FUNCTIONS AND REQUIREMENTS FOR PROJECT W-236B, INITIAL PRETREATMENT MODULE

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DISCLAIMER

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LIST OF TERMS

A&E	Architect and Engineer
ALARA	as low as reasonably achievable
BACT	Best Available Control Technology
BARCT	Best Available Radionuclide Control Technology
CH	contact handled
CW	Cooling Water
DBA	Design Basis Accident
DBF	Design Bases Fire
DF	Decontamination Factor
DOE	U.S. Department of Energy
DSSF	double-shell slurry feed
EPA	U.S. Environmental Protection Association
GFE	Government Furnished Equipment
HLW	high-level waste
HVAC	heating, ventilating, and air conditioning
I&C	instrumentation and control
IDEF	Integrated Computer-aided Manufacturing Definition
IHLW	immobilize high-level waste
LLMW	low-level mixed waste
LLW	low-level waste
NCAW	neutralized current acid wash
NFPA	National Fire Protection Association
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PDC	Project Design Criteria
PS	pretreat supernatant
QA	Quality Assurance
RACT	Reasonably Available Control Technology
RCRA	*Resource Conservation and Recovery Act of 1976*
SG	System Generated Waste
SPP	Support Pretreatment Process
SW	Secondary Waste
TRU	transuranic
TWRS	Tank Waste Remediation System
UPS	Uninterruptable Power Supply
WAC	Washington Administrative Code
WHC	Westinghouse Hanford Company
WRAP	Waste Receiving and Packaging

DEFINITIONS

Decontamination Factor (DF) - The factor by which the concentration of radioactive contaminations is reduced; the ratio of the radioactivity initially present to that subsequently present.

Design Life - The design life is the time span from start of operations until the date (yet to be defined) of mission completion (e.g., the expected life of the facility).

High-level waste - "The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation." (DOE Order 5820.2A)

"Incidental Waste" - Residual waste material incidental to the process of recovering high-level waste. These wastes have been processed to remove key radionuclides to the maximum extent that is technically and economically practical and will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR Part 61; and are managed pursuant to the Atomic Energy Act. (Bernero 1993)

Low-level waste - "Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel, or byproduct material as defined by 5820.2A. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic is less than 100 nCi/g." (DOE Order 5820.2A)

Operating Life - The operating life is the time span from hot start up through processing of the final feed.

Solid Waste - Waste generated during the pretreat supernatant processing. Solid waste includes: high and low-level radioactive waste, mixed low-level waste, TRU waste, mixed TRU waste, dangerous waste, and nonradioactive nondangerous solid waste.

Throughput - The overall design throughput is the product of: (expected total volume feed/14 years of operation/[60 percent total operating efficiency]). The throughput represents the required rate of processing to complete operations in a maximum 14 years of processing.

(9.49 E+8 L/14 yr)(yr/365 d)(d/24 h)(h/60 min)(1/0.6) = 215 L/min *

*Value accurate to two significant figures.

Transuranic Waste - "Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lifes greater than 20 years and concentrations greater than 100 nCi/g at the time of assay." (DOE Order 5820.2A)

FUNCTIONS AND REQUIREMENTS FOR PROJECT W-236B, INITIAL PRETREATMENT MODULE

1.0 INTRODUCTION

Hanford Site tank waste supernatants will be pretreated to separate the low-level and high-level fractions. The low-level waste fraction, containing the bulk of the chemical constituents, must be processed into a vitrified waste product which will be disposed of onsite, in a safe, environmentally sound, and cost effective manner. The high-level waste fraction separated during supernatant pretreatment (primarily cesium) will be recombined with an additional high-level waste fraction generated from pretreatment of the tank waste sludges and solids. This combined high-level waste fraction will be immobilized as glass and disposed in a geological repository.

1.1 PURPOSE

The purpose of this document is to establish the functional requirements baseline for Project W-236B, Initial Pretreatment Module, by defining the level 5 and 6 functions and requirements for the project. A functional analysis approach has been used to break down the program functions and associated physical requirements that each function must meet. The TWRS functions and requirements document (DOE 1994b) provides the upper level (i.e., function levels one through four) systems engineering functions and requirements. This document provides a transition from the TWRS program functions and requirements to the functions and requirements for the pretreat supernatants.

All functions and interfaces are defined, but not all requirements are defined. Requirements will be added or modified as new information becomes available, trade studies are conducted (as identified in the required analyses), architecture is added, and conceptual design progresses. Additional issues and/or required analyses derived by the project will be evaluated by Westinghouse Hanford Company (WHC) to determine the necessary action. The requirements needed to proceed with the project have been identified.

As the systems engineering process evolves, the design requirements document will replace this preliminary functions and requirements document. The design requirements document (DRD) will identify key decisions and associated uncertainties that impact the project. A revision of this document to a DRD is not expected to change the performance requirements or open issues. However, additional requirements and issues may be identified. The design requirements document is expected to be issued well before completion of the conceptual design.

1.2 SCOPE

The project scope includes facilities required to separate tank waste supernatants into low-level and high-level fractions. The major unit operations will include solid/liquid separation, cesium ion exchange, feed and product concentration. At date of this document issue, no existing facilities have been identified as part of the supernatant pretreatment system. Tank waste supernatants are existing tank liquids, liquids generated from pretreatment of tank waste sludges/solids, and liquids from treatment of gaseous and liquid effluents associated with immobilization of tank wastes. Tank waste retrieval and transfer, solids/sludge washing and waste blending, high-level waste (HLW) immobilization, and disposal of the separated waste fractions are outside the scope of this project. Interface requirements between projects will be addressed in a separate document.

1.3 TANK WASTE REMEDIATION SYSTEM MISSION BACKGROUND

The Hanford Site HLW underground storage tanks contain approximately 230,000 m^3 (61 Mgal) of caustic liquids, slurries, salt cakes, and sludges. The Tank Waste Remediation System (TWRS) Program was established in 1991 to safely store, treat, and immobilize highly radioactive Hanford Site waste (current and future tank waste and cesium/strontium capsules) in an environmentally sound, safe, and cost effective manner.

The principle desired end state for the TWRS is immobilized tank wastes. Underground storage tanks and ancillary equipment with contained residues will be transferred to the Environmental Restoration Program for disposition. To reach the desired end state, tank wastes will be retrieved and pretreated before immobilization. The current pretreatment strategy (Alumkal 1994b) for the retrieved wastes uses solids-liquids separation, sludge washing, and ion exchange to provide waste separation into low-activity and high-activity fractions. In-tank pretreatment includes solid/liquid separations by settling and decanting, selective leaching of Al, PO_{4-3}, and Cr, and washing of the leached solids. Out-of-tank pretreatment conditions feed to ion exchange by evaporation, filtration, and chemical adjustment for feed to cesium ion exchange.

The low-activity fraction will be immobilized for onsite disposal and the high-activity fraction will be immobilized for disposal in a deep geological repository offsite.

Execution of the TWRS mission will be accomplished by several subfunctions as defined in the TWRS Functions and Requirements document (DOE/RL-92-60 [DOE 1994b]). The removal of waste from the underground storage tanks is defined by the Retrieve Waste function. Pretreatment of retrieved tank wastes is defined by the Pretreat Waste function. Immobilization and disposal of the low-activity fraction is affected by the Immobilize and Dispose LLW function. Immobilization of the high-activity fraction is affected by the Immobilize HLW/Transuranic (TRU) Waste function.

2.0 SYSTEMS ENGINEERING BACKGROUND

The systems engineering process is being applied at the Hanford Site and is to be used by all TWRS programs for making technical decisions (TWRS Program Leadership Council on Rebaselining Meeting in Richland, Washington, November 1992). The Program requirements to implement the Systems Engineering at the Hanford Site are defined in *Fiscal Year 1995 Hanford Mission Plan*, DOE-RL-93-102 (DOE 1994a). The policy and guidance for application of systems engineering throughout the TWRS Program is described in the *Tank Waste Remediation Systems (TWRS) Systems Engineering Management Plan*, DOE/RL-93-0106 (DOE 1994c, Annex 2).

The systems engineering process is a sequence of activities that transform an identified mission into a description of system performance parameters and a preferred system configuration. The mission analysis contains a well defined mission statement and top level functions. A functional analysis approach is then used to break down the program functions and associated physical requirements that each function must meet.

3.0 FUNCTIONAL ANALYSIS

The functional analysis identifies and defines the lower level functions needed to perform the parent function. The TWRS Function Hierarchy (DOE 1994b) to the fourth level of decomposition is shown in Figure 1. The fourth level function, Pretreat Waste (4.2.2.1), has been decomposed to the fifth level which is shown in Figure 2. This decomposition divided the Pretreat Waste function into Pretreat Sludges/Solids (4.2.2.1.1), Pretreat Supernatants (4.2.2.1.2) and Blend High-Activity Streams (4.2.2.1.3).

TWRS Program System Engineering is using Integrated Computer-aided Manufacturing Definition (IDEF), a software diagramming tool, to produce and maintain the F&R flow diagrams. The level 5 decomposition for the Pretreat Supernatants (PS) function (4.2.2.1.2) is represented by the interface diagram in Figure 3. This interface diagram shows all of the inputs and outputs necessary to complete the PS mission. Inputs are shown coming in the left side of the figure and outputs leave on the right side of the figure. The scope of project W-236B is defined by the PS function.

The other level 5 functions shown in Figure 3, pretreat sludges/solids and blend high-activity stream functions, are not included in the scope of this project. However, definitions of the Level 5 functions are given in Section 3.2 to clarify their relationship with the PS function. The fifth level decompositions will be documented in the Technical Requirements Specification for the Pretreat Waste Function.

3.1 PRETREAT SUPERNATANT FUNCTIONAL ANALYSIS

The Pretreat Supernatant (PS) function receives supernatants for separation into low-activity and high-activity fractions. The PS function was decomposed to the sixth level. The interface diagram in Figure 4 shows this sixth level decomposition consisting of the following:

- Separate Radionuclides
- Treat PS Vessel Offgas
- Analyze PS Samples
- Monitor and Control PS Process
- Prepare PS Solid Waste
- Prepare PS Liquid Waste
- Support Pretreatment Process.

These sixth level functions are needed to perform the parent function Pretreat Supernatant. Figure 4 also identifies the inputs and outputs between each of the level 6 functions and the interfaces with functions outside of pretreat supernatant.

A functional block diagram, shown in Figure 5, was prepared as a working tool from a "facility" perspective during the sixth level functional decomposition. Figure 5 will not be included in the baseline configuration control. Further decomposition of the level six functions will be performed by the project.

3.2 PRETREAT SLUDGES/SOLIDS FUNCTION

The Pretreat Sludges/Solids function includes organic destruction, selective blending, simple solid/liquid separation (settle/decant), chemical leaching and water washing as well as general monitoring and waste handling functions. A separate functions and requirements document is being prepared for the Pretreat Sludges/Solids function.

3.3 BLEND HIGH-ACTIVITY STREAMS FUNCTION

The Blend High-Activity Streams function definition is: Combine the high-activity waste fractions separated from pretreatment of sludges/solids (function 4.2.2.1.1) and pretreatment of supernatants (function 4.2.2.1.2) to produce a mixture suitable for HLW immobilization.

The high-activity waste fraction separated from pretreatment of sludges/solids is a solids slurry contained in a relatively small volume stream compared to the volume of the separated LLW stream (e.g. supernatants). The high-activity waste fraction separated from pretreatment of supernatants consists of a concentrated cesium solution with a small fraction of solids. These high-activity waste fractions may be combined for interim storage before immobilization.

Figure 1. Tank Waste Remediation System Function Hierarchy (DOE 1994b).

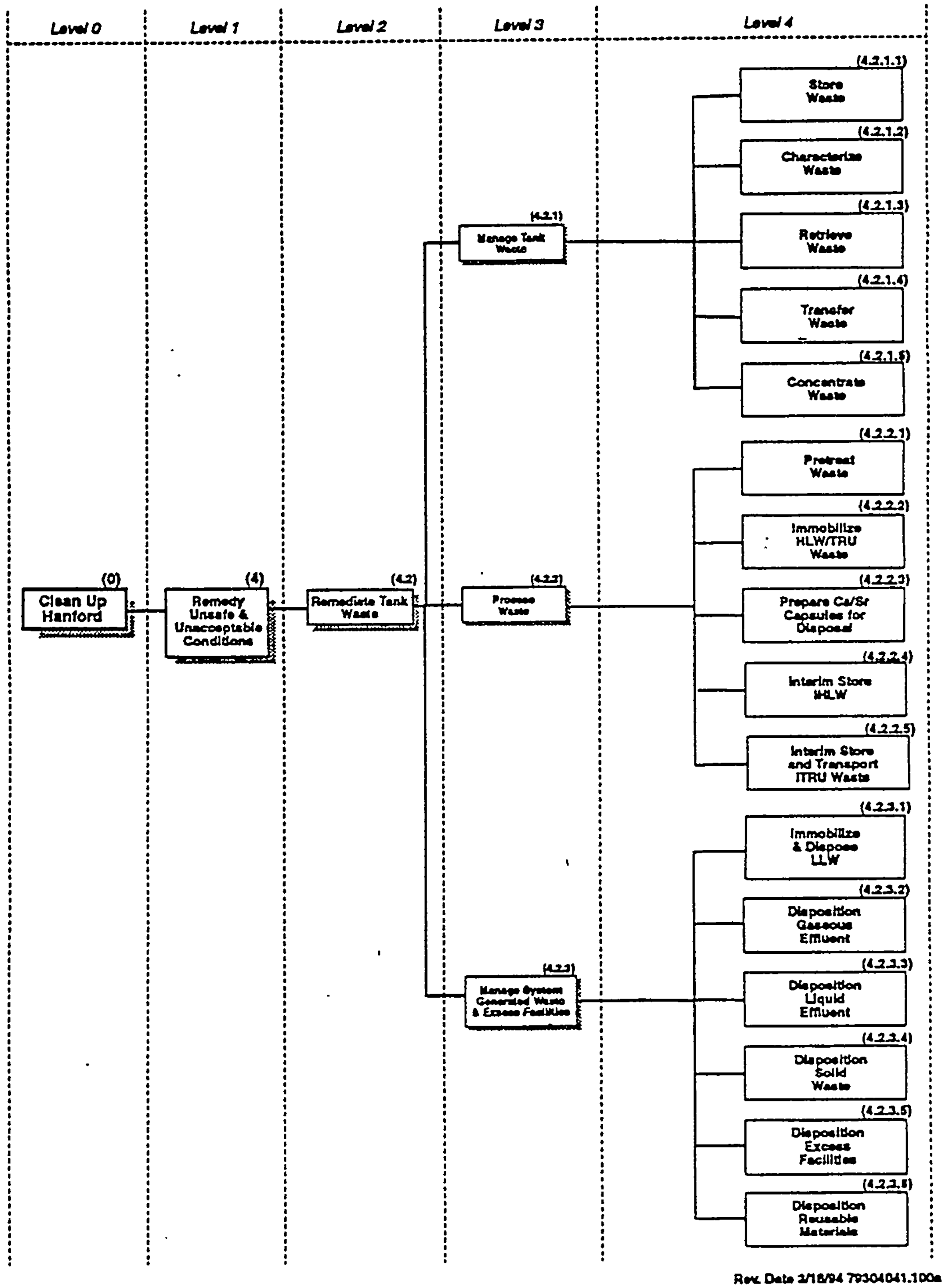
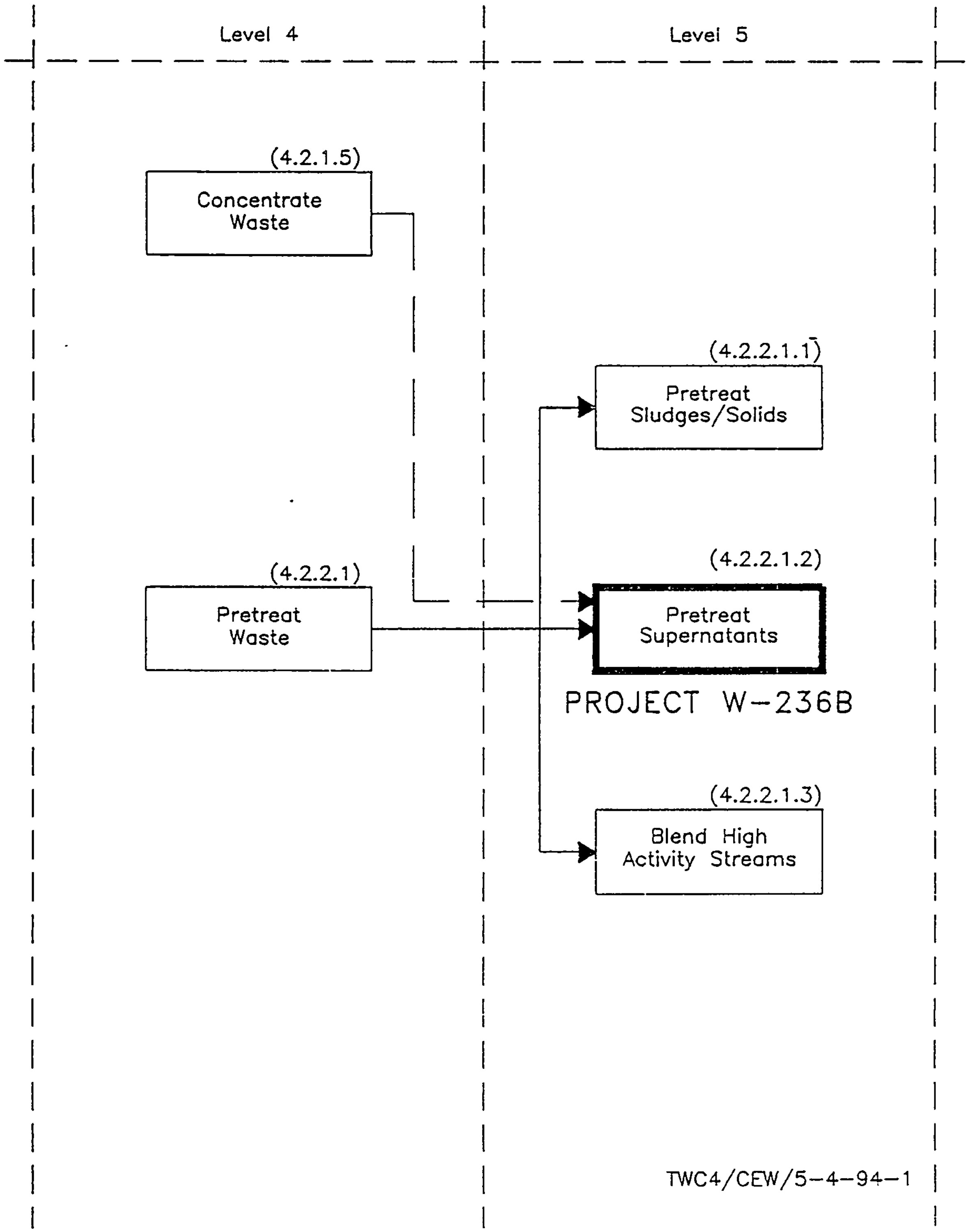
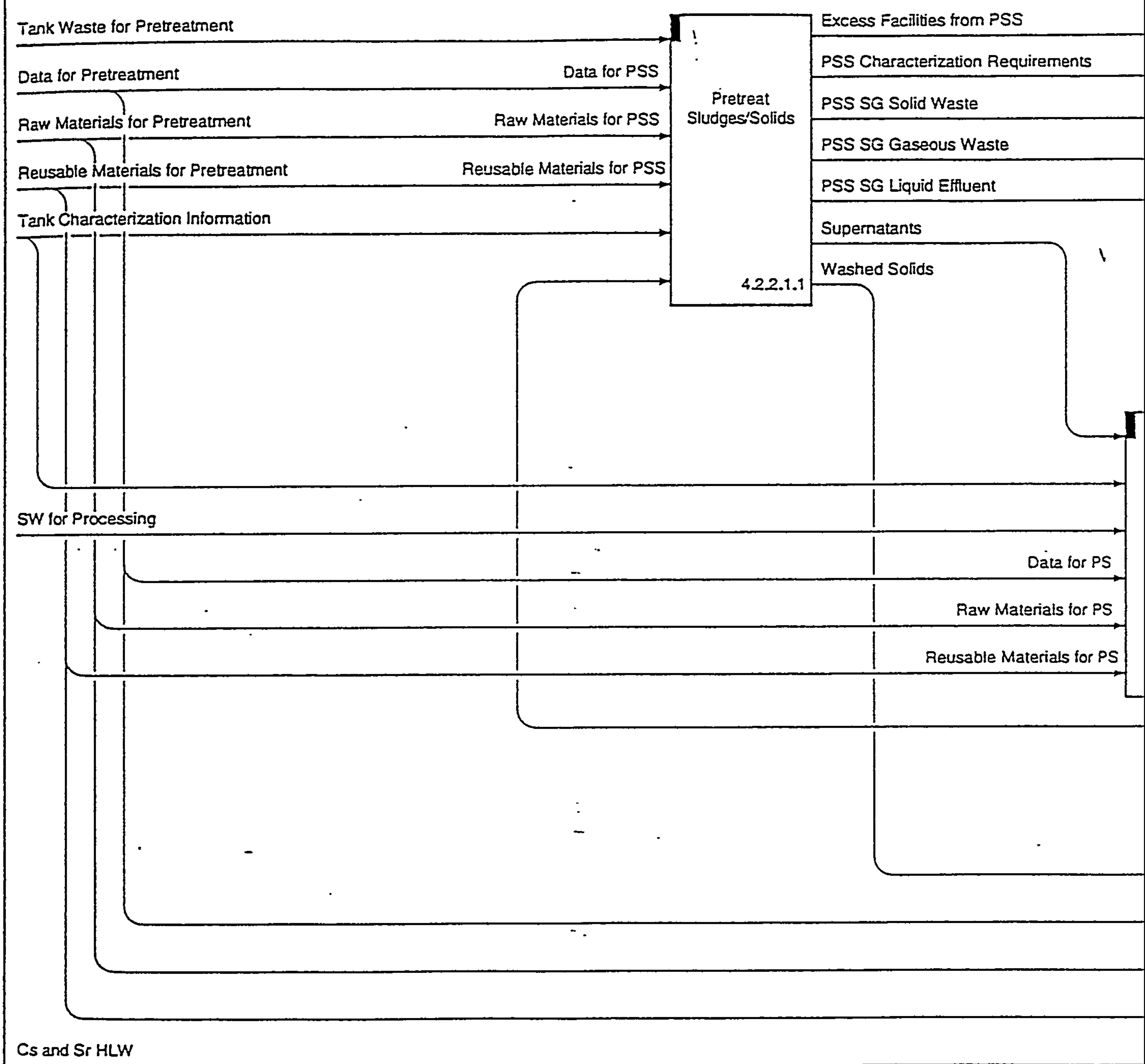


Figure 2. Pretreat Waste Hierarchy to Fifth Level.





NAME: Pretreat Waste

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July 20, 1994 9:55

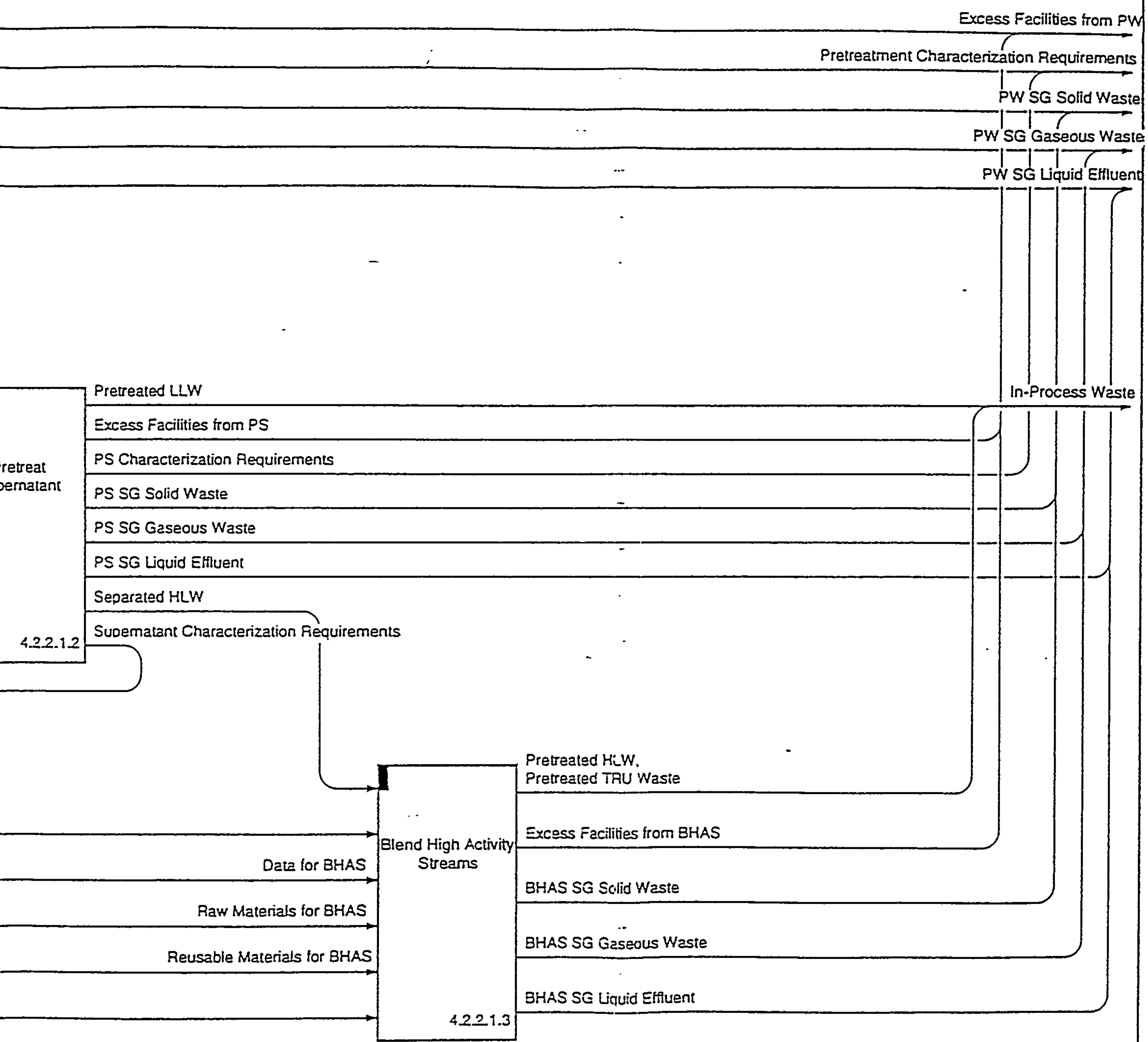

Figure 3. Pretreat Supernatant Interface Diagram, Fifth Level.

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PRINT DATE: July 21, 1994 9:27	

[4.2.2] Process Waste

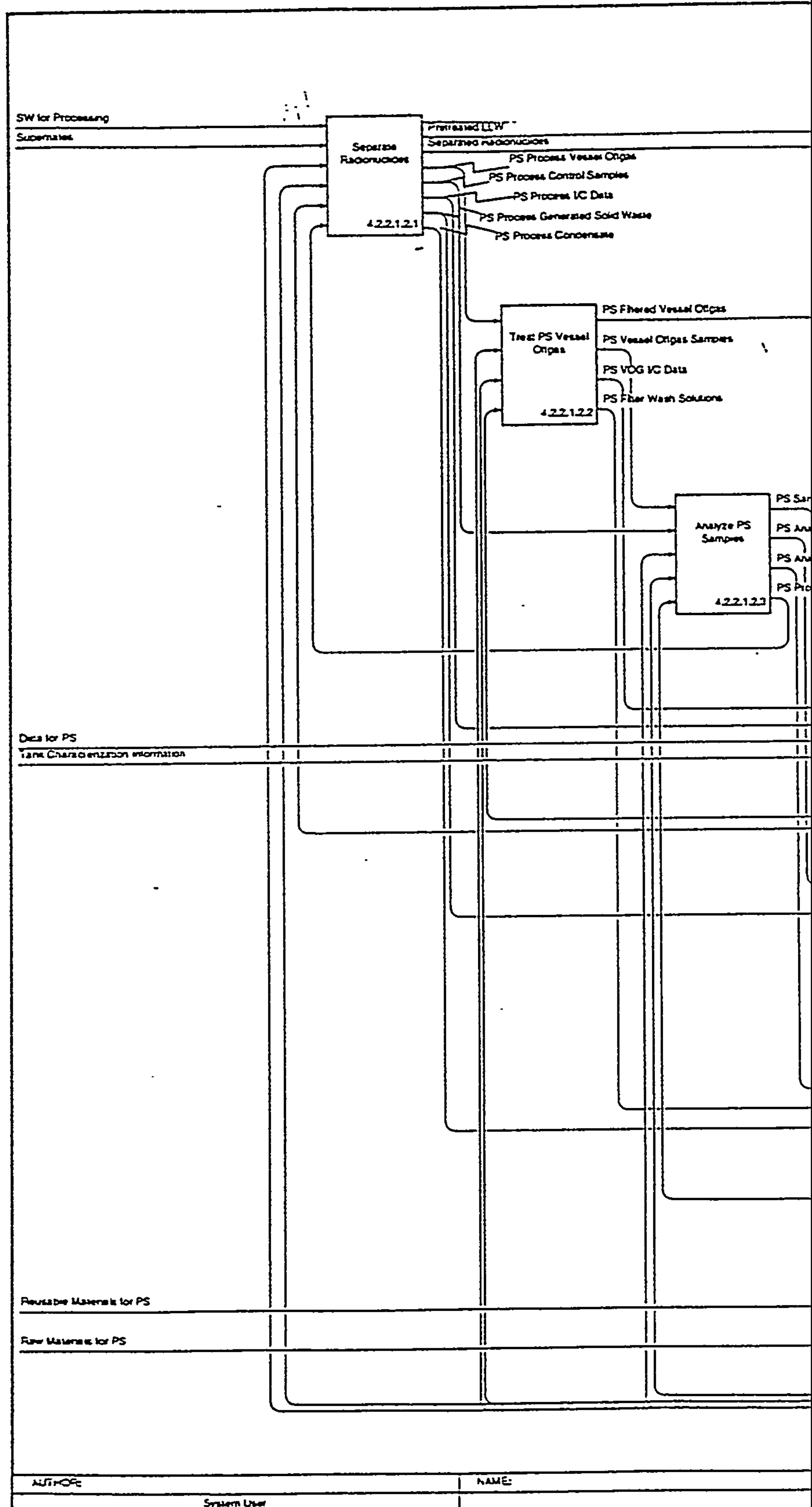
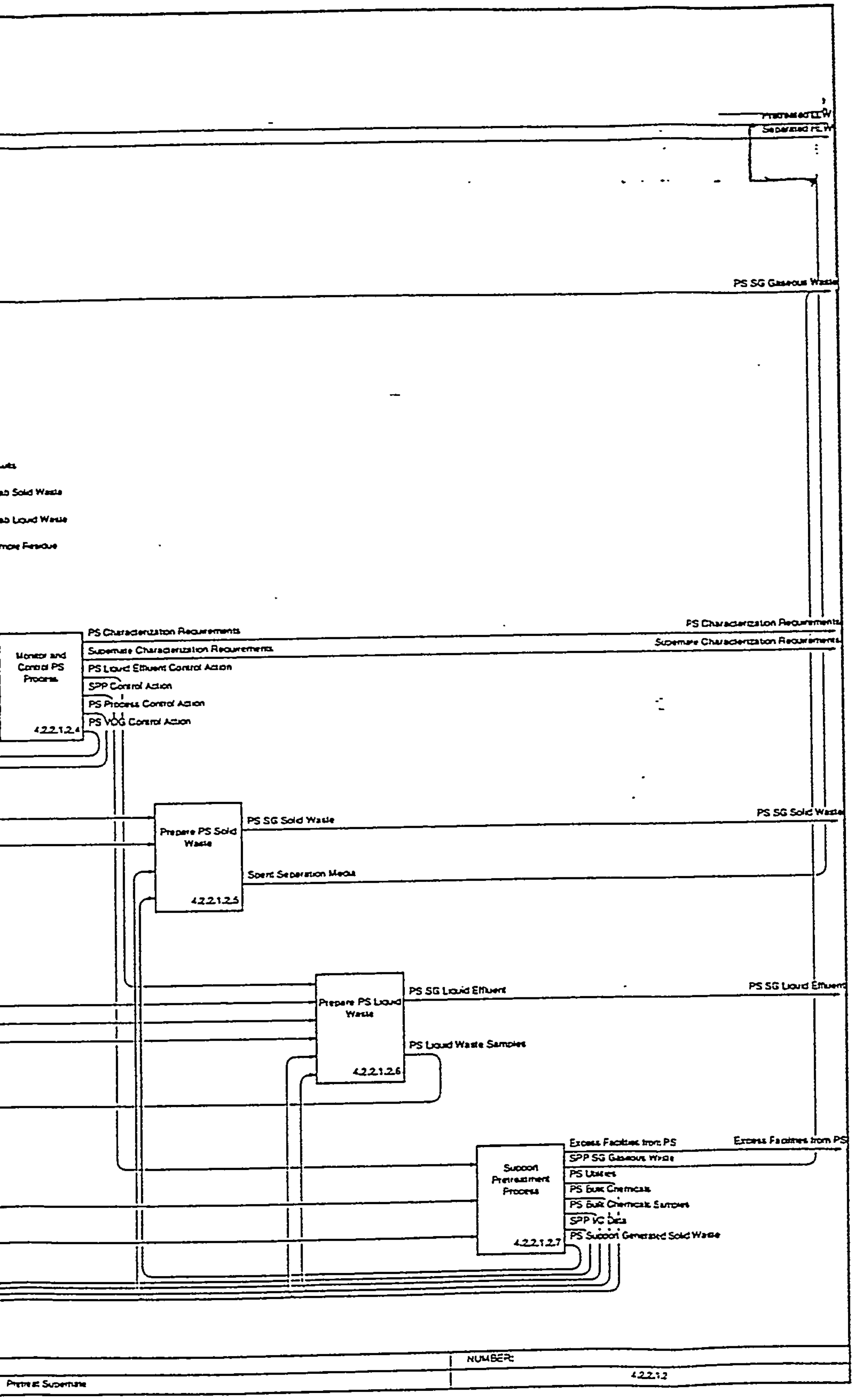
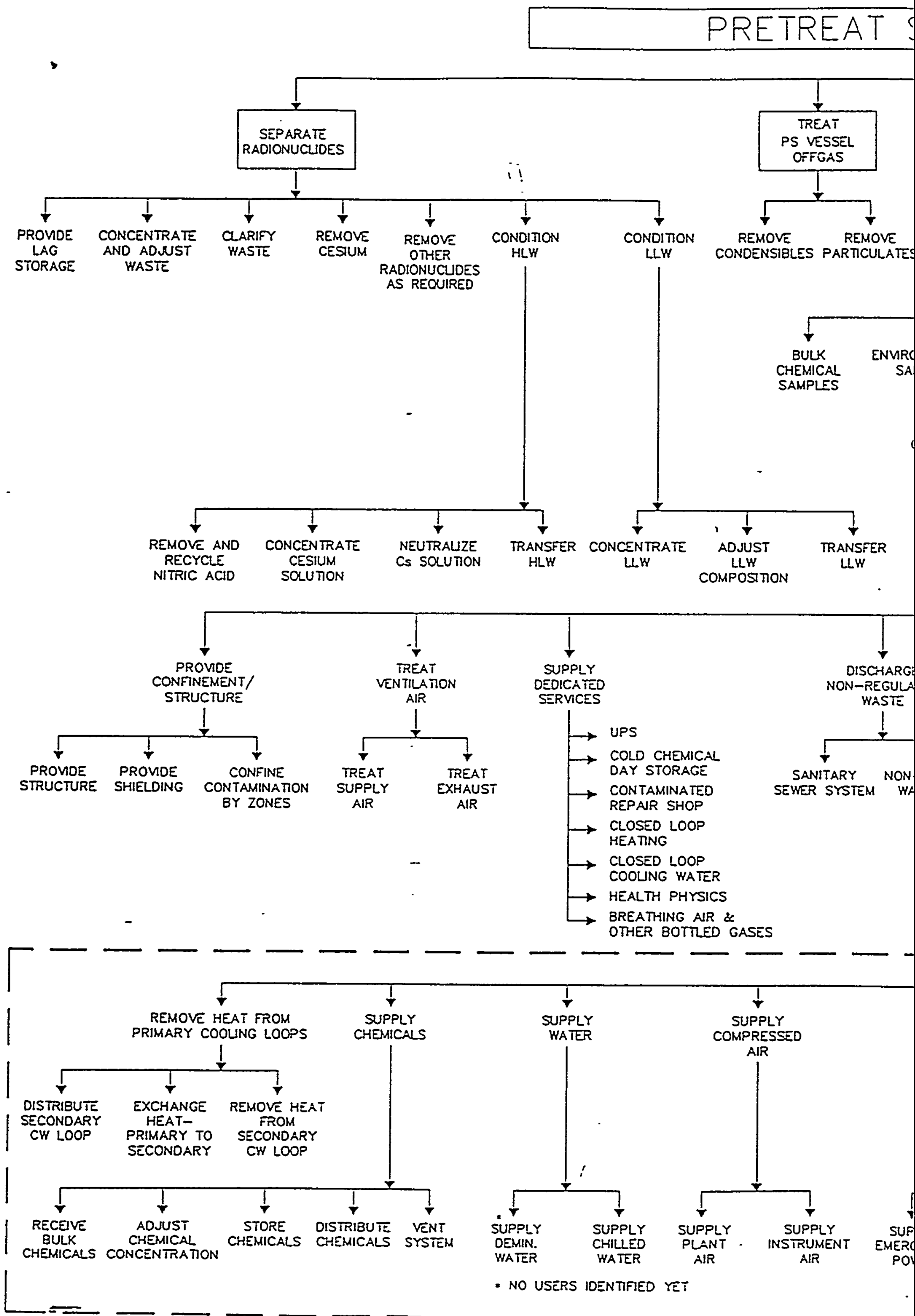


Figure 4. Pretreat Supernatant Interface Diagram, Sixth Level.

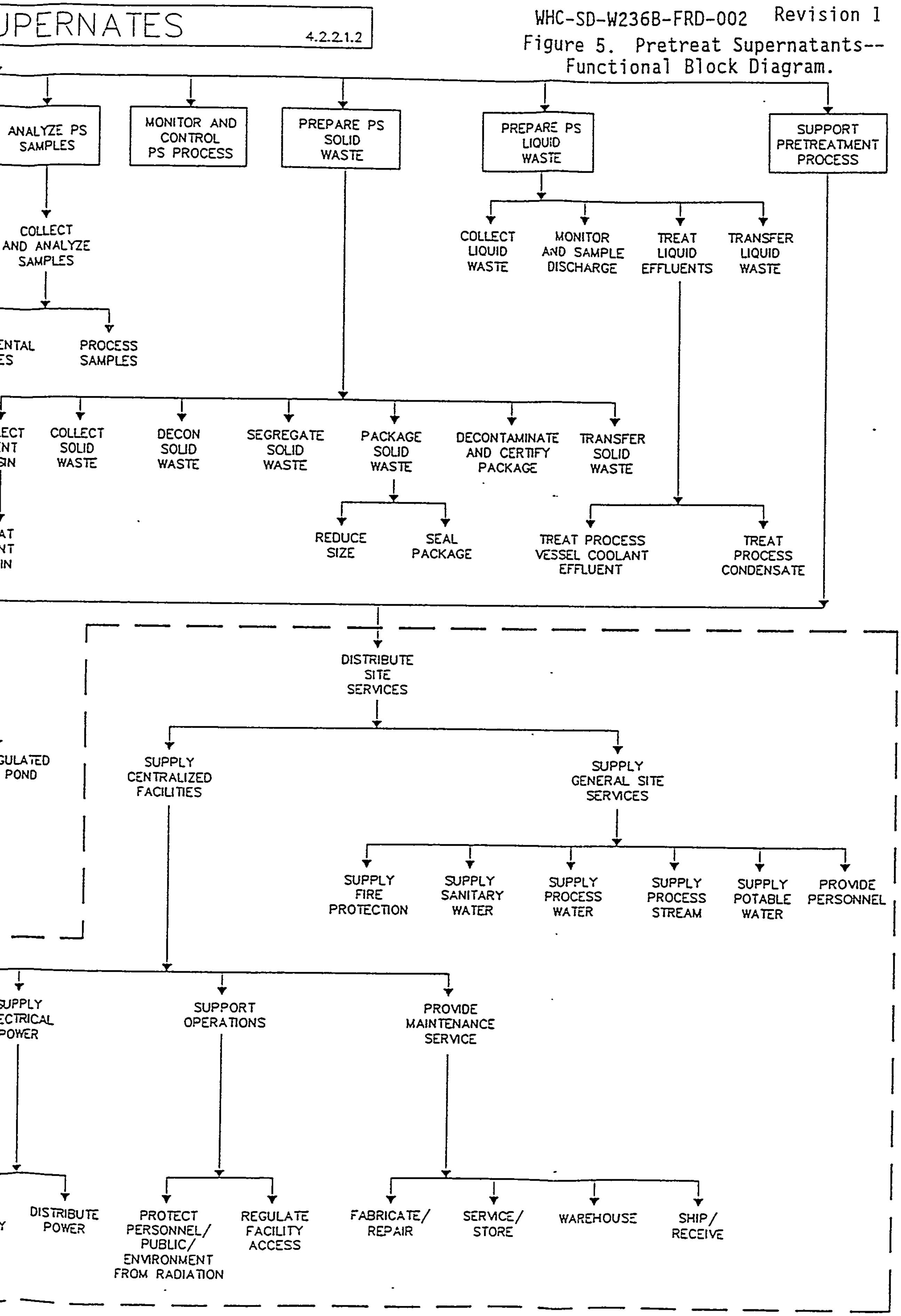




NOTE: DASHED BOX REPRESENTS POTENTIALLY COMMON SERVICES/UTILITIES WITH OTHER FUNCTIONS/PROJECTS

This figure will not be placed under configuration control.

Figure 5. Pretreat Supernatants--Functional Block Diagram.



LMS33/CEW/4-22-94-6

4.0 FUNCTIONS AND REQUIREMENTS FOR PRETREAT SUPERNATANTS (4.2.2.1.2)

The following sixth level functions have been decomposed from the Pretreat Supernatant function: (1) Separate Radionuclides, (2) Treat Vessel Offgas, (3) Analyze PS Samples, (4) Monitor and Control Process, (5) Prepare Solid Waste, (6) Prepare Liquid Waste and, (7) Support Pretreatment Process. This section establishes the known requirements associated with these functions.

The initial feed to the PS will be the liquid fraction from separation of the double-shell slurry feed (DSSF) supernatants (separated by decanting). The DSSF feed will be followed by the liquid fraction from separation of retrieved SST salt cake slurry from entrained solids (conducted by Retrieve Waste and Pretreat Sludges/Solids functions).

All of the information for the functions are presented in the form of a function table as defined by the Systems Engineering process. The function tables in this section have been arranged according to the template in Table 1. The format of the template has been modified from the template given in the TWRS Functions and Requirements document for use in this functions and requirements document.

In addition to the performance and constraint requirements identified in the following sections, other constraints must be reviewed and applied (see Section 5.0 General Requirements). Where requirements do not exist, the project will need to derive the applicable requirements. Also, architecture tables for the functions must be developed and included in the next revision.

Table 2 is a summary of the requirements that are currently defined for the fifth and sixth levels.

Table 1. Functions and Requirements Template. (sheet 1 of 3)

Function Title and Function ID Number

A short description used to identify the function, usually in terms of a verb followed by a noun or a noun phrase. A unique identification number for each function of the TWRS function tree. As indicated, the numbering scheme is based on using a 4.2. at the top level of the TWRS tree, a 4.2.i as the second level, a 4.2.i.j as the third level, etc.

Function Definition

A function is a primary statement of purpose; a definition of what a system or subsystem must accomplish to meet the overall mission. The function definition is a brief description of what this particular function must accomplish, often including the scope of applicability.

Function Requirements

A qualitative or quantitative statement of how well a function must be performed. Function requirements may be one of two types: Performance Requirements or Constraints.

The numbering convention used for the identification of requirements in these tables is as follows:

4.2.2.1.2 P1 is the first performance requirement (P) allocated to function 4.2.2.1.2.

4.2.2.1.2 C1 is the first constraint (C) allocated to function 4.2.2.1.2

Performance Requirements (P)

Requirements imposed upon the function by the TWRS Program itself and, hence, may be traded with respect to other performance requirements to optimize overall performance.

Issues (I)

If the requirements are inadequate, if they conflict with other requirements if they are not yet allocable, or if they are likely to change, an issue should be identified.

Required Analysis

Any activity, study, negotiation etc. that is necessary to resolve the "Issue."

Constraints (C)

Requirements imposed upon the function by the external environment (e.g., U.S. Congress, Washington EPA, DOE Orders).

Table 1. Functions and Requirements Template. (sheet 2 of 3)

Interface Definitions and Requirements

A. Inputs (I)
Anything that is acted upon by a function to produce desired outputs. Inputs can be classified as either internal or external, depending on whether they originate from within TWRS or from the outside environment, respectively.

B. Outputs (O)
Anything that leaves the function after it has been acted upon by that function.

Constraints (C)
Requirements imposed upon the function by the external environment (e.g., U.S. Congress, Washington EPA, DOE Orders).

Issues (I)
If the requirements are inadequate, not yet allocable, or likely to change, an issue should be identified.

Required Analysis
Any activity, study, negotiation etc. that is necessary to resolve the "Issue."

Performance Requirements (P)
Requirements imposed upon the interface by the TWRS Program itself and, hence, may be traded with respect to other performance requirements to optimize overall performance.

4.2.2.1.2 O1 P1 would be the first performance requirement allocated to output number O1 from function 4.2.2.1.2.

4.2.2.1.2 I3 C1 is the first constraint allocated to input number I3 to function 4.2.2.1.2.

Issues (I)
If the requirements are inadequate, if they conflict with other requirements, if they are not yet allocable, or if they are likely to change, an issue should be identified. Issues are numbered sequentially.

Required Analysis
Any activity, study, negotiation etc. that is necessary to resolve the "Issue."

Table 1. Functions and Requirements Template. (sheet 3 of 3)

Expected System Performance (Designated as EP)

A preliminary flowsheet has been prepared as a planning basis for the Remediate Tank Waste and subordinate functions. This preliminary flowsheet conforms to the functional requirements and represents the strategy for storage, treatment, and disposal of tank wastes as presented in the Tri-Party Agreement.

This preliminary flowsheet is based on a limited understanding of the chemical composition of tank wastes and limited engineering information on the performance architectural components (e.g., ion exchange column for separation of cesium from tank wastes, sludge washing in double-shell tanks) that have been assumed to generate an estimate of system performance. The performance information of the assumed architectural components will be replaced with information derived from more detailed engineering analyses of the TWRS system as this information becomes available. Modifications to the functional analysis may be necessary as the flowsheet evolves.

Table 2. Summary of Requirements. (3 sheets)

Requirement Identification	Requirements
Section 4.1	PRETREAT SUPERNATANTS (4.2.2.1.2)
4.2.2.1.2 P1	The design throughput shall be 215 L/min.
4.2.2.1.2 P2	The process and facility design shall accommodate changes in the flowsheet throughout the operating life of the facility by a built-in capability to change process equipment (i.e., process flexibility).
4.2.2.1.2 C1	The facility design life shall support the Hanford mission through 2028. Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) (Ecology et al. 1994) milestone M-50-02 specifies "Start hot operations of the LLW pretreatment facility to remove cesium and strontium and shall commence in December 2004. Milestone M-50-00 states "complete pretreatment processing of Hanford tank waste, December 2028."
4.2.2.1.2 I1 P1	The blended average volume of the supernatants and wash solutions to the PS facility is 9.49 E+8 L at a nominal 3 to 4 M sodium solution.
4.2.2.1.2 I1 P2	The initial process design shall be based on the feed composition given in Table 3.
4.2.2.1.2 I2 C1	Determine requirements and specifications for Hanford Site essential materials (i.e., bulk chemicals, resin, etc.). The Essential Material Specifications Configuration Management Documents are collected in books located throughout the Hanford Site facilities (e.g. 271-B) and can be used as appropriate.
4.2.2.1.2 O1 C1	The waste stream destined for LLW vitrification will have radionuclides removed to meet the 10 CFR 61.55 Class C waste (using the sum of the fractions rule), and NRC's "incidental waste" classification (Bernero 1993).
4.2.2.1.2 O1 P1	^{90}Sr removal is not required to meet NRC "incidental waste" classification.
4.2.2.1.2 O1 P2	Soluble TRU removal is not required for this project (see Section 4.2, Separate Radionuclides (4.2.2.1.2.1) for requirements on insoluble TRU removal).
Section 4.2 SEPARATE RADIONUCLIDES (4.2.2.1.2.1)	
4.2.2.1.2.1 P1	Cesium-137 shall be removed to achieve an average cesium concentration of 0.4 Ci/m^3 at 3.75 M sodium in the pretreated LLW stream.
4.2.2.1.2.1 P2	Cesium shall be removed by ion exchange and loaded on the exchange media at high alkaline conditions (pH >=12) at about 25 °C.
4.2.2.1.2.1 P3	The supernatants from Pretreat Sludges/Solids (4.2.2.1.1) shall be concentrated to provide a nominal 5 M sodium solution and a maximum 7 M sodium solution to the ion-exchange column.
4.2.2.1.2.1 P4	Remove entrained solids from the concentrated supernatants of particle size greater than TBD to a concentration of less than 65 nCi TRU/g (<540 nCi TRU/g Na).

Table 2. Summary of Requirements. (3 sheets)

Requirement Identification	Requirements
4.2.2.1.2.1 I1 P1	This requirement is the same as the requirements given for 4.2.2.1.2 I1.
4.2.2.1.2.1 O1 C1	This constraint is the same as given for 4.2.2.1.2 O1.
Section 4.3 TREAT VESSEL OFFGAS (4.2.2.1.2.2)	Requirements to be determined by the project.
Section 4.4 ANALYZE PRETREAT SUPERNATANT SAMPLES	Requirement to be determined by the project.
Section 4.5 MONITOR AND CONTROL PRETREAT SUPERNATANT PROCESS (4.2.2.1.2.4)	Requirements to be determined by the project.
Section 4.6 PREPARE PRETREAT SUPERNATE SOLID WASTE (4.2.2.1.2.5)	Requirements to be determined by the project.
4.2.2.1.2.5 C1	Treatment of solid waste must include segregation between TRU, HLW, LLW, and uncontaminated wastes.
4.2.2.1.2.5 C2	Characterize TRU waste. Provide characterization regarding presence of particulate, free liquids, pyrophoric materials, explosives and compressed gases, hazardous constituents, combustibility.
4.2.2.1.2.5 C3	Characterize LLW. Measure the radionuclides concentration and record the physical characteristics of the LLW.
4.2.2.1.2.5 C4	Characterize low-level mixed waste. Determine physical and radioactive characteristics in the same manner as for LLW. Determine hazardous waste characteristics or listed waste in the same manner as for hazardous waste.
4.2.2.1.2.5 C5	Package Low-Level Waste. Low-level waste sent to the 200 Area burial grounds must meet the criteria in WHC-EP-0063-4, Section 3.0 (Willis 1993).
4.2.2.1.2.5 C6	Hazardous Waste. Hazardous waste will be identified and managed according to Washington Administrative Code (WAC) 173-303.
4.2.2.1.2.5 P1	Package Low-Level Mixed Waste. Low-level mixed waste must be decontaminated to contact-handled levels and packaged in containers no greater than 1.5 m (5 ft) high by 1.5 m (5 ft) wide by 2.7 m (9 ft) long.

Table 2. Summary of Requirements. (3 sheets)

Requirement Identification	Requirements
4.2.2.1.2.5 P2	Ship low-level mixed waste. WRAP 2A will have the capability to receive, handle, and treat containers as large as 420 L (110-gal) drums weighing 1400 kg (3,000 lbs) and boxes as large as 1.5 m (5 ft) high by 1.5 m (5 ft) wide by 2.7 m (9 ft) long weighing 5450 kg (12,000 lb).
4.2.2.1.2.5 P3	Ship Low-Level Waste requirements are to be determined.
Section 4.7 PREPARE PRETREAT SUPERNATANT LIQUID WASTE (4.2.2.1.2.6)	Requirements to be determined by the project.
Section 4.8 SUPPORT PRETREATMENT PROCESS (4.2.2.1.2.2)	Requirements to be determined by the project.

4.1 FUNCTION TITLE: PRETREAT SUPERNATANTS (4.2.2.1.2)

FUNCTION DEFINITION: Separate supernatants into low-activity and high-activity fractions.

FUNCTION REQUIREMENTS:

4.2.2.1.2 P1. The design throughput of supernatant feed shall be 215 L/min.[1]

> **Basis:** For a 14-year operating life, at a 60 percent total operating efficiency, the instantaneous throughput is 215 L/min for an expected total volume of 9.49 E+8 L of a 3 to 4 *M* sodium solution. A parametric estimating technique has been used to estimate the 14-year operating life at a minimum life-cycle cost (Pajunen 1994). A schedule window of 15 years (includes one year of startup) to complete processing is translated to a design capacity necessary to support retrieval rates (Boomer et al. 1994).

> **4.2.2.1.2 P1 Issue 1:** The capacity of the PS functions may not be compatible with throughputs of retrieval, pretreat sludges/solids and the LLW immobilization systems.

> **Required Analysis:** Verify that the capacity of all PS functions are compatible with the required retrieval, pretreat sludges/solids, LLW immobilization system throughputs, and any blending or storage activities for HLW immobilization. An evaluation of evaporation requirements are included in alternative waste retrieval sequences. The compatibility with current tank farm upgrade projects and existing operations must also be evaluated. (Trade Studies E/B-SD-W236B-RPT-016 [1A], E/B-SD-W236B-RPT-017 [2], E/B-SD-W236B-RPT-019 [4A], E/B-SD-W236B-RPT-021 [5], E/B-SD-W236B-RPT-022 [6A], and E/B-SD-W236B-RPT-026 [11]).

4.2.2.1.2 P2. The process and facility design shall accommodate changes in the flowsheet throughout the operating life of the facility by a built-in capability to change process equipment (i.e., process flexibility).

> **Basis:** The duration of the design and construction schedule and the operating life of the facility are considered long enough that new developments in the flowsheet or equipment efficiencies are likely and will need to be incorporated into the plant without the delay of new construction. The degree of flexibility will be determined during conceptual design.

4.2.2.1.2 C1. The facility design life shall support the Hanford mission through 2028. *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1994) milestone M-50-02 specifies "Start hot

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[1]Valid to two significant figures.

operations of the LLW pretreatment facility to remove cesium and strontium and shall commence in December 2004. Milestone M-50-00 states "complete pretreatment processing of Hanford tank waste, December 2028."

Basis: Currently, a design life basis does not exist except for "general consensus" that a 40-year design life is common for commercial nuclear reactor design. The Tri-Party Agreement strategy for pretreatment of the tank wastes assumes pretreatment of tank waste will begin December 2004, followed by LLW Vitrification starting 2005 (milestone M-60-05, Initiate hot operations of the LLW Vitrification facility).

4.2.2.1.2 C1 Issue 1: The facility design life has not been established. The appropriate facility design life must be determined taking into consideration economic factors and required Tri-Party Agreement schedules and documented for reference. Individual equipment components must be evaluated separately.

Required Analysis: A trade study must document the factors considered and the design life selected for the project. (Trade Study E/B-SD-W236B-RPT-017 [2]).

INTERFACE DEFINITIONS AND REQUIREMENTS

INPUTS

4.2.2.1.2 I1. Supernatants (from 4.2.2.1.1)--Liquids from mixing, decanting, and washing tank sludges and solids. This includes liquids currently stored in underground storage tanks as well as new liquids added to tanks from all other sources (e.g., retrieval, sludge washing, and other facilities).

4.2.2.1.2 I1 P1. The blended average volume of the supernatants and wash solutions to the PS facility is 9.49 E+8 L at a nominal 3 to 4 *M* sodium solution.

Basis: TWRS Process Flowsheet, WHC-SD-WM-TI-613, June 1994. The baseline flowsheet (Orme 1994) provides 9.49 E+8 L feed to the pretreat supernatant function and provides a conservative throughput volume for equipment sizing purposes. This volume assumes enhanced sludge washing (3 *M* NaOH) followed by three water washes.

4.2.2.1.2 I1 P1. Issue 1: The range of supernatant volume stated does not include new liquid wastes generated from other facilities. Currently, the 242-A Evaporator concentrates these facility generated liquid wastes. The project will provide waste evaporator capability adequate to replace future 242-A Evaporator demands (Alumkal 1994). This requirement is allocated from the Concentrate Waste function, 4.2.1.5.

Required Analysis: A trade study is required to determine the expected life of the 242-A Evaporator and estimate the future evaporator capacity requirements (Trade Study E/B-SD-W236B-RPT-022 [6a].

4.2.2.1.2 I1 P2. The initial process design shall be based on the feed composition given in Table 3.

Basis: Table 3 is derived from the baseline flowsheet (Orme 1994). The feed composition tables are based on an average composition derived from blending composition data for all 177 tanks. Feed composition tables for the planned first feeds to the PS function are available for DSSF and salt cake slurry feed, but must be documented for reference in a retrieval strategy document or as updates to the baseline flowsheet. Some DSSF supernatant (i.e., AN-105) may be retrieved and go directly to the PS function without proceeding through sludge washing steps.

4.2.2.1.2 I1 P2. Issue 1: Feed specification requirements of the supernatants and wash solutions will be modified based on the results of enhanced sludge washing studies.

Required Analysis: Laboratory studies are ongoing for sludge washing and caustic leaching. A sludge washing trade study is scheduled to provide feed specifications requirements. The trade study will develop an optimum flowsheet and facility requirements for in-tank and/or out-of-tank processes for sludge washing. (Trade Study E/B-SD-W236B-RPT-021 [5] and other developmental testing provided in WHC-SD-WM-TA-156.)

4.2.2.1.2 I1 P2. Issue 2: A variety of feed definitions are required to support design. These feeds include (1) a shielding basis feed composition represents a feed with elevated radionuclides which dominate shielding requirements as compared to the average plant conditions. This feed is used to define shielding requirements provided by the plant structure and equipment and represents material which would be in the facility for short campaigns and would not be used for evaluations of performance over the entire plant life, (2) a safety/regulatory assessment feed composition is a feed with bounding radionuclides which, if released, dominated the estimate of dose to personnel (both onsite and offsite) as compared to the average plant conditions. This feed is used to analyze design basis accidents and supports definition of mitigation systems, (3) a criticality assessment feed which is feed with elevated fissile material content used to define criticality controls which may impact the system design and, (4) a variability assessment feed which evaluates a range of feeds due to retrieval and blending scenarios as well as campaign runs of a particular type of feed.

Table 3. Preliminary Flowsheet Feed and Product Compositions (Enhanced Sludge Wash).[1]

Stream name	Supernatant[2]	Separated radionuclides[3]	Pretreated LLW[4]
Liquid components			
Volume, Total Liters	9.49 E+08	3.05 E+06	9.09 E+08
Specific Gravity	1.18 E+00	1.31 E+00	1.18 E+00
Total Mass, (MT)[5]	1.11 E+06	4.00 E+03	1.07 E+06
Al, (MT)	4.12 E+03		4.11 E+03
Fe, (MT)	9.85 E+00		9.85 E+00
Cr, (MT)	1.32 E+02		1.32 E+02
Na, (MT)	7.61 E+04	2.07 E+02	7.84 E+04
Si, (MT)	1.34 E+01		1.34 E+01
P, (MT)	1.67 E+03		1.67 E+03
NO2- and NO3-, (MT)	1.20 E+05	1.53 E+03	1.21 E+05
Cs and Ba, (MCi)[6]	8.88 E+01	8.81 E+01	7.00 E-01
Sr and Y, (MCi)	1.40 E+00	1.39 E-01	1.26 E+00
Tc, (MCi)	3.50 E-02		3.50 E-02
TRU, (MCi)	7.96 E-03		7.96 E-03
Total MCi	9.03 E+01	8.82 E+01	2.00 E+00
Solid components			
Total Mass, (MT)	1.67 E+02	1.36 E+02	1.67 E+00
Al, (MT)	5.95 E+00	4.56 E+00	5.95 E-02
Fe, (MT)	6.84 E+00	5.29 E+00	6.84 E-02
Cr, (MT)	2.67 E-01	2.04 E-01	2.67 E-03
Na, (MT)	1.37 E+00	7.63 E+00	1.37 E-01
Si, (MT)	1.23 E+01	2.36 E+01	1.25 E-01
P, (MT)	1.77 E+00	1.36 E+00	1.77 E-02
NO2- and NO3-, (MT)	7.24 E+00	7.11 E+00	7.24 E-02
Cs and Ba, (MCi)	6.89 E+00	7.23 E-02	6.89 E-02
Sr and Y, (MCi)	1.17 E+00	9.06 E-01	1.17 E-02
Tc, (MCi)	3.93 E-04	6.00 E-05	3.93 E-06
TRU, (MCi)	1.50 E-03	1.16 E-03	1.50 E-05
Total MCi	8.06 E+00	9.79 E-01	8.06 E-02

[1] Enhanced sludge wash assumes one 3 M NaOH wash and three H_2O washes.
[2] Assumes all supernatants to the pretreat supernatant function must be concentrated (stream 100 from the baseline flowsheet [Orme 1994]).
[3] Concentrated cesium stream to HLW immobilization (stream 230 from the baseline flowsheet).
[4] Cesium depleted stream to LLW immobilization (stream 233 from the baseline flowsheet).
[5] Total mass includes all feed components, but Table 3 only lists selected components of the feed. Therefore, total mass will not balance with component mass given.
[6] Cesium-137 makes up approximately 51% of the combined cesium and barium curies.

Required Analysis: Feed composition tables for these feeds will be provided during conceptual design. A list of proposed feeds and the intended purpose of the feed definition are described in Appendix H of the *TWRS Facility Configuration Study*, WHC-SD-WM-ES-295, Rev. 0. The facility flowsheet must be calculated using each feed type to provide a basis for material compositions and quantities which can be used in follow-on calculations.

4.2.2.1.2 I1 P2. Issue 3: Additional feed to the PS may include waste from 51 miscellaneous underground storage tanks. Although the waste in the miscellaneous underground storage tanks are not currently within the TWRS scope, this may change in the future (Alumkal 1994).

Required Analysis: A study is required to determine the appropriate disposition of the nearly 200,000 gal. of waste in the 51 miscellaneous underground storage tanks. Previous analyses of these tanks have been performed during 1991 through 1993 (Wodrich 1993; Rymarz and Speer 1991; Neilsen 1992). A literature review of volume projection and assessment of impact to the project must be documented. (Trade Study E/B-SD-W236B-RPT-016 [1A]).

4.2.2.1.2 I2. Raw Materials for Pretreat Supernatant (from 2.0)--Any material (e.g., steam, water, air, electricity, process chemical, laundry, hardware, etc.) needed from outside TWRS for pretreating tank waste supernatant.

4.2.2.1.2 I2 Issue 1. Determine requirements and specifications for Hanford Site essential materials (i.e., bulk chemicals, resin, etc.). The *Essential Material Specifications Configuration Management Documents* are collected in books located throughout the Hanford Site facilities (e.g., 271-B) and can be used as appropriate.

4.2.2.1.2 I3. Reusable Materials for Pretreat Supernatant--Equipment, chemicals (including water), or facilities that have fulfilled their original purpose and are now available and appropriate for use by the PS function.

4.2.2.1.2 I4. Data for Pretreat Supernatant (from 4.2.2.1.1)--Information on previous treatment of supernatant waste during in-tank processing. (See TWRS Functions and Requirements for Process Waste, 4.2.2.)

4.2.2.1.2 I5. Tank Characterization Information (from 4.2.1.2, Characterize Waste)--This includes Characterization Data, the Tank Waste Analysis Plan, Tank Characterization Plans, and all tank characterization information generated or gathered by the Characterize Waste function. (See TWRS Functions and Requirements, Performance Requirements for 4.2 08, pg. 2-53.)

4.2.2.1.2 I6. Secondary Waste (SW) for Processing--Liquid solutions from gaseous effluent treatment, liquid effluent systems, and possible recycle streams, with required characterization information for both.

OUTPUTS FROM PRETREAT SUPERNATANT

4.2.2.1.2 O1. Pretreated LLW (to 4.2.3)--Tank waste that meets the criteria for feed to the LLW immobilization process.

4.2.2.1.2 O1 C1. The waste stream destined for LLW vitrification will have radionuclides removed to meet the 10 CFR 61.55 Class C waste (using the sum of the fractions rule), and NRC's "incidental waste" classification (Bernero 1993) for the vitrified glass product.

Basis: To ensure the vitrified LLW product is below the NRC Class C limit for TRU elements (TRU concentration less than 100 nCi/g), the waste solutions processed by the pretreat supernatant function must contain less than 65 nCi TRU/g (<540 nCi TRU/g Na) (Orme 1994).

4.2.2.1.2 O1 C1. Issue 1: Project W236B shall include complexant destruction as a facility option in the project scope. Inclusion of organic destruction facilitates subsequent WHC isolation and study of complexant destruction techniques. Laboratory data are currently being generated and must be reviewed for applicability to the project. Heat and digest alone, or in conjunction with a pH adjustment, is a strategy that may be applied for removal of normally insoluble radionuclides from complexed solutions.

Required Analysis: Studies and experimental programs evaluating enhanced sludge washing, and possible organic destruction processes on the soluble TRU fraction, must be performed. (Trade Studies E/B-SD-W236B-RPT-019 [4A], E/B-SD-W236B-RPT-020 [4B], E/B-SD-W236B-RPT-021 [5]). Laboratory testing is also being performed by the WHC Process Chemistry Laboratories ("Organic Destruction Technology Development: Laboratory Testing--Heat and Digest, Tests 1, 2, and 3," Internal Memo #12110-PCL94-006).

4.2.2.1.2 O1 C1 Issue 2: It is not known (e.g., final documentation of key decision) if ^{99}Tc removal is required from the supernatants. Project W236B shall include technetium removal as a facility option until the Performance Assessment documentation can form the basis for a final decision on Tc removal requirements.

Basis: Class A limit for Tc has sometimes been applied as a Tc removal requirement. (Note: the criteria currently applied to pretreat LLW are Class C and incidental waste). The criteria for Tc removal must also include the performance assessment criteria. The LLW glass meets Class A with no ^{99}Tc removal. The draft performance assessment includes data indicating a sulfur binder material for the glass inhibits the technetium mobility. The performance assessment of the LLW glass form will provide the basis for a decision on whether ^{99}Tc removal is required.

Also, the current performance assessment strategy assumes (conservatively) that all the Tc produced on site is in the feed to the LLW vitrification facility. Other data (PNL-TR-497, June 1994) indicate a significant amount of Tc is volatilized in the evaporator condensates. Therefore, an agreement on the Tc inventory to be used in subsequent analyses must be finalized.

Required Analysis: Completed performance assessment data are required to verify the feed requirements (i.e. inventory of ^{99}Tc which becomes feed to pretreatment), glass formulation, and disposal system (i.e., barriers, matrix, etc.) for the LLW glass. (Trade Study E/B-SD-W236B-RPT-023 [7], addresses disposal system only.) Data on technetium volatility must be incorporated during conceptual design.

4.2.2.1.2 01 P1. ^{90}Sr removal is not required to meet NRC "incidental waste" classification.

Basis: The percentage of the total estimated strontium inventory provided to the PS function meets the NRC "incidental waste" classification (estimated to be 3 to 5 percent of total curies). An evaluation for a lightly shielded low-level vitrification facility is provided in Boomer, et al. 1994, Appendix H. Strontium removal based on ALARA and facility life-cycle costs was determined to be undesirable.

4.2.2.1.2 01 P1 Issue 1: The initial results of the economic feasibility of ^{90}Sr removal has been documented, but must be approved by DOE. Additional work is being performed to provide a recommendation for the decision process. Project W236B shall include ^{90}Sr removal as a facility option in a manner that facilitates subsequent WHC study and decision making on the economics of ^{90}Sr removal.

Required Analysis: The technical feasibility of the degree of strontium-90 removal (and other radionuclides), specification of a separations process, and the benefits of selected degree of separations is currently being developed. The completion of the trade study is expected November 1994.

4.2.2.1.2 01 P2. Soluble TRU removal is not required for this project (see Section 4.2, Separate Radionuclides (4.2.2.1.2.1) for requirements on insoluble TRU removal).

4.2.2.1.2 01 P2 Issue 1: Liquid wastes that contain too much soluble TRU to satisfy LLW specifications will have a pH adjustment and/or be heat treated to reduce the complexing strength of the solution. This treatment may be done "in-tank." "Out-of-tank" processes are also being considered.

Required Analysis: An assessment of the impacts of pretreatment options for sludges/solids must be evaluated. Separation technologies applied to sludge washing will be assessed for impacts to the pretreatment requirements. (Trade Studies E/B-SD-W236B-RPT-018 [3], E/B-SD-W236B-RPT-019 [4A]; E/B-SD-W236B-RPT-021 [5]; PNL report: "Fiscal Year 1995 Technology Development Plan, Draft; Summary Letter, Laboratory Testing In-Tank Sludge Washing, TWRSPP-93-060.)

4.2.2.1.2 01 EP1 (Expected System Performance). The cesium depleted eluents will be transferred to LLW Immobilization as a nominal 3.75 *M* Na solution.

Basis: *TWRS Process Flowsheet*, WHC-SD-WM-TI-613 (Orme 1994). Concentration of the pretreated LLW will be provided by the Immobilize and Dispose Low-Level Waste function vitrification.

4.2.2.1.2 02. Separated HLW (to 4.2.2.1.3)--Separated radionuclides (and characterization data as required), separated entrained solids from supernatants, and spent ion exchange media (containing primarily cesium and possibly other radionuclides).

4.2.2.1.2 02 Issue 1: The activity and waste classification (e.g., high-level, low-level, hazardous, mixed waste) of the spent ion exchange media is not known. The current strategy (Orme 1994) specifies that the spent ion exchange media will be disposed to LLW.

Required Analyses: The development and selection of the ion exchange resin and configuration of ion exchange columns is ongoing. Trade studies are being developed which will evaluate the column operation, ion exchange material, cost implications, etc. A trade study will also determine the appropriate selection, classification and disposition of the spent ion exchange media. (Trade Study 10 and PNL Quarterly Report for column testing.)

4.2.2.1.2 03. PS System Generated Gaseous Waste (to 4.2.3.2, Disposition Gaseous Effluent)--Gaseous waste, with required characterization information, generated from functions associated with pretreating supernatants.

4.2.2.1.2 04. Excess Facilities from Pretreat Supernatant (to 4.2.3.5)--Excess facilities that, having fulfilled their original purposes and completed the functions/processes described in the PS function, are now available and appropriate for reuse or deactivation. Reuse will be decided at the Site level.

4.2.2.1.2 05. Pretreat Supernatant Characterization Requirements (to 4.2.1.2, Characterize Waste)--The characterization information needs of the PS function concerning existing tank waste solutions.

4.2.2.1.2 05 Issue 1: Characterization requirements are not yet identified.

Required Analysis: Finalization of the TWRS baseline flowsheet is required. The Data Quality Objectives for the pretreatment of supernatants will identify the information needed to define what characterization needs to be done to achieve pretreatment processing.

4.2.2.1.2 06. Supernatant Characterization Requirements (to 4.2.2.1.1)--Requirements for characterization information about the supernatants. Characterization information about supernatants as they are modified by the Pretreat Sludges/Solids function.

4.2.2.1.2 07. PS System Generated Solid Waste (to 4.2.3.4, Disposition Solid Waste)--Solid waste generated from the PS function that has been segregated, packaged, assayed, and certified for transfer for further treatment or disposal (see General Requirements).

4.2.2.1.2 08. PS System Generated Liquid Effluent (to 4.2.3.3, Disposition Liquid Effluent)--All liquid effluents leaving this facility meeting regulatory discharge requirements (any liquids not meeting the discharge requirements are considered recycle streams).

4.2 FUNCTION TITLE: SEPARATE RADIONUCLIDES (4.2.2.1.2.1)

FUNCTION DEFINITION: Separate the supernatant solution into pretreated LLW and radionuclides (primarily cesium and entrained solids).

FUNCTION REQUIREMENTS

4.2.2.1.2.1 P1. Cesium-137 shall be removed to achieve an average cesium concentration of 0.4 Ci/m^3 at 3.75 *M* sodium in the pretreated LLW stream.

> **Basis:** An average decontamination factor of 100 is necessary to remove a quantity of ^{137}Cs which will satisfy the intent of NRC's "incidental waste" classification (Bernero 1993). The estimated ^{137}Cs content of waste solutions requiring cesium ion exchange pretreatment processing is ~45 MCi.
>
> The average cesium decontamination factor (influent cesium to sodium ratio concentration divided by effluent cesium to sodium concentration) for pretreatment of tank wastes is approximately 100. The trade study evaluating facility design parameters (i.e., shielding requirements) necessary and the facility cost of additional cesium removal (Cesium DF = 10,000 and Strontium DF=100) is documented in Boomer et al. (1994).

4.2.2.1.2.1. P2. Cesium shall be removed by ion exchange and loaded on the exchange media at high alkaline conditions (pH >=12) at about 25 °C.

> **Basis:** The current TWRS planning is for cesium removal via ion exchange under current waste conditions (alkaline) as opposed to acid side processing. The selection of cesium ion exchange is based on the information provided in TWRSPP-93-055 (Bray et al. 1993) and WHC-EP-0616, Appendix G (pages G1-3 - G1-23) (Boomer et al. 1993). Separation processes that have been evaluated are summarized below.
>
> A number of studies have evaluated cesium separation processes for application to Hanford Site tank wastes. Organic cation exchange resins were employed very successfully at the Hanford Site on a plant-scale for many years to remove ^{137}Cs from alkaline wastes. Such technology, using newer resins (e.g., Duolite CS-100[2] and a resorcinol-based ion exchanger) are being evaluated (TWRSPP-93-055).
>
> Alternative methods for removing ^{137}Cs from alkaline solutions all appear to have disadvantages compared to well-established ion exchange technology. Silicotitanates and/or zeolites can be used for cesium ion-exchange, but contain significant amounts of aluminum, silicon, and sodium, which are limiting components in glass feed formulations. Various precipitation agents: e.g.,

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[2]Duolite CS-100 is a registered trademark of Rohm and Haas, Philadelphia, Pennsylvania.

tetraphenyl boron, nickel ferrocyanide, and phosphotungstate, must all be applied on a batch basis. Downstream processing of cesium-laden precipitates involves potential safety hazards. Candidate solvent extraction processes (Schulz and Bray 1987) employing such extraction as BAMBP[3], dipicrylamine, polybromides, and crown ethers have not either been fully developed or require use of toxic diluents such as nitrobenzene.

4.2.2.1.2.1 P3: The supernatants from Pretreat Sludges/Solids (4.2.2.1.1) shall be concentrated to provide a nominal 5 *M* sodium solution and a maximum 7 *M* sodium solution to the ion-exchange column.

Basis: Experiments with simulated wastes (double-shell slurry feed solutions, CC waste, and NCAW) performed by PNL provide equilibrium data for cesium ion-exchange. Reference data (*Analysis of Equilibrium Data For Cesium Ion Exchange of Hanford CC and NCAW Supernatant Liquid--Status Report*, TWRSPP-93-051 (Kurath et al. 1993) suggests a maximum 7 *M* sodium solution to the column. In synthetic solutions of 8 *M* sodium, the resin floats (TWRSPP-94-010).

The concentration of the blended average of the supernatants and wash solutions (approximately 4 to 5 *M* sodium) to a maximum 7 *M* results in a volume of 473 E+6 L feed for cesium removal (Orme 1994). Concentration of the feed provides volume reduction and waste minimization.

4.2.2.1.2.1 P3 Issue 1: The maximum sodium concentration in the feed to the column has not yet been determined with actual wastes. Existing DSSF tank supernatant is currently at 10 to 11 *M* sodium solution. An 8 *M* solution has been found to float the resin. Therefore, dilution will be necessary.

Required Analysis: Continue experimental tests with actual waste to verify maximum sodium concentration of ion-exchange feed and perform Trade Study to determine the benefit and means of implementing caustic recycle. (Laboratory data and Trade Study E/B-SD-W236B-RPT-024 [8].)

4.2.2.1.2.1 P4. Remove entrained solids from the concentrated supernatants of particle size greater than TBD to a concentration of less than 65 nCi TRU/g (<540 nCi TRU/g Na).

Basis: Baseline flowsheet, Orme 1994. Feed to the radionuclide separation process (e.g., cesium removal) is filtered for final solid/liquid clarification. The suspended solids within retrieved tank wastes and sludge wash solutions (e.g., neutralized current acid waste [NCAW] liquid fraction) are known to contain transuranic (TRU) elements

[3]-4-sec-butyl-2-(a-methylbenzyl)phenol

and strontium particulates. However, the TRU elements are found in the soluble and insoluble form in retrieved wastes.

4.2.2.1.2.1 P4 Issue 1: Pre-ion exchange filtration is anticipated and particle size requirements need to be specified. Also, an evaluation of post-ion exchange solids/liquid separation is necessary.

Required Analysis: TRU distribution as a function of particle size, as well as the expected range of entrained solids (ppm) for the different waste types, must be verified using the results of the sludge washing and solid/liquid separation trade studies. (Trade Study E/B-SD-236B-RPT-020 [4B], WHC-SD-WM-TA-156).

4.2.2.1.2.1 P4 Issue 2: Filtration of entrained solids before evaporation of the supernatant feed may be necessary. Also, the solubility of TRU during feed preparation and concentration operations needs continued evaluation to form a basis for solids removal in the supernatant feed stream after concentration.

Required Analysis: Provide documentation and expected range of entrained solids carried over from the pretreat sludges/solids function. Continue evaluation of the solubility behavior of TRU. Solid/Liquid Separation Trade Studies have been initiated and laboratory data have been collected. (Trade Studies E/B-SD-W236B-RPT-020 [4b], E/B-SD-W236B-RPT-021 [5], TWRSTP-93-060.)

INTERFACE DEFINITIONS AND REQUIREMENTS

INPUTS

4.2.2.1.2.1 I1. Supernatants (from 4.2.2.1.1)--Liquids from mixing, decanting, and washing tank sludges and solids. This includes liquids currently stored in underground storage tanks as well as new liquids added to tanks from all other sources (e.g., retrieval, sludge washing, and other facilities).

P1. Same as requirements for 4.2.2.1.2, I1 P1 and I1 P2.

4.2.2.1.2.1 I2. PS Process Control Action (from 4.2.2.1.2.4)--Process control feedback to control separate waste functions.

4.2.2.1.2.1 I3. PS Utilities (from 4.2.2.1.2.7)--Utilities in modified form as prepared and distributed to support the PS function (e.g., voltage adjustment, water pressure adjustment, air compression, etc.) (see General Requirements).

4.2.2.1.2.1 I4. PS Process Sample Residue (from 4.2.2.1.2.3)--Excess process samples and concentrated radionuclides from samples.

4.2.2.1.2.1 I5. PS Bulk chemicals (from 4.2.2.1.2.7)--Bulk chemicals in modified form as prepared and distributed to support the pretreat supernatant function (e.g., chemical concentration adjustment, chemical blending, etc.).

4.2.2.1.2.1 I6. SW (secondary waste) for Processing--Liquid solutions from gaseous effluent treatment, liquid effluent systems, and possible recycle streams, with required characterization data.

OUTPUTS

4.2.2.1.2.1 O1. Pretreated LLW (to 4.2.3, Manage System Generated Waste and Excess Facilities)--Tank waste that meets the criteria for feed to the LLW immobilization process.

C1. Same as constraints 4.2.2.1.2 O1.

4.2.2.1.2.1 O2. Separated Radionuclides (to 4.2.2.2, Immobilize HLW/TRU Waste)--Separated radionuclides and separated entrained solids from supernatants (primarily cesium).

4.2.2.1.2.1 O2 P1. The separated radionuclides shall be chemically adjusted to meet the requirements in the tank farm operations specification document.

O2 EP1 (Expected System Performance). The expected performance (e.g., product stream characteristics) of the separate radionuclides function is given in Table 3. The radionuclide concentrations in the product stream is a function of the cesium removal efficiencies and requirements that may be imposed on removal of other radionuclides.

O2 EP2 (Expected System Performance). The cesium eluate is concentrated, neutralized, and transferred to Blend High-Activity Streams (4.2.2.1.3) for interim storage and blending before HLW immobilization.

Basis: TWRS Process Flowsheet (Orme 1994).

4.2.2.1.2.1 O3. PS Process Vessel Offgas (to 4.2.2.1.2.2)--Non-condensables (at exhaust conditions) discharged from process vessels and concentrators.

4.2.2.1.2.1 O4. PS Process Control Samples (to 4.2.2.1.2.3)--Samples of process solutions from locations where process characterization is required.

4.2.2.1.2.1 O5. PS Process I&C Data (to 4.2.2.1.2.4)--Sensory information representing the current state of the process sub-system such as temperature, pressure, flow, or radionuclide concentration measurement signals.

4.2.2.1.2.1 O6. PS process Condensates (to 4.2.2.1.2.6)--Excess liquids removed from supernatants, pretreated LLW, and process equipment.

4.2.2.1.2.1 07. PS Process Generated Solid Waste (to 4.2.2.1.2.5)--Solid waste generated from processing supernatant (e.g., failed equipment, filters, etc.).

4.3 FUNCTION TITLE: TREAT VESSEL OFFGAS (4.2.2.1.2.2)

FUNCTION DEFINITION: Offgas generated by the process that is treated to meet discharge requirements.

FUNCTION REQUIREMENT: To be determined by the project.

INTERFACE DEFINITIONS AND REQUIREMENTS

INPUTS

4.2.2.1.2.2 I1. Process Vessel Offgas (from 4.2.2.1.2.1)--Non-condensable (at exhaust conditions) discharged from process vessels and concentrators in separate waste function.

4.2.2.1.2.2 I2. Vessel Offgas Control Action (from 4.2.2.1.2.4)--Process control feedback to control vessel offgas treatment functions such as damper control, filter bank switchover, or filter washing.

4.2.2.1.2.2 I3. PS Utilities (from 4.2.2.1.2.7)--Utilities in modified form as prepared and distributed to support the PS function (e.g., voltage adjustment, water pressure adjustment, air compression, etc.).

4.2.2.1.2.2 I4. PS Bulk chemicals (from 4.2.2.1.2.7)--Bulk chemicals in modified form as prepared and distributed to support the PS function (e.g., chemical concentration adjustment, chemical blending, etc.).

OUTPUTS

4.2.2.1.2.2 01. Filter Wash Solutions (to 4.2.2.1.2.6)--Solutions from periodic washings of particulate filters.

4.2.2.1.2.2 02. Filtered Vessel Offgas (to 4.2.3.2)--Vessel offgas that has been treated to meet discharge requirements (e.g., filtering to remove particulates).

4.2.2.1.2.2 03. Vessel Offgas Samples (to 4.2.2.1.2.3)--Samples of vessel offgas from locations where VOG characterization is required.

4.2.2.1.2.2 04. Vessel Offgas I&C Data (to 4.2.2.1.2.4)--Sensory information representing current state of vessel offgas treatment system.

4.4 FUNCTION TITLE: ANALYZE PRETREAT SUPERNATANT SAMPLES (4.2.2.1.2.3)

FUNCTION DEFINITION: Collection and analysis of process and environmental samples. Analyses include laboratory and on-line analyses.

FUNCTION REQUIREMENTS: To be determined by the project.

INTERFACE DEFINITIONS AND REQUIREMENTS

INPUTS

4.2.2.1.2.3 I1. PS Process Control Samples (from 4.2.2.1.2.1)--Samples of process solutions from locations where process characterization is required.

4.2.2.1.2.3 I2. PS Vessel Offgas Samples (from 4.2.2.1.2.2)--Samples of vessel offgas from locations where VOG characterization is required.

4.2.2.1.2.3 I3. PS Liquid Waste Samples (from 4.2.2.1.2.6)--Samples of liquid wastes and effluents from locations where liquid waste and effluent characterization are required (e.g., liquid effluent samples to be characterized before discharge from the facility to ensure discharge regulations are met).

4.2.2.1.2.3 I4. PS Bulk Chemical Samples (from 4.2.2.1.2.7)--Samples of bulk chemicals which will be analyzed to ensure the chemicals meet specifications.

4.2.2.1.2.3 I5. PS Utilities (from 4.2.2.1.2.7)--Utilities in modified form as prepared and distributed to support the PS function (e.g., voltage adjustment, water pressure adjustment, air compression, etc.).

4.2.2.1.2.3 I6. PS Solid Waste Samples (from 4.2.2.1.2.5 O3) samples of solid waste generated from processing of supernatants.

OUTPUTS

4.2.2.1.2.3 O1. PS Analytical Lab Liquid Waste (to 4.2.2.1.2.3)--Liquid waste generated from analyzing samples which require treatment before discharge.

4.2.2.1.2.3 O2. PS Analytical Lab Solid Waste (to 4.2.2.1.2.5)--Solid waste generated from analyzing samples which require treatment before discharge.

4.2.2.1.2.3 O3. PS Process Sample Residue (to 4.2.2.1.2.1)--Excess process samples and concentrated radionuclides from samples.

4.2.2.1.2.3 O4. PS Sample results (to 4.2.2.1.2.4)--Data from sample analyses.

4.5 FUNCTION TITLE: MONITOR AND CONTROL PRETREAT SUPERNATANT PROCESS (4.2.2.1.2.4)

FUNCTION DEFINITION: Collect and analyze characterization and instrument data for feedback control of PS processes. Data analysis will also determine the requirements of additional characterization information.

FUNCTION REQUIREMENTS: To be determined by the project.

INTERFACE DEFINITIONS AND REQUIREMENTS

INPUTS

4.2.2.1.2.4 I1. Process I&C Data (from 4.2.2.1.2.1)--Sensory information representing current state of process system.

4.2.2.1.2.4 I2. PS VOG I&C Data (from 4.2.2.1.2.2)--Sensory information representing current state of vessel offgas treatment system.

4.2.2.1.2.4 I3. PS I&C Data (from 4.2.2.1.2.7)--Sensory information representing current state of the process support systems (e.g., utility distribution, chemical makeup, etc.)

4.2.2.1.2.4 I4. PS Sample results (from 4.2.2.1.2.3)--Data from sample analyses.

4.2.2.1.2.4 I5. Data for Pretreat LLW (from 4.2.2.1.1)--Information on previous treatment of supernatant waste during in-tank processing.

4.2.2.1.2.4 I6. Tank Characterization Information (from 4.2.1.2)--This includes Characterization Data, the Tank Waste Analysis Plan and Tank Characterization Plans, and all tank characterization information generated or gathered by the Characterize Waste function.

4.2.2.1.2.4 I7. PS Utilities (from 4.2.2.1.2.7)--Utilities in modified form as prepared and distributed to support the PS function (e.g., voltage adjustment, water pressure adjustment, air compression, etc.).

OUTPUTS

4.2.2.1.2.4 01. PS Process Control Action (to 4.2.2.1.2.1)--Process control feedback to control separate waste functions.

4.2.2.1.2.4 02. PS VOG Control Action (to 4.2.2.1.2.2)--Process control feedback to control vessel offgas treatment functions.

4.2.2.1.2.4 03. PS Liquid Effluent Control Action (to 4.2.2.1.2.6)--Process control feedback to control disposition of liquid effluents.

4.2.2.1.2.4 04. Support Pretreatment Process (SPP) Control Action (to 4.2.2.1.2.7)--Feedback to verify characteristics of bulk chemicals, control utility distribution, and control make-up and distribution of chemicals.

4.2.2.1.2.4 05. PS Characterization Requirements (to 4.2.1.2)--The characterization information needs of the PS function for wastes that are delivered to it from the Manage Tank Waste function.

4.2.2.1.2.4 06. Supernatant Characterization Requirements (to 4.2.2.1.1)--Characterization information about supernatants as they are modified by the Pretreat Sludges/Solids function.

4.6 FUNCTION TITLE: PREPARE PRETREAT SUPERNATANT SOLID WASTE (4.2.2.1.2.5)

FUNCTION DEFINITION: Collection, handling, packaging, and transfer of solid waste generated during supernatant processing.

FUNCTION REQUIREMENTS: The criteria for disposition of facility generated solid waste include segregate, characterize, treat if necessary, package, and transfer system generated solid waste per DOE Order 5820.2A, Chapter II. The central waste complex will provide storage for low-level mixed waste (LLMW). The WRAP Module 1 will accept contact handled TRU waste. WRAP Module 2A will accept contact handled LLMW and WRAP 2B will provide treatment of remote handled TRU and LLMW. These facilities will be used to the extent possible to support the disposition of solid waste generated by the PS function.

4.2.2.1.2.5 C1. Treatment of solid waste must include segregation between TRU, HLW, LLW, and uncontaminated wastes.

> Basis: Any material that is known to be, or suspected of being contaminated with transuranium radionuclides shall be evaluated as soon as possible in the generating process, and determined to be either recoverable material, transuranic waste, low-level waste, mixed waste, or non-radioactive trash to avoid commingling the various material streams. Uncontaminated waste must be separated from LLW. DOE 5820.2A, Chapter II, 3(a)1 and DOE 5820.2A, Chapter III, 3(c)3.

4.2.2.1.2.5 C2. Characterize TRU waste. Provide characterization regarding presence of particulate, free liquids, pyrophoric materials, explosives and compressed gases, hazardous constituents, combustibility.

> Basis: Transuranic waste shall be assayed or otherwise evaluated to determine the kinds and quantities of transuranic radionuclides present prior to storage. Additionally, hazardous waste components shall be estimated or analyzed, whichever is appropriate. DOE 5820.2A, Chapter II, 3(b)2, *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, WIPP/DOE-069 (WIPP/DOE 1991).

4.2.2.1.2.5 C3. Characterize LLW. Measure the radionuclides concentration and record the physical characteristics of the LLW.

> Basis: Low-level waste shall be characterized with sufficient accuracy to permit proper segregation, treatment, storage, and disposal. This characterization shall ensure that, upon generation and after processing, the actual physical and chemical characteristics and major radionuclides content are recorded and known during all stages of the waste management process. DOE 5820.2A, Chapter III, 3(d)1.
>
> The concentration of radionuclides may be determined by direct methods or indirect methods such as scaling factors that relate the inferred concentration of one radionuclides to another that is measured, or by radionuclides material accountability, if there is

reasonable assurance that the indirect methods can be correlated with actual measurements.

4.2.2.1.2.5 C4. Characterize low-level mixed waste. Determine physical and radioactive characteristics in the same manner as for LLW. Determine hazardous waste characteristics or listed waste in the same manner as for hazardous waste.

Basis: Low-level mixed waste shall be characterized as required for both low-level waste and hazardous waste.

4.2.2.1.2.5 C5. Package Low-Level Waste. Low-level waste sent to the 200 Area burial grounds must meet the criteria in WHC-EP-0063-4, Section 3.0 (Willis 1993).

Basis: (Low-level) Waste treatment techniques such as incineration, shredding, and compaction to reduce volume and provide more stable waste forms shall be implemented as necessary to meet performance requirements. DOE 5820.2A, Chapter III, 3(f)2

The 200 Area burial grounds will only accept waste that meets the disposal criteria. Packaging criteria based on burial ground disposal criteria. WHC-EP-0063-4, Section 3.0 (Willis 1993).

4.2.2.1.2.5 C6. Hazardous Waste. Hazardous waste will be identified and managed according to Washington Administrative Code (WAC) 173-303.

4.2.2.1.2.5 P1. Package Low-Level Mixed Waste. Low-level mixed waste must be decontaminated to contact-handled levels and packaged in containers no greater than 1.5 m (5 ft) high by 1.5 m (5 ft) wide by 2.7 m (9 ft) long.

Basis: The function of WRAP Module 2A is to provide non-thermal treatment of contact-handled (CH) MLLW. WRAP 2A will have the capability to receive, handle, and remove boxes as large as 1.5 m (5 ft) high by 1.5 (5 ft) wide by 2.7 m (9 ft) long weighing 5,400 kg (12,000 lb). WHC-SD-W100-FDC-001, Rev. 2, p. 1-1 and 2-10 (Kruger 1993).

4.2.2.1.2.5 P1 Issue 1: Uncertainties associated with the WRAP Module 2A may impact the assumptions for packaging LLMW.

Required Analysis: Obtain current status of WRAP 2A and review of solid waste requirements by the solid waste project department.

4.2.2.1.2.5 P2. Ship low-level mixed waste. WRAP 2A will have the capability to receive, handle, and treat containers as large as 420 L (110-gal) drums weighing 1400 kg (3,000 lbs) and boxes as large as 1.5 m (5 ft) high by 1.5 m (5 ft) wide by 2.7 m (9 ft) long weighing 5450 kg (12,000 lb).

Basis: WHC-SD-W100-FDC-001, Rev. 2 (Kruger 1993).

4.2.2.1.2.5 P3. Ship Low-Level Waste. To be determined.

INTERFACE DEFINITION AND REQUIREMENTS

INPUTS

4.2.2.1.2.5 I1. Process PS Solid Waste (from 4.2.2.1.2.1)--Solid waste generated from processing supernatant (e.g., failed equipment, filters, etc.).

4.2.2.1.2.5 I2. Analytical Lab Solid Waste (from 4.2.2.1.2.3)--Solid waste generated from analyzing samples which require treatment before discharge.

4.2.2.1.2.5 I3. PS Support Generated Solid Waste (from 4.2.2.1.2.7)--Solid waste generated from the preparation of bulk chemicals and failed equipment from utility distribution. Generally this waste will be either non-hazardous or hazardous, but not radioactive.

4.2.2.1.2.5 I4. PS Utilities (from 4.2.2.1.2.7)--Utilities in modified form as prepared and distributed to support the PS function (e.g., voltage adjustment, water pressure adjustment, air compression, etc.).

OUTPUTS

4.2.2.1.2.5 01. PS System Generated Solid Waste (to 4.2.3.4)--Solid waste generated from the PS function that has been segregated, packaged, assayed, and certified for transfer for further treatment or disposal.

4.2.2.1.2.5 02. Spent Separation Media (to 4.2.2.2)--Spent ion exchange resin and any other spent solid separation media containing enough radionuclides to require immobilization with the other HLW streams.

4.2.2.1.2.5 03. PS Solid Waste Samples (to 4.2.2.1.2.3) samples of solid waste generated from processing of supernatants.

4.7 FUNCTION TITLE: PREPARE PRETREAT SUPERNATANT LIQUID WASTE (4.2.2.1.2.6)

FUNCTION DEFINITION: Collection, handling, monitoring, treatment, and transfer of process generated liquid effluents.

FUNCTION REQUIREMENTS: To be determined by the project.

INTERFACE DEFINITION AND REQUIREMENTS

INPUTS

4.2.2.1.2.6 I1. Process Condensates (from 4.2.2.1.2.1)--Excess liquids removed from supernatants, pretreated LLW, and process equipment.

4.2.2.1.2.6 I2. Filter Wash Solutions (from 4.2.2.1.2.2)--Solutions from periodic washings of particulate filters.

4.2.2.1.2.6 I3. Analytical Lab Liquid Waste (from 4.2.2.1.2.3)--Liquid waste generated from analyzing samples which require treatment before discharge.

4.2.2.1.2.6 I4. Liquid Effluent Control Action (from 4.2.2.1.2.4)--Process control feedback to control disposition of liquid effluents.

4.2.2.1.2.6 I5. PS Utilities (from 4.2.2.1.2.7)--Utilities in modified form as prepared and distributed to support the PS function (e.g., voltage adjustment, water pressure adjustment, air compression, etc.).

4.2.2.1.2.6 I6. PS Bulk chemicals (from 4.2.2.1.2.7)--Bulk chemicals in modified form as prepared and distributed to support the PS function (e.g., chemical concentration adjustment, chemical blending, etc.).

OUTPUTS

4.2.2.1.2.6 O1. PS System Generated Liquid Effluent (to 4.2.3.3)--All liquid effluents discharged from this facility must meet regulatory discharge requirements (any liquids not meeting the discharge requirements are considered recycle streams).

4.2.2.1.2.6 O2. PS Liquid Waste Samples (to 4.2.2.1.2.3)--Samples of liquid wastes and effluents from locations where liquid waste and effluent characterization are required (i.e., liquid effluent samples to be characterized before discharge from the facility to ensure discharge regulations are met).

4.8 FUNCTION TITLE: SUPPORT PRETREATMENT PROCESS (4.2.2.1.2.7)

FUNCTION DEFINITION: Provide support services for the PS function. Services include the building structure to perform the process, HVAC, cold chemical make-up and distribution, electrical power distribution, instrument and service air, service water, maintenance services, health physics/operations support, contaminated repair shop, and discharge of non-regulated wastes.

FUNCTION REQUIREMENTS: To be determined by the project.

> **4.2.2.1.2.7 Issue 1:** Maintenance and operating philosophies, as well as key design philosophies, are developed in the *TWRS Facility Configuration Study*, WHC SD-WM-ES-295 (Boomer et al. 1994). The selection of a combined pretreatment and LLW Vitrification facility configuration impacts the requirements for support processes. The TWRS recommendation on the selected facility configuration was issued to DOE-RL July 18, 1994.
>
> **Required Analysis:** Information presented in this study and the decision making process for a facility configuration selection needs to be integrated into the project functions and requirements. (Trade Study E/B-SD-W236B-RPT-026 [11]).

INTERFACE DEFINITION REQUIREMENTS

INPUTS

4.2.2.1.2.7 I1. Raw Materials for Pretreat Supernatant (from 2)--Any material (e.g., steam, water, air, electricity, process chemical, laundry, hardware, IHLW transport vehicle casks, etc.) needed from outside TWRS for pretreating tank waste supernatant.

4.2.2.1.2.7 I2. Reusable Materials for Pretreat Supernatant (from 4.2.3.6)--Equipment, chemicals (including water), or facilities that have fulfilled their original purpose and are now available and appropriate for use by the PS function.

4.2.2.1.2.7 I3. SPP Control Action (from 4.2.2.1.2.4)--Feedback to verify characteristics of bulk chemicals, control utility distribution, and control make-up and distribution of chemicals.

OUTPUTS

4.2.2.1.2.7 O1. SPP System Generated Gaseous Waste (to 4.2.3.2)--Gaseous waste, with required characterization information, generated from functions associated with pretreating supernatants.

4.2.2.1.2.7 O2. Excess Facilities from Pretreat Supernatant (to 4.2.3.5)--Excess facilities that, having fulfilled their original purposes and completed the functions/processes described in the PS function, are now available and appropriate for reuse or deactivation. Reuse will be decided at the Site level.

4.2.2.1.2.7 03. PS Utilities (to 4.2.2.1.2.1 through 4.2.2.1.2.7)--Utilities in modified form as prepared and distributed to support the PS function (e.g., voltage adjustment, water pressure adjustment, air compression, etc.).

4.2.2.1.2.7 04. PS Bulk Chemicals (to 4.2.2.1.2.1, 4.2.2.1.2.2, and 4.2.2.1.2.6)--Bulk chemicals in modified form as prepared and distributed to support the PS function (e.g., chemical concentration adjustment, chemical blending, etc.).

4.2.2.1.2.7 05. PS Bulk Chemical Samples (to 4.2.2.1.2.3)--Samples of bulk chemicals which will be analyzed to ensure the chemicals meet specifications.

4.2.2.1.2.7 06. PS Support Generated Solid Waste (to 4.2.2.1.2.5)--Solid waste generated from the preparation of bulk chemicals and failed equipment from utility distribution. Generally this waste will be either non-hazardous or hazardous, but not radioactive.

4.2.2.1.2.7 07. SPP I&C Data (to 4.2.2.1.2.4)--Sensory information representing current state of the process support systems (e.g., utility distribution, chemical makeup, etc.)

5.0 GENERAL REQUIREMENTS FOR PRETREAT SUPERNATANTS

General design requirements (e.g., constraints) applicable to the project are defined in DOE directives, WHC manuals, State Codes, and Federal Codes and Standards. General design requirements are contractual requirements. A listing of general constraints which apply to this project are found in the TWRS Functions and Requirements document (DOE 1994b). Specific applications of performance or constraint requirements will be developed by the project and documented in the Conceptual Design Report.

6.0 REFERENCES

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DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	R. V. Vaddey	Date 11/04/94
Project Title/Work Order		EDT No.
Project W236B, Initial Pretreatment Module		ECN No. 615167

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
J. N. Appel	G3-21	X			
S. A. Barker	G3-20	X			
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D. L. Banning	G3-20	X			
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COMPLETE

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 615167

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.		4. Date
Supplemental [] Direct Revision [x] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	L. M. Swanson, TWRS Process Design, H5-49, 376-2199		Sept. 26, 1994
	5. Project Title/No./Work Order No. Project W236B, Initial Pretreatment Module	6. Bldg./Sys./Fac. No. N/A	7. Approval Designator ESQD
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) Replace WHC-SD-W236B-FRD-002, Rev. 0	9. Related ECN No(s). N/A	10. Related PO No.

11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	NA	Lynn M. Swanson 9-27-94 Cog. Engineer Signature & Date	NA Cog. Engineer Signature & Date

12. Description of Change

WHC-SD-W236B-FRD-002, Revision 1, incorporates comments received from DOE-RL and replaces Revision 0 in it's entirety.

13a. Justification (mark one)	Criteria Change [X]	Design Improvement []	Environmental []
As-Found []	Facilitate Const. []	Const. Error/Omission []	Design Error/Omission []

13b. Justification Details

This document represents the preliminary design bases for Project W236B and is planned for revision. This functional and requirements analyses will be re-issued as a Design Requirements Document (DRD) for the project to be consistent with the TWRS Systems Engineering Working Plan, WHC-SD-WM-WP-285, Rev. 0, Issued September 1995.

14. Distribution (include name, MSIN, and no. of copies)

See attached distribution sheet.

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ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) 615167

15. Design Verification Required	16. Cost Impact		17. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
[] Yes	Additional [] $	Additional [] $	Improvement []
[X] No	Savings [] $	Savings [] $	Delay []

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
None.		

20. Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog. Eng. L. M. Swanson *Lynn M. Swanson*	9-27-94	PE	
Cog. Mgr. J. S. Garfield *John S. Garfield*	9-27-94	QA	
QA J. S. Sparks/A. Y. Dingle *Hank Chafin*	9-27-94	Safety	
Safety G. D. Wright for K.K. Chitkara	9-27-94	Design	
Environ. D. J. Carrell *[signature] for DJC*	9-27-94	Environ.	
Other R. R. Gadd *R. R. Gadd*	9-27-94	Other	
K. A. Gasper *K A Gasper*	9/27/94		
M. L. Grygiel *[signature]*			
R. C. Roal *[signature]*	[illegible]	DEPARTMENT OF ENERGY	
		Signature or a Control Number that tracks the Approval Signature *R. A. Gilbert*	11/4/94
		ADDITIONAL	

RELEASE AUTHORIZATION

Document Number:	WHC-SD-W236B-FRD-002, REV. 1
Document Title:	Functions and Requirements for Project W-236B, Initial Pretreatment Module
Release Date:	11/8/94

This document was reviewed following the procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

Chris Willingham

C. Willingham 11/8/94

SUPPORTING DOCUMENT

1. Total Pages ~~55~~ 56	

2. Title	3. Number	4. Rev No.
Functions and Requirements for Project W-236B, Initial Pretreatment Module	WHC-SD-W236B-FRD-002	1

5. Key Words	6. Author
functions requirements pretreat supernatant cesium IPM	Name: L. M. Swanson Lynn M. Swanson Signature Organization/Charge Code 7E330/~~D3E18~~ D3021

7. Abstract

Pretreatment of Hanford Site tank waste supernates is being conducted to separate these supernates into a low-activity and a high-activity fraction. The low-activity waste fraction must be suitable for immobilization as glass that will be disposed at the Hanford Site.

The functional and requirements analyses of the Pretreat Supernatant function has been provided in the document. Requirements, as well as outstanding issues and required analyses to resolve these issues, are identified.

8. RELEASE STAMP

A-6400-073 (08/94) WEF124

RECORD OF REVISION

(1) Document Number	Page
WHC-SD-W236B-FRD-002	Page 1

(2) Title
Functions and requirements for project W-236B, Initial Pretreatment Module

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
	(7) EDT-607252, 08/09/94		
1 RS	Incorporates ECN-615167. This ECN incorporates comments received from DOE-RL andreplaces Revision 0 in its entirety.	L.M.SWANSON Lynn Swanson Nov. 10, 1994	J.S.GARFIELD J S Garfield 11/10/94