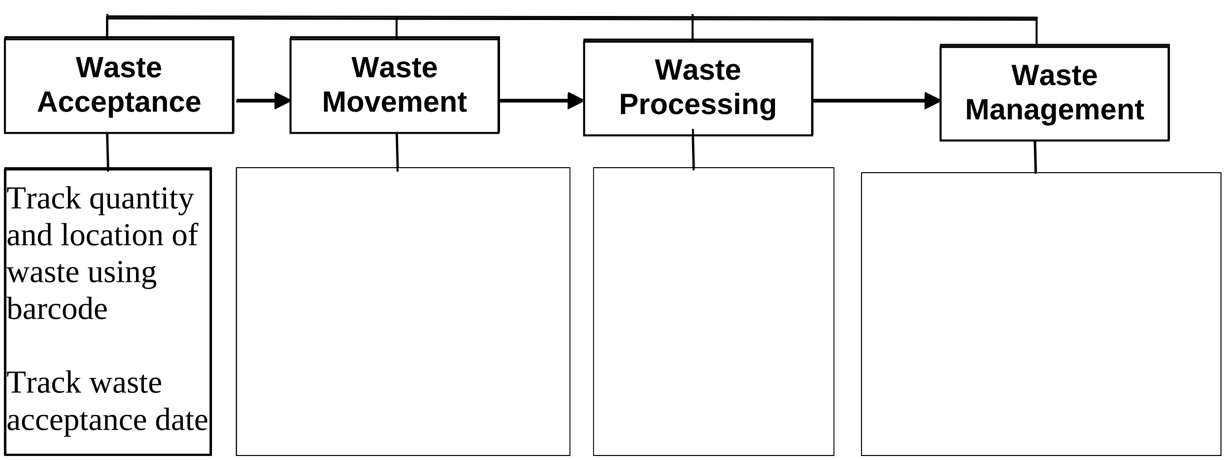
The waste acceptance and confirmation processes to meet WAC 173-303-300 requirements include completing appropriate pre-acceptance and pre-shipment reviews**, fingerprinting (screening) and verification steps described below.**

1.3.3.1 Waste Tracking Process

The waste tracking process provides a mechanism to track waste through a uniquely identified container (see Figure 1.1). The unit should have a waste tracking process to ensure that the waste received at the unit matches the manifest or shipping papers and to maintain the information required in WAC 173-303-380.

A barcode (or equivalent) is used as a unique identifier that is recorded in an electronic data tracking system. Identification numbers are assigned and maintained for new containers as the waste moves through the unit. The identification numbers will be linked to a hard copy or electronic copy of records maintained as part of the operating records at the facility. Location, quantity, physical, and chemical characteristics of the waste are tracked. The mechanism is used from cradle-to-grave in waste handling, treatment, and management of waste. Figure 1.1 describes the waste tracking process.

Figure 1-1: Waste Tracking



1.3.3.2 Pre-acceptance Process/Pre-Shipment Review

Pre-acceptance/pre-shipment review is a process of waste evaluation using the facility's waste acceptance criteria. Complete physical and chemical analyses of a representative sample of the waste are carried out before the waste is accepted or shipped to the facility (per WAC 173-303-300[2]). These "mandatory analyses" are intended to show that the shipping manifest information represents the actual waste being received. They also verify critical information such as ignitability, reactivity, and compatibility, which is required to safely manage the waste in the facility within the constraints of the permit, process, or regulation.

The review focuses on whether the waste stream is defined accurately and the LDR status is

determined correctly. The process also helps identify areas of potential concern. The facility that undergoes a rigorous pre-acceptance screening process may not be required to go through an extensive waste acceptance process during the waste confirmation phase.
In the pre-acceptance process for mixed waste, ALARA principles must be followed in constructing sampling and analysis strategies. Ecology emphasizes safety and avoidance of unnecessary exposure to radioactivity when sampling and testing of waste are inevitable. Hence, acceptable knowledge may be obtained through the use of process knowledge whenever possible, with the approval of the regulator, to eliminate redundant or unnecessary testing of the waste. When process knowledge or history of the waste is not available, sampling and laboratory testing will be necessary. Nevertheless, inaccurate or incomplete waste analysis information provided by the generator is not a defense for noncompliance by the facility.

1.3.3.3 Waste Acceptance Process

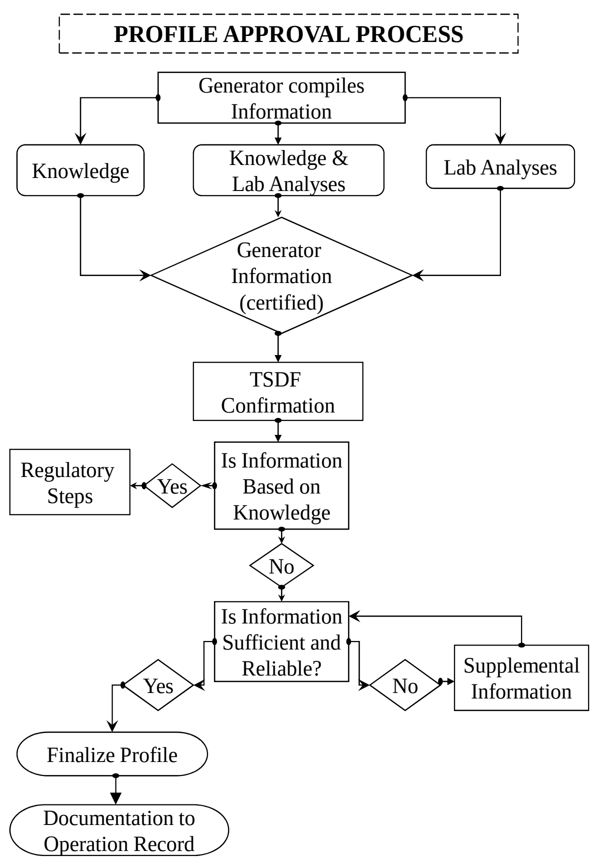
The waste acceptance process section of the WAP consists of:

- Waste profile information.
- Waste stream approval process.
- Waste shipment/transfer approval.
- Container verification.
- Performance Evaluation System.
- Land disposal restriction requirements (where applicable).

1.3.3.3.1 Waste Profile Approval Process

Waste profile approval process can be carried out using information sources as shown in Figure 1.2

Figure 1-2: Waste Profile Approval Process

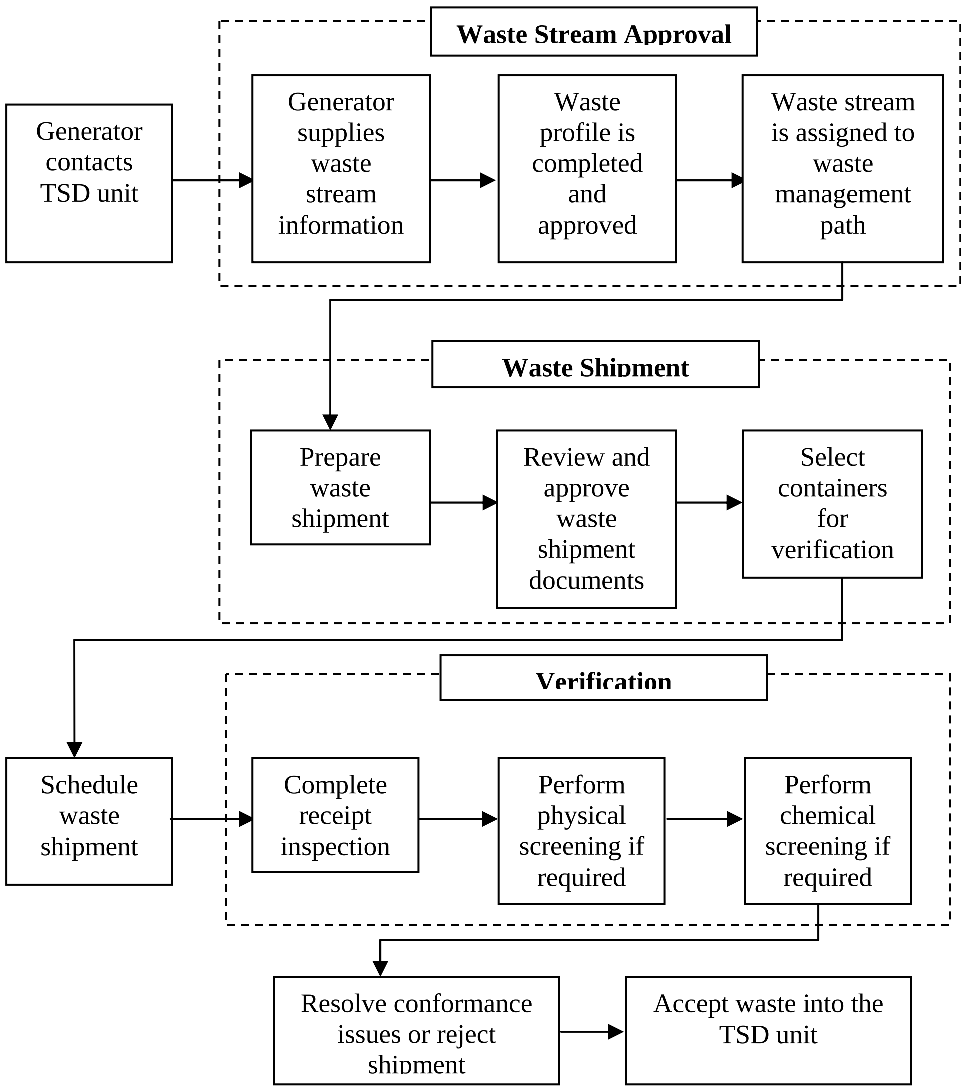


1.3.3.3.2 Waste Stream Approval Process

The waste stream approval process consists of reviewing waste stream information provided on a waste stream profile or other approved documentation (Figure 1.3). Waste approval is based on acceptable knowledge of the waste stream. The information, at a minimum, includes:

- Generator information (e.g., name, address, point-of-contact, telephone number).
- Waste stream name.
- Waste generating process description.
- Chemical characterization information (e.g., characterization method(s), chemicals present, concentration ranges).
- Designation information.
- For mixed and dangerous LDR requirements, including identification of underlying hazardous constituents (UHCs) if applicable.
- Waste type information (e.g., physical state, absorbents used, inert materials, stabilizing agents used).
- Packaging information (e.g., container type, maximum weight, size).
- Attachments could consist of container drawings, process flow information, analytical data, etc.

Figure 1-3: Waste Confirmation and Acceptance Process for Newly Generated Waste



*Verification can occur at the generating unit prior to shipment.

1.3.3.3.3 Waste Shipment/Transfer Approval Process

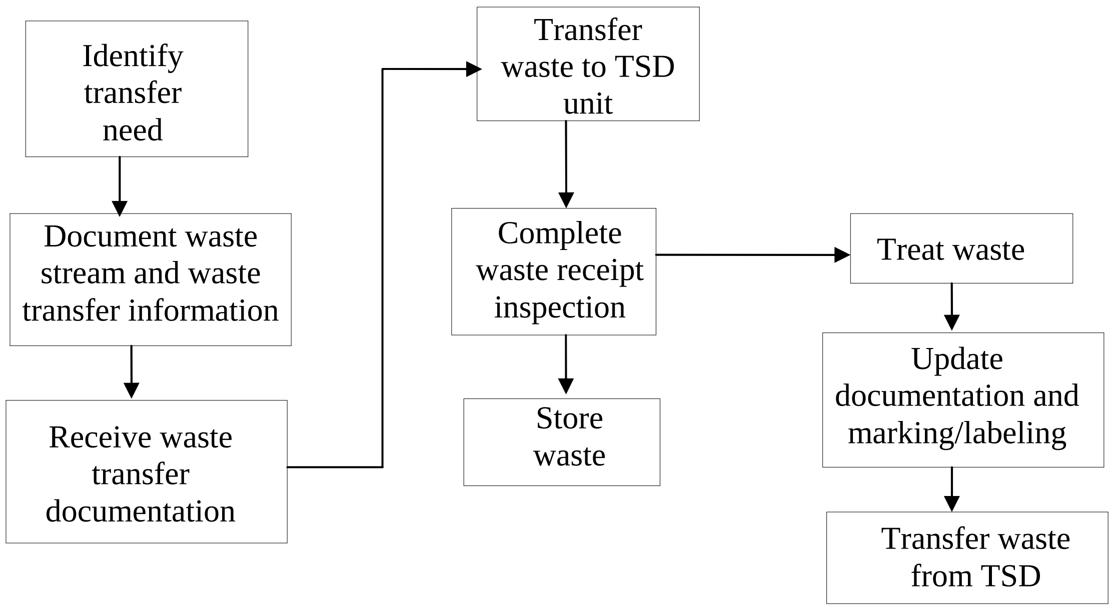
The information provided by the generator for each waste container on the container data sheet is used in the approval process (Figure 1.4).

- Review of the container data are reviewed against the waste profile sheet data and the facility acceptance criteria.
- Determine if any of the containers require verification based on the verification frequency as determined by Performance Evaluation System (PES).

The following information is required for each waste transfer or shipment:

- Container identification number.
- Profile number or other approved processes (except for waste transfers of previously accepted waste).
- Waste description.
- Generator information (e.g., name, address, point-of-contact, telephone number).
- Container information (e.g., type, size, weight).
- Waste numbers.
- Designation of extremely hazardous waste or dangerous waste.
- Dose rate information.
- Reportable radionuclides and quantities.
- Waste composition.
- Packaging materials and quantities.

Figure 1-4: Waste Transfers Between Solid Waste Operations Complex TSD Units



1.3.3.3.4 Verification Process

All waste streams are subject to receipt inspection during the waste shipment acceptance process.

- One hundred percent of all containers are inspected for damage or leaks, labeling and intact seals?
- Containers are opened and verified visually or by NDE.
- The percentage of the waste stream selected for physical and/or chemical screening is determined in accordance with the requirements found in the PES program.
- Non-conformance issues identified and dealt with.

1.3.3.3.5 Performance Evaluation System (PES)

A performance evaluation system is used to trend a generator’s waste acceptance performance and is used to adjust the generator’s overall physical screening frequencies. This evaluation using a written procedure considers the conformance issues documented during the Pre-shipment Review and Verification processes (Figure 1.5).

The PES maintains processes that:

- Perform evaluations based on conformance issues identified.
- Evaluate unsatisfactory performance for corrective actions.
- Adjust physical screening rates accordingly.

The process for reducing the screening frequency is as follows:

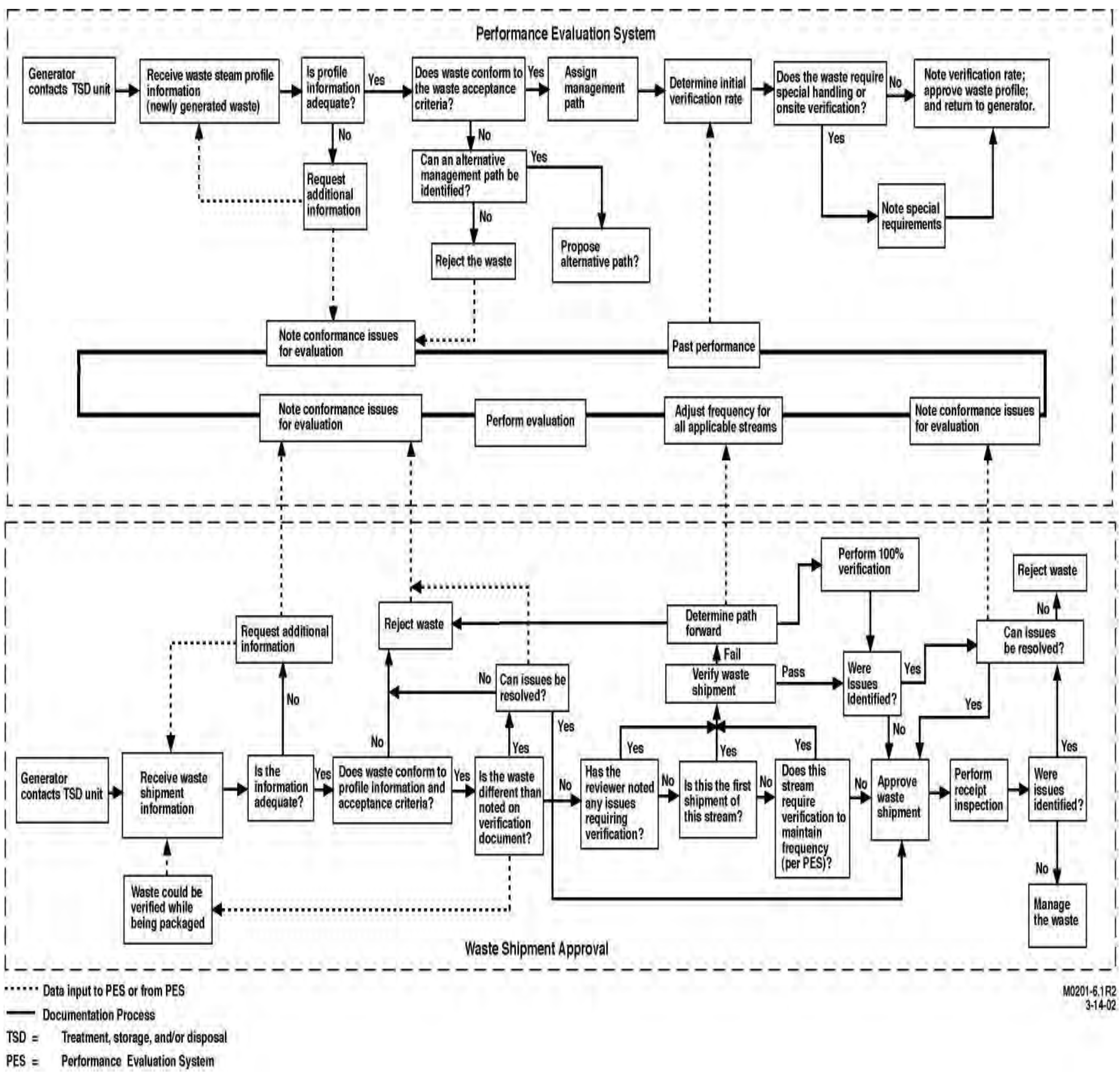
Step 1. The frequency is reduced by up to 66 percent after five containers from the waste stream in question passed verification.

Step 2. The frequency is in Step 1 is further reduced by 50 percent or less after five containers from the waste stream passed verification.

Step 3. The frequency in step 2 is reduced to minimum allowable after five containers pass verification.

Step 4. The TSD unit documents the acceptable evaluation of the corrective action program.

Figure 1-5: Waste Confirmation and Acceptance Process for Newly Generated Waste (A consensus flowchart created by NWP and Hanford Site Contractors)



1.3.4 Special Requirements

1.3.4.1 Land disposal restriction requirements

Waste managed on the Hanford Facility falls within the LDRs (40 CFR 268 and WAC 173-303-140). Waste constituents that are subject to LDRs must meet treatment based on concentration or technology standards. If the knowledge of the generator is not sufficient to make a determination, additional testing will be required. The hazardous wastes or waste extract must be tested using the TCLP.

1.3.4.1.1 Concentration based Land disposal restriction requirements

For concentration based standard, certification statement is required. The certification statement is prepared by the unit using the method described in 40 CFR 268.7b, d, and e. A copy of the certification is placed in the facility operating records. The criteria that apply to concentration based LDR can be worked out as follows:

- The waste is subject to LDR and the generator has determined that the waste meets the LDR for disposal.
- The generator develops the certification based on process knowledge and/or analytical data and supplies the appropriate LDR certification information necessary to demonstrate compliance with the LDR treatment standards of WAC 173-303-140.
- The waste is subject to LDR and the generator has treated the waste. The generator supplies the appropriate LDR certification information.
- State-only LDRs do not require this type of certification.
- When a LDR waste does not meet the applicable treatment standards set forth in 40 CFR 268.40 and WAC 173-303-140, or exceeds the application prohibition levels set forth in 40 CFR 268.32 or Section 3004(d) of RCRA, appropriate reporting should be carried.

1.3.4.1.2 Technology based Land disposal restriction requirements

EPA has consistently deferred to state regulatory agencies in deciding certain technology-based standards, for example, macro-encapsulation technology developed by Ultra-Tech. Ecology encourages testing of technology-based standards but the developed technology must meet the best demonstrated available technology (BDAT) for treatment of waste prior to land disposal. Ecology will evaluate each technology on a case-by-case basis. As a general guide, the documentation for the technology should be able to address among other criteria, the following:

- The capability of the technology to withstand degradation by radiation.
- Limits for the lifetime radiation dose to the technology material must be provided.
- Characteristics other than toxicity must be demonstrated to meet LDR.
- Volatilization of the waste or void filling material due to heat generated by the sealing process must be minimized.
- Free liquids are not present with the waste.
- Void spaces within the liner are minimized or eliminated with sufficient material.

1.3.4.2 Managing Incompatible Wastes

Incompatible wastes are the wastes hazardous waste that, when mixed with other waste or materials can produce harmful effects to human health and the environment. Such effects include generation of:

- Heat or pressure.
- Fire or explosion.
- Violent reaction.
- Toxic dusts, mists, fumes, or gases.
- Flammable fumes or gases.

The facilities managing that manage ignitable, reactive, or incompatible wastes must answer the basic question of how they will screen for contaminants that are incompatible with the storage process and with one another. See Table 1.2. A WAP submitted for approval by Ecology must include information that will ensure that waste management units meet the special requirements for ignitable, reactive, and incompatible wastes and are in compliance with permit conditions. Selection of waste analysis parameters must include measures to address issues associated with incompatible and inappropriate waste. Waste compatibility determinations are also important in selecting waste treatment approaches and methods.

Table 1-2 Compatibility Chart Examples

Compatibility Class*	Flammables (3, 4.1 & 4.2)	Oxidizers/Organic Peroxides (5.1 & 5.2)	Corrosives - Acids (8a)	Corrosives - Bases (8b)	Cyanides / Sulfides (8c)	Dangerous When Wet (4.3)	Poisons (6.1 PGI Zone A)
Flammables (3, 4.1 & 4.2)		X	X	X		X	X
Oxidizers / Organic Peroxides (5.1 & 5.2)	X		X		X	X	X
Class 9 / Compressed Gases (all hazard classes)							
Corrosives - Acids (8a)	X	X		X	X	X	X
Corrosive - Bases (8b)	X		X			X	X
Cyanides / Sulfides (8c)		X	X			X	X
Dangerous When Wet (4.3)	X	X	X	X	X		X
Poisons (6.1 PGI Zone A)	X	X	X	X	X	X	

*Compatibility is based on 49 CFR, Table 174.81 and 40 CFR, Part 265, Appendix V. Materials will be segregated by their primary hazard class. The requirements of this table do not apply to containerized materials packaged such that an outer container provides secondary containment and segregation (e.g., lab packs, overpacks).

An "X" designates that materials are incompatible. Incompatible materials must:

- Be placed in separate cells in container storage areas designated as North Drum Storage Area, South Drum Storage Area, TSCA/RCRA Storage, and Labpack Area on Drawing Number D1-1.
- Be placed in separate rows in container staging areas designated as South Check-in, Process Staging, and Stabilization Staging in Drawing Number D1-1.
- Not be placed together in secondary containment trays used to support processing equipment as described in permit Condition III.B.3.

** Except when there is a subsidiary hazard class, the waste will be segregated according to that class.

1.3.4.3 Health and Safety Considerations

The WAP is not intended to integrate health and safety requirements. However, consideration for incompatible waste, sampling, sample preparations, and analysis protocols do require the need for caution when handling wastes that may contain waste designated as D001, D003, P006, P031, P065, and P105 for example. It is crucial to handle these kinds of wastes with caution to avoid potential exposure of workers and the environment to extreme hazardous and toxic conditions.

The requirements for handling ignitable, reactive, and incompatible waste are contained in WAC 173-303-395. Precautions to prevent accidental ignition or reaction of ignitable or reactive waste by separating and protecting the waste from sources of ignition or reaction such as open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical, or mechanical), spontaneous ignition (e.g., from heat-producing chemical reactions), and radiant heat should be stated. Other precautions include, but are not limited to, use of personal protective equipment, lock-out tag-out procedures, or confined space entry procedures.

1.3.5 Waste Analysis Parameters

Waste analysis parameters are selected to meet the data needs to define waste and provide acceptable knowledge for managing or processing waste at the facility. Waste analysis parameters are facility specific and the rationale for selecting the parameters must be documented in the WAP. These parameters should be sufficient to meet the following:

- Identification of incompatible, reactive, or ignitable waste.
- Permit or regulatory requirements.
- Land disposal restrictions (LDR) requirements.
- Process activities requirements.
- Special waste (incompatible, ignitable, and reactive waste) requirements.

1.3.6 Quality Assurance/Quality Control (QA/QC)

The QA/QC ensures that waste sampling and testing meet the performance expectations set by the facility in order to confirm that waste received is as described in the shipping documentation. In addition, QA/QC program ensures that personnel performing activities are properly trained and current certifications are maintained in effective information management systems. The following QA/QC elements must be well documented in the WAP:

- Representative sampling methods as defined by WAC 173-303-110(2); 40 CFR 261 Appendix I; and/or SW-846 Chapter 8 (Multi-increment sampling) and Chapter 9.0.
- Appropriate sample containers and equipment.
- Appropriate chain-of-custody.
- Maintenance of log entries.
- Compliance with good laboratory practice.
- Field QA/QC samples (applicable SAP).
- Equipment calibration (current as appropriate).
- Sample preservation protocols.
- Sample preparation and analytical process requirements.
- Instrument maintenance and calibration requirements.
- Internal QC measures (e.g., method blanks, spikes, precision, and accuracy).
- Corrective action process.

Physical and chemical screening processes in the WAP do not require rigorous sampling and in-depth laboratory analyses. However, WAP projects that require a SAP must have detailed prescriptive QC clearly outlined for the data quality. In addition, the facility using a WAP must provide a well documented and Ecology approved QA/QC plan.

1.3.7 Sampling Strategies and Procedures

The ultimate strategy is to obtain representative samples that produce scientifically reliable and defensible data. Planning before sampling addresses the objectives of sample collection, types of sample (grab vs. composite), sampling locations and frequencies, number of samples, sample collection methods, and sample handling. The section of the WAP describing the sampling and analysis plan may not necessarily involve standard sampling methods, but whatever sampling methods used should be described in the WAP. All sampling equipment to be used for collection of each sample should be listed. The methods used to obtain representative samples must be provided. Section 2 of this guidance document gives more detailed information about sampling and analysis plans.

1.3.8 Testing and Analytical methods

The WAP will contain testing and analytical methods for each parameter to be used in obtaining information about the waste. Analytical methods chosen must consider ALARA principles, the physical state of the waste, analytes of interest, and required detection limits. The WAP should also contain information on the sample preparation and cleanup methods to be used in the testing. Both field testing and laboratory testing may be used.

1.3.8.1 Field Screening (Physical and Chemical Screening)

Physical and chemical screenings are used as means of verifying waste profile information. The process for selecting containers for physical and chemical screening must be documented during the pre-acceptance/pre-shipment review process. Physical and chemical screening methods must have acceptable performance levels (precision and accuracy) to yield valid information for credible decisions.

All screening equipment must be validated against varying physical conditions such as humidity, temperature, etc. before use in order to document their effectiveness for the testing of interest. Regular calibrations checks before use must be current to ensure that the equipment is functioning properly. This check will be documented in equipment log books. Selection of physical and chemical screening parameters and rationales for using them, testing, and interpretation of data must be documented and conducted by well-trained personnel. Tamper-resistant seals are applied to each container that has been examined.

1.3.8.1.1 Initial Screening Frequency

Initial screening frequency determination is based on concerns identified during the waste profile review process. Misdesignation or inappropriate segregation of waste or other discrepancies will result in more scrutiny of the generator's waste documentation and finger printing. The facility Performance Evaluation System records and tracks discrepancies and initial screening frequencies. For example, a facility may adopt a statistical approach to initial screening or administratively set as a general guidance of initial screening as follows:

- 20 percent No concerns.
- 50 percent Concerns identified in one criterion.
- 100 percent Concerns identified in two or more criteria.

A minimum verification rate of every bulk load and at least 10 percent of containers of every waste stream should be screened in every waste shipment. In case of a waste discrepancy, 100 percent verification is used.

1.3.8.1.2 Physical Screening Quality Control

The following QC elements apply to nondestructive examination (NDE) used for physical screening to ensure that quality data are obtained:

- Perform a penetration test when the components generating image data are changed to document that the system capability has not changed.
- Perform a resolution test at the beginning of a shift. A shift ends when shutdown activities occur. A shift can be up to 24-hours.
- Perform, at a minimum, an annual capability demonstration on a training drum.
- A qualified radiographer who has SNI-TC-IA, Level II certification of American Society of Nondestructive Testing training or equivalent is required to run the NDE test.
- The examination must cover 100 percent of the waste in the container.

Table 1.3 is an example of physical screening parameters and their rationales.

Table 1-3 Example Parameters and Rationale for Physical Screening

Parameter	Method	Rationale for Selection	Failure Criteria
Visual inspection	Field method – open the container, remove contents as needed, observe phases, presence of solids in waste. Probe homogenous loose solids to determine the presence of material not documented on the waste stream documentation, or for improperly absorbed liquids. Compare visual observations with the applicable profile information and the container specific information in the waste stream documentation.	Confirm consistency between waste and shipping documentation.	A container fails inspection for any of the following reasons: • Undocumented, improperly packaged, or inadequately absorbed liquids. • The presence of prohibited articles or materials listed. • Discovery of material not consistent with the applicable waste stream documentation. • Variability greater than 25 percent by volume in listed constituents (e.g., paper, plastic, cloth, metal).
Nondestructive examination (NDE)	Field method - scan the container with a NDE system. Observe data on a video monitor, capture, and record information. Experienced personnel with the interpretation of NDE imagery are required to make and record NDE observations. These observations are compared to the contents listed on the shipping documentation.	Confirm consistency between waste and shipping documentation. Containers that cannot be screened by visual inspection due to their physical content and ALARA concerns can be safely and economically examined.	A container fails the inspection for any of the following reasons: • Undocumented, improperly packaged, or inadequately absorbed liquids. • Discovery of prohibited articles listed. • Image data not consistent with the applicable waste stream documentation. • Variability greater than 25 percent by volume in listed constituents (e.g., paper, plastic, cloth, metal).

1.3.7.1.3 Chemical Screening Quality Control

The following QC elements are used when performing chemical screening. Table 1.4 is an example of chemical screening sampling equipment and Table 1.5 shows parameters and their rationales for chemical screening.

- Use appropriate sample containers and equipment.
  - Containers and equipment must be of appropriate size and are chemically compatible with the waste and testing reagents.
- Reagent checks
  - Use reagent grade water from a documented source.
- Label chemicals and test kits so that they are traceable and documented in the facility operating record.
  - Perform QC checks on each lot of test kits and associated reagents and document in the facility operating record.
- Personnel must be adequately trained. The current qualifications/certifications of personnel performing chemical screening should be on record.

Table 1-4 Examples of Chemical Screening Sampling Equipment

Waste Form	Waste Type	Equipment*
Liquids	Free-flowing liquids and slurries	COLIWASA*, glass thief or pipet
Solidified liquids	Sludges	Trier, scoops and shovels
Sludges	Sludges	Trier, scoops and shovels
Soils	Sand or packed powders and granules	Auger, scoops and shovels
Absorbents	Large-grained solids	Large trier, scoops and shovels
Wet absorbents	Moist powders or granules	Trier, scoops and shovels
Process solids and salts	Moist powders or granules	Trier, scoops and shovels
	Dry powders or granules	Thief, scoops and shovels
	Sand or packed powders and granules	Auger, scoops and shovels
	Large-grained solids	Large trier, scoops and shovels
Ion exchange resins	Moist powders or granules	Trier, scoops and shovels
	Dry powders or granules	Thief, scoops and shovels
	Sand or packed powders and granules	Auger, scoops and shovels

*COLIWASA = composite liquid waste sampler.
*Reference in SW-846, Chapter 9.0 and other equipment approved by American Society for Testing and Materials (ASTM) could be used to collect samples.

Table 1-5 Example Parameters and Rationale for Chemical Screening

Parameter	Method	Rationale for Selection	Failure Criteria
Ignitability and/or headspace volatile organic compound screening	Organic vapor monitor, colorimetric gas sampling tubes, or a lower explosive level meter. Analyze a sample of the headspace gases in a container by one or more of instruments.	Confirm consistency between waste and shipping documentation; ensure compliance with WAC 173-303-395(1)(b). Determine potential ignitability and the presence or absence of volatile organic compounds in waste, Ensure that personnel are adequately protected.	A container fails the inspection if there is high organic vapor readings in matrices compared to the documented contents of the waste profile constitutes failure.
Peroxide	Field peroxide test paper. Dampen a test strip with a pipette drop of liquid sample. Solids are tested by first wetting the test strip with water and contacting a small sample of the waste. A blue color change indicates a positive reaction and compared with a chart on the packaging to determine an approximate concentration of organic peroxide. The test is sensitive to low parts per million ranges.	Confirm consistency between waste and shipping documentation; ensure compliance with WAC 173-303-395(1)(b). Determine the presence of organic peroxides in waste. Alert personnel of potential hazards. Ensure safe segregation and storage of incompatible waste.	Results that are not consistent with documented constituents are a verification failure. Unstabilized organic peroxide formers > 20 parts per million concentrations constitutes failure.
Paint filter test	EPA method 9095 SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (the most recently promulgated version). Add 100 cubic centimeters or 100 grams of waste to a standard paint filter. Allow to settle for 5 minutes.	Confirm consistency between waste and shipping documentation. Verify the presence or absence of free liquid in solid or semisolid material.	Any liquid passing through the filter signifies failure of the test. Small quantities of condensate trapped in inner plastic liner folds are NOT considered failure of the test.

Table 1.5 Example Parameters and Rationale for Chemical Screening Cont'd

Parameter	**Method**	**Rationale for Selection**	**Failure Criteria**
Flashpoint	EPA method 1010/1020 SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Method* or equivalent ASTM tests such as Pensky-Martens Closed Cup Tester.	Confirm consistency between waste and shipping documentation. Provide documentation for safe storage conditions and determine regulatory status as D001 waste. Provide proper waste designation and applicability of LDR requirements	Flash point > 60 ^{o}C (140 ^{o}F) constitutes a failure.
pH	Field pH screen (pH paper method)	Confirm consistency between waste and shipping documentation; ensure compliance with WAC 173-303-395(1)(b). Identify the pH and corrosive nature of an aqueous or solid waste. Ensure safe segregation and storage of incompatible waste,	If waste is not documented as appropriate the container fails verification if the pH of waste exceeds regulatory limits (less than or equal to 2.0 or greater than or equal to 12.5).
Oxidizer	Field potassium iodide test paper. Add 1 or 2 drops of 3N HCl acid to the Oxidizer test paper (potassium iodide, starch). Touch the test paper to a pea-size sample of the waste. A black, blue/black, or purple color change determines a positive oxidizer test. This test can be applied to waste liquids, solids, and semisolids.	Confirm consistency between waste and shipping documentation; ensure compliance with WAC 173-303-395(1)(b). Determine if a waste exhibits oxidizing properties. Ensure safe segregation and storage of incompatible waste,	A positive indication in a waste that is not consistent with documented waste profile constitutes a failure of verification.

Table 1.5 Example Parameters and Rationale for Chemical Screening Cont'd

Parameter	Method	Rationale for Selection	Failure Criteria
Water reactivity	Field water mix screen. Add 2 or 3 drops of distilled water to an oxidizer test paper strip. Touch the test paper to a pea size sample of the waste.	Confirm consistency between waste and shipping documentation; ensure compliance with WAC 173-303-395(1)(b). Determine if the waste has the potential to react vigorously with water to form gases or other toxic reaction products. Ensure safe segregation and storage of incompatible waste.	Observed effervescence, a violent reaction, flaming or boiling indicates a positive test and a failure of verification that if result is not consistent with documented profile.
Cyanides	Field cyanide screen. Dissolve a pea size sample of the waste in a small quantity of water in a stoppered test tube. Add a mixture of ferrous ammonium sulfate and ferrous ammonium citrate to the stoppered test tube. Shake the test tube and add 3N HCl to the solution.	Confirm consistency between waste and shipping documentation; ensure compliance with WAC 173-303-395(1)(b). Indicate if waste could release hydrogen cyanide on acidification near pH 2. Ensure safe segregation and storage of incompatible waste and to confirm consistency	A dark Prussian blue color change indicates the presence of cyanides and a failure if waste profile is not consistent with documented constituents.
Sulfides	Field sulfide screen. Add 5 drops of 3N HCl acid to a pea size sample of the waste. Touch lead acetate test paper to the sample.	Confirm consistency between waste and shipping documentation; ensure compliance with WAC 173-303-395(1)(b). Indicate if the waste would release hydrogen sulfide on acidification near pH 2. Ensure safe segregation and storage of incompatible wastes.	A brown or black color change of paper indicates a positive test and a failure if the waste profile is not consistent with documented constituents.
Halogenated Organic Carbons	Screening test method for PCBs in transformer oil (SW-846, Method 9079 or Field organic chlorine tests appropriate to the matrix, such as those offered by the Dexsil Corporation (e.g., Chlor-N-Oil, Chlor-N-Soil).	Confirm consistency between waste and shipping documentation. Indicate whether PCBs or other chlorinated solvents are present in the waste.	A positive indication of chlorinated organics in a waste that is not documented as having chlorinated organic constituent is a failure.

1.3.7.2 Laboratory Testing

The selection of the laboratories that would perform analytical testing must be based on the ability of the laboratory to demonstrate experience and capability in technical analytical expertise, comprehensive QA/QC program, and effective information management systems. The laboratory QA/QC plan should be available to Ecology for review and acceptance before commencement of analytical work, in accordance with TPA Action Plan Section 6.5.

All analytical work shall be defined and controlled by a statement of work, work order, or other work authorizing documentation. These authorization documents shall include QA performance requirements. Samples will be handled according to written, approved, and controlled laboratory processes. The accuracy, precision, and limitations of analytical data are evaluated through QC performance. An independent organization (or Ecology) will audit each laboratory at regularly scheduled periods to evaluate the effective implementation of the laboratory's QA/QC program. QA personnel and a technical expert shall evaluate the laboratory through onsite observations and/or reviews of copies of the QA/QC documents, records of surveillances/inspections, audits, non-conformances, and corrective actions.

1.3.7.3 Use of Waste Knowledge

Knowledge, as defined in WAC 173-303-040, means information that is known about the generation of a waste that can be used in the place of laboratory analysis. For example, if all chemical constituents used in an industrial process that generates a waste are known and the formation of the waste by-products from the industrial process is well understood, then that information might be adequate, without direct analysis of the waste, to complete a waste profile.

Data used for decision-making need to be scientifically sound, of known quality, and thoroughly documented. Data are assessed to determine compliance with quality standards approved by Ecology. When the Facility relies on "acceptable knowledge" provided by the generator to complete a waste profile for a waste stream, the facility is expected by Ecology to take the following precautions/actions:

- Visit the generator's site to observe and review the generator's processes sampling data and/or other information to ensure that such data and information meets the requirements for using "acceptable knowledge" (WAC 173-303-040).
- Compare the generator's process and documented studies for the profile to ensure the accuracy of the profile.
- Facility is expected to maintain documentation/records of the information used to create the profile.

Process knowledge is acceptable knowledge that can be obtained from existing published or documented waste analysis data or studies on processes similar to those that generated the waste, including but not limited to the following:

- Mass balance from various inputs.
- Material safety data sheets (MSDSs) on unused chemical products.
- Test data from a surrogate sample.

- Analytical data on the waste or a waste from a similar process.
- Interview information.
- Logbooks.
- Procurement records.
- Qualified analytical data.
- Processes and/or methods.
- Process flow charts.
- Inventory sheets.
- Vendor information.

1.3.8 Records

WAC 173-303-300 and WAC 173-303-370 mention required documentation that must be used to track waste and confirm its identity from the “cradle to the grave.” Example of waste documentation for recordkeeping:

- Detailed physical and chemical analysis data.
- Information to meet the definition of “knowledge.”
- Waste received matches waste specified on the manifest or shipping paper.
- Procedures for waste inspection, handling, analysis, sampling, etc.
- Signed manifests and letters.

All records of test results, waste analyses, or other determinations performed for the purpose of designating, treating, storing, or disposing of dangerous waste are kept in the operating record until final facility closure (WAC 173-303-380[1][c] and WAC 173-303-210[1]).

1.4 WAP Checklist

Table 1-6 Waste Analysis Plan (WAP) Checklist

Mark either yes, no, or not applicable (N/A) of the questions depending on the facility specific content of the WAP being reviewed.

Waste Analysis Plan Requirements and Associated Washington Administrative Code		YES	NO	N/A	WAP PAGE #	COMMENTS
1. Waste Analysis Plan: WAC-173-303-300(5) and WAC-173-303-806(3) and (4)(a)(i)-(iii)						
(a) Has the facility provided a copy of the waste analysis plan (WAP) that describes physical and chemical information gathering processes that will enable the facility to safely and effectively manage, treat, store, or dispose of the waste in accordance with the permit and regulations?						
(b) Are descriptions of facility/units provided?	The structures used for storing waste					
	Waste managed in the facility					
	Description of unit processing area					
	Processes that generate and treat wastes					
	Unit compatibility and safety considerations					
	The waste being managed in each unit of the facility.					
(c) Are all hazardous wastes generated or managed at the facility adequately described?	Identity of hazardous waste					
	Waste physical and chemical characteristics					
	Waste classifications					
(d) Does the facility specify how to identify and manage incompatible waste?						
(e) Does the WAP contain limitation of waste **NOT to be** managed in the facility?						
2. Waste Acceptance and Confirmation Process WAC-173-303-300(2), WAC 178-303-140 and WAC-173-303-380						
(a) Does the facility have a waste tracking process?						
(b) Is the waste pre- acceptance criteria clearly described in the WAP?						
(c) Is the waste pre-acceptance/ pre-shipment requirements based on	Generator knowledge *only*					
	Initial finger printing (screening) analysis *only*					
	Both generator knowledge and screening analysis					
(d) Is the waste profiling process described in the WAP?						
(e) Does the WAP contain waste stream approval process?						
(f) Are there processes in place to ensure waste are within the acceptance limits?						
(g) Is the verification process properly described in the WAP?						

Waste Analysis Plan Requirements and Associated Washington Administrative Code		YES	NO	N/A	WAP PAGE #	COMMENTS
(h) Does the WAP contain shipment/transfer approval process?						
(i) Is there a description of Performance Evaluation System to handle discrepancies?						
(j) Are the LDR restrictions requirements described in the WAP?	(i) Concentration based treatment standards					
	(ii) Technology based treatment standards					
(k)						
3. Waste Analysis Parameters						
(a) Does the WAP contain a list of parameters for waste analysis?						
(b) Does the WAP contain the rationale for each parameter listed?						
(c) Will the selected waste analysis parameters be able to address regulator and permit acceptance limits?						
(d) Does the facility test the waste before and after treatment to ensure regulatory and permitting compliance?						
4. Land Disposal Restriction Requirements						
(a) Does the WAP contain LDR requirements?						
(b) Is there a process for the identification of restricted waste under LDR in the WAP?						
(c) For Concentration based treatment standard, does the WAP specify methods to determine that the standards are met?						
(d) Does the WAP describe the certification process for LDR requirements?						
(e) For Technology based standards, does the WAP describe the criteria that meet BDAT?						
5. Quality Assurance/Quality Control (QA/QC)						
(a) Does the WAP contain a description of QA/QC plan?						
(b) Are the physical and chemical screening QA/QC requirements contained in the WAP?						
(c) Are the QC limits such as method blanks, matrix spikes, duplicate samples, detection limits, etc., for laboratory testing clearly specified?						
6. Sampling Strategies and Procedures						
(a) Are sampling strategies (grab vs. composite) specified in the WAP?						
(b) Is the sampling equipment listed appropriate for each waste type?						
(c) Does the WAP identify the sampling location(s), frequencies, and number of samples?						
(d) Are there modified or non-standard methods listed and justification provided?						
(e) Has a statistical strategy for obtaining representative samples been described in the WAP?						
(f) Are there health and safety considerations (e.g., ALARA) for the sampling personnel?						

Waste Analysis Plan Requirements and Associated Washington Administrative Code	YES	NO	N/A	WAP PAGE #	COMMENTS
7. Analytical Methods and Testing					
(a) Have physical and chemical screening methods been identified?					
(b) Are the rationales for the methods specified in the WAP?					
(c) Are the criteria for screening frequencies and retesting identified in the WAP?					
(d) Does the WAP describe methods for ignitable, incompatible, and reactive waste?					
(e) Does the WAP list regulatory methods such as EPA SW-846 method numbers?					
(f) Are there justifications for modified or non-standard methods in the WAP?					
(g) Has the facility specified if they use onsite or offsite laboratory for testing?					
(h) Does the laboratory have a comprehensive QA/QC program accessible for Ecology's review and acceptance?					
(i) Does the facility have written communication methods such as work instructions, statement of work, work order, etc., with the laboratory before start of analysis?					
(j) Is the laboratory accessible for onsite visit, surveillance, and audits?					
(k) Have the criteria for waste re-evaluation frequencies been established in the WAP?					
8. Use of Acceptable Knowledge					
(f) Are there procedures for verification of process information from offsite generator?					
(g) Are the sources of information for Acceptable Knowledge in lieu of testing available in the WAP?					
(h) Does the Acceptable Knowledge meet regulatory requirements such as LDR requirements?					
9. Records					
(a) Does the WAP state that all supporting data for waste Acceptable Knowledge will be maintained in the facility's operating record?					
(b) Does the WAP contain a state that the sampling and analysis records and the associated waste designation information are to be maintained in the facility's operating records?					

2. Sampling and Analysis Plan (SAP)

2.1 Introduction

Sampling and analysis of waste for regulatory compliance is required to determine hazardous waste for safe waste management, treatment, storage, and proper disposal. An SAP begins with the planning process of establishing scope and data usage such as Data Quality Objectives (DQOs) process and establishing Quality Assurance Project Plan (QAPP) for the project. Because SAP is project specific, it gives prescriptive details for obtaining representative samples of the waste, outlines analytical tests, and data assessment. The primary purpose of SAP is identifying or verifying the chemical and physical characteristics of a waste.

Reference documents describing detailed sampling and analysis plan include HASQARD, EPA's RCRA Sampling technical guidance documents, and Ecology's guidelines for preparing quality assurance project plans for environmental studies. For most regulatory work associated with Hanford Site, HASQARD has well detailed section on SAP. Nevertheless, because NWP regulates other facilities as well, it is not redundant in this guidance to summarize Ecology's requirements for SAP that may have been documented in HASQARD.

2.2 Regulatory Drivers

Regulatory drivers for SAP are documented in 40 CFR 261, 264, 265, and 268, WAC 173-303-110, and Model Toxics Control Act (MTCA), WAC 173-340.

2.3 SAP Essential Processes

The essential processes involved in crafting acceptable SAP include but not limited to:

- Documented planning process such as DQO process to establish data needs and requirements and QAPP process.
- Sampling procedures to obtain representative samples.
- Handling of samples (including chain of custody, transportation, storage, and disposal of samples at the end of the analysis).
- QA/QC section.
- Laboratory measurements and re-testing.
- Test reports and data transmission.
- Recordkeeping.

2.3.1 Documented DQO and QAPP process

The initial planning stage of the project involves clearly stating and collectively understanding the purposes for sample collection and analyses. Planning ahead of sampling addresses the objectives of sample collection, types of sample (grab vs. composite), sampling locations and frequencies, number of samples, sample collection methods, and sample handling. Ecology's publication on preparing quality assurance project plans and the EPA's DQO process should be followed in the planning process in order to execute sampling and analysis that are successful, cost-effective, and defensible. The EPA DQO process involves seven steps as listed below.

Steps in the DQO Process

Step 1: State the Problem.

Step 2: Identify the Decision.

Step 3: Identify Inputs to the Decision.

Step 4: Define the Study Boundaries.

Step 5: Develop a Decision Rule.

Step 6: Specify Limits on Decision Errors.

Step 7: Optimize the Design for Obtaining Data.

Ecology's publication on preparing quality assurance project plans listed seven steps of Performance and Acceptance Criteria Process (PAC) as follows:

Steps in PAC Process

Step 1: State the Problem.

Step 2: Identify the Decision.

Step 3: Identify Inputs to the Decision.

Step 4: Define the Study Boundaries.

Step 5: Develop a Decision Rule.

Step 6: Specify Limits on Decision Errors.

Step 7: Optimize the Design for Obtaining Data.

The DQO and PAC are used in initial planning process of the project.

2.3.2 Sampling procedures to obtain representative samples.

Statistical approaches to sampling, though not necessarily required by regulations, should be the norm in a strategy for sample collection. Because analytical data obtained from sampling and analysis are to be used in making informed decisions that affect people and the environment, statistical approaches in sampling and data evaluation are useful in managing uncertainty in the decision process. In sample collection, there is a need to obtain sample(s) that would represent the whole.

A representative sample has been defined as the sample with physical and chemical characteristics that represent the average values of the population of interest with well-defined spatial and temporal boundaries. Depending on sample use, probabilistic sampling (simple random, stratified random, systematic, ranked set, sequential, and multi-increment) or authoritative sampling (judgmental or hotspot and biased) may be used. Whatever sampling methods used should be described in the SAP. The number of samples to be collected should be specified as well.
ASTM offers several sampling guides. SW-846 Chapter 9 contains RCRA sampling guidance

and Chapter 8 includes multi-increment sampling approach. Table 2.1 shows examples of selecting sampling equipment. The Visual Sample Plan software is a statistical tool that is available at Hanford Site for designing sampling plans aimed at obtaining representative sample.

A basic sampling sequence includes the following:

- Obtain a unique sample number and complete the sample tag before sampling.
- Obtain a pre-cleaned sampler and sample bottles.
- Attach sample label to sample bottles.
- For sampling liquid waste, use a sampler or pipet to sample for two phase liquids. Homogeneous liquids in small containers will be poured into a sample bottle.
- For sampling solid waste, use a scoop, trier, or hand auger to obtain a sample of the waste. For large containers of waste, composite several augers or scoops to ensure samples are representative.
- Fill sample containers in the following analyte group sequence: volatile organics, semivolatile organics, metals, ignitability, pH (corrosivity).
- For solid waste, wipe the exterior surfaces of the sample bottles with a dry rag.
- Attach sample labels to outer plastic bags.
- Place samples in an appropriate receptacle for transfer to the laboratory
- Complete the chain-of-custody forms.
- Seal and mark the receptacle.
- Transfer receptacle to the analytical laboratory, as appropriate to meet sample holding times.
- Properly clean and decontaminate nondisposable sampling equipment or package for return to central sampling equipment decontamination area according to onsite requirements.

Table 2-1 Selecting Sampling Equipment Table Example

Waste form	**Reference in SW-846, Chapter 9.0**	
	Waste type	**Equipment**
Liquids	Free-flowing liquids and slurries	COLIWASA, glass thief or pipet
Solidified liquids	Sludges	Trier, scoops and shovels
Sludges	Sludges	Trier, scoops and shovels
Soils	Sand or packed powders and granules	Auger, scoops and shovels
Absorbents	Large-grained solids	Large trier, scoops and shovels

2.3.3 Handling of samples

Selection of appropriate sample containers, chain of custody, transportation, sample preservation and holding times, methods of storage, and disposal of samples at the end of the analysis information should be described in the SAP. Table 2.2 shows examples of sample matrix, analytical parameters, and sample handling detailing sample preservation and holding times.

Table 2-2 Examples of Sample Matrices, Analytical Parameters, Preservation, and Holding Time[a]

Matrix/Parameters To Be Analyzed	Sample Container Type and Materials	Preservation Method	Maximum Holding Time
SOLIDS			
Volatile organics (total)	Widemouth glass w/Teflon liner	Cool to 4° C	14 days
Semivolatile organics (total)	Widemouth glass w/Teflon liner	Cool to 4° C	14 days for extraction 40 days for analysis
Pesticides, herbicides, and insecticides (total EPA scan)	Widemouth glass w/Teflon liner	Cool to 4° C	14 days for extraction 40 days for analysis
Polychlorinated biphenyls (PCBs)	Widemouth glass w/Teflon liner	Cool to 4° C	14 days for extraction 40 days for analysis
Dioxins and furans	Widemouth glass w/Teflon liner	Cool to 4° C	14 days for extraction 40 days for analysis
Mercury (total)	Widemouth glass w/Teflon liner	Cool to 4° C	28 days for extraction 28 days for analysis
Chromium (VI)	Widemouth glass w/Teflon liner	Cool to 4° C	24 hours
All other metals (total)	Widemouth glass w/Teflon liner	None	6 months for extraction 6 months for analysis
pH	Widemouth glass w/Teflon liner	None	Analyze immediately
Total organic halogens (TOX)	Widemouth glass w/Teflon liner	Cool to 4° C	7 days
Total organic carbon (TOC)	Widemouth glass w/Teflon liner	Cool to 4° C	28 days
Toxic volatile organics, per TC rule	Widemouth glass w/Teflon liner	Cool to 4° C	14 days for TCLP 14 days for analysis
Toxic semivolatile organics, per the TC rule	Widemouth glass w/Teflon liner	Cool to 4° C	14 days for TCLP 7 days for extraction 40 days for analysis

Matrix/Parameters To Be Analyzed	Sample Container Type and Materials	Preservation Method	Maximum Holding Time
TC pesticides and herbicides	Widemouth glass w/Teflon liner	Cool to 4° C	14 days for TCLP 7 days for extraction 40 days for analysis
Concentrated Waste Samples w/Teflon liner	Widemouth glass	None	14 days
Metals (TCLP) w/Teflon liner 6 months for analysis	Widemouth Glass	Cool to 4° C	6 months for TCLP
Mercury (TCLP) w/Teflon liner 28 days for analysis	Widemouth Glass	Cool to 4° C	28 days for TCLP
LIQUIDS			
Metals (TCLP))	Widemouth glass	Cool to 4° C	6 months for TCLP 6 months for analysis
Mercury (TCLP)	Widemouth glass	Cool to 4° C	28 days for TCLP 28 days for analysis
Volatile organics	40 mL VOA Vial	Cool to 4° C; pH<2 HCl; $Na_2S_2O_3$	14 days
Semivolatile organics	1 Liter Amber glass	Cool to 4° C $Na_2S_2O_3$	7 days for extraction 40 days for analysis
Pesticides, herbicides, and insecticides	1 Liter Amber glass	Cool to 4° C pH: 5-9	7 days for extraction 40 days for analysis
Polychlorinated biphenyls (PCBs)	1 Liter Amber glass	Cool to 4° C	7 days for extraction 40 days for analysis
Dioxins and furans	1 Liter Amber glass	Cool to 4° C $Na_2S_2O_3$	7 days for extraction 40 days for analysis
Metals (total)	1 Liter polyethylene	Cool to 4° C pH<2 HNO_3	6 months for analysis

Matrix/Parameters To Be Analyzed	Sample Container Type and Materials	Preservation Method	Maximum Holding Time
Mercury (total)	1 Liter polyethylene or Widemouth glass	Cool to 4° C pH<2 HNO_3	13 days (plastic) 38 days (glass)
Chromium (VI)	500 mL Amber glass	Cool to 4° C	24 Hours
pH	Glass or polyethylene	None	Analyze immediately
Total organic halogens (TOX)	1 Liter Amber glass	Cool to 4° C pH<2 H_2SO_4	7 days
Total organic carbon (TOX)	1 Liter Amber glass	Cool to 4° C; pH<2 HCl or H_2SO_4	28 days
Concentrated Waste Samples	Widemouth Glass w/Teflon lines	None	14 days

[a] Samples of high analyte concentration generally do not require preservation. When chemical preservation is required, care must be taken to ensure that incompatible preservations are not added. For example, an aqueous sample that is to be analyzed for metals should not have acid added to it if the sample also contains cyanides.

Source: EPA's SW-846, and Methods for Chemical Analysis of Water and Wastes (600/4-79-020)

2.3.4 Quality Assurance/Quality Control

Quality Assurance/Quality Control section of SAP spells out in detail the processes and parameters that are to be employed in obtaining technically credible, properly documented, and defensible data. These include the following qualitative information:

- Appropriate sample containers and equipment.
- Samples numbering.
- Traceable labeling system.
- Chain-of-custody procedures.
- Maintaining of records.
- Log entries such as date, time, batch numbers, sampling location, etc.
- Industrial hygiene and safety protocols.
- Field observations including sample matrix information.
- Sample preservation protocols.
- Sample preparation and analytical process requirements.
- Corrective action process.
- Signatures of personnel.

The quality control section must have quantitative information including the following:

- Blanks (field, trip, method blanks).
- Spikes (matrix, surrogate) samples.
- Split samples.
- Field duplicate sample.
- Detection limits.
- Duplicate/replicate samples.

2.3.4 Laboratory testing and re-testing

The laboratory analytical testing is intended to support the accurate designation of waste and to demonstrate compliance with regulations. Selection of the laboratory to perform regulatory work will be based on the ability of the laboratory to demonstrate:

- Experience and capability in technical analytical expertise.
- A well-written QA/QC program.
- Following written analytical procedure(s).
- An effective information management system.

Ecology's requirements for testing methods are contained in WAC 173-303-110. Although EPA's new method innovation rule relaxed the requirements for SW-846 methods as the sole regulatory method for RCRA, Washington State Department of Ecology still uses EPA's SW-846 methods to meet its regulatory requirements for quality data.

Table 2.3 shows analytical parameters, methods, and rationale for the testing. Ecology also has some flexibility in methods innovation as written in WAC 173-303-110 and laboratories that have the newest and the best **rigorously proven** methods not listed in WAC 173-303-110 should not hesitate to work with the Nuclear Waste Program to validate the use of such methods.

The laboratory QC program is designed to minimize errors and provide quality analytical data and must include clearly specified internal measures such as

- Instrument calibration and verifications.
- Method detection limits (MDL).
- Precision.
- Accuracy.
- Instrument maintenance.
- Laboratory control sample (LCS).
- Success in externally provided performance evaluation (PE) samples.

Contract Laboratory Services

The Nuclear Waste Program uses a competitive process to select a laboratory to do work. The process involves careful evaluation of the laboratory's capabilities and performance track records. All analytical work shall be defined and controlled by a statement of work, work order, or other work authorizing documentation. Although Ecology has its own certified laboratory, all mixed waste samples are sent to contract laboratories because Ecology's laboratory at Manchester, Washington is not set up to do radioactive samples.

Ecology will audit (or receive audit records from an independent organization) each laboratory on a regularly specified time period to evaluate the effective implementation of the laboratory's QA/QC program.

Table 2-3. Analytical Parameters, Methods, and Rationale Example

<table>
<tr><th colspan="2">Parameter</th><th>Analytical Method[a]</th><th>Waste matrix</th><th>Rationale for analysis</th></tr>
<tr><td colspan="5">General chemistry</td></tr>
<tr><td colspan="2">Flashpoint</td><td>1010/1020</td><td>Liquid</td><td>Waste designation and regulatory status as D001 waste for proper storage and LDR applicability requirements</td></tr>
<tr><td rowspan="2">pH</td><td>Liquid</td><td>9040</td><td>Liquid, sludge</td><td rowspan="2">Waste designation and regulatory status as D002 waste for proper storage, LDR applicability requirements, and State-only requirements.</td></tr>
<tr><td>Solid</td><td>9045</td><td>Solid</td></tr>
<tr><td colspan="2">Hydroxide</td><td>9040</td><td>Liquid</td><td>Proper waste acceptance profile, safe storage, treatment, and disposal.</td></tr>
</table>

Parameter	Analytical Method[a]	Waste matrix	Rationale for analysis
Water reactivity	Field method	Liquid, sludge	Waste designation and regulatory status as D003 waste, safe storage and safe waste management practices.
Free liquids	9095	Liquid, sludge, solid	State-only LDR waste designation status and appropriate waste treatment.
Cyanide	9010/9012	Liquid, sludge, solid	Waste designation and regulatory status as D003 waste for safe storage and LDR applicability requirements and waste treatment.
Sulfide	9030	Liquid, sludge, solid	Waste designation and regulatory status as D003 waste for safe storage and LDR applicability requirements and waste treatment.
Organics			
PCBs	8082	Liquid, sludge, solid	Waste designation and regulatory status as WPSB waste for safe storage, LDR requirements, and the Toxic Substance Control Act (TSCA) of 1976 requirements.
Total organic carbon	9060	Liquid, sludge, solid	State-only LDR waste designation status and appropriate waste treatment.
Total organic halides	9020/9021/9022	Liquid, sludge	State-only LDR waste designation status and appropriate waste treatment.
Persistent constituents	9075/9076/9077/ 9211/9212/9214/ 9250/9251/9253		
Total suspended solids	160.2[b]	Liquid, sludge	LDR waste requirements and applicable wastewater status.
Volatile organic compounds	1311/8260	Liquid, sludge, solid	LDR waste requirements, waste designation, and regulatory status.
Semi volatile organic compounds	1311/8270	Liquid, sludge, solid	LDR waste requirements, waste designation, and regulatory status.

Parameter	Analytical Method[a]	Waste matrix	Rationale for analysis
Chlorinated herbicides	8151	Liquid	State-only LDR waste designation status and appropriate waste management and treatment.
Inorganic			
Arsenic	1311/6010 200.7[b]	Liquid, sludge, solid	Waste designation and regulatory status as D004 toxic characteristic waste for safe storage and LDR requirements and waste treatment.
Barium	1311/6010	Liquid, sludge, solid	Waste designation and regulatory status as D005 toxic characteristic waste for safe storage and LDR requirements and waste treatment.
Cadmium	1311/6010	Liquid, sludge, solid	Waste designation and regulatory status as D006 toxic characteristic waste for safe storage and LDR requirements and waste treatment.
Chromium	1311/6010	Liquid, sludge, solid	Waste designation and regulatory status as D007 toxic characteristic waste for safe storage and LDR requirements and waste treatment.
Lead	1311/6010 200.7[b]	Liquid, sludge, solid	Waste designation and regulatory status as D008 toxic characteristic waste for safe storage and LDR requirements and waste treatment.
Mercury	1311/7470/6020	Liquid, sludge, solid	Waste designation and regulatory status as D009 toxic characteristic waste for safe storage and LDR requirements and waste treatment.
Silver	1311/6010	Liquid, sludge, solid	Waste designation and regulatory status as D011 toxic characteristic waste for safe storage and LDR requirements and waste treatment.
Selenium	1311/6010 200.7[b]	Liquid, sludge, solid	Waste designation and regulatory status as D010 toxic characteristic waste for safe storage and LDR requirements and waste treatment.
Nickel	6010	Liquid, sludge, solid	LDR waste requirements, safe waste storage, treatment, and regulatory status.

[a] Procedures based on EPA SW-846, unless otherwise noted. When regulations require a specific method, the method shall be followed.
[b] EPA-600/4-79020, unless otherwise noted.
LDR = land disposal restriction.
PCB = polychlorinated biphenyls

2.3.5 Test reports and Data Transmission

A data quality assessment is used in evaluating data to ascertain if the data will meet the intended purposes. Before data are reported, trained personnel should carefully review all data for precision, accuracy, completeness, comparability, and representativeness.

2.3.6 Recordkeeping

Record keeping is a very important aspect of QA/QC and will be discussed further in Section 3 of this guidance document.

2.4 SAP Checklist

Table 2-4 Sampling and Analysis Plan (SAP) Checklist

Mark yes, no, or not applicable (N/A) of the questions depending on the Project specific content of the SAP being reviewed.

Sampling and Analysis Plan WAC 173-303-110, WAC 173-340 and MTCA.		**YES**	**NO**	**N/A**	**SAP PAGE #**	**COMMENTS**
1. Does the SAP reference a documented DQO or other planning process?						
2. Sampling Strategies and Procedures						
(a) Are sampling strategies (grab vs. composite) specified in the WAP?						
(b) Is the sampling equipment listed appropriate for each waste type?						
(c) Does the SAP identify the sampling location(s), frequencies, and number of samples?						
(d) Are there modified or non-standard methods listed and justification provided?						
(e) Have statistical strategies (including using Visual Sample Plan software) for obtaining representative samples been described in the SAP?						
(f) Are there health and safety considerations (e.g., ALARA) for the sampling personnel?						
(g) Are the procedures for decontamination of sampling equipment in place?						
(h) Does the SAP contain well described sample handling processes?	Sample containers					
	Chain-of-Custody					
	Transportation					
	Sample preservation					
	Holding times					
	Sample storage					
(i) Does the SAP contain QA/QC requirements to ensure obtaining representative samples and generating statistically defensible data?	Traceable labeling system					
	Sample preservation					
	Holding times					
	Maintaining of records					
	Log entries such as date, time, batch numbers, etc					
	Field observations such as sample matrix information					
	Corrective Actions					
	Signatures of personnel					

Sampling and Analysis Plan WAC 173-303-110, WAC 173-340 and MTCA.		**YES**	**NO**	**N/A**	**SAP PAGE #**	**COMMENTS**
(j) Does the SAP describe quantitative QC requirements of data quality indicators?	Blanks (field, method blanks)					
	Spikes (matrix, surrogate) samples					
	Split samples					
	Field duplicate samples					
	Duplicate/replicate samples					
	Detection limits					
	The precision and accuracy of sampling equipment					
(k) Does the SAP contain criteria for waste re-testing?						
3. Laboratory testing and re-testing						
(a) Does the laboratory have a comprehensive QA/QC program accessible for Ecology's review and acceptance?						
(b) Does the SAP list regulatory methods such as EPA SW-846 method numbers?						
(c) Does the SAP contain Laboratory QC Program?	Instrument calibration and verifications					
	Method detection limit (MDL)					
	Precision					
	Accuracy					
	Instrument maintenance					
	Laboratory control samples					
	Performance evaluation samples					
(d) If an offsite or a new contract laboratory is performing the analyses, are there records showing:	Accreditation for the methods it runs					
	Proficiency in the methods it runs					
	Qualified and trained personnel					
	Audit/surveillance records					
(e) Does the SAP list regulatory methods such as EPA SW-846 methods and their numbers?						
(f) Are there justifications for modified or non-standard analytical methods in the SAP?						
(g) Does the laboratory have data quality assessment review before reports are transmitted?						
(h) Are the reports transmitted in the format that is clear and unambiguous?						
(i) Are the records keeping practices of the laboratory suitable??						

3. Quality Assurance/Quality Control – General Requirements

3.1 Introduction

A Quality Assurance/Quality Control program contains processes and procedures used to ensure the production of quality data used in meeting regulatory compliance, permitting requirements, and making informed decisions. A QA/QC program contains detailed parameters that should be met during data collections.

Various projects call for different levels of QA/QC requirements. Therefore, it is indispensable to use a systematic and graded approach in establishing the QA/QC for the project. The QA/QC activities that support screening data are quite different than those that are used for definitive data. The regulatory action levels are also used in determining the QC, considering the fact that the requirements for Closure of RCRA facility may differ from when the facility is fully operational. For example, Step 6 of the DQO process is vital in establishing the project QC requirements.

The Hanford Analytical Services Quality Assurance Requirements Document (HASQARD) is the primary document "designed to meet the needs of the Hanford Site for maintaining a consistent level of quality" for analytical work performed by USDOE contractors and other commercial analytical operations. This guidance document provides the pertinent requirements and standards not covered by HASQARD. Because overlaps may not be completely avoided, efforts have been made to minimize duplication in the aspects that HASQARD covers for Hanford work. As pointed out in HASQARD, attention should be given to where Washington State permitting and regulatory requirements in this document differ from HASQARD.

NQA-1 quality standards apply for work performed at Waste Treatment and Immobilization Plant (WTP). Washington State regulatory requirements not addressed by NQA-1 standards should be obtained from WAC 178-303 and as relevantly covered by this guidance document. Other non-Hanford work not guided by HASQARD should strictly follow this guidance document. The NWP can assist in obtaining any other details not covered by this guidance document.

3.2 Regulatory Drivers

Federal and Washington State regulatory drivers for QA/QC can be found in EPA's SW-846, RCRA guidance documents, and Washington State regulations such as WAC 173-303-300.

3.3 QA/QC Essential Elements

The basic standards of requirements for QA/QC include:

- Quality objectives for obtaining technically sound and defensible data.
- Quality assurance elements.
- Data quality indicators (precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity).
- Quality control requirements.

- Data management (quality assessment -- (data verification, data validation, and data usability) and reporting.
- Performance Evaluation System and Corrective Action Plan.

3.3.1 Quality Objectives for Obtaining Technically Reliable and Defensible Data

Establishing quality objectives for the data depends on the purposes for which the data are being generated. The DQO process or other planning tools must be used to establish definite objectives and save costs. Because various projects call for different levels of QA/QC requirements, early agreement on the required levels of rigor should be worked out with Ecology during the planning stage of the project. The QA/QC activities that support screening data are quite different than those that are used for definitive data. The regulatory action levels are also used in determining the QC, considering the fact that the requirements for Closure of RCRA facility may differ from when the facility is fully operational. Statistical approaches must be considered during the planning process.

3.3.2 Quality Assurance Elements

QA elements are those qualitative steps that lead to reliable quantitative QC assessment of the measurement systems. These steps include documented equipment maintenance and calibration requirements, meeting of holding time, recordkeeping requirements, and training records for personnel performing various aspects of sampling and testing. These QA measures must be specified in the document.

3.3.3 Data Quality Indicators

Data quality indicators (precision, accuracy/bias/interferences, representativeness, comparability, completeness, and sensitivity [detection limits]) must be well specified to meet the specific regulatory compliance and waste management processes. These indicators are used to assess the quality of the data using quantitative statistics that shows the level of acceptability of the data.

3.3.4 Quality Control Requirements

Quality control samples are the samples used to quantify data quality indicators. Acceptance criteria for data quality indicators must be clearly specified for each project using information obtained during systematic project planning. One of the greatest assets of systematic planning is setting of achievable criteria for the decision of interest in the project. For example, the reproducibility expectation for duplicate samples in solid matrix obtained for a tank waste cleaned for closure will definitely be less stringent than for duplicates of samples for tanks still being operated under RCRA permit.

The quality of the data obtained from field samples are generally assessed through the quality of the QC samples. These include but not limited to matrix spikes, post-digestion spike samples, field duplicates, surrogate spikes, method blanks, laboratory control samples, and calibration verification samples, and low level standards. Table 3.1 shows examples of quality control parameters.

Table 3-1: Quality Control Example

QC Sample	QC Requirements	QC Criteria	Comments/Corrective Action
Calibration Verification Sample	Start of runs and run after every 10 samples	90% to 110%	Investigate and recalibrate. Must pass before running samples
Laboratory Control Sample	Treated as sample through all sample preparation steps	80% to 120%	Investigate, evaluate against data quality requirements. Reanalyze sample if necessary.
Method Blank	Run with the sample	< 5% sample concentration	Investigate, evaluate against data quality requirements. Rerun sample batch if necessary.
Duplicates	One duplicate sample per batch	± 20% Relative percent difference (RPD)	Investigate, evaluate against data quality requirements. Rerun sample batch if necessary.
Matrix Spike	One matrix spike sample per batch	75% to 125%	Investigate, evaluate against data quality requirements. Rerun sample batch if necessary.

3.3.5 Data Management and Reporting

Data quality assessment includes overall evaluation of the data, including whether sampling and instrumentation requirements were met during data generation. It also evaluates whether the data quantity and quality and the uncertainty of data met the data needs for decision making. Data verification and validation are used in data quality assessment.

- Data verification is an independent review of the data to check for acceptability in terms of data consistency in the package from the laboratory, calculation correctness, and completeness of the results.
- Data validation involves an independent review of the laboratory and field samples data to ensure that data quality requirements of the project were met.

Reports sent to Ecology undergo rigorous reviews. Well-documented data quality assessment must be used to meet regulatory requirements such as LDRs and to operate the facility under the permit requirements.

Data reporting, including electronic transmission, should be in a format that includes discussions of deficiencies and deviations, where applicable, when regulatory requirements have not been completely met. Color transmission of colored data records must be considered, knowing that a black and white copy may unintentionally transmit misleading information.

3.3.6. Performance Evaluation System and Corrective Action Plan

A performance evaluation system is an important component of the QA/QC for Permitted facility to trend a generator's waste acceptance performance and to adjust the generator's overall physical screening frequencies.

- If there is a failure, the physical screening is adjusted to 100 percent for all the streams until the problem has been resolved.
- The generator provides a Corrective Action Plan (CAP) that clearly states the reason for the failure and describes the corrective actions taken.
- The TSD unit reviews the CAP and maintains or adjusts the screening frequencies accordingly.

It is necessary to determine the cause of the failure of a test and specify action necessary to correct it. Corrective Action is also used in trending and for quality improvement in data generation and handling.

Table 3-2 Quality Assurance/Quality Control (QA/QC) Checklist

Mark yes, no, or not applicable (N/A) of the questions depending on the Project specific content of the QA/QC being reviewed.

<table>
<tr><th colspan="2">Quality Assurance/Quality Control (QA/QC)</th><th>YES</th><th>NO</th><th>N/A</th><th>QA/QC PAGE #</th><th>COMMENTS</th></tr>
<tr><td colspan="2">1. Was the QA/QC program derived from a DQO, QAPP or other planning process?</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="15">2. QA Elements are those qualitative steps that lead to reliable quantitative QC assessment of the measurement systems. Are the QA elements clearly discussed in the QA section?</td><td>Sample containers</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Chain-of-Custody</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Transportation</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sample preservation</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Holding times</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Sample storage</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instrument calibration requirements</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Traceable labeling system</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instrument maintenance</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Maintaining of records</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Log entries such as date, time, batch numbers, etc</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Field observations such as sample matrix information</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Corrective Actions management</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Signatures of personnel</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Training records for personnel</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Quality Assurance/Quality Control (QA/QC)		YES	NO	N/A	QA/QC PAGE #	COMMENTS
3. Data Quality Assessment						
(a) Does the QA/QC describe quantitative QC requirements of data quality indicators?	Blanks (field, method blanks)					
	Spikes (matrix, surrogate) samples					
	Split samples					
	Field duplicate samples					
	Duplicate/replicate samples					
	Detection limits					
	Laboratory control samples					
	Instrument calibration and verifications					
	Method detection limit (MDL)					
	Precision					
	Accuracy					
	Performance evaluation samples					
(b) Does the QA/QC plan have data quality assessment criteria	Sampling and instrumentation requirements met?					
	Data quantity and quality met data needs?					
	Data uncertainty suitable for decision making needs					
	Data verification and validation used?					
4. Data Reporting and transmission						
(a) Is data reporting and transmission for documents in color format indicated?						
(b) Is electronic data transmission format and requirements defined?						

Bibliography and Reference Documents

1. *Dangerous Waste Regulations Chapter 173-303 WAC.* Washington State Department of Ecology Publication No. 92-91. Amended January 2005.
2. *Model Toxics Control Act Statute and Regulation 173-340 WAC.* Washington State Department of Ecology Publication No. 94-06. Revised November 2007.
3. *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies.* Washington State Department of Ecology Publication No. 04-03-030, July 2004. This document is a product of a systematic planning process and describes the objectives of the study and the procedures to be followed to achieve the objectives.
4. *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD). DOE/RL-96-68, Rev 3, June 2007. HASQARD is a consensus document issued by the U.S. Department of Energy's Richland Operations Office (RL) and Office of River Protection (ORP), based upon the requirements of U.S. Department of Energy Order 414.1C. It provides a consistent level of quality for sampling and for field and laboratory analytical services provided by contractor and commercial field and laboratory analytical operations at the Hanford Site.
5. *Regulatory DQO Optimization* Report, Bechtel National Inc., 24590-WTP-RPT-MGT-04-001, Rev 0, February 2004.
6. EPA guidance documents
    a. *Guidance for the Data Quality Objectives Process, EPA QA/G-4,* August 2000, EPA/600/R-96/055. Provides guidance on how to perform the DQO Process.
    b. *Data Quality Objectives Decision Error Feasibility Trials Software (DEFT) - User's Guide, EPA QA/G-4D*, September 2001, EPA/240/B-01/007. PC-based software for determining the feasibility of data quality objectives defined using the DQO Process.
    c. *Guidance for Quality Assurance Project Plan, EPA QA/G-5*, EPA/240/R-02/009, December 2002. Provides guidance on developing Quality Assurance Project Plans (QAPPs) that will meet EPA expectations and requirements. This document provides a linkage between the DQO process and the QAPP.
    d. *Guidance for the Data Quality Objectives Process for Hazardous Waste Sites, EPA QA/G-4HW*, January 2000, EPA/600/R-00/007. Provides guidance on applying the DQO Process to hazardous waste site investigations.
    e. *Waste Analysis at Facilities that Generate, Treat, Store, and Dispose of Hazardous Wastes, a Guidance Manual,* OSWER 9938.4-03, April 1994. This document is intended to assist facility owners, operators, and facility personnel (regardless of their level of experience in environmental compliance issues) in preparing waste analysis plans (WAP) and in conducting waste analysis.
    f. *RCRA Waste Sampling Draft Technical Guidance: Planning, Implementation, and Assessment,* EPA530-D-02-002, August 2002. This draft document was prepared to provide guidance to project planners, field personnel, data users, and other interested parties regarding sampling for the evaluation of solid waste under the Resource Conservation and Recovery Act (RCRA).

g. *Joint NRC/EPA Guidance on Testing Requirements for Mixed Radioactive and Hazardous Waste,* FR Doc. 97-30528, November 20, 1997, Vol. 62, No. 224, pg. 62079-62094. This guidance was published jointly by the U.S. Nuclear Regulatory Commission and the U.S. Environmental Protection Agency. It emphasizes using process knowledge, whenever possible, to determine if a waste is hazardous as a way to avoid unnecessary exposures to radioactivity.

7. *National Environmental Laboratory Accreditation Conference (NELAC): Constitution, Bylaws, and Standards***,** EPA/600/R-04/003, June 2003. NELAC documents describe the elements of laboratory accreditation that was developed and established by the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies.

8. *Multi-Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual,* EPA 402-B-04-001A-C, July 2004. MARLAP Manual is a guidance document for projects that require laboratory analysis of radionuclides. It provides guidance for the planning, implementation, and assessment with a primary objective of meeting the needs of project planners, managers, and laboratory personnel in ensuring that radioanalytical laboratory data will meet a project's or a program's data requirements. MARLAP is intended to promote national consistency in the generation of radioanalytical data of known quality that are appropriate for its intended use.