APPENDIX 3A
WASTE TREATMENT PLANT WASTE ANALYSIS PLAN

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ACRONYMS

ALARA	as low as reasonably achievable
ASTM	American Society for Testing and Materials
BNI	Bechtel National, Inc.
CFR	*Code of Federal Regulations*
DOE	United States Department of Energy
DOE-RL	United States Department of Energy, Richland Operations Office
DST	double-shell tank
DWPA	*Dangerous Waste Permit Application for the River Protection Project – Waste Treatment and Immobilization Plant*
RDQO Optimization	*Regulatory Data Quality Objectives Optimization Report*
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ETF	Effluent Treatment Facility
HEME	high-efficiency mist eliminator
HEPA	high-efficiency particulate air (filter)
HLVIT	high-level vitrification
HLW	high-level waste
HSSWAC	*Hanford Site Solid Waste Acceptance Criteria*
HSLWAC	*Hanford Site Liquid Waste Acceptance Criteria*
ICN	integrated control network
ID	identification
IHLW	immobilized high-level waste
ILAW	immobilized low-activity waste
LAW	low-activity waste
LDR	Land Disposal Restrictions
LERF	Liquid Effluent Retention Facility
LIMS	laboratory information management system
LSM	locally-shielded melter

MSDS	material safety data sheet
NRC	Nuclear Regulatory Commission
PCB	Polychlorinated Biphenyl
PIN	plant information network
QA	quality assurance
QAPjP	*Quality Assurance Project Plan for the Waste Analysis Plan*
QC	quality control
RCRA	Resource Conservation and Recovery Act of 1976
TOC	total organic carbon
TRU	transuranic elements
TSD	treatment, storage, or disposal (facility)
WAC	*Washington Administrative Code*
WAP	waste analysis plan
WTIS	waste tracking and inventory system
WTP	River Protection Project – Waste Treatment and Immobilization Plant

GLOSSARY

This waste analysis plan (WAP) relies on the definitions of terms as contained in the *Hanford Facility Dangerous Waste Permit* (Ecology 2009) and the Dangerous Waste Permit Application for the River Protection Project – Waste Treatment and Immobilization Plant (DWPA) (Chapter 1.0), except as supplemented or amended below.

Batch	Retrievable waste staged in a single double-shell tank (DST) designated as mixed waste for transfer to the Waste Treatment Plant (WTP) for treatment.
Feed verification	The activities the WTP will perform to verify that the staged waste feed meets the WTP acceptance criteria.
Feed confirmation	The activities the WTP will perform after receiving the waste feed, to confirm that the waste feed received is the same as the waste feed accepted for delivery.
Immobilization	The act or process of reducing the mobility of waste constituents to limit their potential for long-term transport in the biosphere and subsequent exposure to humans, animals, and plants. Vitrification is an example of an immobilization process.

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1.0 INTRODUCTION

This Waste Analysis Plan (WAP) describes the sampling and analysis for dangerous waste constituents for the River Protection Project – Waste Treatment and Immobilization Plant (WTP) to comply with the Washington State Dangerous Waste Regulations contained in Chapter 173-303 of the *Washington Administrative Code* (WAC). It was prepared in accordance with the requirements of WAC 173-303-110, "Sampling and Testing Methods," WAC 173-303-300, "General Waste Analysis," WAC 173-303-806, "Final Facility Permits," and the *Hanford Facility Dangerous Waste Permit* (Ecology 1994). Some non-dangerous constituents are also discussed in this plan if they support compliance activities or if the discussion provides a more complete description of a particular sampling strategy. The descriptions in this plan of the waste feed stored at the Hanford Site double-shell and single-shell tank system units (collectively referred to as Hanford tank waste) and the planned process streams are based on available chemical and physical information and process knowledge.

Reactor fuel reprocessing is the primary source of waste material stored in the Hanford double-shell and single-shell tanks. Minor amounts of other radioactive and mixed waste (such as low-level and transuranic waste) are also included in the double-shell tanks; however, the tank waste is managed as high-level waste (HLW) prior to treatment and vitrification. The waste feed to the WTP will consist of staged transfers of mixed waste from the double shell tank (DST) system unit. This waste is composed of sludge, salt cake, and liquids, and is considered mixed waste as defined by WAC 173-303; that is, it contains both radioactive and dangerous waste.

HLW is defined by the United States Nuclear Regulatory Commission (NRC) in the *Code of Federal Regulations,* 10 CFR 72.3, as:

> "(1) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (2) other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation."

Hanford tank waste is consistent with the HLW definition. The treatment of the Hanford tank waste is required under the Hanford Federal Facility Agreement and Consent Order (Ecology, EPA, and DOE 1996), signed by the Washington State Department of Ecology (Ecology), the United States Environmental Protection Agency (EPA), and the United States Department of Energy (DOE).

In a letter to the Richland DOE Operations Office (DOE-RL) (Paperiello, 1997), the NRC documented an agreement with DOE to classify a portion of the Hanford tank waste as "incidental waste" in accordance with the incidental waste classification criteria specified in an earlier letter from the NRC to DOE (Bernero, 1993). The lower activity portion of the tank waste, referred to as low-activity waste (LAW) feed, generally refers to the supernatant portion of the tank waste. Following radionuclide removal and vitrification, the immobilized low-activity waste (ILAW) will be considered incidental waste, disposed of onsite at Hanford as low-level waste, and will not be subject to the licensing authority of the NRC, consistent with the NRC incidental waste determination. The ILAW will be managed as mixed waste for disposal.

The higher activity and higher solids portion of the tank waste is designated as HLW feed in the Dangerous Waste Permit Application for the River Protection Project – Waste Treatment and Immobilization Plant (DWPA). The two different terms describing the Hanford tank waste are used because the LAW and HLW fractions of the waste feed are processed differently in the WTP, as described in Section 2 of this WAP.

The DST system unit will provide a waste profile and, upon request, a split sample aliquot for each waste feed that is staged for transfer to the WTP. The WTP will perform verification analysis on the aliquot to determine if the waste feed meets WTP acceptance criteria.

The WTP will also compare the volume of waste feed transferred from the DST feed staging tank with the volume received into the feed receipt tanks at the WTP, to confirm that the waste feed received corresponds to the waste feed accepted for transfer.

The WTP will characterize the DST waste feed in conformance with the *Regulatory Data Quality Objectives Optimization Report* (RDQO Optimization) process (24590-WTP-RPT-MGT-04-001). Characterization of the DST waste feed will be completed prior to transfer to the WTP.

Simplified process flow figures of the operations at the WTP are included in Appendix 4A.

Controlled copies of this WAP will be kept at the WTP facility. The Project Document Control Manager, or equivalent title, will be responsible for ensuring that controlled copies of the WAP are kept current when revisions to the WAP are made.

2.0 WASTE TREATMENT PLANT UNIT DESCRIPTION

The WTP is a waste treatment unit described under the unit-specific portion of the *Hanford Facility Dangerous Waste Permit* (Ecology 1994). A plan view of the WTP is located in Chapter 1.0. This section briefly describes the WTP processes and activities. More detailed process information is provided in Chapter 4.0.

Figure B1-1 is a simplified diagram of the treatment components, showing the relationship between:

- Waste feed.
- Pretreatment.
- LAW vitrification.
- HLW vitrification.

Plant equipment will include:

- Pipelines, tanks, and ancillary equipment.
- Evaporation units.
- Ultrafiltration units.
- Ion-exchange columns.
- Chemical addition equipment.
- LAW and HLW melters.
- Service and utility units.
- Container management units.
- Storage facilities.
- Off-gas treatment systems.

The pretreatment and vitrification of the waste feed and the management of off-gas from these processes are described in the following sections. The applicability of air emissions standards to the WTP is also discussed.

2.1 Pretreatment

Pretreatment will prepare the DST waste feed for vitrification. An overview of the pretreatment processes is provided below and illustrated in Figure B1-1. Descriptions of the feed receipt tanks and pretreatment equipment are provided in Chapter 4.0.

Pretreatment of the waste feed will consist of the following processes:

- Concentration of the waste feed by evaporation.
- Separation of entrained solids by ultrafiltration.
- Separation of strontium and transuranic elements (TRU) by precipitation and ultrafiltration.
- Separation of cesium in an ion exchange unit.
- Final concentration by evaporation for the LAW feed.

The following paragraphs provide a description of these processes.

After the receipt of the waste feed from the DST system unit, the waste feed evaporator, a forced-circulation vacuum evaporator, will concentrate the waste feed prior to ultrafiltration. Ultrafiltration will remove entrained solids from the concentrated waste feed. The solids will be washed and will either be transferred to the HLW feed or returned to the DST system unit. For certain waste feed, strontium and TRU will be precipitated by adding reagents to the waste feed. The precipitate containing strontium and TRU will be concentrated and washed in the ultrafiltration system before incorporation into the HLW feed.

Condensate from the evaporator off-gas streams will be collected and transferred to condensate tanks for discharge to the Liquid Effluent Retention Facility (LERF) or the Effluent Treatment Facility (ETF), or both, for subsequent treatment. Non-condensable gases that are extracted from the evaporator system will be routed to the pretreatment process tank ventilation off-gas treatment system. Refer to Section 2.3.1 for a description of the pretreatment off-gas treatment systems.

The liquid separated by ultrafiltration will become the LAW feed. The LAW feed will pass through the cesium ion exchange system to separate cesium from the LAW feed. The cesium will be blended with the HLW feed.

The LAW feed leaving the ion exchange unit will be concentrated by evaporation in the LAW melter feed evaporator. The operation of the LAW melter feed evaporator will be similar to that of the waste feed evaporator. The pretreated LAW feed will be transferred to the LAW vitrification plant for vitrification into the ILAW glass product.

The HLW feed will then consist of washed solids, strontium and TRU precipitates for certain feed streams, and the cesium ion exchange product. The blended HLW feed will be transferred to the HLW vitrification plant for vitrification into the immobilized high-level waste (IHLW) glass product.

2.2 Vitrification Systems

After pretreatment, LAW feed will be transferred to the LAW vitrification plant, and HLW feed will be transferred to the HLW vitrification plant, for conversion to the immobilized glass product.

2.2.1 Low-Activity Waste Vitrification

The pretreated and concentrated LAW feed exiting the LAW melter feed evaporator will be combined with necessary glass-forming additives (for example, Silica, Alumina, Boric Acid, and Calcium Silicate) and reductants. The slurry of waste feed and glass formers will be transferred to the LAW melter feed tanks in a manner to provide a continuous feed to each of the two LAW melters. The electric-powered, joule-heated LAW melters will operate in parallel. The temperature of the molten glass in the melters will be approximately 950° C to 1,250° C.

In the melter, the feed components will be converted to their respective oxides and dissolved in the melt, destroyed by the high temperatures, or partitioned to the off-gas. As these materials are heated, superheated gases will be released into the melter off-gas system. Here, most of the solids entrained in the off-gas will be captured and returned to the waste feed stream for treatment. The LAW off-gas treatment system will treat the volatile constituents that remain in the off-gas. LAW off-gas treatment is discussed in Section 2.3.2.

Molten glass will be discharged from the melters to stainless steel containers for cooling, solidification, and storage. The process will yield a durable glass containing the ILAW. The glass will be cooled and the container sealed, decontaminated, and temporarily stored before being transferred to an appropriate Hanford Site treatment, storage, or disposal (TSD) unit.

2.2.2 High-Level Waste Vitrification

The HLW vitrification system will receive feed slurry from the HLW pretreatment process. The feed slurry will be combined with necessary glass-forming additives (Silica, Boric Acid, Calcium Silicate, Ferric Oxide, and Lithium Carbonate) and reductants, and will then be fed to each of the two HLW melters. The temperature of the molten glass in the HLW melter will be approximately 950° C to 1,250° C.

In the melter, feed components will be converted to their respective oxides and dissolved in the melt, destroyed by the high temperatures, or partitioned to the off-gas. As these materials are heated, superheated gases, including volatile feed components, will be released into the melter off-gas system, where most of the solids entrained in the off-gas will be captured and returned to the waste feed stream for treatment. The HLW off-gas treatment system will treat the volatile constituents that remain in the off-gas. The HLW off-gas treatment system is discussed in Section 2.3.3.

Molten glass will be discharged from the HLW melters to stainless steel canisters for cooling, solidification, and storage. The process will yield a durable glass containing IHLW. The glass will be cooled and the canister sealed, decontaminated, and temporarily stored before being transferred to the Hanford Canister Storage Building unit for storage until final disposal.

2.3 Off-Gas Treatment Systems

The pretreatment plant, the LAW vitrification plant, and the HLW vitrification plant will each have a dedicated off-gas treatment system. These systems are described in the following sections. The off-gas treatment systems are illustrated in Figure B1-1. Air emissions are addressed in Section 2.3.4. Details regarding the off-gas treatment system components are discussed in Chapter 4.0.

2.3.1 Pretreatment Plant Off-gas

Figure B1-1 illustrates the pretreatment plant off-gas treatment system. The pretreatment off-gas from fluidic devices will be treated through a high-efficiency mist eliminator (HEME) and high-efficiency particulate air (HEPA) filter, and routed to the pretreatment plant stack, where it will be monitored and released to the atmosphere.

The pretreatment off-gas from vessels will be treated through the following components operating in series:

- Acid gas scrubber
- HEME
- HEPA filter
- Volatile organic compound oxidizer
- Carbon adsorber

The treated pretreatment off-gas from vessels will be monitored and released to the atmosphere through the pretreatment plant stack.

2.3.2 Low-Activity Waste Vitrification Off-gas

The LAW melter off-gas treatment system will consist of the following components operating in series, as illustrated in Figure B1-1:

- Film cooler
- Submerged bed scrubber
- Wet electrostatic precipitator
- HEPA filter
- Activated carbon adsorber
- Thermal catalytic oxidation unit
- Selective catalytic reduction unit
- Caustic scrubber

The treated LAW off-gas will be monitored and released through the LAW stack.

2.3.3 High-Level Waste Vitrification Off-gas

The HLW melter off-gas treatment system will consist of the following components operating in series, as illustrated in Figure B1-1:

- Film cooler
- Submerged bed scrubber
- Wet electrostatic precipitator
- HEME
- HEPA filter
- Activated carbon adsorber
- Silver mordenite iodine adsorption unit
- Thermal catalytic oxidation unit
- Selective catalytic reduction unit

The treated HLW off-gas will be monitored and released through the HLW stack.

2.3.4 Air Emissions

Emissions from the stacks that vent the WTP processes will be monitored according to the provisions of the WTP and Hanford Site Air Operating Permit, as required by WAC 173-303-395(2). Monitoring and sampling to address air emissions concerns under these permits will not be addressed in this application. However, the applicability of the air emissions requirements found in WAC 173-303 will be evaluated in the following sections. Details of the air emissions control systems for the WTP are provided in Chapter 4.0.

2.3.4.1 Air Emissions from Process Vents (Subpart AA)

WAC 173-303-690, commonly referred to as Subpart AA, regulates process vents that are associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air- or steam-stripping operations that manage hazardous wastes with organic concentrations of at least 10 parts per million by weight. WAC 173-303-690 incorporates the provisions of 40 CFR 264.1031 through 40 CFR 264.1036 by reference. The WTP does not employ any of these listed devices or processes; therefore, the WTP is not subject to regulation under Subpart AA.

2.3.4.2 Air Emission Standards for Equipment Leaks (Subpart BB)

WAC 173-303-691 applies to facilities that treat, store, or dispose of hazardous waste, and regulates air emissions from equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 percent by weight. WAC 173-303-691 incorporates 40 CFR 264.1051 through 1065 (Subpart BB) by reference.

This provision does not apply to the WTP, because the WTP will not accept wastes with organic concentrations at or above 10 percent by weight. Compliance with this provision will be documented through analysis, as described in Section 3.4.1.

2.3.4.3 Air Emission Standards for Tanks, Impoundments, and Containers (Subpart CC)

The regulations specified under WAC 173-303-692 and 40 CFR Part 264 Subpart CC, incorporated by reference, do not apply to the WTP mixed waste tank systems and containers. These tanks and containers qualify as waste management units that are "used solely for the management of radioactive dangerous waste in accordance with all applicable regulations under the authority of the Atomic Energy Act and the Nuclear Waste Policy Act" and are excluded under WAC 173-303-692(1)(b)(vi). Containers or tanks bearing non-radioactive, dangerous waste, such as maintenance and laboratory waste, that are not excluded under WAC 173-303-692(1)(b)(ii) or 40 CFR 264.1082(c), will comply with the container and tank standards specified under 40 CFR Part 264 Subpart CC.

3.0 WASTE ACCEPTANCE [C-1, C-2]

The waste feed to be transferred from the DST system unit to the WTP will undergo several stages of review before acceptance. The DST system unit will provide the WTP with a waste profile for the feed batch staged for transfer to the WTP. If requested, the DST system unit will also provide an aliquot of the split sample of the waste feed for waste verification analysis performed by the WTP. Verification analytical data on the waste feed provided by the DST system unit will be accepted by the WTP for waste acceptance purposes. During sampling and analysis for verification, the waste feed will remain within the control and responsibility of the DST system unit.

After WTP personnel determine that the verification analysis results meet the waste acceptance criteria, the DST system unit will be authorized in writing to transfer the waste feed through double-walled pipes to feed receipt tanks located inside the WTP. After transfer, the WTP will compare the volume of waste feed transferred from the DST feed staging tank with the volume received into the WTP feed receipt tanks. This will confirm that the waste feed received corresponds to the waste feed that was accepted for transfer.

The steps involved in evaluating and accepting the waste feed into the WTP are summarized in Table B1-1, and are described in the following sections. Also discussed in the following sections is the rationale for the removal of dangerous waste numbers D001 (ignitable) and D003 (reactive) from the waste feed and the selection of analytical laboratories.

Dangerous waste will be managed in a way that will preclude adverse reaction or interference with the WTP treatment process.

3.1 Waste Feed Designation

Waste numbers described in the *Double-Shell Tank System Unit Permit, Operating Group 12, Addendum B, Waste Analysis Plan* (DOE-RL 2009) are applicable to the waste feed. A list of these dangerous waste numbers is shown in Table B1-2. Table B1-2 includes multi-source leachate (F039) as a waste derived from non-specific source wastes F001 through F005. Waste feed received from the DST system unit is not expected to exhibit the characteristics of ignitability (D001) or reactivity (D003), based on process knowledge. Section 3.6 describes the process knowledge that will be used to demonstrate that the waste feed is not ignitable or reactive.

3.2 Waste Feed Acceptance Process [C-3a]

For each waste feed batch, the waste acceptance process is summarized in Table B1-1, and is discussed in the remainder of this section.

3.2.1 Waste Feed Profile [C-2a(3)]

The DST system unit will complete a profile of the waste feed batch before making a transfer of that batch to the WTP. The content and format of the profile will be established prior to the transfer of waste feed. An example of the information that will be provided in the profile is:

- General information, such as the identification of the DST tank from which the transfer will be made and the date of the proposed transfer.
- Physical properties of the waste feed, such as the proposed volume of the transfer and the presence or absence of a separate visible organic layer.
- Historical analytical data, such as total organic carbon (TOC).
- Dangerous waste information, such as the designation of dangerous waste numbers.
- Land disposal restriction (LDR) information.

3.2.2 Waste Feed Verification

At the request of the WTP, the DST system unit will supply a split sample aliquot of the staged waste feed for verification analysis. The aliquot will be analyzed by the WTP for the waste acceptance criteria parameters. The verification process is discussed in Section 3.3, and the waste acceptance criteria for verification are discussed in Section 3.4. If the waste acceptance criteria information is provided by the DST system unit for the staged waste feed, then the WTP will not need to repeat analyses for the provided information.

3.2.3 Preshipment Review

Verification analytical information will be obtained for each waste feed batch whether provided by the DST system unit or determined by the WTP through analysis of the DST split sample aliquot. The purpose of the preshipment review is to evaluate the verification analytical results to ensure compatibility and acceptability of the waste feed before it enters the WTP. If the verification analytical results are within the waste acceptance criteria limits, then the waste will be accepted for treatment. If the verification analytical results are outside of the waste acceptance criteria, then the DST system unit will be notified that the waste feed does not conform. Actions in response to non-conformance are addressed in Section 3.2.4.

Following successful completion of the preshipment review, including the resolution of any non-conformance, a representative of the WTP will notify DST system unit personnel in writing that the WTP is ready for a waste feed transfer. The position title of the WTP representative will be provided prior to the commencement of WTP operations. The two parties will agree on the waste feed transfer date, as well as any other pertinent information.

3.2.4 Non-Conformance Action [C-3b, C-3c]

Confirmatory action, such as re-analysis and data review, will be performed for each verification analytical result that does not initially meet the acceptance criteria presented in Table B1-3. Re-analysis of a sample that fails an acceptance criteria will consist of two repeat analyses for the failed criteria. If both of the repeat analyses pass, then the sample will be considered to meet that acceptance criteria. If one or both of the repeat analyses fail, the waste will be considered non-conforming. If the waste feed is determined to be non-conforming, then the waste is returned to tank farms. The WTP, the DST system unit, or both, will determine and execute corrective actions necessary to be able to transfer back to WTP to process the waste feed.

The non-conformance decisions, corrective actions and supporting data, along with the names and titles of the individuals making these decisions, will be documented and retained as a quality assurance (QA) record, according to procedures described in the *Quality Assurance Project Plan for the Waste Analysis Plan* (QAPjP), Appendix 3B.

3.2.5 Waste Feed Transfer

Waste feed transfer will be coordinated between the DST system unit and the WTP. Prior to waste feed transfer, the WTP will ensure that waste feed transfer systems are operational. These systems include, but are not limited to:

- Pipeline interstitial leak detection.
- Feed receipt tank level measurement equipment.
- Feed receipt tank ventilation.

Once the transfer systems are confirmed as operational, the DST system unit will transfer the waste feed to the WTP feed receipt tanks through a double-walled pipeline. The DST system unit will water flush the pipeline after the transfer is complete.

3.2.6 Waste Feed Confirmation [C-2a, C2a(1)]

The purpose of confirmation is to ensure that the waste feed received into the WTP is the same waste feed that was accepted for transfer. The method used for confirmation will be a comparison of the volume removed from the DST system unit feed staging tank with the volume received into the WTP feed receipt tanks. The tank volume measurement systems for the DST system unit and the WTP are discussed in the following sections.

3.2.6.1 Confirmation Frequency [C-2d], Measurement Locations, and Measurement Methods

Volume measurements will be made from the DST system unit feed staging tank and the WTP feed receipt tanks for each waste feed transfer. The locations of the waste feed confirmation measurements are identified on Figure B1-1 as S1 for the DST system feed staging tank, and S2 for the WTP waste feed receipt tanks.

The method for volume measurement at both the DST system unit feed staging tank and the WTP feed receipt tanks will be tank level measurements taken before and after waste feed transfer. The volume is then calculated from the tank level differences, taking into account the volume of the line flush water.

3.2.6.2 Confirmation Volume Reconciliation

The WTP and the DST system unit will reconcile any differences between the measured waste volume transferred out of the DST staging tank and the measured volume received in the WTP waste feed receipt system, including top-off transfers.

3.3 Waste Feed Verification Process

The purpose of verification is to determine whether the DST waste feed staged for transfer can be properly managed in the WTP. Appropriate and reliable analytical information to make this determination will be obtained through the activities discussed in the following sections.

3.3.1 Verification Sampling and Frequency [C-2c, C-2d]

At the request of the WTP, the DST system unit will provide one split sample aliquot for each batch of waste feed prior to transfer to the WTP. The sampling location for the waste feed verification is identified on Figure B1-1 as sample point S1.

Verification analyses, which are the waste acceptance criteria, are listed in Table B1-3, and discussed in Section 3.4. Methods for selecting a laboratory and establishing laboratory quality assurance (QA) and quality control (QC) procedures are addressed in Section 3.5. Detailed QC information is provided in the QAPjP.

3.3.2 Verification Sampling Methods [C-2c]

The verification split sample aliquot of the DST waste feed staged for transfer to the WTP will be collected as described in Section 9.2 of the *Regulatory Data Quality Objectives Optimization Report (RDQO Optimization) (24590-WTP-RPT-MGT-04-001).*

3.3.3 Sample Preservation, Storage and Holding Times

Sample preservation, storage, and holding times for the sample collected from the DST staging tank for verification analysis are described in Section 9.7 of the *RDQO Optimization (24590-WTP-RPT-MGT-04-001).*

3.3.4 Sampling Quality Assurance and Quality Control [C-2a(2)(b)]

Quality assurance and quality control for verification sampling activities performed by the DST system unit are addressed in Sections 9.6 of the *RDQO Optimization (24590-WTP-RPT-MGT-04-001).* Analytical laboratory quality assurance and quality control are discussed in Section 3.5.2.1 of this WAP.

3.3.5 Selection of Verification Analytes [C-2a]

The selected analytes for waste feed verification are:

- Total organic carbon (TOC)
- Polychlorinated biphenyls (PCBs)
- pH
- Compatibility

The analytical methods and waste acceptance criteria for each of these analytes are listed in Table B1-3 and discussed in Section 3.4.

The list of analytes for waste feed verification is described in the *RDQO Optimization (24590-WTP-RPT-MGT-04-001)* and will be re-evaluated as a result of the environmental risk assessment, currently under development and scheduled to be finalized during cold commissioning LAW and HLW demo tests. The RDQO Optimization process is subject to periodic evaluation and may periodically affect the list of analytes.

3.3.6 Selection of Verification Analytical Methods [C-2a(2)]

Table B1-3 presents the currently selected SW-846 (EPA 1997a) preparation and analytical methods that will be applied to the waste feed to verify that it is acceptable for treatment by the WTP. Any applicable analytical method provided in WAC 173-303-110 may be used for analysis. If an analytical method used for regulatory purposes other than the methods provided in WAC 173-303-110 is proposed, approval of the method will be requested from Ecology, according to WAC 173-303-910(2). The proposed analytical method will not be used for regulatory purposes until Ecology authorizes the method. If modifications to a procedure are needed, they will be requested in accordance with WAC 173-303-110(4). Specific technical guidance for modification of SW-846 (EPA 1997a) methods will be obtained from *Guidance on Testing Requirements* (NRC, EPA 1997), *Preparation of Radioactive Mixed Waste Samples* (ASTM 1990), *Methods of Chemical Analysis* (PNL 1993), as well as recent publications (for example, Mong and others, 1997). The SW-846 (EPA 1997a) "method hotline" indicates that sample size is not a method modification, unless detection limits are not sufficient for making decisions.

3.4 Waste Acceptance Criteria

The following sections discuss the waste acceptance criteria that will be used for verification of the DST waste feed. If the waste acceptance criteria information is provided by the DST system unit for the staged waste feed, then the WTP will not repeat analyses for the provided information. Waste feed received into the WTP that meets the waste acceptance criteria will be treated by the WTP.

3.4.1 Total Organic Carbon [C-2a(1), C-2a(2)]

The waste feed will be analyzed to determine the TOC. TOC has been chosen for analysis of the waste feed to ensure that the WTP is not required to comply with Subpart BB found in WAC 173-303-691. Proportionate liquid and solid aliquots of the split sample will be taken for this analysis.

The analytical method is SW-846 Method 9060 (EPA 1997a), or EPA Method 415.2 (EPA 1997b), using persulfate oxidation. The sample aliquot volume requirements for this analysis are expected to be less than 1 milliliter for liquid and 0.1 gram or less for solids. This method typically measures TOC to levels of about 1 part per million. The acceptance level for this verification process is 10 percent TOC. In order to preserve the liquid sample in accordance with Method 9060 (EPA 1997a), the liquid sample will be diluted from 1 part per hundred to 1 part per thousand in water, with enough Sulfuric Acid added to maintain the pH at less than 2 pH units. The dilution will be performed because of the high alkalinity and the need to acidify for preservation. Even with the dilution, Method 9060 (EPA 1997a) will meet the 1 percent detection limit, as given in Table B1-3. The solids will be analyzed separately for TOC, and will not be acidified or diluted.

3.4.2 Polychlorinated Biphenyls [C-2a(1), C-2a(2)]

Portions of the Hanford tank waste may contain PCBs at concentrations below 50 parts per million. These are regulated under the Toxic Substances Control Act (TSCA 1976), and codified in 40 CFR 761.61 as PCB remediation waste (Fitzsimmons and others, 2000). The waste feed verification sample aliquots will be analyzed to ensure that the waste feed contains less than 50 parts per million PCBs. This acceptance criteria of 50 parts per million PCBs may change as a result of the risk-based approval of PCBs in the Hanford tank waste that is being prepared jointly by DOE, Ecology, and EPA.

The sample will be separated into solid and liquid phases and analyzed for PCBs by SW-846 Method 8082 (EPA 1997a). Modification of the basic extraction procedure given in this method is expected to be needed to decrease the sample size and allow the extraction to be performed in a shielded glovebox. It is anticipated that a sample size of 0.5 to 1 gram would be required for solids, and 10 to 20 milliliters for liquids. If any single liquid sample contains more than 5 percent solids after centrifuging, the liquid and solid will be analyzed separately. Refer to Table B1-3 for the acceptance criteria.

3.4.3 Waste Feed pH [C-2a(1), C-2a(2)]

The measurement of pH will ensure that a batch of waste feed is compatible with the WTP materials of construction and treatment processes. SW-846 Method 9040 (EPA 1997a) will be used to measure pH. The estimated sample size is 5 milliliters. The decision criteria is greater than pH 7, as presented in Table B1-3.

3.4.4 Waste Feed Compatibility [C-2a(1), C-2a(2)]

The waste feed will be evaluated for compatibility with the residual aqueous waste in the WTP feed receipt tanks, before being accepted into the WTP. These evaluations will focus on the potential for a waste stream to react in an uncontrolled fashion with another waste (40 CFR 264, Appendix V, "Examples of Potentially Incompatible Wastes"). Although problems associated with co-mingling aqueous waste feeds are not expected, this evaluation will ensure the compatibility of two or more aqueous waste feeds from different DST system unit tanks.

Waste feed compatibility will be evaluated using the American Society for Testing and Materials Method (ASTM) D5058-90, *Standard Test Methods for Compatibility of Screening Analysis of Waste* (ASTM 2001). This evaluation provides three test methods to determine compatibility. Test method A, using a reduced sample volume, will be applied to the proposed DST system unit waste feed and the WTP feed receipt tank residual waste. This method prescribes the mixing of aliquots of the two waste streams and an evaluation of any temperature change of the mixture.

The method also calls for a visual examination to determine whether viscosity has increased. These evaluations will be performed to test for potential incompatibilities that could adversely affect the management of the waste in the WTP.

The recommended sample volume for this test method is 150 to 300 milliliters. The sample size will be decreased to 10 milliliters from each waste feed source, for a total of 20 milliliters of the combined waste feeds for waste minimization, and will comply with the as low as reasonably achievable (ALARA) philosophy.

3.5 Analytical Laboratory

The following sections discuss the WTP's onsite analytical laboratory and the quality assurance and quality control that will be implemented for analytical activities and for sampling performed by the WTP. Also discussed is the selection of other analytical laboratories.

3.5.1 Waste Treatment Plant Analytical Laboratory

The WTP will establish and operate an onsite analytical laboratory. A laboratory quality assurance (QA) program meeting the requirements of SW-846, Chapter 1, Section 4.4 (EPA 1997a) will be prepared before initiation of laboratory operations.

3.5.2 Establishing Quality Assurance and Quality Control Procedures [C-2a(2)(b)]

The following sections discuss the quality assurance (QA) and quality control (QC) for the analytical laboratory and for sampling operations.

3.5.2.1 Laboratory QA and QC

The WTP laboratory will conduct its operation in a way that ensures that reliable information is provided on request. The policies and procedures described in the QAPjP will be implemented to ensure reliable data.

Laboratory equipment and instrumentation will meet the requirements and specifications of the test methods and other procedures described in the QAPjP.

The QAPjP will describe or refer to laboratory activities that may affect data quality. Any deviation from an established procedure during a data collection activity will be documented. QC procedures will be available for the indicated activities as described in the QAPjP.

The QAPjP describes how the following elements of the QC program will be implemented:

- Sample control
- Analyses
- Measures of precision, accuracy, and representativeness
- Deviation
- Corrective action
- Data reduction and validation
- Reporting
- Generation, control, and disposal of records

The QA organization will conduct reviews consisting of internal and external assessments to assure that QA/QC procedures are in use and that laboratory staff conform to these procedures. QA reviews will be conducted as deemed appropriate and necessary. Non-conformances will be documented.

3.5.2.2 Waste Treatment Plant Sampling QA and QC

Sampling procedures, equipment, and sample preservation and handling requirements are discussed in the QAPjP. Policies and procedures commensurate with the complexity and importance of data will be developed and implemented.

Equipment, instrumentation, and supplies at the sampling site will be identified in written procedures that will be developed to accomplish the activities planned. The procedures will typically include the following information:

- Sampling equipment
- Sample management
- Reagent and standard preparation
- Decontamination equipment
- Sample collection
- Field measurements
- Equipment calibration and maintenance

3.5.3 Selecting Other Analytical Laboratories

The WTP may contract with other Hanford Site laboratories to provide analytical services, as necessary, based on a review of the ability of each laboratory to provide acceptable data for the types of waste handled by the WTP. The review will include an onsite surveillance of the laboratory facilities, and a review of its documentation. Evaluation of candidate laboratories will be based on the following criteria:

- Licenses or permits issued by the applicable government authority, allowing the laboratory to handle waste samples that contain chemical and radiological components.
- Laboratory accreditation.
- Analytical capacity, including number and type of analytical instruments, sample preparation facilities, and sufficient uncommitted capacity, or a commitment to procure sufficient capacity to handle the sample load.
- Adequate number of qualified technical staff.
- Demonstrated history of performing acceptable analyses.
- Adequate sample tracking system (refer to Section 7.2, *Sample Tracking*).
- A demonstrated QA program that meets the requirements of SW-846, Chapter 1, Section 4.4 (EPA 1997a).

3.6 Waste Feed Designation

Waste numbers described in the *Double-Shell Tank System Unit Permit, Operating Group 12, Addendum B, Waste Analysis Plan* are applicable to the waste feed. These dangerous waste numbers are listed in Table B1-2.

The waste feed will carry the numbers for ignitable (D001) and reactive (D003) waste. However, based on past process knowledge, which includes the age, temperature, history, and chemical composition of the waste feed stored in the DST system unit, it is not expected to exhibit the characteristics of ignitability or reactivity found in WAC 173-303-090. After the waste feed has been received into the WTP, this process knowledge will be used to remove the dangerous waste number for ignitability and reactivity.

Precautions taken to prevent accidental ignition or reaction of ignitable or reactive waste will be in accordance with WAC 173-303-395(1)(a) through (d), and will be documented in the WTP operating record in accordance with WAC 173-303-395(1)(c), as discussed in the QAPjP. Tank inspection is addressed in Appendix 6A.

3.6.1 Ignitable Waste

Four properties of a waste found in WAC 173-303-090(5)(a) are used to determine whether a waste exhibits the characteristic of ignitability. These four properties are listed in Table B1-4, and discussed below.

WAC 173-303-090(5)(a)(i) states, in part: "It is a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume, and has a flash point less than 60 °C (140 °F)." The *Tank Waste Remediation System Final Safety Analysis Report* (DOE-RL 1999), identifies 241-C-103 as the only tank, at this time, that contains a separate organic solvent phase. The flash point of the separate organic solvent phase on Tank 241-C-103 was determined to be 118 ºC (Pool and Bean, 1994). This flash point is well above the regulatory threshold of 60 ºC for determining the characteristic of ignitability and represents a worst case flash point for the liquid portion of the waste feed. Since the liquid portion of the waste feed is aqueous and contains a maximum of 10 percent total organic carbon, the flash point test will not be performed on the aqueous waste feed.

The WAC 173-303-090(5)(a)(ii) property of ignitability pertains to material that is not a liquid. Portions of the tank waste are in a solid (crust and salt cake) and semi-solid (sludge) form. Process knowledge indicates that this property of ignitability does not apply to the tank waste. Throughout the history of the tank farms (Blankenship, 1990), there has been no evidence of the solid or semi-solid portions of the tank waste "causing fire through friction, absorption of moisture or spontaneous chemical changes, and when ignited, burns so vigorously and persistently that it creates a hazard" (WAC 173-303-090(5)(a)(ii)).

WAC 173-303-090(5)(a)(iii) pertains to compressed gas. This definition does not apply since the tank farm waste is not a compressed gas.

WAC 173-303-090(5)(a)(iv) states: "It is an oxidizer, if it is defined as such in 49 CFR 173.127 and 173.128". According to 49 CFR 173.127 an oxidizer is defined as "a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials." Nitrate and nitrite salts are present in the waste feed (Blankenship, 1990) and can yield oxygen. However, the *Organic Solvent Topical Report* (HNF-4240) determined that the nitrate and nitrite in the DST waste will not cause or enhance the combustion of other materials. Thus, the DST waste does not meet the definition of an oxidizer. The *Organic Solvent Topical Report* (HNF-4240) was independently reviewed and accepted by the Chemical Reactions Subpanel of the Tanks Advisory Panel, the Defense Nuclear Facilities Safety Board staff, and the Oregon Office of Energy (DOE-ORP 2000).

49 CFR 173.128 defines organic peroxides and is not applicable to the waste feed.

The dangerous waste number D001 for ignitability will be removed from the waste feed after it is received into the WTP, based upon the previous discussions of process knowledge.

3.6.2 Reactive Waste

WAC 173-303-090(7)(a) lists eight properties of a waste that would cause it to be designated as a reactive waste. The eight properties are listed in Table B1-5 and are discussed in the following paragraphs.

WAC 173-303-090(7)(a)(i) describes a waste that is unstable and will undergo violent change. The Hanford tank waste has not exhibited a violent change during the history of the tank farms. Differential thermal analysis or differential scanning calorimeter analysis has been performed on the tank waste. These tests have shown that the waste does not react under thermal stress (Blankenship, 1990).

WAC 173-303-090(7)(a)(ii), (iii), and (iv) involve waste that, when mixed with water, produces hazardous reactions, or generates toxic gases, vapors, or fumes. Since the tank waste is already a water solution, it does not meet the definitions that: (ii) "It reacts violently with water" (iii) "It forms explosive mixtures with water," or (iv) "When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment."

Hydrogen, Ammonia, oxides of Nitrogen, and Methane are generated in the Hanford waste tanks. These gases are generated primarily from the radiolytic decomposition of the waste and are not a result of mixing with water (Johnson, 1996). Nevertheless, flammable gases produced by the radiolytic decomposition of the waste, and to a lesser degree, thermolytic decomposition, will be managed at the WTP through ventilation of the vessels that contain the waste feed.

WAC 173-303-090(7)(a)(v) concerns the generation of toxic gases, vapors, or fumes when a Cyanide- or Sulfide-bearing waste is exposed to pH conditions between 2 and 12.5, in a quantity sufficient to present a danger to human health or the environment. Hydrogen Cyanide and Hydrogen Sulfide are the gases that would be generated from Cyanide- or Sulfide-bearing waste when exposed to acidic conditions. In 1985, the EPA published guidance for determining regulated thresholds for these gases as 250 milligrams per kilogram of waste for Hydrogen Cyanide and 500 milligrams per kilogram of waste for Hydrogen Sulfide. Although these numerical thresholds were rescinded by the EPA (EPA 1998), they are still useful as benchmarks for determining the characteristic of reactivity and are still accepted by Ecology.

Thirteen tanks have been investigated by the Pacific Northwest National Laboratory under CH2M Hill Hanford Group, Inc., Project Number 41503, for their potential to generate these gases at pH between 2 and 12.5. Included in these thirteen tanks are the tanks scheduled for vitrification during the first ten years of WTP operation. This report researched the analytical data for the concentrations of Cyanide and Sulfide in the supernatant and solids in the tanks, using the best basis inventory on the Tank Waste Information Network System database current to November 2000 (LMHC 1999). Analytical data for Cyanide was available, but no data was available for Sulfide since there is no history of Sulfide addition to the tank farms. Consequently, the author used total Sulfur and Sulfate concentration values for the evaluation. Standard chemistry principles were used to calculate the potential generation of Hydrogen Cyanide and Hydrogen Sulfide in acidic conditions. This investigation determined that Hydrogen Cyanide and Hydrogen Sulfide would not be generated at the respective benchmark levels of 250 and 500 milligrams per kilogram of waste for these tanks. Thus the waste feed contained in tanks scheduled for the first ten years of WTP operation is not considered to be Sulfide- or Cyanide-bearing waste.

WAC 173-303-090(7)(a)(vi), (vii), and (viii) is concerned with waste that will detonate or explode. Process knowledge and history indicate that the tank waste does not detonate or explode. As mentioned previously, differential thermal analysis or differential scanning calorimeter analysis has been performed on the tank waste, showing that it does not react under thermal stress (Blankenship, 1990). Finally, the tank farm waste is not regulated as an explosive in 49 CFR 173.50.

The WTP will remove the dangerous waste number D003 for reactivity from the waste feed based upon the above process knowledge.

4.0 WASTE CHARACTERIZATION [C-1, C-2]

Prior to the transfer of DST waste feed, the WTP will characterize the waste feed in conformance with the RDQO Optimization (24590-WTP-RPT-MGT-04-001). After the the set of analytes are determined and methods are developed and approved by Ecology, the waste feed will be analyzed and the results used to characterize the waste. The data quality objective process is an ongoing activity and may periodically affect the set of analytes and analytical methods.

4.1 Sampling Methods and Sampling Frequency [C-2c, C-2d]

The samples collected for characterization of the DST waste feed staged for transfer to the WTP will be collected as described in Section 9.2 of the RDQO Optimization (24590-WTP-RPT-MGT-04-001). One sample will be collected from the DST waste feed tank for characterization of the waste stored in that tank.

4.2 Sample Preservation, Storage, and Holding Times

Sample preservation, storage, and holding times for the samples collect to support characterization of the DST waste feed are discussed in Section 9.7 of the RDQO Optimization (24590-WTP-RPT-MGT-04-001).

4.3 Selection of Analytes [C-2a(1)]

The analytes for characterization of the DST waste feed have been determined as a result of the RDQO Optimization (24590-WTP-RPT-MGT-04-001) process and will be re-evaluated as a result of the environmental risk assessment, currently under development. These activities are scheduled to be completed prior to the commencement of cold operations, and will be used to establish a set of analytes appropriate to perform characterization of the DST waste feed.

4.4 Selection of Analytical Methods [C-2a(2)(a)]

Identification of analytical methods that will be used to obtain the necessary data for characterizing the DST waste feed is addressed in Section 9.8.3 of the RDQO Optimization (24590-WTP-RPT-MGT-04-001). Modified SW-846 (EPA 1997a) methods, except for sample size or as otherwise identified in the RDQO Optimization (24590-WTP-RPT-MGT-04-001), will not be used for characterization until they are authorized by Ecology.

4.5 Quality Assurance and Quality Control [C-2a(2)(b)]

Quality assurance and quality control for DST waste feed characterization are addressed in Sections 9.6 and 9.8.5 of the RDQO Optimization (24590-WTP-RPT-MGT-04-001) report.

5.0 WASTE STREAMS

In addition to the vitrified glass product, the pretreatment processes and the LAW and HLW vitrification processes will generate a variety of solid, liquid, and gaseous waste streams. Some of these waste streams include waste derived from the incoming feed from the DST system unit. Other wastes include spent materials used in processing the waste feed, such as rinsate and scrubber solutions that come into contact with the waste feed or its derivatives, and contaminated equipment. General facility operations and maintenance activities will also generate dangerous waste.

Waste streams regulated under WAC 173-303 (because of dangerous waste concerns) include the ILAW and IHLW, as well as miscellaneous secondary solid and liquid waste streams. Air emissions subject to regulation, commonly referred to as Subparts AA, BB, and CC, are discussed in Section 2.3.4. Other regulated air emissions are addressed under the permit applications to be developed under the Clean Air Act of 1990 (CAA 1990) and the Washington Clean Air Act of 1967 (WCAA 1967), and are not included in the following discussions.

Section 5.1 describes the land disposal restriction (LDR) evaluation for the immobilized waste streams. Section 5.2 describes the secondary waste streams generated by the WTP, including characterization of secondary waste, the associated sampling and analysis activities, and the ultimate treatment, storage, or disposal of regulated waste.

5.1 Land Disposal Restrictions Evaluation for Immobilized Waste

This section describes the approach for addressing the LDR program requirements applicable to the land disposal of ILAW and IHLW.

5.1.1 Land Disposal Restrictions Treatment Standards

Land disposal restrictions are codified in WAC 173-303-140, which incorporates 40 CFR Part 268 by reference. 40 CFR 268.40 identifies the treatment standards for the land disposal of a dangerous waste. It states:

"(a) A waste identified in the table "Treatment Standards for Hazardous Wastes" may be land disposed only if it meets the requirements found in the table. For each waste, the table identifies one of three types of treatment standard requirements:

(1) All hazardous constituents in the waste or in the treatment residue must be at or below the values found in the table for that waste ("total waste standards"); or

(2) The hazardous constituents in the extract of the waste or in the extract of the treatment residue must be at or below the values found in the table ("waste extract standards"); or

(3) The waste must be treated using the technology specified in the table ("technology standard"), which are described in detail in § 268.42, Table 1 – Technology Codes and Description of Technology-Based Standards."

The "total waste standards" and "waste extract standards" require repeated sampling and analysis of the waste to demonstrate that the dangerous constituents in the waste are at or below the values found in the table. These standards are appropriate for a limited dangerous waste stream, but are not a good choice for a mixed waste stream of extended duration because of repeated human exposure during sampling and analysis.

Table 1 – Technology Codes and Description of Technology-Based Standards (40 CFR 268.42) includes the technology standard HLVIT. At the request of DOE, the HLVIT treatment technology was promulgated by the EPA to treat the tank wastes at the Savannah River Site. According to the *Treatment Standards for Hazardous Wastes* table (40 CFR 268.40), HLVIT is the technology for the treatment of the following dangerous waste numbers from radioactive high-level wastes generated during the reprocessing of fuel rods:

D002	Corrosivity (pH)
D004	Arsenic
D005	Barium
D006	Cadmium
D007	Chromium (total)
D008	Lead
D009	Mercury
D010	Selenium
D011	Silver

5.1.1 Treatment Standard for the Hanford Tank Waste

Similar to the treatment of the Savannah River Site tank waste, the treatment of the Hanford tank waste will require many years of WTP operation. Rather than repeated sampling and analysis of the waste to demonstrate LDR using the total waste standard or the waste extract standard, it would be appropriate to treat the Hanford tank waste to a specific treatment standard, such as the HLVIT treatment standard described above for the Savannah River Site tank waste. Consequently, the WTP will submit a land disposal restriction treatability variance petition to the EPA and Ecology to establish a new treatment standard that will be specific to the Hanford tank waste. The new treatment standard would specify vitrification as the land disposal treatment standard for Hanford double-shell and single-shell tank waste for the characteristic and listed waste numbers applicable to the Hanford tank waste.

As required by 40 CFR 268.44, *Variance from a treatment standard*, the petition will be submitted in accordance with the procedures specified in 40 CFR 260.20. The negotiated petition would be published in the Federal Register for public comment. After successful resolution of public comments, the EPA would promulgate a final rule establishing the treatment standard. The Hanford tank waste would then meet LDR through treatment by the promulgated treatment standard.

5.2 Secondary Waste Streams

The WTP's primary mission is to vitrify the Hanford tank waste. This process will also generate a variety of secondary waste streams that must be properly managed. The management of secondary waste streams that will be regulated as dangerous waste is discussed in this section.

Secondary waste streams that will be transferred back to the DST system unit will be designated with waste numbers based upon process knowledge. Waste transferred to the DST system unit will meet the DST waste acceptance criteria.

Secondary waste streams are divided into solid waste streams (discussed in Section 5.2.1) and liquid waste streams (discussed in Section 5.2.2). Dangerous waste streams generated within the WTP will meet the waste acceptance criteria or protocols established by the receiving TSD facilities' permits and operating authority. This document does not outline the details of sampling and analyzing each waste stream because each TSD receiving waste may update its waste acceptance criteria and thus alter the required waste analyses.

The following general information related to waste classification applies to solid and liquid secondary waste streams:

- Normally, waste streams will be designated using process knowledge. Acceptable process knowledge includes:
  - Historical analytical data.
  - Mass balance from a controlled process with a specified output for a specified input.
  - Material safety data sheets.
  - Analytical data on the waste from a similar process.
  - For mixed waste, process knowledge could include information from surrogate material.
- The listed waste numbers F001 through F005 will follow the secondary waste if the secondary waste is derived from the waste feed. F039 waste was never placed in the DST system unit, and will not be applied to secondary waste. If the DST system unit receives F039 waste in the future, then F039 will be applied to secondary waste that contacts the DST waste feed.
- Secondary wastes that are not derived from the waste feed, such as laboratory and maintenance waste, will be characterized and designated with the appropriate EPA hazardous waste numbers and Washington State dangerous waste numbers, and managed accordingly.
- If analyses are required for determining waste numbers for a secondary waste, laboratory procedures will be prepared using applicable SW-846 (EPA 1997a) methods. Analytical procedures will be revised, as appropriate, if SW-846 (EPA 1997a) methods are revised.
- Documentation of the process knowledge or analytical data used to designate the waste numbers will be maintained in the WTP operating record. Documentation is discussed in Section 6 of this report, and waste tracking is presented in Section 7.
- Characteristic of ignitability (D001) and reactivity (D003) waste numbers can be removed after testing or the application of process knowledge, as appropriate.

5.2.1 Solid Waste Streams

Solid waste streams that are designated as dangerous or mixed waste will be transferred to Hanford Site TSDs in accordance with the current *Hanford Site Solid Waste Acceptance Criteria* (HSSWAC) (HNF 2001). The WTP will meet the unit specific waste acceptance criteria for the receiving Hanford Site or other appropriate TSD. Solid wastes that are stored at the WTP will meet the acceptance criteria of the specific WTP storage area.

5.2.1.1 Solid Waste Designated as Mixed Waste

Solid waste streams that will come into contact with the waste feed during any stage of the treatment processes will be designated as mixed waste by process knowledge. These secondary waste streams are listed in Table B1-6. EPA hazardous waste numbers and Washington State dangerous waste numbers will be assigned to these mixed waste streams, based on the characterization of the waste feed. Each waste stream discussed below will meet the waste acceptance criteria of the receiving facility. A discussion of each of these mixed waste streams is provided.

Out-of-Service Melters

It is anticipated that melters will require replacement at some point, due to the harsh conditions of the vitrification process. When the end of a melter's operational life is reached, residual molten glass will be removed as immobilized product, as much as is practical. The melter will be allowed to cool and then will be disconnected.

The locally shielded melter (LSM) will be a disposal container or overpack, defined as a Resource Conservation and Recovery Act (RCRA 1976) miscellaneous unit, containing the LAW melter. The LSM, including residual glass, will be the final disposal container. After disconnection, the openings will be closed to provide complete containment. The LAW LSM will be transported to a permitted Hanford TSD. Refer to Chapter 4.0 for a more complete description of the LSM.

A HLW melter that is removed from service and that meets the HSSWAC will be placed into an overpack that will serve as its disposal container. The HLW disposal container is not a LSM. The overpacked HLW melter will be transported to a permitted Hanford Site TSD for disposal.

An out-of-service HLW melter may not meet the HSSWAC, depending on its radionuclide content. If this should occur, the overpacked HLW melter will be stored at the WTP or another permitted facility until facility closure, at which time it will be dismantled, packaged, and transported to a permitted Hanford Site TSD for disposal.

The details for the disposal of the LAW LSM and overpacked HLW melters are currently under development.

HLW Glass Residue

The disposal path for HLW glass residue that may be removed from an out-of-service HLW melter will be determined case-by-case. Final disposal will be based on the radionuclide content and dangerous characteristics of the glass residue.

Melter Components

Melters will be fitted with various ancillary equipment (such as bubbler assemblies, heating elements, and thermocouples) that may require periodic replacement. The ancillary equipment will be removed, designated by process knowledge as mixed waste, and packaged and transferred to an appropriate TSD.

Off-gas Treatment System Components

HEMEs, HEPA filters, and silver mordenite canisters will be components of the off-gas treatment system incorporated to remove contaminants from the off-gas streams prior to discharge. These components will periodically be replaced to maintain treatment efficiency. They will be designated by process knowledge, packaged, and transferred to an appropriate TSD.

Spent Carbon and Catalyst from Off-gas Treatment

Spent carbon and catalyst from off-gas treatment will periodically be replaced to maintain treatment efficiency. These materials will be designated by process knowledge and managed as mixed waste. They will be removed from their respective equipment, packaged, and transferred to an appropriate TSD.

Spent Ion Exchange Resins

Ion exchange resins used for cesium removal will periodically be replaced to maintain treatment efficiency. These resins will be designated by process knowledge and managed as mixed waste. They will be eluted, removed from their respective columns, packaged, and transferred to an appropriate TSD.

Spent Ultrafilters

Ultrafilters may be periodically replaced to maintain treatment efficiency. They will be designated as mixed waste by process knowledge, packaged, and transferred to an appropriate TSD.

Out-of-Service Equipment

Ancillary equipment, such as pumps, valves, piping, motors, and electrical equipment that is no longer fit for use will be removed from service and designated as out-of-service equipment. Out-of-service equipment that contacted the waste feed or secondary waste liquid streams will be designated by process knowledge, packaged and transferred to an appropriate TSD.

Entrained Solids

Entrained solids will be generated by pretreating the LAW feed using ultrafiltration. The separated solids will be washed and again concentrated using ultrafiltration. The entrained solids will be incorporated into the HLW feed.

5.2.1.2 Variable Waste Streams

The waste streams listed in Table B1-7 can be dangerous waste or mixed waste, depending on the source of the waste and whether it had contact with the waste feed. EPA hazardous waste numbers and Washington State dangerous waste numbers will be assigned to these waste streams, based on the designation of the waste by process knowledge. In addition to the waste streams listed in Table B1-7, raw process materials and chemicals will be brought onto the WTP site. Some of these substances may subsequently become waste and will require characterization for proper waste management. The material safety data sheet (MSDS) provides the information necessary to properly characterize and designate a substance when it becomes a waste. Vendors will be required to provide MSDS for substances that will be brought onto the WTP site, and a MSDS file will be maintained by the WTP. Examples of these types of substances are process and laboratory chemicals, lubricants such as oils and greases, and maintenance products, such as paints, solvents, and adhesives.

Subcontractors to the WTP will be required to have an MSDS for the substances that they bring onto the WTP site. Subcontractors will also be required to remove the residuals of any substance that they bring onto the WTP site, including wastes generated such as wipes, paintbrushes, and personal protective equipment. Subcontractors may make arrangements with another waste management organization to manage the generated wastes.

Laboratory Waste

Liquid laboratory waste collected in the hot cell drain and lab area sink drain collection vessels will be transferred to the pretreatment facility for recycle. Non-wastewater laboratory waste derived from the waste feed will be designated as mixed waste by process knowledge, packaged, and transferred to an appropriate TSD. Other non-wastewater laboratory wastes, such as off-specification laboratory chemicals, will be designated by process knowledge and managed accordingly. These wastes will be packaged and treated as necessary and disposed of at an appropriate TSD.

Personal Protective Equipment

Personnel performing certain tasks such as facility maintenance, treatment process operations, and waste packaging activities, may wear personal protective equipment. Used personal protective equipment may be returned to the vendor for cleaning and refurbishment. Used personal protective equipment that cannot be recycled to the vendor and has had contact with waste feed will be designated as mixed waste by process knowledge, packaged, and transferred to an appropriate TSD. Personal protective equipment waste that is not radioactive but is designated as dangerous waste by process knowledge will be packaged as necessary and disposed of at an appropriate TSD.

Maintenance Waste

Maintenance wastes such as paints, lubricants, cleaning solvents, adhesives, and off-specification chemicals will be generated at the WTP. Maintenance wastes derived from the waste feed will be designated as mixed waste by process knowledge, packaged, and transferred to an appropriate TSD. Those not derived from the waste feed and designated as dangerous waste by process knowledge will be packaged as necessary and disposed of at an appropriate TSD.

5.2.2 Liquid Waste Streams [C-2c]

The dangerous liquid waste streams generated at the WTP will be managed in accordance with the *Hanford Site Liquid Waste Acceptance Criteria* (HSLWAC) (WMFS 1998). The LERF or the ETF, or both, will receive hazardous aqueous waste generated at WTP. The waste will meet the acceptance criteria as outlined in the HSLWAC. The LERF and ETF allow process knowledge to be used in lieu of some analyses in instances where process knowledge is adequate, and a LERF or ETF representative will work with a WTP representative to identify the waste acceptance criteria and analyses appropriate for liquid waste characterization.

The liquid waste streams listed in Table B1-8 will be collected in an effluent collection tank. Should sampling be required, the sample will be drawn from a location identified in Figure B1-1 as S3. Samples will be taken from the effluent collection tank by a computer-controlled auto-sampling system. Auto-sampling of waste streams is described in Section 7.2.1 of the American Society for Testing and Materials (ASTM) Designation D6232-98, *Standard Guide for Selection of Sampling Equipment for Waste and Contaminated Media Data Collection Activities* (ASTM 1998). The effluent collection tank will be stirred during sample collection to provide representative samples.

Disposable sampling equipment will eliminate the need for equipment decontamination after use. If the use of disposable equipment is not practical, the sampling equipment will be decontaminated before and following each sample event.

A discussion of each aqueous waste stream is presented below.

Aqueous Waste from Processes

Table B1-8 lists the aqueous waste streams that will be generated by the WTP from processing the DST waste feed. The analytical laboratory will also generate aqueous waste. These waste streams will contain both radioactive and dangerous waste components and will be similar to the process condensate stream described in the *Hanford Facility Dangerous Waste Permit Application, 242-A Evaporator* (DOE-RL 2005). These aqueous waste streams will be piped to the effluent collection tank prior to transfer to the LERF/ETF by underground pipeline for treatment.

Plant Wastewater

Wastewater will be generated primarily from decontamination and wash-down activities in the WTP. The wastewater will be designated as mixed waste by process knowledge, since it will contain dilute waste feed constituents. Wastewater will also be piped to the effluent collection tank prior to transfer to the LERF/ETF by underground pipeline for treatment.

6.0 WASTE TRANSFER DOCUMENTATION SYSTEM [C-3]

The WTP is part of the Hanford Site facility because it will operate under the same EPA identification number as the other Hanford Site facilities. The WTP will prepare transportation documentation for the transfer of dangerous or mixed waste to a Hanford TSD according to the requirements of Condition II.N of the Hanford Facility Dangerous Waste Permit (Ecology 1994). Condition II.N.2.d exempts waste that will be transported by rail or pipeline unless required by unit-specific conditions. This exemption will apply to waste feed that is transferred to and from the WTP by underground pipeline, and to effluent transferred to the LERF/ETF by underground pipeline.

Waste transfer documentation and supporting process knowledge will be considered QA records and managed in accordance with the requirements for document control, as outlined in the QAPjP. This documentation will specify the identity of the receiver and confirm that the receiver accepted the waste. WTP staff and the waste receiver's acceptance personnel will date and sign the waste transfer papers. Electronic waste transfer documentation may be used, as appropriate.

Solid and liquid waste transfers and LDR notifications are discussed in the following sections.

6.1 Solid Waste Transfer

The WTP, as a waste generator, will provide documentation with each shipment of regulated solid waste to a Hanford Site TSD in accordance with the current HSSWAC (HNF 2001). Regulated solid waste transferred from the WTP to a Hanford Site TSD will meet the unit-specific waste acceptance criteria for the receiving TSD. Regulated waste shipped to an offsite TSD will be accompanied by a manifest, according to WAC 173-303-180.

6.2 Liquid Waste Transfer

Aqueous waste transfers from the WTP to the 200 Area LERF/ETF will comply with the current HSLWAC (WMFS 1998). A waste profile sheet will accompany aqueous waste transfers.

6.3 Land Disposal Restrictions Notification and Certification

WTP will provide LDR notification and certification of WTP shipped waste that contain LDR constituents above the treatment standards listed in 40 CFR 268.40. The information will be included with transfer documents to the receiving TSD facility for solid waste and liquid waste transfers.

7.0 TRACKING SYSTEM [C-4]

The plant information network (PIN) system is designed to collect and maintain information. The PIN enables WTP operational and support activities. In addition, it provides data on the glass product, secondary wastes, and monitoring activities. The PIN consists of software applications designed to meet specific requirements and functions. An overview of the network software systems is provided in Figure B1-2.

The PIN will consist of the following:

- Computerized Maintenance Management System (CMMS).
- Plant Data Warehouse and Reporting System (PDWRS).
- Laboratory Information Management System (LIJ).
- Waste tracking and inventory system (to be developed).

The PIN will interface with the integrated control network (ICN). The ICN will consist of the process control system, mechanical handling control system, and the auto-sampling control system.

These systems will be discussed in the following sections as they relate to waste tracking.

7.1 Inventory and Batch Tracking

The waste tracking and inventory system serves as the main repository for the relevant information pertinent to a given waste batch. Data is collected for each sequence or step throughout the processing history of a given batch of waste, from receipt of raw feed to disposition of the finished products, including secondary waste. At the end of a batch cycle, the data applicable to that particular batch will be catalogued to facilitate historical recording and reporting.

The waste tracking and inventory system will also record the inventory of glass product containers, including the data generated for each container of vitrified waste, and including the final QA checks. Each glass product container will bear a unique identification number to facilitate tracking.

7.2 Sample Tracking

Sampling activities will be started, monitored, and controlled through the plant ICN, with key sequence durations and operations logged. These requests will be time and date stamped, as will the actual sampling operation and the associated sample handling and laboratory activities.

The LIMS will be an integral feature of the PIN. Workstations will be located within the laboratory and the plant control rooms. The required quality control checks to assure correct sample preparation and selection of analyses will be recorded in the LIMS.

Sample containers received in the laboratory preparation area will be identified by their identification (ID) label. The ID label correlates the sample container with the sample source and, therefore, identifies the required preparation and analysis techniques. The ID will be registered at the locations where manual intervention is required, such as manual samplers. The results of calibration checks on equipment and analyzers will be recorded.

Analytical results will be compiled by the LIMS and held, pending checking and approval by laboratory staff, before being formally recorded within the waste tracking and inventory system. Process control sample results will be communicated to appropriate plant personnel.

Samples transferred to an analytical laboratory external to the WTP will be tracked in the LIMS. The LIMS will be capable of accurately tracking samples through the laboratory, and accurately recording analytical results and quality control data. Section 3.5.3 discusses the evaluation of external analytical laboratories.

7.3 Secondary Waste Stream Tracking

Secondary waste streams will be tracked within the waste tracking and inventory system in a manner similar to that of primary waste streams. Secondary waste streams will be managed by using assigned, unique ID numbers. Corresponding histories and data collection triggers will gather process and status information during the processing of secondary waste in order to satisfy tracking of waste disposal records. Shipments of overpacks will be labeled and tracked as part of the inventory control function of the waste tracking and inventory system.

Maintenance, decommissioning, or disposal activities may generate consumables, including such items as equipment, hardware, personal protective equipment, and materials used in the normal operation of the facility. Consumables that are designated as dangerous waste will be tracked by the waste tracking and inventory system, with appropriate fields denoting the hazardous classification of the disposed parts and materials, and cross-linked to disposal records. Waste being accumulated in satellite accumulation areas under the provisions of WAC 173-303-200 will also be tracked.

8.0 RECORDKEEPING

Records generated for environmental compliance will be legible, identifiable, and retrievable, and will be protected against damage, deterioration, or loss. Requirements and responsibilities for record transmission, distribution, retention, maintenance, and disposal will be established and documented. The requirements contained in (a), (b), and (c) of WAC 173-303-380 "Facility Recordkeeping" are addressed in this WAP and will be managed through the waste tracking system record keeping policies. Additional requirements listed under WAC 173-303-380 are addressed in the QAPjP. Records generated to support activities described in the WAP will be considered QA records. These may be in electronic or hardcopy format, and will be managed according to the requirements outlined in the QAPjP.

The following documents that support this WAP are considered QA records:

- Sample information provided by the DST system unit, including constituents of concern from sampling activities, laboratory analysis results, waste certifications, shipping and transfer papers.
- Verification analytical data.
- Documentation used for any discrepancy resolution and non-conformance action.
- Confirmation volume measurement data, including any discrepancy resolution.
- Documentation used for LDR evaluation.
- Sampling and analytical data developed for meeting the waste acceptance criteria of receiving facilities.
- Calibration data from analytical equipment.
- Shipment and waste transfer documentation, including waste profile sheets, and LDR information forms.

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9.2 Codes and Standards

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40 CFR 260. *General*, Code of Federal Regulations, as amended.

40 CFR 261. *Identification and Listing*, Code of Federal Regulations, as amended.

40 CFR 264. *Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*, Code of Federal Regulations, as amended.

40 CFR 268. *Land Disposal Restrictions*, Code of Federal Regulations, as amended.

40 CFR 761.61. *PCB Remediation Waste*, Code of Federal Regulations, as amended.

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Table B1-1 Summary of the Waste Feed Acceptance Process [C-3a]

Section Reference	Action
3.2.1	The DST system unit submits a waste profile.
3.2.2	The DST system unit submits a split sample aliquot of the waste feed to WTP for waste verification analyses, if requested. The verification analysis process is discussed in Section 3.3.
3.2.3	Qualified WTP personnel perform a pre-shipment review by examining the waste profile and the verification analytical results to ensure compatibility and acceptability of the waste feed. If the review finds that the waste feed is acceptable, the WTP notifies the DST system unit that the waste feed can be transferred. If the review finds that the waste feed is not acceptable, non-conformance actions are initiated.
3.2.4	Non-conformance actions include a second review of the data and information and may include a second analysis of the verification split sample aliquot. If the waste feed continues to be outside of the waste acceptance criteria, the waste will be refused for transfer.
3.2.5	Acceptable waste feed is transferred from the DST system unit to the WTP.
3.2.6	After waste feed is received into the WTP, the DST system unit and the WTP perform confirmation volume measurements to ensure that the waste feed transferred is the waste feed that was accepted for transfer.

Table B1-2 Summary of Dangerous Waste Numbers for WTP

Characteristic Waste Numbers				Listed Waste Numbers		
D001	D002	D003	D004	F001	F002	F003
D005	D006	D007	D008	F004	F005	F039 [a]
D009	D010	D011	D018			
D019	D022	D028	D029			
D030	D033	D034	D035			
D036	D038	D039	D040			
D041	D043	WT01[b]	WT02[b]			
WP01[b]	WP02[b]					

[a] Multi-source leachate (F039) is included as a waste derived from non-specific source wastes F001 through F005.

[b] Washington State criteria

Table B1-3 Waste Feed Analysis, Waste Acceptance Criteria, and Non-
[C-2a(2)]

lytical thod[a]	Estimated Sample Volume[b]	Required Detection Limit[d]	Acceptance Criteria	Non-Conformance Actions
46, d 9060 or lethod	1 mL liquid or 0.1 g solid	1 % by weight	TOC < 10 % by weight	Reject waste feed
46, d 8082	10 to 20 mL liquid or 0.5 g solid	5 ppm[e]	PCBs < 50 ppm[e]	Reject waste feed
ter, SW- ethod	5 mL	1 pH unit	Acceptable pH range >7	Corrective actions to correct pH
[d] Method -90	10 mL of each waste stream	Temperature Change = 1 °C	Acceptable temperature change < ± 20 °C No viscosity change adversely affecting waste processing	Corrective actions to eliminate incompatible conditions

[a] SW-846 Method (EPA 1997a) unless specified otherwise.
[b] Sample volume needed for each analysis.
[c] EPA Method 415.2 (EPA 1997b).
[d] American Society for Testing and Materials (ASTM 2001).
[e] Parts per million = milligrams per liter or milligrams per kilogram (approximate).

Table B1-4 Properties for the Determination of Ignitable Waste

Regulatory Citation	Ignitable (D001) Waste Property
WAC 173-303-090 (5)(a)(i)	It is a liquid, other than an aqueous solution containing less than 24 % alcohol by volume, and has a flash point less than 60 °C (140 °F), as determined by a Pensky-Martin Closed Cup Tester, using the test method specified in ASTM Standard D-93-79 or D-93-80, or a Setaflash Closed Cup Tester, using the test method in ASTM Standard D-3278-78.
WAC 173-303-090 (5)(a)(ii)	It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes, and when ignited, it burns so vigorously and persistently that it creates a hazard.
WAC 173-303-090 (5)(a)(iii)	It is an ignitable compressed gas that is defined in 49 CFR 173.115 and is determined to be flammable by the test methods described in that regulation.
WAC 173-303-090 (5)(a)(iv)	It is an oxidizer, if it is defined as such in 49 CFR 173.127 and 173.128.

Table B1-5 Properties for the Determination of Reactive Waste

Regulatory Citation	Reactive (D003) Waste Property
WAC 173-303-090 (7)(a)(i)	It is normally unstable and readily undergoes violent change without detonating.
WAC 173-303-090 (7)(a)(ii)	It reacts violently to water.
WAC 173-303-090 (7)(a)(iii)	It forms potentially explosive mixtures with water.
WAC 173-303-090 (7)(a)(iv)	When mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.
WAC 173-303-090 (7)(a)(v)	It is a cyanide- or sulfide-bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment.
WAC 173-303-090 (7)(a)(vi)	It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.
WAC 173-303-090 (7)(a)(vii)	It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.
WAC 173-303-090 (7)(a)(viii)	It is a forbidden explosive as defined in 49 CFR 173.54, or a Class 1 explosive, Division 1.1, Division 1.2, Division 1.3, and Division 1.5, as defined in 49 CFR 173.50.

Table B1-6 Secondary Solid Mixed Waste Streams

Waste Stream	Characterization	Disposal
Out-of-service melters	Designated by process knowledge	[a]
HLW glass residue		Determined case-by-case
Melter components		These wastes will be packaged and transferred to the appropriate Hanford TSD.
Off-gas treatment system components: High-efficiency mist eliminators HEPA filters Silver mordenite canisters		
Spent carbon and catalyst from off-gas treatment		
Spent ion exchange resins		
Spent ultrafilters		
Out-of-service equipment		
Entrained solids		[b]

a Disposal of out-of-service melters is currently under development.

b Entrained solids will be added to the HLW feed for vitrification.

Table B1-7 Variable Solid Waste Streams

Waste Stream	Characterization	Disposal
Non-wastewater laboratory waste	Each generation event of these wastes will be individually designated by process knowledge and will comply with the receiving TSD waste acceptance criteria	The wastes will be packaged and transferred for disposal to an appropriate TSD
Personal protective equipment		
Maintenance waste		

Table B1-8 Liquid Mixed Waste Streams

Waste Stream	Characterization and Disposal	Sampling Point	Sampling Frequency
Waste feed evaporator condensate	The waste streams will collect in a mixer tank, be designated as mixed waste by process knowledge and analysis, as necessary, and will be transferred to the LERF or ETF.	The streams collected in a mixer tank are grab sampled by autosampler.	Sampling will be: • before initial discharge • at major process change • at request for re-sampling by the ETF
LAW melter feed evaporator condensate			
Pretreatment, LAW, and HLW off-gas condensate			
LAW and HLW melter off-gas scrubber blowdown			
Cesium process condensate			
Cesium ion exchange rinse water			
Laboratory wastewater			
Plant wastewater containing waste feed			

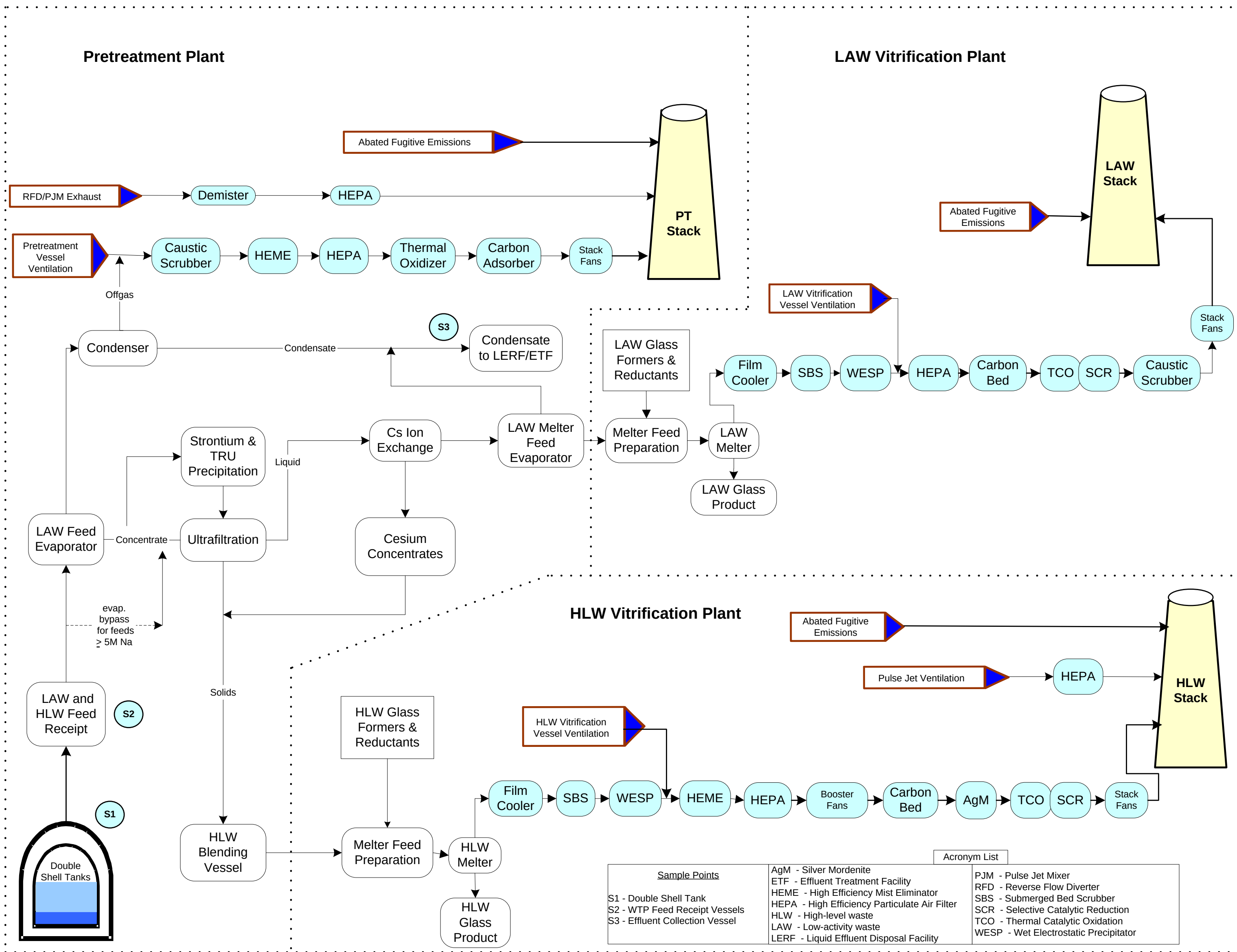

Figure B1-1 Simplified Flow Diagram and Sampling Locations

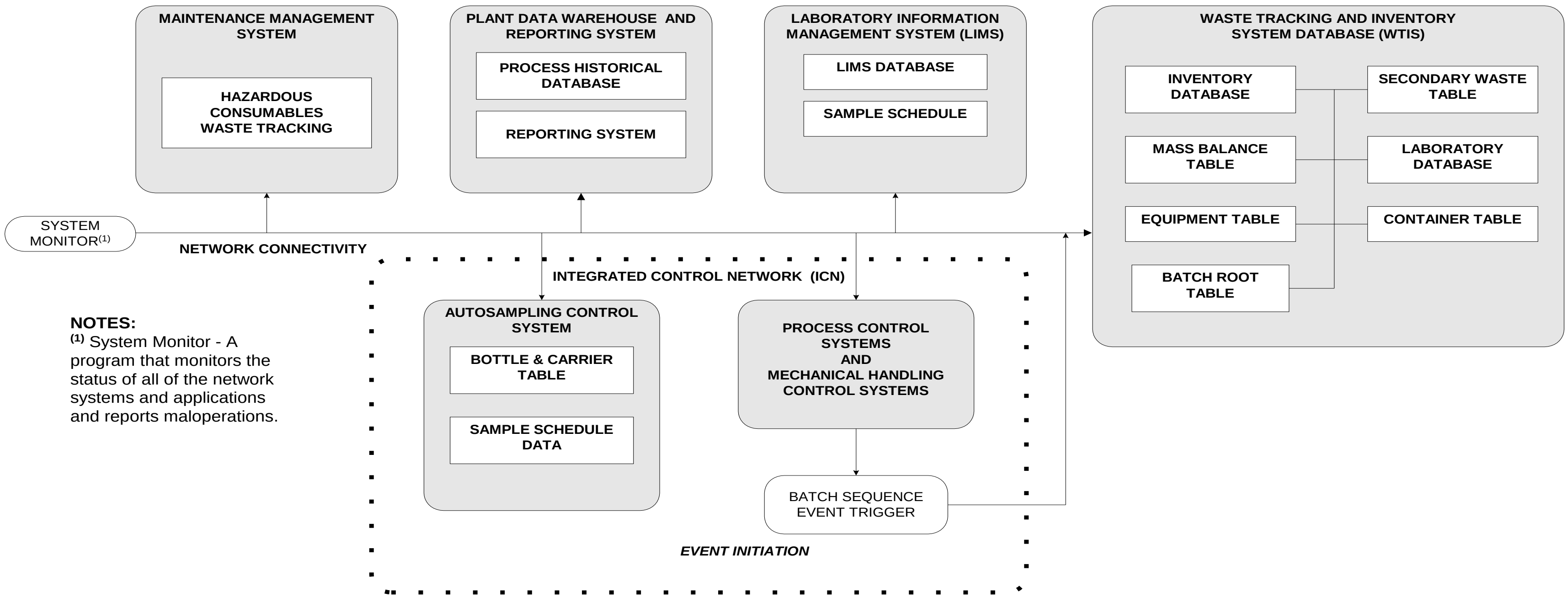

Figure B1-2 Plant Information Network Data Relationships