JUL 24 1996 (20) Sta. 37

# ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 605666

| 2. To: (Receiving Organization) | 3. From: (Originating Organization) | 4. Related EDT No.: |
|---|---|---|
| Distribution | Retreival Engineering 73530 | N/A |
| 5. Proj./Prog./Dept./Div.: | 6. Cog. Engr.: | 7. Purchase Order No.: |
| TWRS/ISSTRS | J. S. Hertzel | N/A |
| 8. Originator Remarks: | | 9. Equip./Component No.: |
| The attached supporting document is for approval. | | N/A |
| | | 10. System/Bldg./Facility: |
| | | N/A |
| 11. Receiver Remarks: | | 12. Major Assm. Dwg. No.: |
| | | N/A |
| | | 13. Permit/Permit Application No.: |
| | | N/A |
| | | 14. Required Response Date: |
| | | 7/19/96 |

15. DATA TRANSMITTED

| (A) Item No. | (B) Document/Drawing No. | (C) Sheet No. | (D) Rev. No. | (E) Title or Description of Data Transmitted | (F) Approval Desig-nator | (G) Reason for Trans-mittal | (H) Origi-nator Dispo-sition | (I) Receiv-er Dispo-sition |
|---|---|---|---|---|---|---|---|---|
| 1 | WHC-SD-WM-DRD-010 | ALL | 0 | Preliminary Design Requirements Document for the Initial Single-shell Tank Retrieval System | N/A | 1/2 | 1 | |
| | | | | | | | | |
| | | | | | | | | |

16. KEY

| Approval Designator (F) | Reason for Transmittal (G) | Disposition (H) & (I) |
|---|---|---|
| E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7) | 1. Approval 4. Review<br>2. Release 5. Post-Review<br>3. Information 6. Dist. (Receipt Acknow. Required) | 1. Approved 4. Reviewed no/comment<br>2. Approved w/comment 5. Reviewed w/comment<br>3. Disapproved w/comment 6. Receipt acknowledged |

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

| (G) Reason | (H) Disp. | (J) Name | (K) Signature | (L) Date | (M) MSIN | (J) Name | (K) Signature | (L) Date | (M) MSIN | (G) Reason | (H) Disp. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Cog.Eng. J. S. Hertzel | | 7/16/96 | H5-61 | E. A. Fredenburg | | | H5-61 | 3 | |
| 1 | 1 | Cog. Mgr. R. P. Marshall | | 7/19/96 | H5-61 | E. J. Kosiancic | | | H5-61 | 3 | |
| | | QA | | | | G. A. Meyer | | | H5-61 | 3 | |
| | | Safety | | | | S. A. Krieg | | | H5-68 | 3 | |
| 3 | | Env. | | | | C. E. Grenard | | | H5-61 | 3 | |
| 3 | | J. S. Hertzel | | | H5-61 | | | | | | |
| 3 | | D. B. Hagmann | | | H5-61 | Central Files | | | A3-88 | 3 | |

18. J. S. Hertzel 7-15-96
Signature of EDT Originator — Date

19. G. A. Meyer 19 July 96
Authorized Representative for Receiving Organization — Date

20. R. P. Marshall 7/19/96
Cognizant Manager — Date

21. DOE APPROVAL (if required)
Ctrl. No. N/A
[ ] Approved
[ ] Approved w/comments
[ ] Disapproved w/comments

BD-7400-172-2 (04/94) GEF097

BD-7400-172-1 (07/91)

# Preliminary Design Requirements Document for the Initial Single-shell Tank Retrieval System

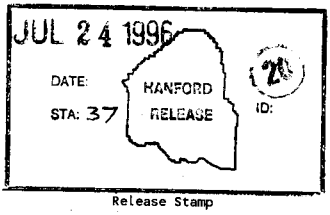
**J. S. Hertzel**
Westinghouse Hanford Company, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: 605666 UC: Ø2000
Org Code: 73530 Charge Code: D2007
B&R Code: EW3130010 Total Pages: 167

Key Words: design, requirements, ISSTRS

Abstract: The scope of this Preliminary Design Requirements Document is to identify and define the functions, with associated requirements, which must be performed to demonstrate and accomplish the initial single-shell tank saltcake retrieval from selected tanks. This document sets forth functions, requirements, performance requirements and design constraints necessary to begin conceptual design for the Initial Single-shell Tank Retrieval System . System and physical interfaces between the Initial Single-shell Tank Retrieval System project and the Tank Waste Remediation system are identified. The constraints, performance requirements, and transfer of information and data across a technical interface will be documented in an Interface Control Document. The design requirements provided in this document will be augmented by additional detailed design to be documented by the project.






Release Stamp

Release Approval Date

**Approved for Public Release**

WHC-SD-WM-DRD-010
Revision 0,

# PRELIMINARY DESIGN REQUIREMENTS DOCUMENT FOR THE INITIAL SINGLE-SHELL TANK RETRIEVAL SYSTEM

Prepared By:

LOS ALAMOS TECHNICAL ASSOCIATES, INC.
Richland, WA

For:

U.S. DEPARTMENT OF ENERGY
Richland Operations Office
Richland, Washington

&

WESTINGHOUSE HANFORD COMPANY
Richland, WA

**MAY 1996**

# CONTENTS

**CONTENTS (Continued)**

## LIST OF FIGURES



## LIST OF TABLES

# LIST OF TERMS

## Acronyms

| | |
|---|---|
| ACTR | Acquire Commercial Technology for Retrieval |
| ALARA | As Low As Reasonably Achievable |
| ANSI | American National Standards Institute |
| AWP | Air and Water Permit |
| BACT | Best Available Control Technology |
| BACRT | Best Available Radionuclide Control Technology |
| CC | Complexant Concentrate |
| CFR | Code of Federal Regulations |
| CP | Concentrated Phosphate Waste |
| DC | Dilute Complexant Waste |
| DCG | Derived Concentration Guide |
| DIL | Drainable Interstitial Liquid |
| DOE | U.S. Department of Energy |
| DST | Double-Shell Tank |
| DQO | Data Quality Objectives |
| EDE | Effective Dose Equivalent |
| EEM | Environmental Emission Management |
| EIS | Environmental Impact Statement |
| ETF | Effluent Treatment Facilities |
| HEPA | High Efficiency Particulate Air |
| HLW | High Level Waste |
| HSRCM | Hanford Site Radiological Control Manual |
| HVAC | Heating, Ventilating and Air Conditioning |
| ISSTRS | Initial Single-Shell Tank Retrieval System |
| LERF | Liquid Effluent Retention Facility |
| LLW | Low Level Waste |
| NEHRP | National Earthquake Hazards Reduction Program |
| NRC | Nuclear Regulatory Commission |
| OSD | Operating Specification Document |
| PNL | Pacific National Laboratory |
| ppm | Parts per Million |
| PSD | Prevention of Significant Deterioration |
| PSO | Plant Safety Officer |
| QAPP | Quality Assurance Program Plan |
| RACT | Reasonable Available Control Technology |
| RAEP | Radionuclide Air Emission Program |
| RCRA | Resource Conservation and Recovery Act of 1976 |
| RL | Richland Operations Office |
| SSC | Structures, systems and components |
| SpG | Specific Gravity |
| SST | Single-shell Tank |

**LIST OF TERMS (Continued)**

| | |
|---|---|
| SWDP | State Waste Discharge Permit |
| TBD | To Be Determined |
| TGA | Thermo Gravimetric Analysis |
| TCO | Total Organic Carbon |
| TOX | Total Organic Halogen |
| TPA | Tri-Party Agreement |
| TRU | Transuranic |
| TWRS | Tank Waste Remediation System |
| USQ | Unreviewed Safety Question |
| WAC | Washington State administrative Code |
| WHC | Westinghouse Hanford Company |
| WPS | Waste Pretreatment Storage |
| WRS | Waste Retrieval System |
| WTS | Waste Tank Storage |

**Definitions**

**Availability** - Availability is the probability that a particular component will be capable of operation for a predicted time duration. In other words, it is the measure of how often a system will be operational (available) when needed. Availability is dependent on reliability, the effects of failures, and maintainability. Conceptually, availability is Up Time divided by Total Time (Total Time = Up time + Down Time). As with reliability, there are different types of availability, such as inherent availability, operational availability, and achieved availability.

**Design Requirements Document (DRD)** - The design requirements baseline is documented by project-level design requirements documents (DRDs), associated interface control documents, and functions and requirements. This documentation captures all of the functions, interfaces, and requirements that are allocated to a specific architectural solution, and will provide a basis for design by an Architect-Engineer (a-E). The design basis includes all results of formal decision analysis, technical analyses, studies, and other products of systems engineering that are used to provide a rationale for baseline requirements.)

**Hazardous Waste** - At the Hanford Site, this usually means nonradioactive chemical toxins or otherwise potentially dangerous materials such as sodium, heavy metals, beryllium, or some organics.

**High-Level Waste** - The highly radioactive waste that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing an 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, *Radioactive Waste Management* [DOE 1988]).

**Logistics Reliability** - This is the measure selected to account for or address all incidents that require a response from the logistics system.

**Low-Level Waste** - Any gaseous, liquid or solid waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel or byproduct material as defined by DOE Order 5820.2A, Radioactive Waste Management (DOE 1988). 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 $< 100$ nCi/g.

**Maintainability** - Maintainability is a characteristic of design and installation expressed as the probability that an item will be restored to operational effectiveness within a given period of time when the maintenance action is performed in accordance with prescribed procedures.

**Maintenance** - Maintenance is defined as all actions required to retain or restore the system to a specified condition. This may include diagnosis, repair, or inspection.

**Mission Reliability** - Mission reliability is the probability that a system will perform mission-essential functions for a given range of operating conditions, a specific environmental condition, and a prescribed economic survival time for the conditions stated in the mission profile. Reliability measures are concerned with the expected frequency of failure.

**Operating Life** - The operating life is the time span from startup through to the final D&D report given to the customer and management.

**Operation Availability** - Operational availability is defined as operating time divided by total calendar time.

**Reliability** - Reliability is defined as the probability that an item will perform its intended function for a specified interval under stated conditions. This definition does not specifically consider the effect of the age of the system. Reliability can be further subdivided into mission reliability.

**Dependability** - Dependability of a component is another important design parameter that provides a measure of the system condition combining its reliability and maintainability.

# 1.0 SCOPE

The scope of this preliminary Design Requirements Document (DRD) is to identify and define the functions, with associated requirements, which must be performed to demonstrate and accomplish the initial single shell tank salt cake retrieval from selected tanks. This document sets forth functions, requirements, performance requirements and design constraints necessary to begin conceptual design for the Initial Single Shell Tank Retrieval System (ISSTRS). System and physical interfaces between the ISSTRS project and the Tank Waste Remediation system (TWRS) are identified. The constraints, performance requirements, and transfer of information and data across a technical interface will be documented in an Interface Control Document. The design requirements provided in this document will be augmented by additional detailed design to be documented by the project.

## 1.1 IDENTIFICATION

**Program:** TWRS, Remove Limited SST Waste (Function 4.2.2.1.4)

**Project:** ISSTRS (Project XXX)

**Mission:** The goals of ISSTRS are to: satisfy the 45-M-04 series of the Tri-Party Agreement (TPA) milestone; provide the initial retrieval portion of the tank farm demonstration step by defining the limit of technology as seen in the TPA Change Form M-45-93-01, approved 1/25/94; and demonstrating the feasibility of sluicing from a tank farm or the equivalent number of tanks.

## 1.2 PROJECT OVERVIEW

The fourth amendment to the *Hanford Federal Facility Agreement and Compliance Order* (Tri-Party Agreement) and U.S. Department of Energy (DOE) policy decision form the bases for the *Tank Waste Remediation System* (TWRS) mission. The bases includes: (1) retrieval and closure of both single shell, double-shell, miscellaneous underground tank waste, (2) disposal of immobilized Low Level Waste (LLW) onsite, (3) disposal of immobilized High Level Waste (HLW) offsite, (4) separation of immobilized transuranic wastes. The *Hanford Federal Facility Agreement and Compliance Order* (Tri-Party Agreement) specifies milestones which form the bases for ISSTRS as shown in Tables 1-1. Compliance with the Tri-Party Agreement to fulfill the commitment to complete retrieval of SST waste will be accomplished by the successful saltcake demonstration of ISSTRS.

Table 1-1. Selected Tri-Party Agreement Milestones.

| Milestone Number | Title | Date |
|---|---|---|
| M-45-04A | Complete conceptual design for the initial SST retrieval systems. | April 30, 1997 |
| M-45-04-T02 | Complete design for the initial SST retrieval systems. | December 31, 2000 |
| M-45-04-T03 | Complete construction for the initial SST retrieval systems. | June 30, 2003 |
| M-45-05-T01 | Provide initial single-shell tank retrieval system. Complete construction and related testing of the initial SST retrieval systems. This milestone will provide retrieval systems for an entire single-shell tank farm or an equivalent number of tanks. | November 30, 2003 |
| M-45-08-T02 | Establish the criteria through stakeholder, participation and ecology approval for: (1) Determining allowable leakage volumes, and (2) Acceptable leak monitoring/detection and mitigation measures necessary to permit sluicing operations. Consistent with authorities granted by EPA and the state under its delegated hazardous waste management program, ecology will have final authority in determining acceptable criteria for this target activity. | April 30, 1997 |
| M-45-08A | Complete systems design and operating strategy for tank leak monitoring and mitigation for systems to be used with initial retrieval systems for SSTs. | December 31, 2000 |
| M-45-08B | Complete demonstration and installation of leak monitoring and mitigation systems for initial SST retrieval. | June 30, 2003 |
| M-45-09A through -09H | Submit annual progress reports on the development of waste tank leak monitoring/detection and mitigation activities in support of M-45-08. Reports will describe work accomplished under M-45-08, technologies, applications, cost, schedule, and technical data. Reports will also evaluate demonstrations done by DOE and private industry for applicability to SST retrieval and provide recommendations for further testing for use in retrieval operations. | September 30, 1996 to September 30, 2003 |

The objective of the SST Retrieval is the retrieval of waste from Single Shell Tanks (SSTs)

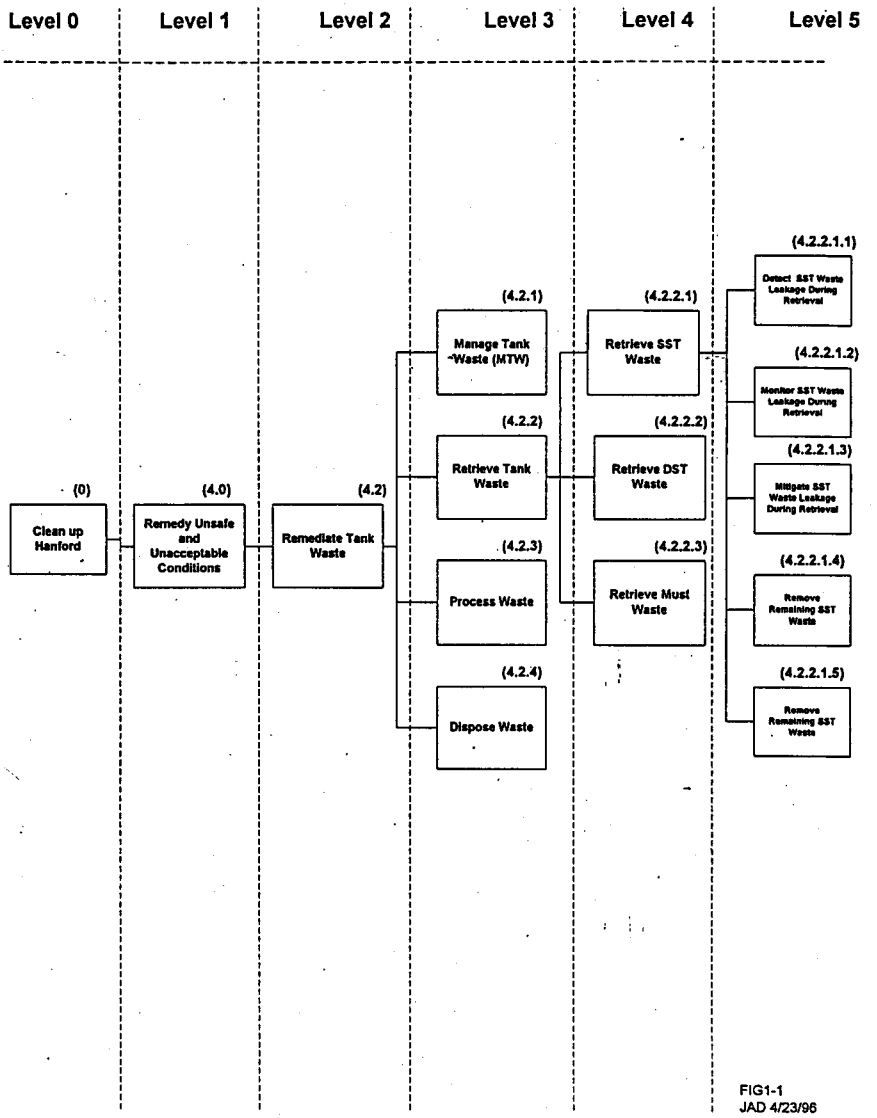
to permit the closure of these tanks in accordance with regulatory requirements. The regulatory requirement for SSTs is retrieval of 99% of the waste volume.

Sluicing alone will not accomplish the objective to retrieve 99% of SST waste. Enhancements to sluicing and alternate retrieval technologies will be identified and developed in partnership with industry through Acquire Commercial Technology for Retrieval (ACTR). A full-scale demonstration of SST retrieval technology, with the goal of retrieving 99% of the waste from a tank, is to be complete by September 30, 2003.

A systems engineering process has been applied to the Hanford Site and has been implemented by the TWRS to establish the functions and requirements necessary for accomplishing the TWRS mission. The initial TWRS Functional baseline has been established through four levels of functional decomposition and documented in the *Tank Waste Remediation Systems Functions and Requirements*, WHC SD-WM-FRD-020, Draft, Revision C. The policy and guidance for application of systems engineering throughout the TWRS Program are described in the *Tank Waste Remediation Systems (TWRS) System Engineering Management Plan*, WHC-SD-WM-SEMP-002, Draft.

The development of the functions that form the basis for the ISSTRS has been provided through continuation of the systems engineering process from the top-level system requirements. The results of the TWRS systems engineering functional hierarchy to the fourth level are shown in Figure 1-1. Figure 1-1 also shows level five. The approval of the fifth-level functions is part of the Technical Requirements Specifications (TRS). The TRS for TWRS is currently being prepared for review. This document is a preliminary DRD until approval of the TRS.

Figure 1-1. Tank Waste Remediation System Systems Engineering Functional Hierarchy.



# 2.0 APPLICABLE DOCUMENTS

The documents provided in the following Tables form a part of this specification to the extent specified. In the event of conflict between the documents referenced in the Tables and the contents of the specification, the contents of this specification shall be considered a superseding requirement.

## 2.1 GOVERNMENT DOCUMENTS

Federal government and Washington State regulations along with the DOE orders have been reviewed to determine constraints applicable to the design, construction, and operation of the ISSTRS to extent specified. To the extent specified, the references listed in Table 2-1 represent requirements imposed on the ISSTRS by sources external to the TWRS program.

Table 2-1. Applicable Constraint Documents (3 sheets).

| Document Identifier | Title |
|---|---|
| 10 CFR 61 | Licensing Requirement for Land Disposal of Radioactive Waste |
| 10 CFR 830 | Nuclear Safety Management, Subpart a, General Provisions, Section 830.120, Quality Assurance Requirement |
| 10 CFR 835 | Occupational Radiation Protection |
| 20 CFR 1910 | Occupational Safety and Healthy Standards |
| 20 CFR 1926 | Safety and Health Regulations for Construction |
| 40 CFR 50 | EPA Regulations on National Primary and Secondary Air Quality Standards |
| 40 CFR 52 | Approval and Promulgation of Implementation Plans. |
| 40 CFR 61 | National Emission Standards for Hazardous Air Pollutants. |
| 40 CFR 260 | Hazardous Waste Management System: General |
| 40 CFR 262 | Standards Applicable to Generators of Hazardous Air Pollutants |
| 40 CFR 264 | Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities |
| 40 CFR 270 | EPA Administered Permit Programs: The Hazardous Waste Permit Program |
| 40 CFR 280 | Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST) |
| 40 CFR 300 | National Oil and Hazardous Substances Pollution Contingency Plan |
| 40 CFR 302 | Designation, Reportable Quantities and Notification |

Table 2-1. Applicable Constraint Documents (3 sheets).

| Document Identifier | Title |
|---|---|
| 42 USC 6901 | Resource Conservation and Recovery Act of 1975 (RCRA) and Hazardous and Solid Waste Amendments of 1984 (HSWA) |
| DOE Order 1540.2 | Hazardous Material Packaging for Transportation - Administrative Procedures |
| DOE Order 5000.3B | Occurrence Reporting and Processing Operations Information |
| DOE Order 5400.1 | General Environmental Protection Program |
| DOE Order 5400.3 | Hazardous and Radioactive Protection Program |
| DOE Order 5400.4 | Comprehensive Environmental Response, Compensation, and Liability Act Requirements |
| DOE Order 5400.5 (1990) | Radiation Protection of the Public and the Environment |
| DOE Order 5480.1B | Environment, Safety, and Health Program for Department of Energy Operations |
| DOE Order 5480.1E | National Environmental Policy Act Compliance Program |
| DOE Order 5480.3 (1985) | Safety Requirement for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Waste |
| DOE Order 5480.4 (1984) | Environmental Protection, Safety, and Health Protection Standards |
| DOE Order 5480.6 (1992) | Radiological Control |
| DOE Order 5480.7A (1987) | Fire Protection |
| DOE Order 5480.11 (1988) | Radiation Protection for Occupational Workers |
| DOE Order 5480.19 | Conduct of Operations Requirements for DOE Facilities |
| DOE Order 5480.20 (1991) | Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities |
| DOE Order 5480.21 | Unreviewed Safety Questions |
| DOE Order 5480.22 | Technical Safety Requirements |
| DOE Order 5480.23 | Nuclear Safety Analysis Reports |
| DOE Order 5480.24 (1992) | Nuclear Criticality Safety |
| DOE Order 5480.28 | Natural Phenomena Hazards Mitigation |

Table 2-1. Applicable Constraint Documents (3 sheets).

| Document Identifier | Title |
|---|---|
| DOE Order 5483.1A (1983) | Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities |
| DOE Order 5500.7B | Emergency Operations Record Protection Program |
| DOE Order 5820.2A (1993) | Radioactive Waste Management |
| DOE Order 6430.1A (1989) | General Design Criteria |
| DOE RL Order 5440.1A | Implementation of the National Environmental Policy Act at the Richland Operations Office |
| DOE RL Order 5480.1A | Environment, Safety, and Health Program for Department of Energy Operations for Richland Operations |
| NFPA 70 (1993) | National Electric Code |
| RCW 70.105 | Washington Hazardous Waste Management Act |
| RLID 5480.7 | Fire Protection |
| RLID 5480.2A | Radioactive Waste Management |
| RLID 5480.4C (1992) | Environmental Protection, Safety, and Health Protection Standards for RL |
| RLID 5480.11 (1991) | Radiation Protection for Occupational Workers |
| Tri-Party Agreement (1994) | Hanford Federal Facility Agreement and Consent Order (Amendment 4) |
| WAC 173-400 | General Air Regulations |
| WAC 173-401 | Operating Permit Regulation |
| WAC 173-460 | Toxic Air Pollutants |
| WAC 173-480 | Ambient Air Quality Standards and Emission Limits for Radionuclides |
| WAC 173-303 | Dangerous Waste Regulations |
| WAC 173-200 | Waste Quality Standards for Groundwater of the State of Washington |
| WAC 246-220 | Radiation Protection - General Provision |
| WAC 246-247 | Radiation Protection - Air Emissions |

### 2.1.1 Hanford Site Documents/Other

Selected DOE Orders and Federal Government and Washington State Regulations have been reviewed by Westinghouse Hanford Company (WHC) to provide a consistent interpretation of the constraints for application at the Hanford Site. These constraints are represented in WHC Controlled manuals (CM). Also, the U.S. Department of Energy - Richland Field Office has prepared a collection of Hanford Site specific requirements and specifications.

## 2.2 NON-GOVERNMENT DOCUMENTS

Table 2-2 provides a list of non-government documents that contain requirements applicable to the ISSTRS.

Table 2-2. Westinghouse Hanford Company Documents and Other Applicable Codes (2 sheets).

| Document Identifier | Title |
|---|---|
| ASME | Boiler and Pressure Vessel Codes, Section VIII, American Society of Mechanical Engineers |
| ANSI/ISA (1985) | Graphic Symbols for Process Displays |
| ANSI/ISA (1991) | Instrument Loop Diagrams |
| ANSI/ISA (1992) (R) | Binary Logic Diagrams for Process Operations |
| ANSI/ISA (1994) | Instrumentation Symbols and Identification |
| ASHRAE ISBN (1993) | Heating Ventilation and Air-Conditioning for Department of Energy Nuclear Facilities |
| ASME (1989) | Quality Assurance Program Requirements for Nuclear Facilities |
| HSCRM-1 | Hanford Site Radiological Control Manual |
| WHC-CM-1-3 (1991) | Management Requirements and Procedures |
| WHC-CM-2-14 (1993) | Hazardous Materials Packaging and Shipping |
| WHC-CM-4-29 (1991) | Nuclear Criticality Safety Manual |
| WHC-CM-4-46 | Non-reactor Facility Safety Analysis Manual |
| WHC-CM-7-5 (1994) | Environmental Compliance |
| WHC-EP-0063-4 (1993) | Hanford Site Solid Waste Acceptance Criteria |
| OSD-T-151-00007, H-13 | Operating Specifications for the 241-AN.AP, AW, AY, AZ & SY Tank farms |
| OSD-T-151-00013, D-5 | Operating Specifications for Single-shell Waste Storage Tanks |
| OSD-T-151-00017, D-5 | Operating Specifications for 241-AY & 241-AZ |
| OSD-T-151-00030 | Operating Specification for Watch List Tanks |
| WHC-IP-0842 | Tank Waste Remediation System Administration Manual |

Table 2-2. Westinghouse Hanford Company Documents and Other Applicable Codes (2 sheets).

| Document Identifier | Title |
|---|---|
| WHC-SD-WM-DRD-009, Rev.0 | Controlled, Clean , and Stable Preliminary Design Requirements Document for Single Shell Tanks |

Table 2-3. Supporting Documents.

| Standard Number and Title | |
|---|---|
| **General** | |
| WHC/BCSR/ICF KH and PNL | Industry References (Standards, and National Codes) |
| WHC/BCSR/ICF KH | ICF KH A/E Standard CG-DWG-01 (Preparation and Control of Engineering and Fabrication Drawings) |
| WHC/BCSR/ICF KH | WHC-CM-6-1, EP-1.2 (Preparation and Control of Multi use Hanford Specifications) |
| **Architectural-Civil** | |
| WHC/BCSR/ICF KH | DOE 6430.1A and ICF KH A/E STD, GC-LOAD-01 (Design Loads for Facility) |
| **Mechanical** | |
| WHC/BCSR/ICF KH | DOE 6430.1A and ICF KH A/E STD, DFDC-1XX (Fire Alarm Systems) |

### 2.2.1 Information Documents: Process Flowsheet (WHC-SD-WM-TI-613)

A reference flowsheet has been developed for retrieval of Hanford Site tank wastes (Orme 1995). This flowsheet provides information on the expected retrieval of 100%[1] of the tank waste into a composite feed stream.

This approach does not account for retrieval inefficiencies and day-to-day variability, but establishes a conservative reference mass balance and overall throughput requirements.

---

Eventually, waste will be retrieved from DSTs and SSTs to the extent required for closure. The closure requirements have not been fully specified. (Note: The TPA conditions for closure are that residues in 100 series tanks shall not exceed 360 $ft^3$ and in 200 series tanks shall not exceed 30 $ft^3$, but if the retrieval technology is capable of better, then the limit of the technology is required. Further, decontamination of the tanks may be required to satisfy closure requirements).

Section 3.2.1 contains the expected system performance requirements derived from the reference flowsheet.

The TWRS flowsheet will be revised and updated periodically as additional data become available. Also, revisions to the DRD must be evaluated as the flowsheet is revised.

# 3.0 PROJECT FUNCTIONS AND REQUIREMENTS

## 3.1 DEFINITION

The primary function of ISSTRS is to provide a tank farm demonstration for retrieval for selected SSTs (i.e., preliminary tanks selection: 241-C-103, 241-A-102, 241-C-105, and 241-AX-103). One of the select tanks shall be based on the saltcake content and be used to demonstrate saltcake retrieval. The retrieval demonstration shall remove sludge as well as saltcake from the selected tanks.

The TPA milestone M-45-05 initiated the tank selection. DOE/RL has directed (REF: Bader Letter) the SST Retrieval plan for a saltcake retrieval demonstration. The criteria for saltcake tank selection to retrieve was the amount of saltcake contained in the tank, at least a minimum of 3 ft of saltcake in the tank, not to exceed 500 k of saltcake and sludge, and the minimum fraction of sludge.

The ISSTRS supports the TWRS mission by accomplishing the TWRS retrieve waste function identified in Section 3.2.1 and in Section 1.2. The TWRS that the ISSTRS interfaces with are identified in Section 3.2.2. Function hierarchy diagrams displaying the hierarchial relationship of the ISSTRS Tank Farm Retrieval Demonstration to other TWRS functionality can be found in TWRS Systems Engineering Functions & Requirements database. Section 3.2 provides the performance requirements for the ISSTRS and Section 3.7 provides the requirements for the specific sub-elements.

The major sub-elements that makeup the ISSTRS are briefly described below:

a. **Detect SST Waste Leakage During Retrieval.** The ISSTRS detect SST waste leakage during retrieval shall perform the leak detection. This function shall detect and confirm leakage from SSTs and ancillary components during retrieval activities.

b. **Monitor SST Waste Leakage During Retrieval.** The ISSTRS shall monitor SST waste leakage during retrieval. The waste leakage from retrieval activities shall be monitored during the pre-retrieval and post-retrieval activities to obtain data that will be used to determine information about the leakage.

c. **Mitigate SST Waste Leakage During Retrieval.** The ISSTRS shall mitigate SST waste leakage during retrieval. The activities shall include the operational, procedural, and administrative methods in conjunction with retrieval equipment used to mitigate leakage of SST waste during retrieval. This function shall assist in prevention and response to new leaks if they occur.

d. **Remove In-Tank Obstructions.** The ISSTRS shall remove the existing in-tank equipment and equipment that obstructs the retrieval activity.

e. **Deploy Retrieval System.** The ISSTRS shall deploy the retrieval

equipment/system which includes the installation of the equipment at the various tank interfaces.

f. **Mobilize SST Waste.** The ISSTRS mobilize system elements consists of a sluicer system that agitate waste into a slurry consistency for transfer to a designated DST storage facility. The sluicer will operate in the A, AX, and C tank farms sluice pits. The sluicer is a vertical design with its articulation point located at a one or more fixed elevation in the tank. The sluicer direction of aim is adjustable in both elevation and azimuth.

g. **Convey/Transfer Slurry Waste.** The ISSTRS conveys the waste with the slurry system which includes two pumps located in the pump pit. The system includes a booster pump, a transport system to transfer the slurry waste the distance between the two tanks at a desired flow rate, valve pits, diversion boxes, pump pits, and ancillary equipment (e.g., fittings, valves) required to route through or connect the transport system.

h. **Ventilation and Cooling.** The ISSTRS ventilation and cooling system shall cool the tank during the retrieval operation and maintain the appropriate negative pressure while discharging the decontaminated stream to the atmosphere. The system is a combination of exhaust and recirculation system. The recirculation portion of the system is used to provide the needed cooling. The exhaust portion of the system maintains the required pressure in the tank.

i. **Monitor & Control Operations.** The ISSTRS monitoring and control system shall provide the structures, monitoring and instrumentation devices, and cabling required to properly supervise and operate the retrieval activities associated with ISSTRS.

j. **Decontaminate Equipment.** The ISSTRS decontaminate equipment shall consist of activities that fully decontaminate the retrieval equipment to be decommissioned at a future date.

## 3.2 CHARACTERISTICS

### 3.2.1 Performance Characteristics

**3.2.1.1 ISSTRS Tank Farm Retrieval Demonstration.** The Initial Single-Shell Tank Retrieval System (ISSTRS) shall retrieve waste from four select tanks (i.e., preliminary tank selection 241-A-102, 241-AX-103, 241-C-103, & 241-C-105). The ISSTRS shall mobilize the tank waste, convey the slurry waste from the tank, transfer the slurry waste to the designated storage facility, and recirculate decant liquid from the DST storage facility back to the SST subject to the retrieval activities. The ISSTRS shall include a saltcake retrieval demonstration from the select four tanks. The tank farm demonstration shall retrieve sludge and saltcake from the remaining tanks. The ISSTRS shall consists of a sluice and slurry system, a tank ventilation and

cooling system, monitoring and control systems, leak detection during retrieval, and decontamination of equipment. The process flow activities consist of preparing the receiving DST liquid from the storage facility to the sluicer in the SST, sluicing the waste, pumping the waste to the designated DST storage facility. The operational activities shall include preparing the designated DST liquid, start-up and routine sluicing operations, sluicing completion evaluation, transfer to designated DST storage facility, material balance and leak detection, leak prevention and mitigation, monitoring and control instrumentation, and flushing and cleaning the ISSTRS and the transport system.

Basis: Derived from the TPA milestone M-45-04-T01, "Provide initial single-shell tank retrieval system. Complete construction and related testing of the initial SST retrieval systems. This milestone will provide retrieval systems for an entire single-shell tank farm or an equivalent number of tanks." In addition, the DOE/RL direction (REF: Bader Letter) that SST Retrieval plan for a saltcake retrieval demonstration.

**3.2.1.1.1 The ISSTRS Total Waste Volume.** The ISSTRS shall have the capabilities to transport the retrieved waste at a maximum of 5 M Na and 10% weight percent solids. The expected ISSTRS retrieved waste volume shall be the existing non-dilute waste of 483 kgal ($1.8 \times 10^6$ L) and approximating the dilution of water to solids using the molarity limit for sodium and the weight percent solids.

[WHC-SD-WM-ER-029, Rev. 21, pg. 14.]
[ WHC-SD-WM-TI-613, REV.1, Table 3-3, pg. 33]

**Issue 1:** Determine the appropriate weight percent solids for each of the selected SST retrieval tank selected for ISSTRS.

**Required Analysis 1:** The weight percent by solids to be retrieved is based on the TWRS Process Flowsheet and the expected behaviors of the constituents of the selected tanks. The ISSTRS demonstration shall analyze and establish on a tank-by-tank basis the appropriate weight percent by solids based on the viscosity of the saltcake/sludge of the selected ISSTRS retrieval tanks.

**Issue 2**: Determine and establish the appropriate retrieved waste volume.

**Required Analysis 2:** The expected waste volume to be retrieved is an approximate value. The ISSTRS demonstration shall analyze and establish the actual expected volume of sluicing the saltcake/sludge of ISSTRS selected tanks.

**3.2.1.1.2 ISSTRS Productivity Rate.** The ISSTRS shall have the capabilities of hydraulically retrieving at the expected productivity rate of 7.2 $m^3$/day of sludge or saltcake per day per sluicer system used.

**Issue 1:** Establish and verify the productivity rate of hydraulic retrieval system considering the overall system efficiencies, considering failures, replacement and maintenance of the hydraulic system and interfacing support systems. The estimate of the sluicer availability (i.e., installed at a tank and ready for use) is 70% and when available, in use 70% of the for an overall operating efficiency of 49% (Boomer et al. 1995). The approach estimates an optimistic 4 sluicer system to meet the retrieval rate of 14.4 $m^3$/day. The effective rate is the 7.2 $m^3$/day of sludge or saltcake per day per sluicer.

**Required Analysis:** Verify through the ISSTRS demonstration the actual productivity rate of the systems considering the overall system efficiencies and in conjunction with the interfacing support systems.

**3.2.1.1.3 Tank-To-Tank Sluicing.** ISSTRS shall implement tank-to-tank sluicing for the retrieval of the single shell tank farm demonstration. Tank-to-tank sluicing is preparing the designated DST facility liquid waste by adding caustic treated water, transferring to the selected SST to be used by the sluicing operations to agitate the tank waste into slurry waste. This slurry waste shall be transferred and dispersed into the designated DST facility and the solids suspended in the slurry shall be allowed to settle out. The adequately clarified sluice stream shall be re-circulated back to the selected SST to initiate the sluicing operations.

**Issue 1:** The Tank-to-Tank sluicing decision analysis shall be required as a necessary implementation to the sluicing process.

**Required Analysis:** A decision analysis shall be required that selects Tank-to-Tank sluicing a the appropriate alternatives for the sluicing process. The decision analysis shall specifically document the decision and criteria associated with the chosen alternative.

**3.2.1.1.4 Single Shell Tank Selection.** The M-45-04 series requires the completion of the conceptual design, design, and construction for the initial SST retrieval systems (ISSTRS). TPA milestone M-45-04-T01, "Provide initial single-shell tank retrieval system. Complete construction and related testing of the initial SST retrieval systems. This milestone will provide retrieval systems for an entire single-shell tank farm or an equivalent number of tanks." The preliminary selection for ISSTRS is four single shell tanks (i.e., preliminary tank selection 241-A-102, 241-AX-103, 241-C-103, & 241-C-105 from *Initial Single Shell Retrieval System - Tank Selection*, WHC-SD-WM-ES-367, Rev. 0).

**Issue 1:** The issue is to determine how many tanks shall be included in the Initial Single Shell Tank Retrieval System work scope. The TPA milestone does not define how many tanks must be retrieved as the equivalent to an entire single-shell tank farm. The tank farm size range from 4 tanks in AX farm to 18 tanks in the TX farm. The average tank farm contains 12 tanks.

**Required Analysis:** The decision analysis shall be required to establish the criteria for tank farm selection, and select the preferred tank farm.

### 3.2.2 System Relationships

Relationships between the function performed by the ISSTRS and other, interfacing system functions are shown in Figure 3-1 (TWRS functions are shown in the TWRS F&R) and described below.

The ISSTRS shall accomplish the performance characteristics defined in paragraph 3.2.1.1 through the appropriate interface with other TWRS system functions as shown in Figure 3-1.

The ISSTRS shall obtain and assimilate information regarding the retrieval operations and permissibility from the Manage System Information and Characterize Waste function (TWRS function 4.2.1.4, and 4.2.1.2). All raw materials (e.g., electricity, raw water, steam, and compressed air) associated with the ISSTRS shall come through interfacing with function 2.0, Acquire Mission Essential Capabilities. The ISSTRS shall mobilize, retrieve, and convey the tank waste to the designated DST storage facility with the architecture performing Store In-Process Waste (TWRS function 4.2.3.1). Once Store In-Process Waste has received the ISSTRS retrieved waste, the solids in the waste stream have settled (i.e., solids settling time), the decant supernatant will be recycled for retrieval and is sent to the ISSTRS Tank Farm Retrieval Demonstration function from the Store In-Process Waste function. This "recycled decant liquid for retrieval" will continue until all the retrieval activities have been concluded.

The ISSTRS shall feed back to function 4.2.1.1.4 and 4.2.1.4 operations data affecting the tank storage and characterization requirements for tank waste retrieved. Solid Waste resulting from the ISSTRS operations shall be transferred to the function Remedy Solid Waste, function 4.3. The ISSTRS equipment once having fulfilled it function shall be taken over by Deactivate Facilities function (Site Function No. 4.1). The liquid waste resulting from flushing the transport system shall be transferred to the Store In-Process function. Listed below are the interface descriptions.

### 3.2.3 External Interface Requirements

**3.2.3.1 Physical Descriptions.** The physical interfaces described in this document are based on current ISSTRS scope. Additional scope and modification of the contents of this section may be required.

**3.2.3.1.1 ISSTRS Selected DST Receiving Storage Facility.** The existing infrastructure (i.e., sluice, pump and distributor pit) which are located within the circumference of the tank dome shall interface with the ISSTRS. The physical interface is the riser which extends from the tank dome through the pit floor.

**3.2.3.1.2 ISSTRS Selected SST Retrieval Tank's Sluice and Pump Pits.** The sluice and pump pit are located below grade, and above the tank dome. The pits are adjacent to one another and within the diameter of the SST. The pit shall contain the ISSTRS, specifically the sluicer system and slurry systems, and supporting motive forces architecture. The physical interface between the pit and the tank dome is riser configuration which includes a plated flange that seats on the riser.

**3.2.3.1.3 ISSTRS the Existing Waste Transfer System.** The ISSTRS shall have the capabilities to transport the retrieved waste from the SST storage facility to the DST storage facility using the existing waste transfer system.

**3.2.3.1.4 ISSTRS and the Existing Valve Pits/Diversion Boxes.** The ISSTRS selected retrieval tank's valve pits/diversion boxes that provide a central and common point where waste can be transferred into and out of the tanks in the ISSTRS selected farm complex. The physical interfaces are defined to be at the valve pit.

**3.2.3.1.5 ISSTRS and Existing Power Systems.** ISSTRS shall require electrical power to be provided the ISSTRS and associating retrieval components. The physical interface is the transformer which takes utility power (13.8 kV) and transforms it to a usable voltage level (480V). ISSTRS shall provide the connection to the existing utility system, the transformer(s) and the associating equipment required to provide 3-1phase power at the ISSTRS equipment.

**3.2.3.1.6 ISSTRS and the Existing Raw Water System.** The ISSTRS requires raw water to perform operational flushes of the ISSTRS and associating ancillary equipment. The physical interface shall be with the raw water system.

**3.2.3.1.7 ISSTRS and the Existing Fire Protection.** The ISSTRS requires fire protection to insure adequate fire protection. The physical interface is with the existing fire water system, and alarm systems and components.

**3.2.3.2 External Interface Requirements**

**3.2.3.2.1 The DST Receiving Storage Facility for ISSTRS Interface Requirements.** See section 3.7 for the requirements description.

**3.2.3.2.2 ISSTRS Selected SST Retrieval Tank's Sluice and Pump Pits Requirements.**

[RESERVED]

**3.2.3.2.3 ISSTRS the Existing Waste Transfer System Requirements**

[RESERVED]

**3.2.3.2.4 ISSTRS and the Existing Valve Pits/Diversion Boxes Requirements.**

**Ancillary Equipment Assessment.** for ancillary equipment, a leak test or other integrity assessment as approved by the Department of Ecology must be conducted at least annually.
[WAC 173-303-640(4)(o)(c)]

**3.2.3.2.5 ISSTRS and Existing Power Systems Requirement.**

[RESERVED]

**3.2.3.2.6 ISSTRS and the Existing Raw Water System Requirement.**

[RESERVED]

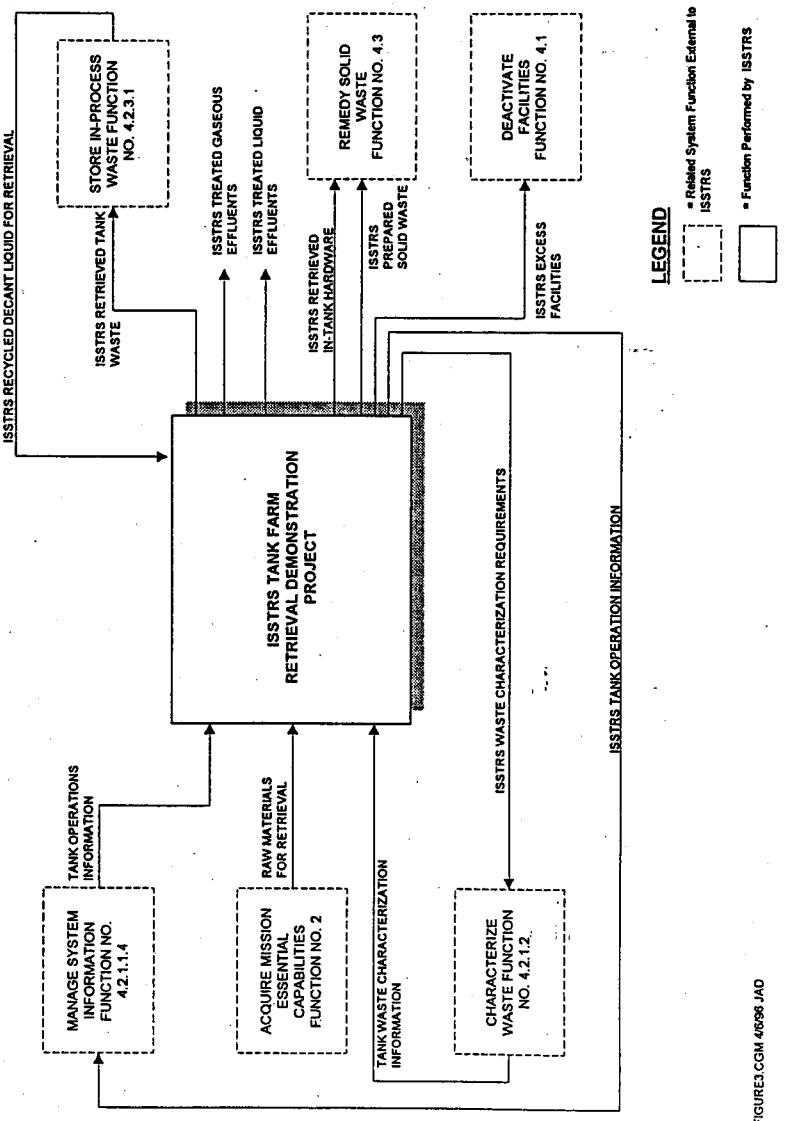
**3.2.3.2.7 ISSTRS and the Existing Fire Protection Requirement.**

[RESERVED]

**3.2.3.2 Functional Interface Requirements for ISSTRS Tank Farm Retrieval Demonstration.** The functional interface requirements as they correspond to the above physical interfaces are shown below. The functional interfaces described below are shown in Figure 3-1.

**3.2.3.2.1 Input: Tank Operations Information.** Characterization waste requires tank operations information consisting of monitoring and surveillance data which includes: in-tank temperature measurements, pressure measurements, waste level measurements, photographs, emission monitoring data, data from specialty equipment, as well as information related to the structure of the tank and its safety status. Tank operations information is provided by the Store Manage tank Waste (sub-function Manage System Information) function.

Figure 3-1. ISSTRS Relationships for Retrieving Single-Shell Tank Waste.



#### 3.2.3.2.1.1 Tank Operations Information Interface Requirements.

**Transfer System Temperature Ranges Operations.** The waste storage facility shall transfer waste that does not exceed the temperature limits of at least 82.2°C (180°F) and up to 149°C (300°F). Maximum temperatures will vary based on the storage facility that the waste will be sent to.

The primary tank waste temperature limits for each tank are limited to prevent excessive stress to the primary tank and vary depending on the particular DST in question. It can be derived that the temperatures of the wastes to be transferred should not exceed these temperature limits.

[TWRS F&R Requirements - Transfer System Temperature Ranges Operations]

**3.2.3.2.2 Input: Raw Materials for Retrieve SST Waste.** Any material or services (e.g., steam, water, air, process chemicals, electricity) needed from outside TWRS for retrieving SST waste.

#### 3.2.3.2.2.1 Raw Materials for Retrieve SST Waste Interface Requirements.

**Corrosion Control.** The chemistry of liquid high-level waste shall be adjusted to control corrosion within design limits for the storage system.

[DOE 5820.2A, Chapter I, 3.b (7)(c)]

**Treatment Reagents.** Treatment reagents shall not be placed in a tank system without proven effective mitigative action if they could cause the tank, its ancillary equipment, or the containment system to rupture, leak, or otherwise fail.

[DOE 5820.2A, Chapter I, 3.b(7)(d)]

**3.2.3.2.3 Input: Tank Waste Characterization Information.** Tank Waste Characterization Information consists of the technical basis sampling priority list, yearly Tank Waste analysis Plan, Tank Characterization Plans, Sampling and Analysis Plans, optimized sampling Schedule, Tank Waste Layer Model (TLM), Historical Tank Content Estimates (HTCEs), waste analysis data packages, waste in-situ measurement data, Tank Characterization Reports (TCRs), and other statistical data analysis and technical reports.

#### 3.2.3.2.3.1 Tank Waste Characterization Information Interface Requirements.

ISSTRS elements shall meet the tank waste characterization information requirements for the following requirements. See section 3.7 for requirements description.

Characterization Information Accessibility.
Heat Generation Limit.
TRU Waste Segregation.
Transfer System Specific Gravity Limits.
Waste Pumpability.
Tank Waste Type (DST Wastes).
Energetics.
High Phosphate Waste.
Chemical Compatibility.
Chemical Concentrations Limits.
Complexant Waste Segregation.
Criticality Prevention Requirement.

**3.2.3.2.4 Output: ISSTRS Waste Characterization Requirements.** Characterization information needs of the ISSTRS retrieve/transfer functions that can be transformed into data quality objectives with requirements for analytical measurements, precision, and accuracy.

**3.2.3.2.4.1 ISSTRS Waste Characterization Interface Requirements.**
ISSTRS shall perform the waste characterization requirement by satisfying the following requirement. See Section 3.7 for requirement description.

Characterization Information Accessibility.
Chemical Concentrations Limits.
Criticality Prevention Requirement.
Heat Generation Limit.
TRU Waste Segregation.
Transfer System Specific Gravity Limits.
Chemical Compatibility.
Complexant Waste Segregation.
Energetics.
High Phosphate Waste.
Tank Waste Type (DST Wastes).
Waste Pumpability.

**3.2.3.2.5 Output: ISSTRS Retrieved In-Tank Hardware.** Pipe, equipment, and miscellaneous, non-radioactive or hazardous debris that has been installed in or put in an underground storage tank. ITH includes, but is not limited to, instrument trees, air lifts, steam lances, level tapes, pumps, and rocks. This waste has been segregated, packaged, assayed, and certified for transfer to Hanford Site Function 4.3; Remedy Solid Waste, for further treatment or disposal. This includes mixed, and radioactive solid wastes.

**3.2.3.2.5.1 ISSTRS Retrieved In-Tank Hardware Interface Requirements**

**Waste Analysis.** Before an owner or operator treats, stores, or disposes of any hazardous wastes, or nonhazardous wastes if applicable under [Section] 264.113(d), he must obtain a detailed chemical and physical analysis of a representative sample of the wastes. At a minimum, the analysis must contain all the information which must be known to treat, store, or dispose of the waste in accordance with this part and part 268 of this chapter.

40CFR268.41(a)
40CFR268.41(b)
40CFR268.41(c)
40CFR268.42(a)

[40 CFR 264.13(a)(1)]

**TRU Concentrations**. Radioactive wastes with quantities of transuranic radionuclides in concentrations of 100 nCi/g of waste or less shall be considered to be low-level waste, and shall be managed according to the requirements of Chapter III of this Order.
[DOE 5820.2A, Chapter II, 3.a(3)]

**TRU Concentration Limits.** The lower concentration limit for transuranic waste (> 100 nCi/g of waste) shall apply to the contents of any single waste package at the time of assay.
[DOE 5820.2A, Chapter II, 3.a(2)]

**TRU Waste Storage.** Newly generated transuranic waste shall be placed in noncombustible packaging that meets DOT requirements. All Type A transuranic waste containers shall be equipped with a method to prevent pressure buildup. Acceptable pressure-relief devices include permeable gaskets, vent clips, and filtered vents.

[DOE 5820.2A, Chapter II, 3.d]

**Low Level Waste Characterization.** 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 radionuclide content are recorded and known during all stages of the waste management process.
Waste characterization data shall be recorded on a waste manifest, as required by paragraph 3m, and shall include:

- The physical and chemical characteristics of the waste.
- Volume of the waste (total of waste and any solidification or absorbent media).
- Weight of the waste (total of waste and any solidification or absorbent media).
- Major radionuclides and their concentrations.
- Packaging date, package weight, and external volume.

The concentration of a radionuclide may be determined by direct methods or by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect methods can be correlated with actual measurements.

[DOE5820.2A, Chapter III, 3.d]

**Solid Radioactive Waste Transfer.** Transfer of solid radioactive waste to the Hanford Site Solid Waste program for dispositioning shall be in accordance with criteria specified in the Hanford Site Solid Waste Acceptance Criteria, WHC-EP-0063, DOE 1540.1 Material, Transportation and Traffic Management, and DOE 95-SWT-186 for on site shipment.

[TWRS F&R Performance Requirement - Solid Radioactive Waste Transfer]

**WHC-CM-7-5, Chapter 7, 6.5.2.** Threshold doses and/or concentrations are established to define levels below which soil and included rubble do not require controls as site radioactive materials (see Tables 6.1 and 6.2 in WHC-CM-7-5, chapter 7).

**3.2.3.2.6 Output: ISSTRS Treated Gaseous Effluents.** Treated gaseous waste from sub-elements associated with ISSTRS Tank Farm Retrieval Demonstration. Treated gaseous effluents are discharged to the atmosphere.

### 3.2.3.2.6.1 ISSTRS Treated Gaseous Effluents Interface Requirements

**Gaseous Emission Limits.** Discharge of hazardous organics, nitrogen dioxide, lead, sulfur oxide/dioxide, particulates, carbon monoxide and ozone will not exceed the limits in 40 CFR 264.1032 (a) (1) or 40 CFR 50. Pressure relief devices shall comply with the control of emission requirements of 40CFR 264. 1054.

| | |
|---|---|
| 40CFR264.1032(a)(1). | 40 CFR50.11(a-b). |
| 40 CFR50.12. | 40 CFR50.4 |
| 40 CFR50.5 | 40 CFR50.6 |
| 40 CFR50.8(a) | 40 CFR50.9 |

**Toxic Air Emissions (Hazardous Air Pollutants).** The establishment and/or operation of a new toxic air pollutant source shall install and operate best available control technology for toxics (T-BACT) in accordance with WAC 173-460-060. In addition all sources of emissions, including reasonably available control technology (RACT) as defined under this regulation. It should be noted that NOC approval orders can also contain specifications for control technologies and other conditions for the proposed activity being approved by the agency.

Criteria pollutants are those pollutants subject to the Prevention of Significant Deterioration (PSD) program as enforced by the State of Washington Department of Ecology through WAS 173-400-141. If criteria pollutant(s) from TWRS activities approaches trigger levels specified under WAC 173-400 and 40 CFR 52 (as incorporated by reference) the information required for the PSD process would need to be included in an application to the agency.

[WAC 173-400]
[WAC 173-460]
[WHC-CM-7-5]

**General Regulations for Air Pollution Sources.** The General Regulations for Air Pollution Sources, WAC 173-400 shall apply except for sections WAC 173-400-070 (Emission Standards for Certain Source Categories) and WAC 173-400-190 (Requirements for Nonattainment Areas).

**Radioactive Air Emission Control.** Discharge of radioactive air emission shall be controlled in accordance with the requirements of WAC 173-246.

| | |
|---|---|
| WAC246-247-001. | WAC246-247-002. |
| WAC246-247-010. | WAC246-247-020. |
| WAC246-247-030. | WAC246-247-040. |
| WAC246-247-060. | WAC246-247-065. |
| WAC246-247-075. | WAC246-247-080. |
| WAC246-247-085. | WAC246-247-100. |

**Toxic Air Pollutants.** Discharge of toxic air pollutants shall be controlled in accordance with the requirements of WAC 173-460.

| | |
|---|---|
| WAC 173-460-010. | WAC 173-460-020. |
| WAC 173-460-030. | WAC173-460-040. |
| WAC173-460-050. | WAC173-460-060. |
| WAC173-460-070. | WAC173-460-080. |
| WAC173-460-090. | WAC173-460-100. |
| WAC173-460-110. | WAC173-460-120. |
| WAC173-460-150-Table 1. | WAC173-460-150-Table 2. |
| WAC173-460-150-Table 3. | WAC173-460-160. |

**Effective Dose Equivalent.** ISSTRS shall meet this requirement as stated in WHC-CM-7-5, 2.5.2.1 (1-3) The requirements specify the effective dose equivalent for the emission of radionuclides in air from the combined discharge of all WHC-managed facilities and all other facilities on the Hanford Site. The basis is that DOE facilities are subject to the regulations of the EPA and specifically names 40 CFR 61 as the primary regulation for control of atmospheric emissions. Individual airborne emissions shall not result in the annual average concentration at any ground-level ambient location or other occupied area exceeding any DCG-public value. The third requirement of this section states the annual discharge for Noble Gases of Kr-85, discharge of radon (including thoron) and the resultant decay products, and the discharge of Rn-220 or Rn-222 from all WHC facilities.

[WHC-CM-7-5, 2.5.2.1(1-3)]

**3.2.3.2.7 Output: ISSTRS Treated Liquid Effluents.** Liquid effluents which meet interface acceptance criteria for discharge directly to the 200 Area Treated Effluent Disposal Facility (TEDF).

**3.2.3.2.7.1 ISSTRS Treated Liquid Effluents Interface Requirements**

**200 Area TEDF Waste Acceptance Criteria.** The dispositioned aqueous waste must meet the acceptance criteria and associated administrative procedures of the 200 Area Treated Effluent Disposal Facility.

[TWRS F&R Requirement - 200 Area TEDF Waste Acceptance Criteria]

**SWDP Permit 4502 and Fact Sheet.** Comply with the requirements of the State Waste Discharge Permit #ST 4502 for 200 Area Treated Effluent Disposal Facility.

[TWRS F&R Requirement - SWDP Permit 4502 and Fact Sheet]

**Waste Certification.** Generator low-level waste certification programs shall be subject to a periodic audit by operators facilities to which the waste is sent by the generator.

[DOE 5820.2A, Chapter III, 3.e(4)]

**3.2.3.2.8 Output: ISSTRS Retrieved Tank Waste.** Waste retrieved and transferred by ISSTRS to another facility for storage.

**3.2.3.2.8.1 ISSTRS Retrieved Tank Waste Interface Requirements**
ISSTRS shall retrieve tank waste in accordance with the listed requirement below. See section 3.7 for requirements description.

Chemical Compatibility.
Criticality Prevention Requirement
Heat Generation Limit.
Solution Temperature Ranges.
TRU Waste Segregation.
Waste Characterization Data.
Complexant Waste Segregation.
Energetics.
High Phosphate Waste.
Specific Gravity Limits.
Transfer System Flush.
Waste Pumpability.
Corrosion Control - DOE5820.2A, Chapter I, 3.b(7)(c).
Treatment Reagent - DOE5820.2A, Chapter I, 3.b(7)(d).

**Quantity of Retrieved Tank Waste.** ISSTRS shall retrieve tank waste in accordance with the quantity of retrieved tank waste requirement. The requirement states: The estimated quantity of retrieved tank waste is 3.1E+05 metric tons, based upon hydraulic retrieval methods.

(TWRS combined facility top-level flow diagram streams 1, 13)

**Issue 1:** ISSTRS retrieval volumes to be transferred to the designated DST have not been estimated.

**Required Analysis:** Establish the estimated retrieval volumes applicable to the four selected SST for ISSTRS activities.

**SST Waste Retrieval Rate.** ISSTRS shall retrieve tank waste in accordance with the SST waste retrieval rate requirement. The requirement states: The SST waste retrieval rate must average approximately 21 cubic meters per day of SST waste. This waste retrieval rate is a linear assumption, will vary over time, and does not include solutions (if any) added to mobilize the SST wastes.

This requirement is derived from the Hanford Federal Facility Agreement and Consent Order milestone M-45-00 (specifies SST waste retrieval will be conducted from 12/2003 through 9/2018) and the inventory of waste contained in the SSTs.

**Issue 1:** ISSTRS needs to establish the estimated and actual retrieval rates.

**Required Analysis:** ISSTRS shall establish the retrieval rate applicable to the future retrieval activities.

**3.2.3.2.9 Output: ISSTRS Recycled Decant Liquid for Retrieval.** Decant liquid from the storage facility which was used during processing of the ISSTRS retrieval tank wastes. This liquid includes caustic water that was used to initiate the retrieval activities and all flush water. The decant liquid is now available and appropriate for use by the ISSTRS Tank Farm Retrieval Demonstration function.

**3.2.3.2.9.1 ISSTRS Recycled Decant Liquid for Retrieval Interface Requirements**

Corrosion Control - DOE5820.2A, Chapter I, 3.b(7)(c)
Treatment Reagent - DOE5820.2A, Chapter I, 3.b(7)(d)

**HLW Constituents Limitations.** No additives shall be allowed which would have a detrimental impact on the operation of the HLW immobilization process, interim storage operations, or the volume of immobilized HLW produced. Additionally, inclusion of nonradioactive constituents should be minimized to avoid impacting the volume of immobilized HLW produced. This requirement is based upon achieving the TWRS mission goals of cost effectiveness and minimizing HLW volume (WHC-SD-WM-MAR-008).

[TWRS F&R Requirement - HLW Constituents Limitations]

**Recycle of Water for Tank Waste Retrieval and Pretreatment.** Where feasible and cost effective, treated process condensate should be recycled for use in tank waste retrieval and pretreatment process activities. An engineering evaluation (E/B-SD-W236B-RPT-022, rev. 0) indicates the recycle of treated process condensate for tank waste retrieval and pretreatment is feasible. The volume of make-up water could potentially be reduced by over 300 million gallons for the life cycle of pretreatment operations. This study was conducted for the baseline facilities described in the fourth amendment to the TPA. Alternative facility concepts will need to be evaluated to determine the feasibility and cost effectiveness for conducting recycle of process condensate.

[Evaporation and Water Recycle Trade Study E/B-SD-W236B-RPT-022, rev. 0]

**3.2.3.2.10 ISSTRS Prepared Solid Waste.** Solid waste generated from the retrieve/transfer ISSTRS Tank Farm Demonstration waste function that has been segregated, packaged, assayed, and certified for transfer to Hanford Site Function 4.3; Remedy Solid Waste, for further treatment or disposal. This includes mixed, and radioactive solid wastes.

**3.2.3.2.10.1 ISSTRS Prepared Solid Waste Interface Requirements.**
ISSTRS shall prepared solid waste in accordance with the following requirements.

40CFR264.13(a)(1). 40CFR268.41(a)
40CFR268.41(b) 40CFR268.41(c)
40CFR268.42(a)
TRU Concentration Limits - DOE5820.2A, Chapter II, 3.a(3)
LLW Characterization - DOE5820.2A, Chapter III, 3.d
Solid Radioactive Waste Transfer.
Threshold Doses and/or Concentrations - WHC-CM-7-5, Chapter 7, 6.5.2.

**3.2.3.2.11 ISSTRS Excess Facilities.** Facilities that have reached the end of their useful life or have no identifiable or planned programmatic use by the ISSTRS Tank Farm Retrieval Demonstration or Retrieve SST Waste function. Excess facilities are transferred to Hanford Site Function 4.1; Deactivate Facilities.

**3.2.3.2.11.1 ISSTRS Excess Facilities Interface Requirements.** ISSTRS shall excess facilities in accordance with the following requirements.

**Operational Records Requirements.** The requirement provides for the surveillance, maintenance, and decommissioning requirements for contaminated facilities. Each field organization shall prepare and maintain a complete list of contaminated facilities both operational and excess under its jurisdiction. Operational records (e.g., facility design drawings and modifications, characterization data on contamination levels, prior decontamination activities, and incident reports required by DOE Orders) for all contaminated facilities shall be maintained by the cognizant field organization for use in preparing decommissioning plans. Planning for facility decommissioning shall be initiated during the design phase for new facilities and prior to termination of operations for existing operational facilities. Program offices shall be responsible for placing the facility in a safe storage condition, providing surveillance and maintenance, and decommissioning the facilities under their jurisdiction when they become excess to programmatic needs, or for finding another programmatic sponsor for them. Responsibility for contaminated facilities may be transferred from one program organization to another by mutual agreement of the programs involved.

[DOE5820.2A, Chapter V, 3.a]

**Maintenance of Operational Records.** Operational records (e.g., facility design drawings and modifications, characterization data on contamination levels, prior decontamination activities, and incident reports required by DOE Orders) for all contaminated facilities shall be maintained by the cognizant field organization for use in preparing decommissioning plans.

[DOE5820.2A, Chapter V, 3.a(2)]

**Transfer of Organization Requirements.** Responsibility for contaminated facilities may be transferred from one program organization to another by mutual agreement of the programs involved. The program organization to which a facility is transferred shall accept full responsibility for surveillance, maintenance, and decommissioning of the facility according to the requirements of this Order. Agreements to transfer facilities for functional purposes shall be in writing and shall identify explicitly the concurrent transfer of responsibility for surveillance, maintenance, and decommissioning.

[DOE5820.2A, Chapter V, 3.a(5)]

**Facilities with Radioactive or Hazardous Materials.** Facilities in which radioactive or hazardous materials are utilized shall be designed to simplify decontamination and decommissioning and/or increase the potential for reuse. Features and procedures that simplify and facilitate decommissioning shall be identified during the planning and design phase based upon a proposed decommissioning method or conversion to other use.

[DOE5820.2A, Chapter V, 3.b.]

**Post-Operational Activities.** DOE Program organizations shall identify contaminated facilities

under their jurisdiction, document the potential for reuse and recovery of materials and equipment, and develop schedules for decommissioning them. Projects consisting of one or more facilities shall be identified as appropriate, and priorities shall be developed based on:

- Maintaining employee and public health and safety,
- Protection of the environment,
- Compliance with the National Environmental Policy Act, the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, the Superfund Amendments and Reauthorization Act, and other contractual or legal requirements,
- Cost effective program management (e.g., maintaining manpower pools, selecting economical decommissioning alternatives), and
- Future site plans.
- Program organizations shall assure that, prior to initiation of decommissioning activities, adequate surveillance and maintenance is performed for their surplus facilities to meet applicable radiation protection (DOE 5480.1B), hazardous chemical and safety standards, to maintain physical safety and security, and to reduce potential public and environmental hazards. All high-level waste and stored hazardous materials should be removed by the operator as part of the last operational activities prior to entering into the decommissioning phase.

  [DOE5820.2A, Chapter V, 3.c]

### 3.2.4 Physical Characteristics

**3.2.4.1 Protective Coatings.** The ISSTRS components and piping shall be constructed of or lined with materials that are compatible with the waste to be placed in the primary system. The system shall have sufficient strength and thickness to prevent failure owing to physical contact with the waste to which it is exposed, climatic conditions, and the stress of daily operation to the reliability requirements outlined in section 3.2.5.1. The ISSTRS components and ancillary systems shall comply with [WAC173-303-640(3)(c).]

**3.2.4.2 Site Boundary.** A site boundary, consistent with the draft Tank Waste Remediation System (TWRS) Environmental Impact Statement (EIS) shall be used to describe in detail the boundaries. The site boundaries for the EIS shall be as follows:

North Columbia River (1/4 mile from bank per REACH EIS);
East Columbia River (1/4 mile from bank per REACH EIS);
South Columbia River (A line running west from the Columbia River just north of the Washington Public Power Supply System leased are, through the Wye barricade to Highway 240; West Highway 240 and Highway 24.

[Preliminary TRWS EIS (DOE/EIS - 0189 Draft)

### 3.2.4.3 Land Use

The 200 Area is a limited land use.

The remediate tank waste (or TWRS) function is a portion of the future Hanford Site waste management activities. The Hanford Site Uses Working Group recommends that the waste management available land area for the site encompass the "squared off" boundaries of the 200 East and West Areas. The remainder of the Central Plateau that encircles the 200 Areas should be a buffer zone. Further, the working group recommends that waste management, storage, and disposal activities be limited to within the present 200 Area boundaries whenever feasible.

The operations complex for the TWRS function must be sited on available land. According to the Draft Environmental Impact Statement for the Tank Waste Remediation System, about 500 acres will be temporarily committed for the TWRS complex construction and operations. Finally, about 100 acres will be permanently committed for waste management and disposal.

The Tank Waste Remediation System Complex Site Evaluation Report recommends 200 East Area for the TWRS complex.

[DOE. SEC. DIR.B.6.A.4
The Future of Hanford: Use and Cleanup - Drummond 1992.
WHC-SD-WM-SE-021, Rev. 0
DOE/EIS-0189, Draft]

### 3.2.5 Project Quality Factors

This paragraph describes the requirements for the reliability, maintainability, availability, and other quality factors for the system.

**3.2.5.1 Reliability.** The ISSTRS design shall provide design features to enhance remote equipment reliability. Evaluation of equipment system failures must be provided to fully define equipment reliability.

**Issue:** Develop applicable reliability requirements.

**Required Analysis:** An approved Reliability, Availability and Maintainability (RAM) analysis must be performed for the ISSTRS design.

**3.2.5.1.1 Failure Mode and Effects.** The ISSTRS design shall perform a qualitative Failure Mode, and Effects Analysis (FMEA) using MIL-STD-1692A as a guide. The FMEA will be prepared on the ISSTRS system and control system components.

**Issue:** Develop a qualitative Failure Mode and Effect requirements.

**Required Analysis**: An approved Failure Mode, and Effects Analysis (FMEA) must be performed during preliminary design and updated during detail design. The approved FMEA will contain a summarization section and recommendations.

**3.2.5.1.2 Fault Tree Analysis.** a qualitative Fault Tree Analysis (FTA) will be prepared using NUREG-0492 as a guide. This top level analysis shall be tailored to complement the FMEA.

**Issue:** Develop a qualitative Fault Tree Analysis. From the analysis derived requirements applicable to reliability.

**Required Analysis:** An approved Fault Tree Analysis (FTA) must be performed during preliminary design.

**3.2.5.2 Maintainability.** (c)(2)(g) Each facility shall use remote maintenance features and other appropriate techniques to maintain personnel radiation exposure as low as reasonably achievable.

[DOE5820.2A, Chapter I, 3.c(2)(g)]

**Monitoring and Surveillance Schedule.** A schedule and procedure shall be developed for monitoring, surveillance, and calibration checks. The frequency of these activities shall be based on the potential rate of equipment deterioration and the possibility of an environmental or human health incident, assuming that a malfunction from equipment failure or human error is not detected between checks. Schedules, procedures, and performance requirements shall be documented in the operating and maintenance documentation.

[DOE5820.2A, Chapter I, 3.b(4)(e)]

**Remote Features.** Each facility shall utilize remote maintenance features and other appropriate techniques to minimize personnel radiation exposure in accordance with DOE 5481.1B.

[DOE5820.2A, Chapter I, 3.b(2)(j)]

**Power Loss.** Upon loss and subsequent recovery of normal electrical power, high-level waste transfer equipment shall not have the capability to restart without active operator action.

[DOE5820.2A, Chapter I, 3.b(2)(k)]

**Equipment Maintainability**. The design of equipment shall incorporate the objective of efficient maintainability. The surveillance, testing, and maintenance of a system and its restoration to operational effectiveness shall be achieved at minimum cost with a minimum level of support services. UCRL 15673 shall be considered for system design.

[DOE6430.1A, Section 1300-12.4.10]

**Equipment Maintainability Factors**. The design shall consider the maintainability factors

peculiar to the specific equipment to be used in the facility. Facility design shall provide for routine maintenance, repair, or replacement of equipment subject to failure. The design of all process equipment shall include features to minimize self-contamination of the equipment, piping, and confinement areas. The design of process equipment shall also include features to minimize the spread of contamination out of local areas.

[DOE6430.1A, Section 1300-3.5]

The ISSTRS design shall provide for routine maintenance, repair or replacement of equipment subject to failure. Remote maintenance, inspection and testing capabilities shall be incorporated where required in the design of the mechanism that are involved in movement, insertion, and retrieval of the sluicing nozzles, their control components, systems and equipment (DOE Order 6430.1A, Section 1300-3.5).

**Issue:** Develop applicable and specific maintainability requirements.

**Required Analysis:** a maintainability plan must be developed and include the use of diagnostic systems for built-in test equipment and external diagnostic systems to test equipment.

**3.5.3.3 Availability.** The ISSTRS overall availability (e.g., operational availability) shall be sufficient to produce the required total retrieval rates over the designated life of the system. Reliability and maintainability analyses shall be conducted for each major equipment component development item to obtain availability predictions.

**Issue 1:** Availability requirements need to be prepared for each equipment system, subsystem and component.

**Required Analysis**: An approved Reliability, Availability, and Maintainability (RAM) analysis must be performed for the ISSTRS task.

**3.2.5.4 Operability and Maintainability.** Four maintenance and operations (M&O) categories shall be used to assist in evaluating the design of all facilities. Each facility shall utilize remote maintenance features and other appropriate techniques to minimize personnel radiation exposure in accordance with DOE 5481.1B, Chapter I, 3.b(2)(I).

Categories 1&2 - Fully Remote Maintenance and operation/Remotely Operated and "No" Maintenance. Each system or portion of a system having radiation levels greater than 50 mrem/hr contact exposure shall be either (1) remotely maintained and operated or (2) designed to require no maintenance and be remotely operated.

M&O - Category 1 Definition: equipment and operational areas falling into this category have radiation levels higher than that which would allow full contact maintenance and operations. Selection of this category should be considered when operational practicalities and economics dictate the need for maintenance and replacement capabilities, while ALARA considerations restrict worker contact. Design for this category should minimize active components. In-cell remote operations may use an in-cell remote crane with an impact wrench, master slave manipulators for light operations in close proximity to shielding windows, and electro-mechanical manipulators. The amount of remote handling equipment is dependent of the

operations to be performed.

M&O - Category 2 Definition: Equipment and operational areas falling into this category have radiation levels higher than that which would allow full contact maintenance and operations. Selection of this category should consider worker exposure as well as operational practicality and economics. Systems and equipment designed for the M&O category have little external contamination potential because they are typically all-welded systems. Moving parts, wear surfaces, gaskets, and stress cycles (e.g. thermal) are minimized. The corrosion potential for all materials must be low and the flowsheet fully demonstrated with no potential for change. "No maintenance" facilities/areas have little or no remote handling equipment installed.

Category 3 - Limited Contact Maintenance and Operation. Each system or portion of a system having radiation levels greater than 0.1 mrem/hr to less than or equal to 50 mrem/hr shall be designed for limited contact maintenance and operation. Designs shall consider remote removal of radiation sources and decontamination prior to personnel entry.

M&O - Category 3 Definition: "Equipment and operational areas falling onto this category have radiation levels higher than that which would allow full contact maintenance and operations. Selection of this category should consider occupational dose, operational practicality and economics which favor design for a limited amount of contact M&O over design for fully remote M&O. Design for this category may include sealed sources in-cell that can be remotely removed with effective contamination control. Personnel entry is then allowed for contact maintenance."

Category 4 - Full Contact Maintenance and Operation. Each system or portion of a system having radiation levels less than or equal to 0.1 mrem/hr shall be designed for full contact maintenance and operation.

M&O - Category 4 Definition: Full Contact Maintenance and Operation (Reference Appendix H) "Equipment and operations falling into this category have levels of radiation and potential for contamination so low that the area may either be considered uncontrolled, such that full-time access is allocated, or controlled, such that a maximum of 40 h/week of individual worker occupancy is permitted. This corresponds to "uncontrolled radiation areas" and "controlled radiation zone 1 areas". Additionally, levels of contamination are so low as to require no posting, consistent with he criteria presented in DOE 5480.6

[TWRS Facility Configuration Study, WHC-SD-WM-ES-295, Appendix H, "Maintenance, Operations, and Design Philosophy."]

**3.2.5.4.1 Operations and Maintenance Considerations.** Operations and Maintenance (O&M) design requirements relate specifically to the personnel-to-physical system interface. O&M qualities of design pertain to the ability of personnel to safely and efficiently interface with the physical system to perform the intended functions. A particular design solution/approach can

either enhance, be neutral, or degrade O&M as opposed to another solution/approach. This section defines and quantifies (as best possible) O&M considerations to be used for design of the ISSTRS and is based on a philosophy of "good operating practices".

The ISSTRS design approach shall enhance operations and maintenance to the greatest extent practicable while fulfilling all other design requirements.

Factors such as life-cycle cost, radioactive waste minimization, and number of personnel and time required to perform plant functions shall be considered in the design. These design requirements need to be met or exceeded to enhance O&M. Enhancements of O&M can be further achieved by incorporation of design features and considerations such as the ones listed below.

Operations Considerations. The system shall be designed with operations considerations taken into account. Examples include the following:

- Modifications of SSTs and DSTs made by ISSTRS shall not preclude, or significantly add to the difficulty of accomplishing tank closure.
- The design of ISSTRs systems/subsystems shall be modular to the maximum extent practical. Equipment may be moved from tank to tank. Modular design also reduces exposure (ALARA) problems.
- Commercially available equipment and parts shall be used to the greatest extent practical.
- The ISSTRS shall provide a method to cool the pump/sluice pits as determined necessary by analysis.
- Equipment shall be positioned away from potential leaks of corrosive liquids. Where this is not practical, splash guards shall be provided to protect the equipment.
- A design analysis shall be prepared that considers loads seen throughout the entire product life cycle, including fabrication, storage, operation, and decommissioning. The analysis shall verify the structural integrity of the ISSTRS and that the proper margins of safety have been maintained in the design.
- The ISSTRS design shall preclude, as far as practical, the need for confined space entry during construction and operations.
- The materials used in the ISSTRS shall be (1) resistant to radiation, process solutions, acid and caustic vapors and solutions, and decontamination agents; (2) nonabsorbent, easily removable if not contamination resistant; and/or (3) oversized to permit partial destruction without affecting structural integrity.
- Rotating equipment, electrical components, and other high-maintenance items

should be located outside radiation areas to the extent practical.

- The ISSTRS shall be designed such that the failure of any part or component will not preclude the safe removal of the equipment from the pits or tanks.

- Equipment should be designed for recovery from in-process failures. These criteria apply particularly to remotely operated in-tank equipment.

- Equipment shall be designed so no single failure of mechanical or electrical equipment can cause a loss of control resulting in an unrecoverable condition. Functions shall be provided that facilitate placement of the equipment in the appropriate position to establish a safe configuration during a faulted condition.

- I&C: Instrument and power cable runs shall be housed in separate raceways within the tank farm for protection and for facilitating future modifications.

- I&C: Instrumentation shall be designed for the intended service and shall be qualified for the environmental conditions in which it is required to function.

- I&C: The instrumentation and monitoring systems shall be designed to alert the operator when failure has occurred.

- I&C: Instrumentation and monitoring equipment systems shall be specified and designed to facilitate troubleshooting and replacement.

- I&C: Where limit switches are used for equipment stops or position indication, the following guidelines should be observed. The limit switch shall be mounted in a stationary position with the actuator mounted to the movable member. The limit switch should be protected to preclude damage from inadvertent bumping. The positioning and configuration of the limit actuator shall prevent damage to the limit switch if overtravel, misalignment, or malfunction occurs. Failure detection circuitry or mechanical stops should be designed to protect equipment from overtravel caused by limit switch failures. Limit devices shall be adjustable with positive position locking hardware. Mounts and actuators shall have indexes for reference during limit switch adjustment or replacement. Enclosed units shall be used with secondary actuation and bellows-type seals.

- Electrical Systems: All electrical equipment or components shall be selected or protected to resist adverse affects of the environment in which they are installed. Electrical enclosures and junction boxes of the proper National Electrical Manufacturers Association rating and material shall be sued to resist and protect internal components from the corrosive effects of moisture and chemicals.

- Electrical Systems: Stainless steel enclosures, junction boxes, and pull boxes shall only be used in a corrosive environment.

- Electrical Systems: Sensitive electrical/electronic devices should not be located

in high-radiation areas. When such devices are located in high radiation areas, the devices shall be designed to withstand the demands of the environment and meet the design life requirements identified previously.

- Pneumatic Systems: Piping and valve arrangements shall be designed to preclude misrouting liquids outside of confinement boundaries due to incorrect valve settings.

- Pneumatic Systems: Equipment such as dip tubes, sample lines, transfer lines, and drains shall be designed to preclude the possibility of syphoning or backflow.

- Pneumatic Systems: All piping, regardless of safety class, shall be arranged for gravity flow wherever possible and sloped to drain.

- Pneumatic Systems: Process piping sizes shall be specified to minimize solids from accumulating.

- Pneumatic Systems: Valve and actuation design or selection shall consider the minimization of the accumulation of solids in crevices or water hammer caused by fast-closing valves.

- Pneumatic Systems: Adequate physical protection shall be provided for waste transfer lines, with consideration given to radiological exposure to personnel and damage by vehicles.

**3.2.5.4.2 Contaminated Equipment Maintenance.** The ISSTRS shall be designed and constructed to meet the maintenance requirements of DOE Order 6430.1A, and the design requirements of DOE Order 4330.4A, *Maintenance Management Program.*

**3.2.5.4.3 High Dose-Rate Areas Equipment Maintenance.** The ISSTRS shall be designed to preclude the need for routine, hands-on maintenance in contaminated or high-dose-rate areas using the ALARA design principles, WHC-IP-1043, *ALARA Program Manual.*

**3.2.5.4.4 Remote Maintenance Equipment.** Provisions for remote replacement of system equipment that operates in a high-radiation area shall be made as required to meet ALARA criteria. The capability shall be provided to perform a preliminary decontamination, where practical, of equipment before repair or removal using ODE/EV/1830-T5, a *Guide to Reducing Radiation Exposure to as Low as Reasonably Achievable (ALARA),* and WHC-IP-1043, *ALARA Program Manual.*

### 3.2.6 Environmental Conditions

Temperature, pressure and humidity environments shall be based on the most severe postulated accident affecting the particular item. The postulated environment shall reflect an environment that considers both radiological composition (i.e., elements, isotropic, total radioactivity) and chemical composition (i.e., abrasives, acids, smoke, caustic vapors) of all material physical forms likely to affect the equipment (DOE 6430.1A, Div. 1300-3.4.2).

Each system for ISSTRS shall be design not meet the requirements for exposure to the following natural and induced environmental conditions:

**3.2.6.1 Natural Environments.** New facilities and systems functioning on the Hanford site shall withstand the environmental conditions specified below. Thermal effects of the soil shall be considered for the buried portions of the system.

| | |
|---|---|
| Ambient Air Temperature Range: | -6.67 to 48.89°C (20 to 120°F) |
| Rate of Increase: | -3.34°C (26°F) per 20 minutes maximum |
| Rate of decrease: | -4.45°C (24°F) |
| Relative Humidity: | 5 to 100% (Rate of change is neglible) |
| Mean annual precipitation | 16 cm (6.3 in.) |
| Maximum precipitation rate of change: | 1.52 cm/hr (0.6 in./hr) |
| Blowing Dust & Smoke Visibility: | 6 miles or less with sky completely obscured |
| Frequency: | 10 times per year, maximum |
| Duration: | 24 hrs. Per occurrence |

Winds Gusts up to 80 miles per hour can be expected on site with the average wind speed in the 200 Area of 7.7 mph in the WNW direction.

| | |
|---|---|
| Frost Line: | 36 inch |
| Solar Radiation: | Frequent exposure due to minimal cloud cover |

Additional information on Hanford site weather conditions can be obtained from the Hanford Site vicinity weather bureau.

[The Hanford Site Weather Bureau Data is compiled by Battelle Northwest Laboratories (PNL 4622) and is documented and can be reference at the Hanford Technical Library]

**3.2.6.1.1 Ashfall.** The ashfall requirements that shall be used for this project are located in DOE 6430.1A and ICF KH A/E Standard, GC-LOAD-01. The requirement for ashfall loading on a roof is 117 kg/m$^2$ (24 lb/ft$^2$), for Safety Class 1 structures, systems, components, and equipment. There are no additional loading requirements for ashfall for Safety Class 2, 3, and 4 items. Ashfall requirements for ventilation systems are to be determined.

### 3.2.6.2 Induced Environments.

**3.2.6.2.1 Radiation and Chemical.** Equipment installed in the tanks shall be capable of performing their intended function for the duration of their intended useful life with no adverse affects due to the radiological and chemical environment in the tanks. (DOE Order 6430.1A,)

**3.2.6.2.2 Internal - Radionuclide.** The ISSTRS Elements shall be capable of withstanding the worst case liquid waste radionuclide concentrations specified in Table A-1.

**3.2.6.2.3 Internal - Waste Chemical Characteristics.** The ISSTRS elements shall be capable of withstanding the liquid waste chemical composition ranges specified in Appendix A, Table A-2.

**3.2.6.2.4 Internal - Waste Physical Properties.** The ISSTRS elements shall be capable of withstanding slurry wastes and liquids with the physical characteristics in Table A-3.

### 3.2.7 Transportability

**3.2.7.1 Packaging and Marking of Materials for Transportation.** Properly preparing materials for transportation is the responsibility of the shipper. Proper preparation enables the materials to reach destination in good order. Except for those goods which can be shipped in bulk or loose, goods should be packaged in material of sufficiently substantial construction to withstand the ordinary hazards of transportation. Both packaged and loose materials must be marked to assure prompt, safe, and correct delivery. Minimum packaging and marking requirements for materials in transportation are contained in the "Freight Classifications" of the various modes of transportation. Noncompliance can result in penalty rate assessments, denial of claims or both when materials are damaged in transit. More detailed guidance regarding packaging and marking of specific items may be developed locally as necessary. b. The packaging, marking, labeling, and placarding regulations of the Department of Transportation applicable to all shippers, are contained in 49 CFR parts 171-179. Noncompliance with these regulations carry both civil and criminal penalties. Reporting requirements for hazardous material incidents are those listed on page II-11 paragraph 7d.

[DOE1540.1, Chapter II, Section 2]

**Transportation of Hazardous Materials.** Any system or component used to ship hazardous materials shall be designed to meet the requirements of WHC-CM-2-14.

[WHC-CM-2-14.]

### 3.2.8 Flexibility and Expansion

Flexibility is a major design requirement for all facilities except those with highly specialized functions. Even in those special facilities, however, the design shall, to the maximum extent practicable, provide sufficient flexibility to accommodate for programmatic changes or operational modifications.

[Design Flexibility DEC1, which is derived from: DOE6430.1A, 0110-3]

### 3.2.9 Portability

[RESERVED].

## 3.3 DESIGN AND CONSTRUCTION

DOE Order 6430.1A provides general design criteria for the acquisition of the DOE Order 6430.1A shall be used for the design and construction of the ISSTRS. Additional specific requirements are identified in the following sections.

### 3.3.1 Materials, Processes and Design Practices

**3.3.1.1 Facility Design and Shielding Criteria.** Guidelines for radiological design are provided in Radiological Design Guide, WHC-SD-GN-DGS-30011 (WHC 1994X). The shielding design criteria in table 3-1 are summarized from Radiological Design Guide, Section 7.0, and shall be used to determine the shielding requirements of different areas in the ISSTRS Design. Shielding shall be designed to limit the total whole body dose less than 5 mSv per year. The source term used for shielding design will be provided by WHC.

Table 3-1. Shield Design Criteria.

| Zone Category | Access Time Allowed | Maximum (mSv/h) | Maximum (mrem/h) |
|---|---|---|---|
| Uncontrolled Area | Full time | 0.0005 | 0.05 |
| Controlled Area | | | |
| 1 | Full time | 0.0025 | 0.25 |
| 2 | Less than 1 h/day | 0.02 | 2.0 |
| 3 | Less than 1 h/week | 0.1 | 10.0 |
| 4 | Less than 10 h/yr | 0.5 | 50.0 |
| 5 | No normal access permitted | > 0.5 | > 50.0 |

Note:

For design purposes, the dose from neutrons should be calculated by doubling the neutron quality factors (DOE Order 5480.1).

[WHC-SD-GN-DGS-30011, Radiological Design Guide, Section 7.0]

**Facility Design and Modification**
During the design of new facilities or modification of old facilities, the following objectives shall be adopted:

- Optimization methods shall be used to assure that occupational exposure is maintained ALARA in developing and justifying facility design and physical controls.

- The design objective for controlling personnel exposure from external sources of radiation in areas of continuous occupational occupancy (2000 hours per year) shall be to maintain exposure levels below an average of 0.5 mrem (5 microsieverts) per hour and as far below this average as is reasonably achievable. The design objectives for exposure rates for potential exposure to a radiological worker where occupancy differs from the above shall be ALARA and shall not exceed 20 percent of the applicable standards in Sec. 835.202.

- Regarding the control of airborne radioactive material, the design objective shall be, under normal conditions, to avoid releases to the workplace atmosphere and in any situation, to control the inhalation of such material by workers to levels that are ALARA; confinement and ventilation shall normally be used.

- The design or modification of a facility and the selection of materials shall include features that facilitate operations, maintenance, decontamination, and decommissioning.

[Facility Design and Modification; TWRS RDD-100 Database Requirement No. 1507]

**3.3.1.2 Support Devices.** Design for supporting structures, housing modules, and services of the ISSTRS shall be in accordance with DOE Order 6430.1A, *General Design Criteria.*

**3.3.1.3 Structural Supports.** All structural system, components, and structures shall be designed, fabricated, inspected, and installed in accordance with the requirements of DOE Order 6430.1A.

**3.3.1.4 Air Control for Contaminated Areas.** The ISSTRS shall provide ventilation control (differential pressure) for confinement by directing air from uncontaminated areas, or areas of lower contamination, toward areas of higher contamination, and by high-efficiency particulate air filtration.

[WHC-SD-GN-DGS-3011, *Radiological Design Guide*].

**Nonradioactive Airborne Emissions.** A notice of Construction application for the emission of toxic air pollutants and/or criteria pollutants will be required by Ecology (WAC 173-400, "General Regulations for Air Pollutants"). The preconstruction approval requires that BACT and T-BACT analyses be performed regardless of emission levels. The applicant must also demonstrate that (1) the facility complies with all applicable air quality standards, new source performance standards (NSPS), and NESHAP; (2) the task will not delay the attainment date or

cause or contribute to a violation of any ambient air quality standard; and (3) the facility meets small-quantity emission levels or acceptable source impact levels, or performs a second-tier analysis.

**3.3.1.5 Retrieval Construction and Operations Solid Waste.** The ISSTRS shall be designed to comply with all onsite packaging and shipping requirements. All waste retrieval equipment shall be disposed of as well as in-tank equipment that obstructs the retrieval activities. All waste generated shall be designated in accordance with WHC-EP-0063-1, *Hanford Site Radioactive Solid Waste Acceptance Criteria* (Stickney 1989), and WHC-CM-2-4, *Hazardous Material Packaging and Shipping* and shall meet waste acceptance requirements contained therein.

**Minimized Waste Segregation.** Waste generation shall be controlled, reduced, segregated, and minimized in accordance with DOE Order 5820.2A, Chapter III, 3.c.E.

**Transfer of Radioactive Solid Waste.** Transfer of solid radioactive waste to the Hanford Site Solid Waste program for dispositioning shall be in accordance with criteria specified in the *Hanford Site Solid Waste Acceptance Criteria,* WHC-EP-0063-4 (Willis 1993) and WHC-CM-2-12, *Hazardous Materials Packaging and Shipping* (WHC 1993). The facility design shall be capable of segregating and packaging the categories of waste generated from the ISSTRS. Once separated, it is recommended the solid waste be packaged into 208-L (55 gal) drums or boxes (5 ft x 5 ft x 9 ft). The exterior of all waste packages must not be smearable above 220dpm/100 $cm^2$ for beta-gamma per WHC-EP-0063.

**Hazardous Waste Management**. A waste management plan is required (DOE Order 5820.2A) to be developed for facilities that produce radioactive waste and mixed waste (containing both hazardous and radioactive waste components). Hazardous waste is regulated in accordance with the *Resource Conservation and Recovery Act of 1976* (RCRA) and the WAC173-303-630, "Dangerous Waste Regulations". Hazardous Waste constraints identified in 40 CFR 264 are identical to WAC 173-303-630.

**3.3.1.6 Facility Fire Water System.** Fire protection systems provided by ISSTRS shall be designed to meet the following requirements, as applicable:

- DOE Order 6430.1A, *General Design Criteria*, all sections
- DOE Order 5480.4, *Environmental Protection, Safety, and Health Protection Standards*, Attachment 2, "Mandatory ES&H Standards," Section 2C, "Fire Protection".
- DOE Order 5480.7A, *Fire Protection.*
- DOE RLID 5480.7, *Fire Protection..*
- DOE/EV-0043, *Standards on Fire Protection for Portable Structures.*
- WHC-CM-4-41, *Fire Protection Program Manual*, Section 3.0, "Requirements".

- National Electrical Code (NFPA 1990a)
- National Fire Codes (NFPA 1990b)

The Fire Water System shall include all equipment necessary to provide a reliable source of fire water to TWRS complex facilities (e.g., storage tanks, pumps, hearers, and distribution piping, etc.). The fire water system shall be capable of providing service under all credible accident and emergency scenarios.

**3.3.1.7 Fire Hazards Analysis.** A fire hazards analysis (FHA) shall be provided for the project in accordance with DOE Order 5480.7A, Fire Protection. Recommendations in the FHA shall be incorporated into the design of the facility. The Fire scenarios in the safety analysis documentation shall be provided or validated by the FHA. The following documents provided the basis WHC-CM-4-41, *Fire Protection Program Manual*, Section 3.0, "Requirements,", WHC-SD-GN-FHA-30001, "Integration of Fire Hazards Analysis and Safety Analysis Report Requirements."

**3.3.1.8 Power Systems.** The electrical power systems shall be in accordance with DOE 6430.1A Division 16, NFPA 70 and ANSI C2 for primary uninterruptible, and emergency backup power. WHC-SD-GN-DGS-303, Backup electrical Power System Definitions and Design Criteria shall be used to determine the proper definition of backup electrical power systems.

**Emergency Power System.** An Emergency Power shall be provided by ISSTRS. An emergency power system shall be provided to the degree it is required to maintain confinement and bring the ISSTRS into a safe shutdown condition in the event of loss of normal AC power. The system shall comply with the requirements of DOE Order 6430.1A, section 1660 as applicable.

**Uninterruptible Power Supply System.** The ISSTRS shall provide UPS system close to the equipment item requiring UPS support. The UPS system provides continuous power to equipment requiring continuous power during short-duration power outages. Or the UPS will provide continuous electrical power for any attribute of safety classification that requires electrical power to perform its safety or environmental protection functions as identified in the ISSTRS Hazard Analysis.

The system consists of rectifiers/battery chargers, inverters, switching components and batteries.

This system shall comply with the requirement of DOE Order 6430.1A, and WHC-CM-5-46, Safety Analysis Manual.

**Other Electrical.** The electrical system shall be accordance with DOE 6430.1A Division 16, NFPA 70, and ANSI C2.

**Electrical Loads & Operational Design Requirements.** All systems shall comply with NFPA 70 and ANSI C2. Electrical systems shall be designed so that all components operate within their capacities for initial and projected loads. Preferred standard voltages in conformance with ANSI C84.1 shall be used, with a single-voltage level characteristic in any classification, to minimize stocks of spare equipment and to standardize operating and maintenance practices and procedures.

Electrical materials and equipment shall be UL- or FM-tested, with label attached, for the purpose intended, whenever such products are available. Where there are no UL- or FM-listed products of the type, testing and certification by another nationally recognized testing agency may be acceptable. Installation methods shall be in accordance with the manufacturer's instructions, with NFPA 70, and with other applicable requirements.

On-site acceptance testing shall be required for each major electrical system. Tests shall be specified to demonstrate that each function and important parameter is implemented. Specific criteria shall be included to determine pass/fail acceptance. Tests shall be performed in the presence of a government representative. Copies of all test results shall be submitted for approval.

[DOE6430.1A, Section 1605-1]

**Lighting Design and Construction Requirements.** Lightning protection systems shall comply with NFPA 78. Lightning protection systems shall be considered for buildings containing facilities for the use, processing, and storage of radioactive, explosive, and similarly hazardous materials; for buildings over 50 feet in height; and for buildings containing valuable equipment. A risk assessment using the guide in Appendix I of NFPA 78 shall be made of these buildings to determine the risk of loss due to lightning. Electric power and communication services to all buildings and facilities and to underground power cables, where connected by overhead power distribution lines, shall have lightning and surge protection.

[DOE6430.1A, Section 1630-5 ]

**3.3.1.9 Containment System Design.** All new high-level waste handling, transfer, and storage facilities (e.g., tanks, bins, pipelines, and capsules) shall be doubly contained.

[DOE Order 5820.2A, Chapter I, 3.b.(2)(a)]

**Conditional Use for Singly Contained Pipelines.** Singly contained pipelines may be used routinely for liquid waste that has a total radioactivity concentration of less than 0.05Ci/gal (4.9 X $10^{11}$ Bq/$m^3$). They may be used on a temporary basis for higher activity waste, if appropriate design and administrative controls are in place to mitigate adverse effects from a pipeline failure.

[DOE Order 5820.2A, Chapter I, 3.b (2)(b)
DOE Order 5820.2A, Chapter I, 3.c(2)(d)]

**Secondary Containment System.** Secondary containment system shall be capable of containing liquid that leak into them from the primary system and shall be equipped with transfer capability to retrieve the leaked liquid. Secondary containment systems for solidified high-level waste shall provide for physical isolation of the waste from the environment.

[DOE Order 5820.2A, Chapter I, 3.b(2)(d)]

**Singly Containment System and Fuel Types.** Singly contained tank system shall not be used

to store fresh high-level waste from fuel reprocessing operations except under emergency conditions as determined by the Operations Office manager.

[DOE Order 5820.2A, Chapter I, 3.c(2)(a)]

**Secondary Containment System to Prevent Migration of Waste.** The ISSTRS secondary containment system shall comply with the items below:

Secondary containment systems must be:

- Designed, installed, and operated to prevent any migration of wastes or accumulated liquid out of the system to the soil, ground water, or surface water at any time during the use of the tank system; and

- Capable of detecting and collecting releases and accumulated liquids until the collected material is removed.

[WAC173-303-640(4)(b)]

**Minimum Requirements for Secondary Containment System.** The ISSTRS system shall meet the minimum requirements for the system to have construction of the system to be lined with materials that are compatible with the waste(s) to be placed in the tank system and must have sufficient strength and thickness to prevent failure owing to pressure gradients (including static head and external hydrological forces), physical contact with the waste to which it is exposed, climatic conditions, and the stress of daily operations (including stresses from nearby vehicular traffic);foundational or base capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift; a leak-detection system that is designed and operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous waste or accumulated liquid in the secondary containment system within twenty-four hours; and sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation.

[WAC 173-303-640(4)(c)]

**Ancillary Equipment Secondary Containment Requirement.** ISSTRS shall comply with the ancillary equipment requirements for above ground piping, welded flanges, sealless and magnetic pumps, and pressurized systems.

- Ancillary equipment must be provided with secondary containment (e.g., trench, jacketing, double-walled piping) that meets the requirements of (b) and (c) of this subsection except for:

- Aboveground piping (exclusive of flanges, joints, valves, and other connections) that are visually inspected for leaks on a daily basis;

  - Welded flanges, welded joints, and welded connections, that are visually inspected for leaks on a daily basis;

  - Sealless or magnetic coupling pumps and sealless valves, that are visually

inspected for leaks on a daily basis; and

- Pressurized aboveground piping systems with automatic shut-off devices (e.g., excess flow check valves, flow metering shutdown devices, loss of pressure actuated shut-off devices) that are visually inspected for leaks on a daily basis.

[WAC173-303-640(4)(f)]

**Ancillary Equipment Support and Protection Requirements.** ISSTRS shall support and protect in accordance with the requirement listed below to mitigate the excessive stresses caused from settlement, vibration, expansion, or contraction on ancillary equipment.

Ancillary equipment must be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.

Note: The piping system installation procedures described in American Petroleum Institute (API) Publication 1615 (November 1979), "Installation of Underground Petroleum Storage Systems," or ANSI Standard B31.3, "Petroleum Refinery Piping," and ANSI Standard B31.4 "Liquid Petroleum Transportation Piping System," may be used, where applicable, as guidelines for proper installation of piping systems.

[WAC 173-303-640(3)(f)]

**Secondary Containment for Hazardous Waste.** ISSTRS shall comply with the hazardous waste requirements for secondary containment by meeting the itemized requirement of 40 CFR265.196(a-c). The summary of the requirement is that a tank system or secondary containment system from which there has been a leak or spill, or which is unfit for use, must be removed from service immediately, and the owner or operator must satisfy the following requirements: Cessation of use; prevent flow or addition of wastes; removal of waste from tank system or secondary containment system; and containment of visible releases to the environment. The owner/operator must immediately conduct a visual inspection of the release and, based upon that inspection.

[40CFR264.196(a-c)]

**3.3.1.10 Cathodic Protection.** ISSTRS shall implement cathodic protection that has been engineered to protect against abnormal conditions such as stray currents or system failure.

[DOE5820.2A, Chapter I, 3.b(2)(g)]

**Cathodic Calibration.** The cathodic protection systems shall be calibrated annually, and all sources of impressed current shall be inspected and/or tested at least every other month.

[DOE5820.2A, Chapter I, 3.b(2)(g)]

**3.3.1.11 Corrosion Control.** Underground storage tanks, and associating piping and ancillary equipment (e.g., piping, fittings, flanges, valves, and pumps used to distribute meter or control the flow regulated substances to or from any underground storage tank) shall be designed to have corrosion control. The following requirements outline corrosion control:

[DOE5820.2A, Chapter I, 3.b(7)(c)]

**Corrosion Inspection.** The owner or operator must provide the type and degree of corrosion protection recommended by an independent corrosion expert, based on the information provided under (a)(iii) of this subsection, or other corrosion protection if the department believes other corrosion protection is necessary to ensure the integrity of the tank system during use of the tank system. The installation of a corrosion protection system that is field fabricated must be supervised by an independent corrosion expert to ensure proper installation

[WAC173-303-640(3)(g)]

**Factors for Potential Corrosion Sources.** For new tank systems or components in which the external shell of a metal tank or any external metal component of the tank system will be in contact with the soil or with water, a determination by a corrosion expert of:
Factors affecting the potential for corrosion, including but not limited to:

- Soil moisture content;
- Soil pH; (III) Soil sulfides level;
- Soil resistivity;
- Structure to soil potential;
- Influence of nearby underground metal structures (e.g., piping);
- Existence of stray electric current;
- Existing corrosion-protection measures (e.g., coating, cathodic protection); and

The type and degree of external corrosion protection that are needed to ensure the integrity of the tank system during the use of the tank system or component, consisting of one or more of the following:

- Corrosion-resistant materials of construction such as special alloys, fiberglass reinforced plastic, etc.;

- Corrosion-resistant coating (such as epoxy, fiberglass, etc.,) with cathodic protection (e.g., impressed current or sacrificial anodes); and

- Electrical isolation devices such as insulating joints, flanges, etc.

Note: The practices described in the National Association of Corrosion Engineers (NACE) standard, "Recommended Practice (RP-02-85)--Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems," and the American Petroleum Institute (API) Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems," may be used, where applicable, as guidelines in providing corrosion protection for tank systems.

[WAC173-303-640(3)(a)(iii)]

**Corrosion Assessment and Storage Integrity.** A method for periodically assessing waste storage system integrity (e.g., coupons for corrosion testing, photographic and periscopic inspections, leak detectors, liquid level devices) shall be established, documented, and reported as required in the Waste Management Plan.

[DOE5820.2A, Chapter I, 3.b(3)(c)]

**Method for Periodic Assessment.** A method for periodically assessing waste storage tank integrity (e.g., coupons, photographic inspections, leak detectors, liquid level devices) shall be established and documented.

[DOE5820.2A, Chapter I, 3.c(3)(b)]

### 3.3.1.12 Monitoring & Control Systems

**Control Liquid Inventory Data.** Engineering controls shall be incorporated to provide liquid volume inventory data and to prevent spills, leaks, and overflows from tanks or containment systems. Examples are level-sensing devices, liquid level alarms, and maintenance of sufficient freeboard. The high-level waste shall be stored at pressures lower than those of ancillary systems (e.g., cooling water).

[DOE5820.2A, Chapter I, 3.b(2)(h)]

**Waste Volume Inventory Data.** Engineered systems shall be incorporated to provide waste volume inventory data, consistent with the nature of the specific waste stored in singly contained tanks. Examples are surface level sensing devices and interstitial liquid level sensing devices.

[DOE5820.2A, Chapter I, 3.c(2)(c)]

**Monitoring and Surveillance.** Monitoring and surveillance capability shall exist to provide liquid volume, waste inventory data, and identification of failed containment.

[DOE5820.2A, Chapter I, 3.c(3)(a)]

**3.3.1.13 Monitor SST Waste Leakage during Retrieval.** ISSTRS shall design and construct the system to monitor the SST waste leakage during retrieval.

**Monitoring Leak Detection Capabilities.** Monitoring and leak detection capability shall be incorporated in the engineering systems (e.g., liquid level sensing devices and alarms for high-level waste liquid systems) to provide rapid identification of failed containment, and measurement of abnormal temperatures. The following, at a minimum, shall be monitored; temperature; pressure; radioactivity in ventilation exhaust; and liquid effluent streams associated with high-level waste facilities. Where the possibility exists for the generation of flammable and explosive mixtures of gases, monitoring shall be conducted. For facilities storing liquid high-level waste, the following should also be monitored: liquid levels; sludge volume; tank chemistry; condensate and cooling water.

[DOE5820.2A, Chapter I, 3.b(3)(a)]

**Leak Detection Systems.** Leak detection systems (e.g., conductivity probes) shall be designed and operated so that they will detect the failure of the primary containment boundary, the occurrence of waste release, or accumulated liquid in the secondary containment system.

[DOE 5820.2A, Chapter I, 3.b(3)(b)]

**Surveillance Capability.** (a) Monitoring and surveillance capability shall exist to provide liquid volume, waste inventory data, and identification of failed equipment.

[DOE 5820.2A, Chapter I, 3.c.(3)(a)]

**Monitoring Wells.** A system of ground water or vadose zone monitoring wells meeting the Resource Conservation and Recovery Act requirements per 40 CFR 264 shall be installed, as a minimum, around clusters of liquid waste storage tanks.

[DOE 5820.2A, Chapter I, 3.c.(3)(d)]

**Detection of Released Radioactive Materials.** (B) Upon detection of released radioactive materials, steps shall be taken to prevent further migration of the release to soil or surface water. Major contamination in the soil shall be removed or stabilized unless compliance with this requirement would cause greater harm to human health or the environment.

[DOE 5820.2A, Chapter I, 3.c.(4)(b)]

**Environmental Monitoring.** ISSTRS shall monitor leak during retrieval activities by satisfy satisfying the environmental monitoring requirement. The requirement states that operational or non-operational low-level waste treatment, storage, and disposal facility shall be monitored by an environmental monitoring program that conforms with DOE 5484.1 {DOE 5400.1, Chapter IV, 5.b] and, at a minimum, meet the requirements of paragraph 3K(2) through 3K(4).

[DOE 5820.2A, Chapter III, 3.k]

**Well Drilling.** Monitoring wells and other bore holes shall be appropriately sealed after use so as to not provide a pathway for contamination to the ground-water.

[WAC 173-160]

**Schedule and Procedure for Inspecting Overfill Controls.** The owner or operator must develop and follow a schedule and procedure for inspecting overfill controls. (B) The owner or operator must inspect at least once each operating day; (I) Above ground portions of the tank system, if any, to detect corrosion or releases of waste; (ii) Data gathered from monitoring any leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design; and (iii) The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g., dikes) to detect erosion of signs of releases of dangerous waste (e.g., wet spots, dead vegetation).

[WAC 173-303-640(6)(a)]

**Groundwater Monitoring** - [RESERVED].

[40 CFR 265, Subpart F]

**Groundwater monitoring** - [RESERVED].

[40 CFR 264.97 - per DOE 5400.5, Chapter I, 3.c(3)(d)]

**3.3.1.14 Mitigate SST Waste Leakage During SST Waste Retrieval.** ISSTRS shall implement the following requirements in the design and construction of the retrieval system.

**Maximum Contaminant Levels.** Maximum contaminant levels for $^{226}Ra$, $^{228}Ra$, and gross alpha particle radioactivity in community water systems. The following are the maximum contaminant levels for $^{226}Ra$, $^{228}Ra$, and gross alpha particle radioactivity: (a) Combined $^{226}Ra$ and $^{228}Ra$ - 5 pCi/l. (b) gross alpha particle activity (including $^{226}Ra$ but excluding radon and uranium) - 15 pCi/L.

[40 CFR 141.15]

**Beta Particles Maximum Contaminant Levels.** Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water systems. (a) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 mrem/year.

[40 CFR 141.16 - per DOE 5400.5, Chapter II, 1.d(3)]

**Containment and detection of releases** - [RESERVED].

[40 CFR 265.193]

**Inspections.** (a) The owner or operator must inspect, where present, at least once each operating day: (3) Data gathered from monitoring equipment and leak-detection equipment, (e.g., pressure and temperature gauges, monitoring wells) to ensure that the tank systems being operated according to its design; and...

[40 CFR 265.195(a)(3)]

**Response to leaks or spills** - [RESERVED].

[40 CFR 265.196]

**Migration of Leaks.** For tank systems in interim status from which there has been a leak, the owner or operator must prevent further migration of the leak or spill to soils or surface water.

[40 CFR 265, Section 265.196(c)(1)]

**Designation, Reportable Quantities, and Notification** - [RESERVED]

[40 CFR 302 - multiple entries]

**Environmental Surveillance.** ISSTRS shall detect leaks of the SST waste by meeting the environmental surveillance requirement. The summarized requirement itemized these components of the requirement by requiring that environmental surveillance shall be conducted to monitor the effects onsite and offsite environmental and natural resources. Environmental surveillance shall be designed to satisfy one or more of the following program objectives: (a) Verify compliance with applicable environmental laws and regulations; (b) Verify compliance with environmental commitments; (c) Characterize and define trends in the physical, chemical

and biological condition of environmental media; (d) Establish environmental baselines; (e) Provide a continuing assessment of pollution abatement programs; and (f) Identify and quantify new or existing environmental quality problems. Surveillance programs are likely to include one or more of the following: (a) Monitoring stations; (b) Sampling and analysis; and (c) Monitoring data record keeping.

[DOE 5400.1, Chapter IV, 5.b]

**Impact on Other Systems.** The liquid effluents from DOE activities shall not cause private or public drinking water systems downstream of the facility discharge to exceed the drinking water radiological limits of 40 CFR 141.

[DOE 5400.5, Chapter II, 1.d(3)]

**Monitoring Wells.** Monitoring wells - A system of ground water or vadose zone monitoring wells meeting the Resource Conservation and Recovery Act requirements per 40 CFR 264 shall be installed, as a minimum, around clusters of liquid waste storage tanks.

[DOE 5820.2A, Chapter I, 3.c.(3)(d)]

**Well Drilling.** Monitoring wells and other bore holes shall be appropriately sealed after use so as to not provide a pathway for contamination to the ground-water.

[WAC 173-160]

**External Liners.** (I) External liner systems must be: (A) Designed or operated to contain one hundred percent of the capacity of the largest tank within its boundary; (B) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such additional capacity must be sufficient to contain precipitation from a twenty-five-year, twenty-four-hour rainfall event. (c) Free of cracks or gaps; and (D) Designed and installed to surround the tank completely and to cover all surrounding earth likely to come into contact with the waste if the waste is released from the tank(s) (i.e., capable of preventing lateral as well as vertical migration of the waste).

[WAC 173-303-640(4)(e)(I)]

**Variance for Alternative Design and Operating Practices in the Prevention of Leaks.** ISSTRS shall consider when necessary the variance for alternative design and operating practices to prevent leaks requirement. The requirement summarizes these components. The owner or operator may obtain a variance from the requirements of this subsection if the department finds, as a result of a demonstration by the owner or operator that alternative design and operating practices, together with location characteristics, will prevent the migration of any dangerous waste or dangerous constituents into the ground water, or surface water at least as effectively as secondary containment during the active life of the tank system or that in the event of a release that does migrate to ground water or surface water, no substantial present or potential hazard will be posed to human health or the environment.

[WAC 173-303-640(4)(g)]

**Inspections.** The owner or operator must develop and follow a schedule and procedure for

inspecting overfill controls. (b) The owner or operator must inspect at least once each operating day: (I) Above ground portions of the tank system, if any, to detect corrosion or releases of waste; (ii) Data gathered from monitoring any leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design; and (iii) The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g.,dikes) to detect erosion or signs of releases of dangerous waste (e.g., wet spots, dead vegetation).

[WAC 173-303-640(6)(a)]

**3.3.1.15 Retrieval Ventilation System.** A separate ventilation system shall be provided by the ISSTRS for vapors and off gas from the retrieval activities. These gases shall be collected and treated before discharge from the facility. Ventilation system shall be designed to maintain airflow from the waste retrieval system facilities that form part of the confinement barrier into the waste tank. Airflow within the system shall move from non-contaminated to progressively more contaminated areas. The ventilation system shall be capable of decontaminating the vapors and off gas so that component concentrations shall meet requirements for stack release to an uncontrolled area as defined in Environmental Compliance, WHC-CM-7-5 (WHC 1994). This system shall also meet the requirement of DOE Order DOE/EH-0173T,5400.5, 6430.1A, 1550-990, Radiation Protection of the Public and Environment, and applicable ASME codes.

Ventilation and filtration system shall be provided to maintain radionuclide releases within the guidelines specified in DOE 5481.1B and applicable EM Orders. Ventilation system shall be provided where the possibility exists for generating flammable and explosive mixtures of gases (e.g., hydrogen/air or organic/air).

[DOE Order 5820.2A, Chapter I, 3.b(2)(f)
DOE Order 5820.2A, Chapter I, 3.c(2)(e)]

**Notification of Startup, Shutdown, or Other Change That May Affect Emissions Measurement.** WHC Environmental Emission Management (EEM) shall be notified directly by the appropriate facility management as soon as practicable, but no later than one working day after any radioactively contaminated forced ventilation exhaust systems start-up or shut-down. The date and time for each such exhaust system startup or shutdown shall also be recorded in the facility operating log. This requirement addresses equipment of any size involving any radioactive emissions to air resulting from forced air flow.

Relocation of any portable exhaust unit (e.g., HEPA-filtered portable exhausters, greenhouse exhausters, or HEPA-filtered vacuums) requires the earliest possible prior notification. Use of hand held HEPA filtered vacuums does not require such notification. Such notification shall also include any shutdown of stack sampling or monitoring systems or any other change that may affect the measurement of airborne radioactive emissions to the environment, including those outlined in the applicable Facility Effluent Monitoring Plan (FEMP). WHC EEM shall then notify WHC Air and Water Permits (AWP) of any shutdown, abnormal operation, or other change in facility operation which could result in an airborne radionuclide emissions violation of applicable standards.

Basis: WAC 246-247-090, "Special Reports," and reporting requirements of 40 CFR 61.14 and

61.94.

[WHC-CM-7-5, CHAPTER 2, 2.5.7]

**Maintain Tank Emissions.** A ventilation System shall be designed to maintain tank emissions of radionuclides ALARA (WAC 173-480). Additionally, the ventilation system shall use, as a minimum, best available control technology (WAC 173-400), best available control technology (WAC 246-247).

**Continuous Monitoring and Alarm Requirements.** ISSTRS elements shall be designed with the provisions of continuous monitoring and alarm capability. The determination shall require an emissions testing to state the potential offsite radiological impacts that require continuous monitoring and alarm capability or if radionuclide record sampling. Monitoring and alarm requirements shall be based upon criteria provided in Table 2.2, Monitoring and Alarm Criteria. Design of the monitoring equipment required shall meet the intent of the guidance provided in the ANSI N13.1 and in Chapter 3.0, Section 3.5.8, of DOE/EH-0173T. Theoretical annual emissions of radionuclides (used to calculate the projected offsite dose) are to include those expected from routine operations at maximum expected capacity combined with those expected from process upsets more likely than not to occur. Audible and visible indications shall be easily discernible. The monitoring systems described above shall be calibrated and maintained.

[TWRS F&R Requirement - Continuous Monitoring and Alarm Requirements.]

**Emission Filtration and Treatment.** ISSTRS elements shall be designed to provide high-efficiency particulate air (HEPA) filtration is required in all areas of facilities that contain radioactive materials in a dispersible form and in facilities, areas, or containment boundaries that contain unsealed, radioactive material. Plutonium processing and handling or storage facilities shall have ventilation systems that are designed to control radioactive air contaminants. Plutonium processing and handling or storage facilities shall have an additional HEPA filter installed as close as practical to the source of contamination to minimize the contamination of ductwork. Stationary sources of airborne radioiodine shall use iodine removal systems (charcoal absorbers, silver reactors, etc.) of sufficient capability to ensure compliance with the limits described in the requirement. At a minimum, the control equipment of all emission units shall represent every reasonable effort to maintain radioactive materials in effluents to unrestricted areas ALARA. All airborne filtration systems used by WHC other than those built in place (e.g., sand filters) shall be efficiency tested (batch tested) using a DOE-approved test aerosol and according to the applicable approved procedure (e.g., HPS-157-M through -160). On-line effluent filter systems shall have an in-place, an approved particulate filtration efficiency test before initial startup and after each filter change. Each filter stage shall be tested individually. Existing multi-stage HEPA filtration systems for which testing of individual stages is precluded by the design shall be tested under procedures and to standards.

[Emission Filtration and Treatment TWRS No.1023
Source: WHC-CM-7-5, CHAPTER 2, 2.5.5]

**General Regulations for Air Pollution Sources.** ISSTRS shall design the system elements to meet the requirements of air pollution sources following WAC173-400.

**General standards for maximum emissions.** All sources and emissions units are required to meet the emission standards of this chapter. Where an emission standard listed in another chapter is applicable to a specific emissions unit, such standard will take precedent over a general emission standard listed in this chapter. The codes summarizes requirements applicable to these topic areas: Visible emissions; Fallout; Fugitive emissions; Odors; Sulfur dioxide; Concealment and masking; and Fugitive dust sources.

[WAC173-400-040 ]

**Records, Monitoring, & Reporting.** The owner or operator of a source shall upon notification by the director of ecology, maintain records on the type and quantity of emissions from the source and other information deemed necessary to determine whether the source is in compliance with applicable emission limitations and control measures. This codes summary includes requirements for emission inventory, monitoring, investigation of conditions, source testing, continuous monitoring and recording, exemptions, and change in raw materials or fuels for sources not subject to requirements of the operating permit program.

[WAC173-400-105]

**Record Sampling Requirements.** ISSTRS shall design the system elements to meet the requirements of 40 CFR 61, subpart H criteria and apply to any point of emissions that, if all pollution control equipment did not exist, could provide a maximum offsite exposure of greater tan 0.1 mrem/year or the equivalent dose exposure (EDE).

[Record Sampling Requirement, TWRS No. 1064,
Source: WHC-CM-7-5, CHAPTER 2, 2.5.4]

**Toxic Air Emissions (Hazardous Air Pollutants).** ISSTRS shall design the system element to be in accordance with the established operational guidelines stated below.

The establishment and/or operation of a new toxic air pollutant source shall install and operate best available control technology for toxic (T-BACT) in accordance with WAC 173-460-060. In addition all sources of emissions, including reasonably available control technology (RACT) as defined under this regulation. It should be noted that NOC approval orders can also contain specifications for control technologies and other conditions for the proposed activity being approved by the agency.

Criteria pollutants are those pollutants subject to the Prevention of Significant Deterioration (PSD) program as enforced by the State of Washington Department of Ecology through WAS 173-400-141. If criteria pollutant(s) from TWRS activities approaches trigger levels specified under WAC 173-400 and 40 CFR 52 (as incorporated by reference) the information required for the PSD process would need to be included in an application to the agency.

[TWRS Requirement: Toxic Air Emissions (Hazardous Air Pollutants)]

### 3.3.1.16 Materials

**Secondary Containment Materials.** The system secondary containment materials shall be compatible with waste(s).

[WAC 173-303-640(4)(c)]

**Compatible Materials for Hazardous Waste Storage.** The owner or operator must use a container made of or lined with materials which will not react with, and are otherwise compatible with, the hazardous waste to be stored, so that the ability of the container to contain the waste is not impaired.

[40CFR 264. 172]

**Incompatible Waste and Materials.** ISSTRS shall comply with the incompatible wastes, and or materials that line the container as outlined below.

(a) Incompatible wastes, or incompatible wastes and materials (see appendix V for examples), must not be placed in the same container, unless [Section] 264.17(b) is complied with. (b) Hazardous waste must not be placed in an unwashed container that previously held an incompatible waste or material.

[Comment: As required by [Section] 264.13, the waste analysis plan must include analyses needed to comply with [Section] 264.177. Also, [Section] 264.17(c) requires wastes analyses, trial tests or other documentation to assure compliance with [Section] 264.17(b). As required by [Section] 264.73, the owner or operator must place the results of each waste analysis and trial test, and any documented information, in the operating record of the facility.]

(c) A storage container holding a hazardous waste that is incompatible with any waste or other materials stored nearby in other containers, piles, open tanks, or surface impoundments must be separated from the other materials or protected from them by means of a dike, berm, wall, or
other device.

[Comment: The purpose of this section is to prevent fires, explosions, gaseous emission, leaching, or other discharge of hazardous waste or hazardous waste constituents which could result from the mixing of incompatible wastes or materials if containers break or leak.]

[40CFR264.177]

**3.3.1.17 Toxic Products and Formulations.** The ISSTRS shall be designed without components or hardware which uses asbestos, Polychlorinated Biphenyl (PCBs), or ozone depleting chemicals.

[DOE 6420.1A, 0110-5.5]

Asbestos-Containing Materials
The system shall comply with 29 CFR 1910 during maintenance, repair, and demolition of DOE facilities.

[DOE 6420.1A 0110-5.4]

### 3.3.2 Radiation

**DOE Sponsored Radiological Requirements.**
The Radiological Health and Safety Policy provides the general framework for the conduct of radiological control activities throughout the DOE complex. Below the policy statement are both regulatory and contractual systems of basic requirements established through 10 CFR 835, which is enforced through a regulatory system established in 10 CFR 820, and DOE Order 5480.11, which is enforced through contractual commitments. The requirements of the Rule are augmented by complementary guidance provided in Implementation Guides while the requirements of the Order are augmented by complementary guidance provided in the DOE Radiological Control Manual.

The Hanford Site Radiological Control Manual (HSRCM) has been developed through a cooperative effort between the DOE Richland Operations Office (RL) and the Hanford contractors. As required by Article 114.1, the HSRCM has been approved by the senior site executives of the Hanford contractors and provides the basis for consistent and uniform implementation of radiological control requirements for the Hanford Site.

Non-DOE Sponsored Radiological Requirements. For any Non-DOE sponsored work 10 CFR 20.1201, 10 CFR 20.1301, 10 CFR 20.1601, 10 CFR 20.1602, 10 CFR 20.1603, 10 CFR 20.1701, 10 CFR 20.1702, 40 CFR 191, 40 CFR 192, and 40 CFR 193 are applicable.

**Accidental Public Exposure.** DOE facilities will be designed, constructed, operated, and decommissioned to assure the protection of the public, workers, and the environment.
DOE has adopted two quantitative safety goals to limit the risks of fatalities associated with its nuclear operations. These goals are the same as those established for nuclear powerplants by the Nuclear Regulatory Commission (NRC) and, like the NRC goals, should be viewed as aiming points for performance. The goals are:

The risk to an average individual in the vicinity of a DOE nuclear facility for prompt fatalities that might result from accidents should not exceed one tenth of one percent (0.1%) of the sum of prompt fatalities resulting from other accidents to which members of the population are generally exposed. For evaluation purposes, individuals are assumed to be located within one mile of the site boundary.

The risk to the population in the area of a DOE nuclear facility for cancer fatalities that might result from operations should not exceed one tenth of one percent (0.1%) of the sum of all cancer fatality risks resulting from all other causes. For evaluation purposes, individuals are assumed to be located within 10 miles of the site boundary.

In striving to reach these goals, DOE nuclear facilities and activities shall be designed, constructed, operated, and decommissioned with: a) appropriate barriers to prevent or minimize potential radioactive releases; b) engineered safety features to minimize potential releases; and c) procedural controls to mitigate the effects of potential releases. These goals shall be addressed for both new and existing facilities. Proposed modifications to existing facilities to

achieve these goals shall be prioritized along with other proposed modifications based on their safety significance. DOE shall pursue the evolution of additional potential safety goals for plant and co located workers to support enhanced safe operations of its facilities.

[Nuclear Safety Policy, SEN-35-91]

**Control of Access to High Radiation Areas.** ISSTRS shall design the elements of the system that meet the requirements of the control of access to high radiation areas. The requirement summary includes the access requirements, control device for entry area, control device to energize an alarm, control and locked high radiation areas, electronic surveillance of entry, and control of entrance or access to areas with qualified personnel trained to take necessary precautions.

[10CFR20.1601]

**Radiation Exposure Rates in Controlled Workplace.** Radiation exposure rates in controlled workplace areas should be reduced to as low as reasonably achievable levels by proper facility design and control. The primary means for maintaining exposures as low as reasonably achievable are to be through physical controls, e.g., confinement, ventilation, remote handling, and shielding. Administrative controls and procedural requirements are to be considered supplemental means to achieve control. The requirement summary includes design, optimization, external radiation exposure, internal radiation exposure, maintenance, decontamination, and decommissioning.

[DOE5480.11, Chapter 0, 9.j]

### 3.3.3 Nameplates and Product Marking

**Packaging & Marking of Materials For Transportation.** Properly preparing materials for transportation is the responsibility of the shipper. Proper preparation enables the materials to reach destination in good order. Except for those goods which can be shipped in bulk or loose, goods should be packaged in material of sufficiently substantial construction to withstand the ordinary hazards of transportation. Both packaged and loose materials must be marked to assure prompt, safe, and correct delivery. Minimum packaging and marking requirements for materials in transportation are contained in the "Freight Classifications" of the various modes of transportation. Noncompliance can result in penalty rate assessments, denial of claims or both when materials are damaged in transit. More detailed guidance regarding packaging and marking of specific items may be developed locally as necessary. b. The packaging, marking, labeling, and placarding regulations of the Department of Transportation applicable to all shippers, are contained in 49 CFR parts 171-179. Noncompliance with these regulations carry both civil and criminal penalties. Reporting requirements for hazardous material incidents are those listed on page II-11 paragraph 7d.

[DOE1540.1, Chapter II, Section 2 ]

**Safety Requirements for the Packaging & Transportation of Hazardous Materials, Hazardous Substances, & Hazardous Wastes.** The purpose is to establish requirements for the packaging and transportation of hazardous materials, hazardous substances, and hazardous wastes. The summary of the requirement includes Normal Conditions of Transport: (Heat, Cold, Pressure, Vibration, Water Spray, Free Drop, Corner Drop, Penetration & Compression.); Hypothetical Accident Conditions: The following hypothetical accident test conditions are to be

applied sequentially, in the order indicated, to determine their cumulative effect on a package or array of packages: Free Drop, Puncture, Thermal, Water Immersion (fissile material packages only); Values for Radionuclides; and Tests For Special Form Material ( Free Drop, Percussion, Heating, Immersion).

[DOE5480.3, Chapter 0, 11-14]

**Identification of Subparts Legibly Marked.** Identification of disconnecting means and circuits. Each disconnecting means required by this subpart for motors and appliances shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident. Each service, feeder, and branch circuit, at its disconnecting means or over current device, shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident. These markings shall be of sufficient durability to withstand the environment involved.

[29CFR1910, 303(f)]

**Durability and Legibility of Labels.** Equipment and any parts of that equipment to be used by personnel shall be identified with appropriate labels. The label shall indicate clearly and concisely the function and purpose of the item being labeled.

Permanent labels shall be attached to the specific component or equipment in such a manner that environmental conditions or usage by personnel will not remove or destroy the label.

Labeling shall be legible and conform to human visual capabilities and limitations in regard to physical characteristics such as letter and symbol size, contrast, font, simplicity, spacing and stroke width.

Specific guidelines for addressing labeling considerations are contained in NUREG 0700, Section 6.6 and MIL- STD-1472D, Section 5.5.

[DOE6430.1A, Section 1300-12.4.11]

### 3.3.4 Workmanship

The ISSTRS system elements shall conform to the workmanship standards specified in WHC-CM-8-9, "Workmanship Standards".

### 3.3.5 Interchangeability

ISSTR system elements shall include interchangeability factors. These requirements are "To BE Determined". Interchangeability is required to allow, as much as is practical, for temporary use of parts/equipment until a replacement is procured, (i.e., use of a pipe fitting or electrical fitting) which may suffice until its replacement is obtained.

### 3.3.6 Safety

The policy of Westinghouse Hanford Company is to assure that all activities are strictly controlled, from design, to operation and maintenance, all components, system, and processes must meet safety and environmental requirements. Requirements and standards outlined in DOE 5480.4, Environmental Protection, Safety and Health Protection, applicable to system design shall be incorporated for safety.

**Safety Analysis.** A contractor, as designated in writing by the PSO, who is responsible for the design, construction, or operation of DOE nuclear facilities shall be required to perform a safety analysis that develops and evaluates the adequacy of the safety basis for each such facility.

[DOE 5480.23]

**Unreviewed Safety Questions.** Perform all safety evaluations to determine whether a situation involves USQ. Prior to implementation of a proposed action, obtain PSO approval for situations determined to involve a USQ or a Technical Safety Requirements (TRS) change; and develop and implement procedures to govern the need for , and the performance of safety evaluations under this section.

[DOE 5480.21.10.a]

**Technical Safety Requirements.** In accordance with this Order, a contractor responsible for the operation of a DOE nuclear facility shall prepare and submit the Technical Safety Requirements to the PSO for approval for the facility. The contractor shall operate the facility in accordance with the Technical Safety Requirements as approved by the PSO including any modification by the PSO.

[DOE 5480.22.9.a]

**Environmental, Safety and Health.** The purpose of this Order is to specify and provide requirements for the application of the mandatory environmental protection, safety, and health (ES&H) standards applicable to all Department of Energy (DOE) and DOE contractor operations, to provide a listing of reference ES&H standards; and to identify the sources of the mandatory adherence ES&H standards. This Order shall be followed during facility design, construction, operation, modification, and decommissioning.

[DOE 5480.4]

**Environmental Surveillance.** ISSTRS shall detect leaks of the SST waste by meeting the environmental surveillance requirement. The summarized requirement itemized these components of the requirement by requiring that environmental surveillance shall be conducted to monitor the effects onsite and offsite environmental and natural resources. Environmental surveillance shall be designed to satisfy one or more of the following program objectives: (a) Verify compliance with applicable environmental laws and regulations; (b) Verify compliance with environmental commitments; (c) Characterize and define trends in the physical, chemical and biological condition of environmental media; (d) Establish environmental baselines; (e) Provide a continuing assessment of pollution abatement programs; and (f) Identify and quantify

new or existing environmental quality problems. Surveillance programs are likely to include one or more of the following: (a) Monitoring stations; (b) Sampling and analysis; and (c) Monitoring data record keeping.

[DOE 5400.1, Chapter IV, 5.b]

(1) Each operational or non-operational low-level waste treatment, storage, and disposal facility shall be monitored by an environmental monitoring program that conforms with DOE 5484.1 and, at a minimum, meet the requirements of paragraph 3K(2) through 3K(4).

(2) The environmental monitoring program shall be designed to measure: (a) operational effluent releases; (b) migration of radionuclides; (c) disposal unit subsidence; and (d) changes in disposal facility and disposal site parameters which may affect long-term site performance.

(3) Based on the characteristics of the facility being monitored, the environmental monitoring program may include, but not necessarily be limited to, monitoring surface soil, air, surface water, and, in the subsurface, soil and water, both in the saturated and the unsaturated zones.

(4) The monitoring program shall be capable of detecting changing trends in performance sufficiently in advance to allow application of any necessary corrective action prior to exceeding performance objectives. The monitoring program shall be able to ascertain whether or not effluents from each treatment, storage, or disposal facility or disposal site meet the requirements of applicable EH Orders.

[DOE 5820.2A. Chapter III, 3.k]

### 3.3.6.1 Fire Protection

**Fire Protection Program.** In accordance with DOE5480.7A, Fire Protection, as required by the PSO or the Heads of Field Organizations and directed by the Contracting Officer. The fire protection program summary includes these requirements: 1) Provide and maintain a level of fire protection, 2) Provide and maintain a system to ensure that the requirements of the DOE fire protection program are documented and incorporated in the plans and specifications for all new facilities and for major modifications of existing facilities. 3) Assist DOE in coordinating fire safety assessments at those facilities included in the survey program, 4) Establish and maintain a list of facilities for fire protection assessment, 5) Conduct fire protection assessments of facilities, 6) Provide fire protection technical assistance to DOE, 7) Submit requests for exemptions and fire safety equivalencies for those facilities where compliance with specific program elements is not attainable and where an acceptable level of safety has been achieved, and 8) Maintain or have access to an adequate fire protection staff, including a qualified fire protection engineer(s).

[DOE.5480.7.A.8.i ]

**Uniform Fire Codes.** Containers holding reactive waste exhibiting a characteristic specified in WAC 173-303-090 (7)(a)(vi), (vii) or (viii) must be stored in a manner equivalent to the Uniform Fire Code's "American Table of Distances for Storage of Explosives," Table 77-201, 1979 edition or the version adopted by the local fire district.
(b) The owner or operator shall design, operate, and maintain ignitable waste and reactive waste (other than a reactive waste which must meet (a) of this subsection) container storage in a

manner equivalent with the Uniform Fire Code. Where no specific standard or requirements are specified in the Uniform Fire Code, or in existing state or local fire codes, applicable sections of the NFPA Pamphlet # 30, "Flammable and Combustible Liquids Code," shall be used. The owner/operator shall also comply with the requirements of WAC 173-303-395 (1)(d).

[WAC173-303-630(8)]

### 3.3.6.2 ALARA

**ALARA.** In accordance with the recommendations of the Environmental Protection Agency, formerly the Federal Radiation Council, approved by the president of the United States of America, persons engaged in activities under licenses issued by the Washington state department of health pursuant to the Atomic Energy Act of 1954, as amended, shall, in addition to complying with the requirements set forth in chapter 246-221 WAC, make every reasonable effort to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as low as is reasonably achievable.

[WAC 246-220-007]

**ALARA Design.** The cost/benefit analysis used by Westinghouse Hanford Company is based on guidance provided in Health Physics Manual of Good Practices for Reducing Radiation Exposures to Levels That Are As Low As Reasonably Achievable, PNL-6577. This document is cited in DOE Order 5480.11, Radiation Protection for Occupational Workers as providing useful information for implementing the requirements of the order.

The detriment associated with exposure to radiation is expressed in PNL-6577 as follows:

$X = A + B$

where

A = cost of a person-rem due to health detriment ($)
B = cost of a person-rem due to nonhealth-related detriment ($)
X = cost of a person-rem due to total detriment ($).

The minimum value of A accepted by Westinghouse Hanford Company is $2,500 (WHC-SD-SQA-20003).

A value for the B component is not assigned in PNL-6577, but is considered to be variable; the actual value depends on application. As applicable to Westinghouse Hanford, the value of B is considered to be a range from essentially zero dollars to an upper limit value dependent on application.

The maximum value for B is limited in practical terms, to the cost of replacing the individual worker in the specific work force who has approached a preset limit. A specific evaluation of B for Westinghouse Hanford Company is developed in WHC-SA-1533-FP. The method used in this paper can be employed to develop quantitative values of B for other situations.

[TWRS F&R Requirement No 1514 - ALARA Design]

### 3.3.6.3 Design for Safety

**Design Objectives.** Design objectives for new facilities will assure protection of the public and operating personnel from hazards associated with normal high-level waste operations, accident conditions, and the effects of natural phenomena. Other objectives are compliance with DOE policies regarding nuclear safety, quality assurance, fire protection, pollution control, and safeguards and security protection for high-level waste and protection of essential operations from the effects of potential accidents.

[DOE5820.2A, Chapter I, 3.a(1)(a)]

**Safety Analysis Reports.** (2) Design Review for Existing Facilities. Uniform requirements for the preparation of safety analysis reports for high-level waste operations, detailed in DOE 5481.1B, include the review of existing operational facilities based on current technical criteria. When hazards are identified that should be eliminated, controlled, or mitigated, appropriate upgrading, actions in accordance with paragraph 3a(1) above, shall be identified and implemented according to the requirements of DOE 5481.1B.

[DOE 5820.2A, Chapter I, 3.a(2)]

**Worker Occupational Safety.** TWRS activities shall conform to 29 CFR 1910 and DOE 5483.1a Occupational Safety and Health Administration (OSHA) Program at Government owned contractor operated facilities.

[TWRS F&R Requirement - Worker Occupational Safety]

**Safety Class.** ISSTRS shall satisfy the following safety class criteria for the identification of safety structures, systems and components (SSCs). These requirements shall be used for design and quality assurance.

1. Prevent or mitigate offsite public exposure in excess of 500 mrem (5mSv) EDE.
2. Place or maintain an operating process in a safe condition that prevents or mitigates consequences to the public in excess 500 mrem EDE.
3. Monitor the release of radioactive materials to the environment during and after accidents where the monitor's output initiates Emergency Response Plan actions or operator actions to place the operating process in a safe condition per criterion 2.
4. Maintain operating parameters within the TSRs or OSRs that protect the public per criteria 1 or 2.
5. Maintain double contingency protection against an accidental nuclear criticality as defined in WHC-CM-4-29, Nuclear Criticality Safety.
6. Support the safety function of safety class structures, systems, and components (SSC). This includes control and monitoring functions (operating air, electrical power, instrumentation, etc.). See Notes 3 and 4.

**Safety Significant.** ISSTRS shall satisfy the following safety class criteria for the identification of safety structures, systems and components (SSCs). These requirements shall be used for design and quality assurance.

1. Prevent or mitigate onsite exposure to radiological materials in excess of 5 rem (50 mSv) EDE. See Notes 1 and 2.
2. Prevent or mitigate toxic chemical exposure to within the risk guidelines of WHC-CM-4-46, Chapter 7.0. Se notes 2 and 4.
3. Place or maintain an operating process in a safe condition that prevents or mitigates consequences that exceed criteria 6 or 7.
4. Prevent or mitigate exposure in excess of 5 rem EDE or an airborne concentration of toxic material in excess of the applicable chemical ERPG-2 limit to facility operators who are relied on to achieve the safe condition of criteria 2 and 8.
5. Monitor the release of radioactive and/or hazardous materials to the environment during and after accidents where the monitor's output initiates Emergency REsponse Plan actions or operator actions to place the operating process in a safe condition per criterion 8.
6. Maintain operating parameters within the TSRs or OSRs that protect the onsite worker per criterion 6.
7. Provide defense-in-depth prevention or mitigation of an uncontrolled release of radioactive and/or hazardous material deemed significant. See Note 4.
8. Prevent or mitigate an acute fatality to a facility worker or serious injury to a group of workers, except where the SSCs are controlled through an implemented institutional safety or radiation protection program.
9. Support the safety function of a safety significant SSC. This includes control and monitoring functions (operating air, electrical power, instrumentation, etc.). See Notes 3 and 4.

[WHC-CM-4-46, Rev. 2, Safety Analysis Manual, pg. 8-9]

**Maintenance Management Program.** The Maintenance management program for all DOE property be consistent with this Order and that all DOE property be maintained in a manner which promotes operational safety, worker health, environmental protection and compliance, property preservation, and cost-effectiveness while meeting the programmatic mission.

Structures, systems, and components that are important to safe operation shall be subject to a maintenance program in order to meet or exceed their design requirements throughout their life.

Periodic inspection of structures, systems, components, and equipment be performed to determine deterioration or technical obsolescence which threaten performance and/or safety.

[DOE4330.4B Maintenance Management Program]

**Warning and Annunciator.** Warning and Annunciator Systems. An effective warning system shall alert personnel to a problem of abnormal condition and shall provide sufficient time to respond appropriately to the problem. General warning guidelines are found in MIL-STD-1472D, Section 5.3. For the special case of control room annunciators, see NUREG 0700, Section 6.3. For auditory signals guidelines, see NUREG 0700, Section 6.2.

[DOE6430.1A, Section 1300-12.4.8]

**Emergency Lighting.** Emergency lighting systems shall be provided as required by NFPA 101. A control room emergency lighting system shall be automatically activated and immediately available for a stated minimum length of time on failure of the normal lighting system. The emergency lighting system for vital areas shall be an electronically independent system that is not degraded by failure of the normal lighting system. Control room emergency lighting levels shall be in accordance with NUREG 0700, Section 6.1.5.4.

[DOE6430.1A, Section 1300-12.4.3]

**Display Device.** Displays shall provide only the information about system status and parameter values that is needed to meet task requirements in normal, abnormal and emergency situations. Status, rather than demand information, shall be displayed for important parameters. Displays shall indicate whether they reflect demand or actual values.

Each display device, including meters, CRTs, LCDs, consoles, and other electronic or mechanical media shall be formatted and designed to ensure that both the display and display content are readable, understandable, and accessible.

Failure of a display of any type shall be easily recognized and shall not affect equipment or system performance.

Where CRTs are used, rapid, error-free access to the information required for the task shall be accomplished by ensuring that system response to any query is less that 2 seconds and that user feedback to control action is less that 0.2 seconds or faster whenever possible.

More specific information regarding these requirements is contained in NUREG 0700, Section 6.5, MIL-STD- 1472D, Section 5.2, and NUREG CR-2496.

[DOE6430.1A, Section 1300-12.4.6]

### 3.3.7 Human Engineering

Human Dimension Consideration. Equipment that is to be used by personnel shall be designed or selected to accommodate their body dimensions. This equipment shall include control panels, work tables and counters, enclosures, seating, storage, special clothing, and any other equipment designed for an operator. The design of equipment for personnel shall accommodate a wide variety of body dimensions. Generally, it is recommended that equipment dimensions accommodate the fifth to ninety-fifth percentile of the user population. For recommended data representing these percentiles, see NUREG 0700, Section 6.1, and MIL-STD-1472, Section 5.6.

[DOE 6430.1A, 1300-12.4.2]

### 3.3.8 Nuclear Control

### 3.3.8.1 Criticality

**Criticality Safety Program.** The criticality safety program defined herein applies to all storing, retrieving, processing, transfer operations, transport and storage activities and waste form operations involving fissionable material quantities in excess of 3% of a minimum critical mass. Designs shall incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible. Protection shall be provided by either (a) the control of two independent process parameters (which is the preferred approach, if practical) or (b) a system of multiple (at least two) controls of a single parameter. In all cases, no single credible failure shall result in the potential for a criticality accident. The basis for selecting one approach over another shall be fully documented. New criticality safety evaluations (CSEs) and major revisions to existing CSEs shall provide this documentation; existing CSEs are not required to be revised just to provide this documentation.

[TWRS F&R Requirement - Criticality]

**Nuclear Criticality Safety Considerations.** (b)(2)(I) Nuclear criticality safety considerations and controls shall be evaluated for normal operations and, before any significant operational changes are made, to protect against an uncontrolled nuclear criticality incident (e.g., dissolution of sludge for removal from tank).(b)(2)(I) Nuclear criticality safety considerations and controls hall be evaluated for normal operations and, before any significant operational changes are made, to protect against an uncontrolled nuclear criticality incident (e.g., dissolution of sludge for removal from tank)

[DOE5820.2A, Chapter I, 3.b(2)(I)
DOE5820.2A, Chapter I,3.c(2)(f)]

Safety/Hazard Classification for Nuclear Facilities and Operations. Facilities that treat, store or dispose of hazardous (dangerous) waste and mixed waste (containing both hazardous and radioactive waste components) shall conform to DOE Order 5820.2A. Hazardous waste is regulated in accordance with the Resource Conservation and Recovery Act (RCRA) and the Washington Administrative Code (WAC) 173-303, Dangerous Waste Regulations.

[TWRS F&R Requirement No. 1033, Hazardous Waste Management]

### 3.3.9 Security

Safeguard and security system shall meet the requirements of DOE 470.1. Detailed requirements for personnel security activities, protection operations, information security, and materials control and accountability are set forth in the Orders listed below:

1) Program Management, DOE 0 470 series
2) Personnel Security, DOE 0 472 series
3) Protection Operations, DOE 5632 and DOE 0 473 series
4) Materials Control and Accountability, DOE 5632 and DOE 0 474
5) Information Security, DOE 5639 and DOE 0 471 series

[DOE 470.1]

### 3.3.10 Government Furnished Property Usage

[RESERVED].

### 3.3.11 Computer Resource Reserve Capacity

[RESERVED].

## 3.4 INFORMATION

**Records & Document Control.** Records, documents, and document control pertinent to design functions shall be in accordance with ASME-NQA-1-1994-IA, DOE 5500.7b, DOE-5480.CM, and ANSI/ANS-3.2-88.

[TWRS F & R Performance Requirement - Documentation]

**Response Procedures.** Each high-level waste facility shall have response procedures for credible emergencies, as identified in the Safety Analysis Reports.

[DOE5820.2A, Chapter I, 3.b(4)(f)]

**Record Control System.** Each field organization shall develop and maintain a record keeping system that records the following: a historical record of waste generated, treated, stored, shipped, disposed of, or both, at the facilities under its cognizance.

[DOE5820.2A, Chapter III, 3.m(1)]

**Waste Manifests Records.** Records shall be kept and accompany each waste package from generator through final disposal. The manifest shall contain data necessary to document the proper classification, and assist in determining proper treatment, storage, and disposal of the waste. Waste manifests will be kept as permanent records.

[DOE5820.2A, Chapter III, 3.m(2)]

**Waste Characteristics and Compatibility Information.** Waste characteristics and compatibility information shall be documented in a safety analysis report (see DOE 5481.1B) and be used as a basis for designing new facilities.

[DOE5820.2A, Chapter I, 3.b(1)(b)]

**Operational Records.** Operational records (e.g., facility design drawings and modifications, characterization data on contamination levels, prior decontamination activities, and incident reports required by DOE Orders) for all contaminated facilities shall be maintained by the cognizant field organization for use in preparing decommissioning plans.

[DOE5820.2A, Chapter V, 3.a(2)]

**Handling Procedures.** The owner or operator of a new tank system must ensure that proper handling procedures are adhered to in order to prevent damage to the system during installation.

[WAC-173-303-640. 3c]

**Conduct of Operations.** It is the policy of the Department that the conduct of operations at DOE facilities be managed with a consistent and auditable set of requirements, standards, and responsibilities.

[DOE 5480.19]

## 3.5 LOGISTICS

### 3.5.1 Maintenance

ISSTRS shall meet all applicable ALARA requirements from WHC-CM-4-11, *ALARA Program Manual*, and WHC-CM-4-10, *Radiation Protection Manual*, and shall make every effort to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as low as is reasonably achievable.

Equipment items shall be in contact with waste, or in inaccessible areas such as the interior of the tank, will not be routinely/periodically maintained. These shall be designed for long life (relative to the service life), and shall be replaced during routine overhauls prior to failure. These will include: seals, elastomers, pumps, and waste property instrumentation. The items shall be designed fail in a recoverable mode, and replacement and decontamination of equipment can be done by remotely. The overhauls shall be performed after a retrieval campaign, when the equipment has been decontaminated to allow contact maintenance, prior to installation for a new retrieval campaign. Equipment shall be reusable, decontaminatable, and/or replaceable.

[DOE5820.2A, Chapter I, 3.b(2)(j)]
[DOE5820.2A, Chapter I, 3.c(2)(g)]
[DOE5820.2A, Chapter V, 3.b]
[DOE5820.2A, Chapter V, 3.c]

Remote, limited or contact maintenance and operation shall be in accordance with the following radiation contact exposure threshold values.

**Contaminated Equipment Maintenance.** The ISSTRS shall be designed and constructed to meet the maintenance requirements of DOE Order 6430.1A, and the design requirements of DOE Order 4330.4A, *Maintenance Management Program.*

**High Dose-Rate Areas Equipment Maintenance.** The ISSTRS shall be designed to preclude the need for routine, hands-on maintenance in contaminated or high-dose-rate areas using the ALARA design principles, WHC-IP-1043, *ALARA Program Manual.*

**Remote Maintenance Equipment.** Provisions for remote replacement of system equipment that operates in a high-radiation area shall be made as required to meet ALARA criteria. The capability shall be provided to perform a preliminary decontamination, where practical, of equipment before repair or removal using ODE/EV/1830-T5, a *Guide to Reducing Radiation*

*Exposure to as Low as Reasonably Achievable (ALARA),* and WHC-IP-1043, *ALARA Program Manual.*

**Spare Parts.**

[RESERVED]

### 3.5.2 Transportation of Hazardous Materials

The ISSTRS elements shall be designed to be handled, packaged, marked and transported in accordance with WHC-CM-2-14, Hazardous Materials packaging and Shipping. The ISSTRS elements shall meet the transport requirements applicable to the various activities (i.e., to maintenance depots, to deactivation facilities at the end of their design life, etc.).

**Impact to Existing Facilities and Equipment.** The equipment shall be designed to maintain Operating, Safety requirements during construction, testing, and normal operations. This includes maintaining proper confinement and ventilation during equipment insertion and removal from the tank, as well as ventilation system construction, testing and connection.

**Supply/Support.** The system design shall use readily available parts and components.

### 3.5.3 Waste Handling, Storage and Disposal

Solid waste handling, storage and disposal shall be preformed in accordance with WHC-SD-GN-DGS-30011, Section 10.1 through 10.3 and WHC CM-7-5, Section 7.0.

## 3.6 PERSONNEL & TRAINING

### 3.6.1 Personnel

Operator training and qualification standards shall be developed and an up-to-date record of training status shall be maintained.

[DOE5820.2A, Chapter I, 3.b(5)]
[DOE5820.2A, Chapter I, 3.c(5)]

**System Design for Operating Qualified Personnel.** The system shall be designed for operation by personnel possessing qualifications in accordance with DOE 5480.20 Chapter IV, and trained in accordance with Chapter I. [TWRS F&R Requirement - Personnel and Training]

## 3.7 CHARACTERISTICS OF SUBORDINATE ELEMENTS.

### 3.7.1 System Definition

Table 3-2. ISSTRS Task Definition (4 sheets).

| ISSTRS Task Elements for Tanks A-102, AX-103, C-103 & C-105 | Tank Farm Facilities |
|---|---|
| **Instrumentation:** | |
| Waste Storage Instrumentation | Designated DST storage tank equipment:<br>- Annulus leak detectors, Liquid Level, and Continuous Air Monitors<br>- Tank waste monitors<br>- Specific gravity, temperature, liquid level, primary tank vapor space pressure<br>- Pressure/vacuum monitoring<br>- Leak Detection Pit leak detectors, high level detectors, and alarms<br>- Tank waste high liquid level alarm<br>- Gaseous Effluent Monitoring System<br>- Primary Ventilation Exhaust System and Stack within designated DST storage tank.<br>Secondary tank equipment:<br>- Tank concrete structures thermocouple tree monitors<br>- Pressure/vacuum system |
| | SST retrieval tank equipment:<br>- tank temperature: thermocouples<br>- tank liquid-level: ENRAF, and manual tapes<br>- tank leak detection |
| Primary & annulus ventilation radiation system, and HEPA filter monitors | Designated DST storage tank equipment:<br>- -differential pressure<br>- exhaust temperature<br>- exhaust deferential pressure |
| | SST Retrieval tank equipment:<br>- exhaust radiation monitor<br>- continuous air monitors and record samplers |
| Backup ventilation system | Designated DST storage tank equipment:<br>- Exhauster |

Table 3-2. ISSTRS Task Definition (4 sheets).

| ISSTRS Task Elements for Tanks A-102, AX-103, C-103 & C-105 | Tank Farm Facilities |
|---|---|
| Waste Transfer Instrumentation | Designated DST storage tank equipment:<br>- Primary and secondary intertank transfer pipes<br>- Waste transfer system pits<br>- Waste transfer system pit equipment (e.g., pumps, valves, pipes, flanges, leak detectors) |
| Compressed Air Instrumentation | Designated DST storage tank equipment:<br>- process air<br>- instrument air |
| | SST Retrieval Equipment:<br>-Air supply monitoring instrumentation |
| Raw Water Instrumentation | Designated DST storage tank equipment:<br>- service pit<br>- radiation detectors |
| Backup Power | Designated DST storage tank equipment:<br>- ventilation system<br>- primary tank instrumentation |
| Signal Routing and Display | SST Retrieval Monitoring and Control Room equipment:<br>- Control panels with monitoring and control instruments<br>- Alarms to detect leakage, radiation, and loss of ability.<br>- Alarms with visible indication and high-intensity strobe indicators.<br>- In-tank imaging with remote capabilities. |
| **Ventilation Element:** | |
| Ventilation and Cooling | Designated DST storage tank equipment:<br>- Primary ventilation<br>- Deentrainers, condensers, heaters<br>- duct work<br>-seal loop<br>-exhaust fans<br>- Existing underground annulus and primary ducts<br>-Backup ventilation system<br>-exhauster<br>-ventilation duct work<br>-Annulus ventilation system |

Table 3-2. ISSTRS Task Definition (4 sheets).

| ISSTRS Task Elements for Tanks A-102, AX-103, C-103 & C-105 | Tank Farm Facilities |
|---|---|
| Ventilation Exhaust Radiation System | Designated DST storage tank equipment:<br>- Continuous air monitors<br>- Record samplers |
| Annulus Exhaust Radiation System | Designated DST storage tank equipment:<br>- Continuous air monitors<br>- Record samplers |
| Active Ventilation System | SST retrieval tank equipment:<br>- exhaust headers<br>- exhaust fan, HEPA filters<br>- Steam or electric preheaters<br>- process condensate drain with seal pot<br>- air inlet filters |
| Active Ventilation Exhaust Radiation Monitoring System | SST retrieval tank equipment:<br>- Continuous air monitors<br>- Record Samplers |
| Ventilation System | SST retrieval tank equipment:<br>- process building skid<br>- chiller skid<br>- exhaust skid |
| **Waste Transfer Element:** | |
| Sluicing waste transfer system | SST retrieval tank equipment:<br>- Seismic switch<br>- primary and secondary transfer pipes to DST storage tank equipment:<br>- slurry distributor<br>- syphon distributor<br>- pit cover blocks<br>-seal loop<br>-waste transfer equipment (e.g., pumps, valves, pipes, flanges) in pits<br>-raw water supply and transfer line flushing system<br>- compressed air system |

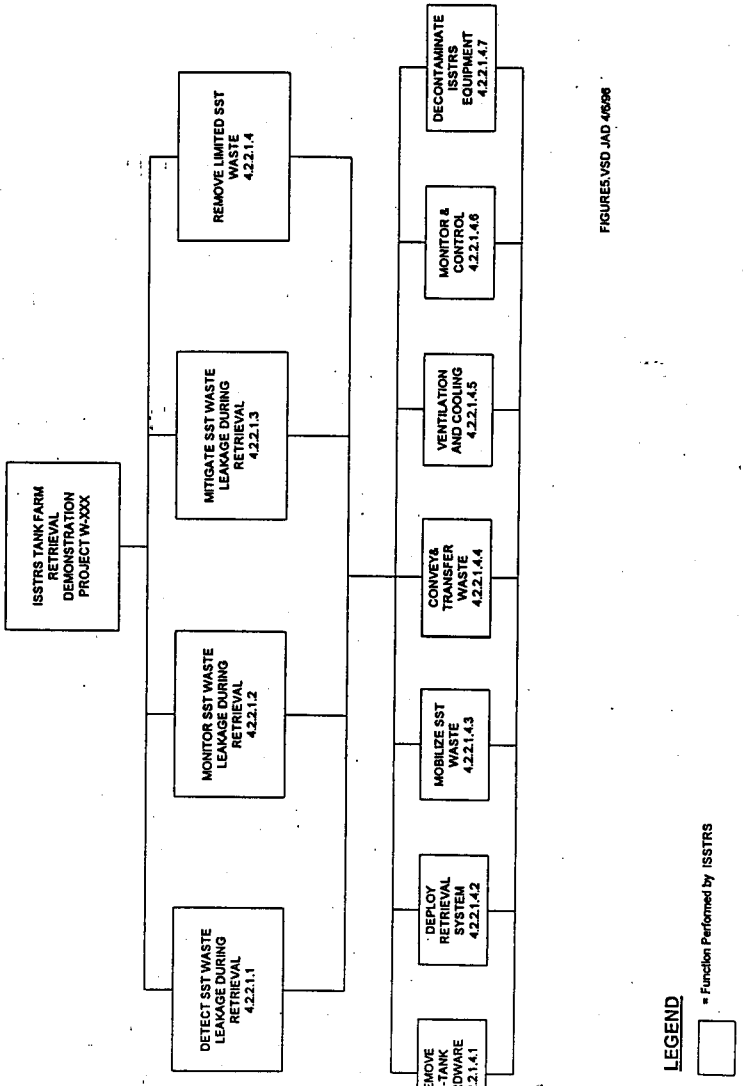
Table 3-2. ISSTRS Task Definition (4 sheets).

| ISSTRS Task Elements for Tanks A-102, AX-103, C-103 & C-105 | Tank Farm Facilities |
|---|---|
| **Electrical Distribution:** | |
| AC Power | DST Storage Tank Equipment:<br>- Primary tank instrumentation<br>- Ventilation |
| | SST Retrieval Tank Equipment:<br>- Active Ventilation System<br>- Temperature Monitoring System<br>- Liquid Level Monitoring System<br>- Leak Detection Monitoring system |
| **Support Services:** | |
| Compressed Air | SST Retrieval Tank Equipment:<br>- Air supply monitoring instrumentation |
| | DST Storage Tank Equipment:<br>- Process Air<br>- Instrument Air |
| Raw Water | SST Retrieval Activities & Transfer Activities |
| | DST Storage & Transfer Activities |
| Fire Protection System | SST Retrieval Activities & DST Storage Activities |
| Emergency Cooling System | DST Storage Activities & SST Retrieval Activities |
| Steam Supply | SST Retrieval & DST Storage Activities |

Figure 3-2 describes the functional break down for ISSTRS. The system consists of two pumping systems, the sluice and slurry pump systems; a sluicer system, a slurry distributor, and an HVAC system. The sluice and slurry system convey the waste from the SST tank and mobilizes the waste from the SSTs. The slurry distributor dispenses the waste into the tanks. The Tank sluicing HVAC system ventilates and maintains the tank pressure.

Sluicing involves contacting the solid waste with the sluicing liquid to form a slurry which will be pumped directly to the designated DST tank farm for additional storage prior to processing. The select SSTs will be equipped with sluicers to mobilize the waste with decant liquid from the AY storage facility.

Figure 3-2. ISSTRS Functional Decomposition.



### 3.7.1.1 Detect SST Waste Leakage During Retrieval

**Functional Description:** Detect and confirm leakage of waste from SSTs and ancillary components during sluicing to remove limited SST waste.

Detect leakage in the near-field zone by acquiring and evaluating the following data:

- potential leakage conditions within the SST structure
- waste inventory in the retrieval system
- monitor changes in the size and location of existing contaminant plumes

SST Leakage Detection During Retrieval activities shall be conducted as required to support the other function associated regulatory requirements until all of the SSTs have been retrieved.

### 3.7.1.2 Detect SST Waste Leakage During Retrieval Requirements

**Inspections.** (a) The owner or operator must inspect, where present, at least once each operating day: (3) Data gathered from monitoring equipment and leak-detection equipment, (e.g., pressure and temperature gauges, monitoring wells) to ensure that the tank systems being operated according to its design; and...
[40 CFR 265.195(a)(3)]

(a) The owner or operator must develop and follow a schedule and procedure for inspecting overfill controls. (b) The owner or operator must inspect at least once each operating day: (I) Above ground portions of the tank system, if any, to detect corrosion or releases of waste; (ii) Data gathered from monitoring any leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design; and (iii) The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g.,dikes) to detect erosion or signs of releases of dangerous waste (e.g., wet spots, dead vegetation).
[WAC 173-303-640(6)(a)]

**Notifications, reports.** (1) Any release to the environment, except as provided in paragraph (d)(2) of this section, must be reported to the Regional Administrator within twenty-four hours of detection. If the release has been reported 40 CFR Part 302, that report will satisfy this requirement.

(2) A leak or spill of hazardous waste that is: (I) Less than or equal to a quantity of one (1) pound, and (ii) Immediately contained and cleaned-up is exempted from the requirements of this paragraph. (3) Within thirty days of detection of a release to the environment, a report containing the following information must be submitted to the Regional Administrator: (I) Likely route of migration of the release; (ii) Characteristics of the surrounding soil (soil composition, geology, hydro geology, climate); (iii) Results of any monitoring or sampling conducted in connection with the release (if available). If sampling or monitoring data relating to the release

are not available within thirty days, these data must be submitted to the Regional Administrator as soon as they become available; (iv) Proximity to downgradient drinking water, surface water, and populated areas; and (v) Description of response actions taken or planned.

[40 CFR 265.196(d)]

(d) Notifications, reports. (I) Any release to the environment, except as provided in(d)(ii) of this subsection, must be reported to the department within twenty-four hours of its detection. Any release above the "reportable quantity" must also be reported to the National Response Center pursuant to 40 CFR Part 302. (ii) A leak or spill of dangerous waste is exempted from the requirements of (d) of this subsection if it is: (A) Less than or equal to a quantity of one pound, or the "Reportable Quantity" (RQ) established in 40 CFR Part 302, whichever is less; and (B) Immediately contained and cleaned-up. (iii) Within thirty days of detection of a release to the environment, a report containing the following information must be submitted to the department: (A) Likely route of migration of the release; (B) Characteristics of the surrounding soil (soil composition, geology, hydro geology, climate); (c) Results of any monitoring or sampling conducted in connection with the release (if available). If sampling or monitoring data relating to the release are not available within thirty days, these data must be submitted to the department as soon as they become available; (D) Proximity to down gradient drinking water, surface water, and populated areas; and (E) Description of response actions taken or planned.

[WAC 173-303-640(7)(d)]

**Environmental Surveillance.** (1) Environmental surveillance shall be conducted to monitor the effects, if any, of DOE activities on onsite and offsite environmental and natural resources. An environmental surveillance screening program shall be undertaken at DOE sites to determine the need for a permanent surveillance program.

[DOE 5400.1, Chapter IV, 5.b]

**Discharge of Other Liquids.** Liquid discharges, even though uncontaminated, are prohibited in inactive release areas to prevent the further spread of radionuclides previously deposited.

[DOE 5400.5, Chapter II, 3.c(2)]

**Periodic Waste Storage Assessment.** A method for periodically assessing waste storage tank integrity (e.g., coupons, photographic inspections, leak detectors, liquid level devices) shall be established and documented.

[DOE 5820.2A, Chapter I, 3.c.(3)(b)]

**Emergency Power.** Electrical leak detection devices essential to safe operations shall be provided with backup power, as appropriate, to ensure operability under emergency conditions.

[DOE 5820.2A, Chapter I, 3.c.(3)(c)]

**Identification and Monitoring of Tanks.** Within 90 days after the date of the enactment of this Act, the Secretary of Energy shall identify which single-shelled high-level nuclear waste tanks at the Hanford Nuclear Reservation, Richland, Washington, may have a serious potential for release of high-level waste due to uncontrolled increases in temperature or pressure. After completing such identification, the Secretary shall determine whether continuous monitoring is being carried out to detect a release or excessive temperature or pressure at each tank so identified. If such monitoring is not being carried out, as soon as practicable the Secretary shall

install such monitoring, but only if a type of monitoring that does not itself increase the danger of a release can be installed.

[PL 101-510 Sec 3137, (a)]

**Safety Measures for Waste Tanks at Hanford Nuclear Reservation**: Action Plans. - Within 120 days after the date of the enactment of this Act, the Secretary of Energy shall develop action plans to respond to excessive temperature or pressure or a release from any tank identified under subsection (a).

[PL 101-510 Sec 3137, (b)]

**Safety Measures for Waste Tanks at Hanford Nuclear Reservation**: Report. - Within six months after the date of the enactment of this Act, the Secretary shall submit to Congress a report on actions taken to promote tank safety, including actions taken pursuant to this section, and the Secretary's timetable for resolving outstanding issues on how to handle the waste in such tanks.

[PL 101-510 Sec 3137, (d)]

### 3.7.2 Monitor SST Waste Leakage During Retrieval

**Functional Description:** The waste leakage from retrieval of limited SST waste is monitored to obtain data that will be used to determine waste plume volume and plume direction. Monitoring includes obtaining, transmitting, receiving, recording, and displaying the leakage data.

#### 3.7.2.1 Monitor SST Waste Leakage During Retrieval Requirements

**Inspections.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.

[40 CFR 265.195(a)(3)]

**Notifications, reports.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.

[40 CFR 265.196(d)]

**Environmental Surveillance.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.

[DOE 5400.1, Chapter IV, 5.b]

**Discharge of Other Liquids.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.

[DOE 5400.5, Chapter II, 3.c(2)]

**Monitoring & Surveillance Capability.** Monitoring and surveillance capability shall exist to provide liquid volume, waste inventory data, and identification of failed containment.

[DOE 5820.2A, Chapter I, 3.c.(3)(a)]

**Emergency Power.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[DOE 5820.2A, Chapter I, 3.c.(3)(c)]

**Monitoring Wells.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[DOE 5820.2A, Chapter I, 3.c.(3)(d)]

**Release Migration Prevention.** Upon detection of released radioactive materials, steps shall be taken to prevent further migration of the release to soil or surface water. Major contamination in the soil shall be removed or stabilized unless compliance with this requirement would cause greater harm to human health or the environment.
[DOE 5820.2A, Chapter I, 3.c.(4)(b)]

**Environmental Monitoring.** (1) Each operational or non-operational low-level waste treatment, storage, and disposal facility shall be monitored by an environmental monitoring program that conforms with DOE 5484.1 *[DOE 5400.1, Chapter IV, 5.b]* and, at a minimum, meet the requirements of paragraph 3K(2) through 3K(4).

(2) The environmental monitoring program shall be designed to measure: (a) operational effluent releases; (b) migration of radionuclides; (c) disposal unit subsidence; and (d) changes in disposal facility and disposal site parameters which may affect long-term site performance.

(3) Based on the characteristics of the facility being monitored, the environmental monitoring program may include, but not necessarily be limited to, monitoring surface soil, air, surface water, and, in the subsurface, soil and water, both in the saturated and the unsaturated zones.

(4) The monitoring program shall be capable of detecting changing trends in performance sufficiently in advance to allow application of any necessary corrective action prior to exceeding performance objectives. The monitoring program shall be able to ascertain whether or not effluents from each treatment, storage, or disposal facility or disposal site meet the requirements of applicable EH Orders.
[DOE 5820.2A, Chapter III, 3.k]

**Safety Measures for Waste Tanks at Hanford Nuclear Reservation: Action Plans.** See section 3.7.1.1 Detect SST Waste leakage During Retrieval.
[PL 101-510 Sec 3137, (b)]

**Safety Measures for Waste Tanks at Hanford Nuclear Reservation: Report.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[PL 101-510 Sec 3137, (d)]

**Identification of Potential Release of High Level Waste.** Identify those tanks which may have potential for serious release of high level waste. (2) Determine whether continuous monitoring is being done to detect release or excessive temperature or pressure. No additional wastes added to tank. Report on actions taken or proposed actions.
[PL 101-510 Sec 3137, (1-2)]

**Well Drilling.** Monitoring wells and other bore holes shall be appropriately sealed after use so

as to not provide a pathway for contamination to the ground-water.

[WAC 173-160]

**Inspections.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.

[WAC 173-303-640(6)(a)]

**Notifications, Reports.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.

[WAC 173-303-640(7)(d)]

### 3.7.3 Mitigate SST Waste Leakage During Retrieval

**Functional Description:** Operational, procedural, and administrative methods in conjunction with retrieval equipment design employed to mitigate leakage of SST waste during the removal of limited SST waste. Applicable to preventing new leaks from occurring and responding to new leaks if they do occur.

#### 3.7.3.1 Mitigate SST Waste Leakage During Retrieval Requirements

**Maximum Contaminant Levels.** Maximum contaminant levels for $^{226}Ra$, $^{228}Ra$, and gross alpha particle radioactivity in community water systems. The following are the maximum contaminant levels for $^{226}Ra$, $^{228}Ra$, and gross alpha particle radioactivity: (a) Combined $^{226}Ra$ and $^{228}Ra$ - 5 pCi/l. (b) gross alpha particle activity (including $^{226}Ra$ but excluding radon and uranium) - 15 pCi/L.

**Maximum Contaminant Levels for Beta Particle & Photon Radioactivity.** Maximum contaminant levels for beta particle and photon radioactivity from man-made radionuclides in community water systems. (a) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 mrem/year.

[40 CFR 141 - per DOE 5400.5, Chapter II, 1.d(3)]

**Groundwater Monitoring** - [RESERVED].

[40 CFR 264.97 - per DOE 5400.5, Chapter I, 3.c(3)(d)]

**Groundwater Monitoring** - [RESERVED].

[40 CFR 265, Subpart F]

**Containment and Detection of Releases** - [RESERVED].

[40 CFR 265.193]

**Inspections.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.

[40 CFR 265.195(a)(3)]

**Response to leaks or spills** - [RESERVED].

[40 CFR 265.196]

**Migration of Leaks.** For tank systems in interim status from which there has been a leak, the

owner or operator must prevent further migration of the leak or spill to soils or surface water.
[40 CFR 265, Section 265.196(c)(1)]

**Notifications, Reports.** See section 3.7.1.1 Detect SST Waste Leakage during Retrieval.
[40 CFR 265.196(d)]

**Environmental Surveillance.** See section 3.7.1.1 Detect SST Waste Leakage during Retrieval.
[DOE 5400.1, Chapter IV, 5.b]

**Impact on Other Systems.** The liquid effluents from DOE activities shall not cause private or public drinking water systems downstream of the facility discharge to exceed the drinking water radiological limits of 40 CFR 141.

[DOE 5400.5, Chapter II, 1.d(3)]

**Discharge of Other Liquids.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[DOE 5400.5, Chapter II, 3.c(2)]

**Monitoring & Surveillance Capability.** See section 3.7.2.1 Monitor SST Waste Leakage During Retrieval.

[DOE 5820.2A, Chapter I, 3.c.(3)(a)]

**Periodic Waste Storage Assessment.** See section 3.7.2.1 Monitor SST Waste Leakage During Retrieval.

[DOE 5820.2A, Chapter I, 3.c.(3)(b)]

**Emergency Power.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[DOE 5820.2A, Chapter I, 3.c.(3)(c)]

**Monitoring Wells.** See section 3.7.2.1 Monitor SST Waste Leakage During Retrieval.
[DOE 5820.2A, Chapter I, 3.c.(3)(d)]

**Contingency Action Plan.** A contingency action plan shall be maintained to respond to spills or leaks and other credible emergencies as identified in the Safety Analysis Reports.
[DOE 5820.2A, Chapter I, 3.c.(4)(a)]

**Release Migration Prevention.** See section 3.7.2.1 Monitor SST Waste Leakage During Retrieval.

[DOE 5820.2A, Chapter I, 3.c.(4)(b)]

Singly Contained Tanks. For emergency situations involving pumpable liquid in singly contained tanks, appropriate equipment (e.g., pumps) shall be maintained to provide removal of liquid.

[DOE 5820.2A, Chapter I, 3.c.(4)(c)]

**Environmental Monitoring.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[DOE 5820.2A, Chapter III, 3.k]

**Safety Measures for Waste Tanks at Hanford Nuclear Reservation: Action Plans.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[PL 101-510 Sec 3137, (b)]

**Safety Measures for Waste Tanks at Hanford Nuclear Reservation: Report.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[PL 101-510 Sec 3137, (d)]

**Identification of Potential Release of High Level Waste.** See section 3.7.1.2 Monitor SST Waste Leakage During Retrieval.
[PL 101-510 Sec 3137, (1-2)]

**Well Drilling.** See section 3.7.2.1 Monitor SST Waste Leakage During Retrieval.
[WAC 173-160]

**Containment and detection of releases** - [RESERVED]].
[WAC 173-303-640(4)]

**External Liner System.** External liner systems must be: (A) Designed or operated to contain one hundred percent of the capacity of the largest tank within its boundary; (B) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such additional capacity must be sufficient to contain precipitation from a twenty-five-year, twenty-four-hour rainfall event. (c) Free of cracks or gaps; and (D) Designed and installed to surround the tank completely and to cover all surrounding earth likely to come into contact with the waste if the waste is released from the tank(s) (i.e., capable of preventing lateral as well as vertical migration of the waste).
[WAC 173-303-640(4)(e)(I)]

Variance of Requirements. The owner or operator may obtain a variance from the requirements of this subsection if the department finds, as a result of a demonstration by the owner or operator that alternative design and operating practices, together with location characteristics, will prevent the migration of any dangerous waste or dangerous constituents into the ground water, or surface water at least as effectively as secondary containment during the active life of the tank system or that in the event of a release that does migrate to ground water or surface water, no substantial present or potential hazard will be posed to human health or the environment.
[WAC 173-303-640(4)(g)]

**Inspections.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[WAC 173-303-640(6)(a)]

**Notifications, Reports.** See section 3.7.1.1 Detect SST Waste Leakage During Retrieval.
[WAC 173-303-640(7)(d)]

**Groundwater Protection.** Groundwater protection standards applicable to the Hanford single and double shell radioactive waste storage tanks can be divided into two categories: those applicable during tank operations and the closure period, and those that must ultimately be met to achieve closure.

[Based on WAC 173-303-645 and WAC 173-340]

### 3.7.4 Remove Limited SST Waste

**Functional Description:** The removal of wastes from the SSTs using established technologies and the transfer of these wastes to the Store In-Process Waste function.

#### 3.7.4.1 Remove Limited SST Waste Requirements

Table 3-3. Remove Limited SST Waste Requirements (2 sheets).

| Standard | Description |
|---|---|
| 40CFR264.1054 | Pressure Release Device for Hazardous Waste |
| 40CFR264.13(a)(1) | Hazardous Waste Analysis |
| 40CFR264.171 | Hazardous Waste Containers |
| 40CFR264.172 | Hazardous Waste Container Liner Material |
| 40CFR264.173 | Hazardous Waste Handling |
| 40CFR264.175 | Hazardous Waste Storage Area/Containment System |
| 40CFR264.177 | Hazardous Waste Incompatibility |
| 40CFR264.194(a) | Hazardous Waste Treatment Reagent |
| 40CFR264.194(b) | Hazardous Waste Spill Prevention & Control |
| 40CFR264.196(a-c) | Hazardous Waste Secondary Containment, Leak Detection |
| DOE Secretary Direction B.6.A.4 | Initiate 106-C Accelerated Retrieval |
| DOE5820.2A, Chapter I, 3.b(2)(a) | Double Containment |
| DOE5820.2A, Chapter I, 3.b(2)(d) | Secondary Containment |
| DOE5820.2A, Chapter I, 3.b(2)(f) | Ventilation Filtration Devices |
| DOE5820.2A, Chapter I, 3.b(2)(g) | Cathodic Protection for Containment Systems |
| DOE5820.2A, Chapter I, 3.b(2)(h) | Spill/Leak Prevention |
| DOE5820.2A, Chapter I, 3.b(2)(I) | Nuclear Criticality Prevention |
| DOE5820.2A, Chapter I, 3.b(2)(j) | Remote Features for Maintenance |
| DOE5820.2A, Chapter I, 3.b(2)(k) | Recovery of Normal Electrical Power |
| DOE5820.2A, Chapter I, 3.b(4)(d) | Maintenance & Operational Condition of Transfer Lines and Volume Capacity |
| DOE5820.2A, Chapter I, 3.c(2)(e) | Ventilation Point of Discharge |

Table 3-3. Remove Limited SST Waste Requirements (2 sheets).

| Standard | Description |
|---|---|
| DOE5820.2A, Chapter I, 3.c(2)(g) | Remote Maintenance Features |
| DOE5820.2A, Chapter I, 3.c(3)(a) | Surveillance and Monitoring of Failed Equipment |
| DOE5820.2A, Chapter I, 3.c(4) | Spill/Leak Contingency Plan |
| DOE5820.2A, Chapter III, 3.f(1-2) | Disposal Site Waste Treatment |
| DST Retrieved Waste Properties | DST Retrieved Waste Properties |
| Leakage Limits for SSTs | SST Leakage Limits |
| Non-DOE Sponsored Radiological Requirements | Non-Sponsored DOE Requirements |
| SEN-35-91 | Facility Design to Protect Worker Health, Public and Environment |
| TPA Change Control Form (M-48-01 - M-48-05) | Develop single-shell tank (SST) retrieval technology |
| TPA Change Control Form M-43-05 | Transfer System Upgrades Project W-314C |
| WAC173-303-640(3)(f) | Support Protection |
| WAC173-303-640(3)(g) | Corrosion Protection |
| WAC173-303-640(4)(b) | Secondary Containment |
| WAC173-303-640(4)(c) | Secondary Containment |
| WAC173-303-640(4)(f) | Ancillary Equipment |
| WAC173-303-640(5) | Leak Detection |
| WAC173-303-640(7)(a-c) | Leak/Spill Response |
| WAC173-303-645(8)(a-c) | Ground Water Monitoring |
| WAC173-303-645(9)(a-c) | Waste Constituent Monitoring |

### 3.7.5 Remove In-Tank Hardware

**Functional Description:** The ISSTRS shall remove in-tank hardware described as solids (e.g., failed equipment, concrete, rocks, bricks, and etc.). Solids shall be removed only to the extent necessary to prevent interference with the retrieval of other wastes or as required to allow completion of closure activities. The in-tank hardware (ITH) shall be retrieved by: locating the ITH; extracting the ITH; moving the ITH to a container.

### 3.7.5.1 Remove In-Tank Hardware Requirements

**Secondary Waste Handling**, The design shall include waste handling and storage facilities for all secondary wastes (as opposed to retrieved waste) generated by the facility. Waste facilities shall provide for waste segregation, storage, and shipping.

Basis: All generated wastes shall be designated according to the requirements of WHC-EP-0063-1, *Hanford Site Radioactive Solid Waste Acceptance Criteria* (Stickney 1989), and WHC-CM-2-14, *Hazardous Material Packaging and Shipping*, and shall meet waste acceptance requirements contained therein.

**Solid Radioactive Waste Transfer.** Transfer of solid radioactive waste to the Hanford Site Solid Waste program for dispositioning shall be in accordance with criteria specified in the Hanford Site Solid Waste Acceptance Criteria, WHC-EP-0063, DOE 1540.1 Material, Transportation and Traffic Management, and DOE 95-SWT-186 for on site shipment.

**WHC-CM-7-5, Chapter 7, 6.5.2.** Threshold doses and/or concentrations are established to define levels below which soil and included rubble do not require controls as site radioactive materials (see Tables 6.1 and 6.2 in WHC-CM-7-5, chapter 7).

**Radioactive Waste Transuranic Radionuclides.** Radioactive wastes with quantities of transuranic radionuclides in concentrations of 100 nCi/g of waste or less shall be considered to be low-level waste, and shall be managed according to the requirements of Chapter III of this Order.

[DOE5820.2A, Chapter II, 3.a(3)]

**Characterization of Low Level Waste. DOE5820.2A, Chapter III, 3.d**
d(1) 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 radionuclide content are recorded and known during all stages of the waste management process.
(2) Waste characterization data shall be recorded on a waste manifest, as required by paragraph 3m, and shall include:
(a) The physical and chemical characteristics of the waste.
(b) Volume of the waste (total of waste and any solidification or absorbent media).
(c) Weight of the waste (total of waste and any solidification or absorbent media).
(d) Major radionuclides and their concentrations.
(e) Packaging date, package weight, and external volume.
(3) The concentration of a radionuclide may be determined by direct methods or by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect methods can be correlated with actual measurements.

[DOE5820.2A, Chapter III, 3.d]

**Disposal Site Waste Treatment.** Waste shall be treated by appropriate methods so that the disposal site can meet the performance objectives stated in paragraph 3a.
(2) 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. Use of waste treatment techniques to increase the life of the disposal facility and improve long-term facility performance, by improved site stability and reduction of infiltrating water, is required to the extent it is cost effective.

[DOE5820.2A, Chapter III, 3.f(1-2)]

**Hazardous Waste Analysis.** Chemical and physical analysis of hazardous waste.

[40CFR264.13(a)(1)]

**Hazardous Waste Container.** Requirements of hazardous waste containers; requirements for hazardous waste container liner material; handling and storing hazardous waste containers requirements; hazardous waste containers storage area and containment system; and incompatibility requirements for hazardous waste.

[40CFR264.171
40CFR264.172
40CFR264.173
40CFR264.175
40CFR264.177]

**Land Disposal.** Waste restriction requirements for Land Disposal; treatment standards for land disposal; treatment standards for listed constituents for land disposal; and polychlorinated biphenyl, halogenated organic compounds, organic constituents and waste water treatment requirements.

[40CFR264.41(a)
40CFR268.41(b)
40CFR268.41(c)
40CFR268.42(a)]

### 3.7.6 Deploy Retrieval System

**Functional Description:** The ISSTRS shall deploy and install the system equipment. Subordinate elements to this function shall be monitoring and controlling equipment (i.e., cranes, hoisting and rigging), interfacing with support services for electrical utilities, raw water, and etc.

#### 3.7.6.1 Deploy Retrieval System Requirements

[RESERVED]

### 3.7.7 Mobilize Waste

The SST Waste Retrieval System shall mobilize the tank waste with supernate from the designated DST storage facility. The mobilization of the waste includes positioning the equipment at a determined level, equalizing the tank temperature, inducing a sluice stream aimed at agitating the area around the equipments in-take area. The accepted solids content shall be ensured in the solution described as slurry waste. Continuous monitoring of slurry flow rate and pressure shall be achieved until slurry loading is acceptable.

The subordinate elements include controlling and monitoring SST waste chemical composition, percent solids content of the slurry waste, slurry flow rate and slurry pressure, waste transfer requirements applicable to transferring into a SST tank farm, the supernate recirculated from the DST storage facility, SST waste level, and SST flammable gas concentrations. The sub-elements include defining and initiating actions for mitigation / resolution of safety issues.

The discrete elements of the Mobilize Waste shall include a sluicing system, sluice and slurry pump systems, sluicer system, slurry distributors, in-tank removal system, an analysis and waste transfer system.

#### 3.7.7.1 Mobilize Waste Requirements

**Static Dome Loading.** The static dome loading shall not exceed the equivalent maximum depth of soil above the tanks measured at the center (crown) of the tank dome and the live load shall not exceed the maximum value as described in the table below in order to prevent structural damage to tank domes.

Table 3-4. Maximum Soil Depth/Live Loads Above Tanks.

| Tank Description | Maximum Soil Depth Above Tank | Live Load Maximum |
|---|---|---|
| Single Shell Waste Storage Tanks (A, AX, B, BX, BY, C, S, SX, T, TX, TY and U) | | |
| 200 Series Tanks (20 ft. dia.) | 12 ft. | 50 tons |
| 100 Series Tanks (75 ft. dia.) | 10 ft. | 100 tons |

[OSD-T-151-00013, Section 13.2.1C]

**SST Waste Characterization Requirements**
The waste characterization requirements for supporting SST retrieval are defined in WHC-SD-WM-DQO-008.

[DOE/RL 94-0001]
[WHC-SD-WM-DQO-008]

**Manage Hazardous Flammable Gas.** Administrative Controls shall be established to manage flammable gas hazards related to the WASTE storage tanks that generate flammable gases. The Administrative Controls shall include not only tanks in which WASTE exhibits the potential to retain flammable gases and release them episodically but also tanks in which WASTE generates and releases flammable gases chronically. The program elements shall include as a minimum: a. Flammable gas generation rates and ventilation effectiveness, as well as tank physical parameter information (e.g., WASTE level, pressure, temperature), shall be evaluated and compared with established criteria to (1) assign the proper NFPA classifications and (2) identify tanks in which WASTE exhibits the potential to retain flammable gases and release them episodically and thus comprise the Flammable Gas Watch List. The Flammable Gas Watch List is a subset of Watch List Tanks (AC 5.15). b. Administrative Control elements for the tanks on the Flammable Gas Watch List are to include controls for work performed on or in the tanks to manage the risk of flammable gas ignition events within acceptance criteria. c. For tanks not on the Flammable Gas Watch List, the flammable gas Administrative Controls shall include:
1. Providing adequate ventilation, actively or passively, to prevent vapor spaces reaching flammable concentrations, including establishing ventilation outage times.
2. Establishing the non-flammability of vapor spaces.
3. Until the vapor space is established to be non-flammable, work controls shall be in place to minimize ignition sources that might cause a gas ignition event.

[WHC-SD-WM-OSR-005, Rev 0, Sec.5.29]

**Tank Corrosion Limits and Requirements.** NOTE: The following restrictions apply only to activities that may significantly change the concentration of the contents of an SST.
Tank Corrosion Limits and Requirements
The corrosion control program shall include the following limits and requirements:

A. LIMITS

1. WASTE composition of pH > 8.

2. For WASTE Temperatures 212 °F:

Variable Specification Limit
For [NO3-] 1.0M.
[OH-] 0.010M [OH-] 5.0M
[NO2-] 0.011M [NO2-] 5.5M

For solutions below 167°F, the 0H- limit is 8.0M

For 1.0M < [NO3-] 3.0M:
[OH-] 0.1*[NO3-] [OH-] < 10M
[OH-] + [NO2-] 0.4*[NO3-]

For [NO3-] >3.0M:
[OH-] 0.3M [OH-] <10M
[OH-] + [NO2-] 1.2M
[NO3-] 5.5M

3. For WASTE temperatures > 212°F: The limits in 2. apply except that [OH-] must be < 4M

[WHC-SD-WM-OSR-005, Rev. 0, Table B-5.17-1]

**SMTW Characterization Requirements.** WASTE sampling program shall be established to provided WASTE characterization. The program shall be sufficient to meet the requirements of the following administrative controls:
Nuclear Criticality
WATCH LIST TANKS
Corrosion Control
Compatibility
Heat Load
Hydrostatic Load
Spare Tankage
Flammable Gases

[WHC-SD-WM-OSR-004, Section 5.16]
[WHC-SD-WM-OSR-005, Section 1.11]

**Flammable Gases - Lower Flammability Limit.** The flammable gases concentration shall be maintained 20% of the lower flammability limit (LFL) when potential spark operations are
taking place within the tank.

[OSD-T-151-00030, Section 30.2.A.2]

**Flammable Gases - Vapor Space Monitoring.** The insertion, temporary use, and/or removal of electrically non conductive objects into the tank or vapor space shall require constant monitoring during movement of the object to verify the vapor space is 20% of the LFL. Constant monitoring shall mean use of installed monitors or every 15 minutes for portable monitors. Insertion or removal shall cease if the vapor space flammable gas concentration is 20% of the LFL.

[OSD-T-151-00030, Section 30.2.A.2]

**Waste Transfer Out of Watch List Tank**
30.2.A.3 Transfer of Waste

| Variable | Specification Limit |
|---|---|
| A. Transfer waste out of a tank* | Requires written approval by Tank Waste Remediation Systems, TWRS Nuclear Safety and DOE. Requires sample analysis from both receiving and sending tanks. |

*Limit does not apply to the potential Flammable Gas Watch List Tanks denoted by footnote 1 in Appendix B. This exception is a result of discussions held during a Plant Review Committee meeting on May 11, 1995. Tanks identified as potential Flammable Gas Watch List Tanks in the future as a result of a correlation between tank waste levels and atmospheric pressure will qualify for similar exemptions and will also be denoted by footnote 1 in Appendix B.

[OSD-T-151-00030, Operating Specification for Watch List Tanks, P. 9, Section 30.2.A.3, (A)]

**Temperature - Tank Dome**
The maximum tank dome temperature is 250° F for SSTs (OSD-T-151-00013, section 13.2.1.E) and 240° F for aging waste DSTs (OSD-T-151-00017, section 17.2.7). The maximum tank dome temperature is not specified for non-aging waste DSTs because the primary tank waste temperatures are limited to 180°F in AP Farm DSTs and 200°F in AN, AW, and SY Farm DSTs (non-aging waste DSTs). These waste temperature limits preclude dome vapor space from reaching the previously specified non-aging waste tank dome temperature limit of 250°F.

Basis: The technical basis for these requirement are derived from WHC-SD-WM-SAR-006, *Single Shell Tank Isolation Safety Analysis Report*, (O.S.R. 11.4.2.1) and WHC-SD-RE-TI-012, *Single Shell Waste Tank Load Sensitivity Study*, pg. 18. Temperatures and temperature changes in excess of these limits may lead to severe structural stress. The maximum temperature limit and monitoring frequency for single shell tanks is given in WHD-SD-WM-OSR-005, Single Shell Tank Interim Operational Safety Requirements. The 20°F per day maximum temperature change applies to bulk temperature conditions in the tank.

[Temperature - SST Waste: OSD-T-151-00013, Section 13.2.1.E]
[Temperature - Tank Dome: OSD-T-151-00013, Section 13.2.1.E.]

### 3.7.8 Convey and Transfer Waste

**Functional Description:** The mobilized transfer waste shall meet the acceptance criteria for receiving storage facility and in accordance with architectural infrastructures: Waste Storage Facilities, and Tank Waste Transport Systems. Wastes to be removed from the tank shall include liquids, saltcake/sludge slurries.

The recirculated supernate liquid shall be transferred to the selected SSTs in order to

mobilize the SST waste. The retrieved transfer waste shall meet the acceptance criteria for receiving storage facility and in accordance with Manage Tank Waste function, and architectural infrastructures Waste Storage Facilities, and Tank Waste Transport Systems.

This function also includes treatment/preparation of liquid, gaseous, and solid wastes generated as a result of the retrieved tank waste transfer activities in accordance with facilities criteria.

The subordinate function include the preparing the waste transfer system, set-up transfer route, contain waste, move waste, clean liquid waste transfer system, and respond to abnormal conditions.

The discrete elements of the waste transfer system include monitor and control instrumentation for slurry transfer line flow rate and pressure, bulk liquid density, sluice stream percent solids, specific gravity, temperature, tank concrete structures temperature, liquid level, primary tank vapor space pressure, pressure/vacuum monitoring, leak detection pit leak detectors, and gaseous effluent monitoring system.

### 3.7.8.1 Convey and Transfer Waste Requirements

**Characterization Information Accessibility.** Tank Waste Characterization Information shall provide controlled, accessible, and usable data resources (electronic and hard copy). This includes receiving, retrieving, compiling, maintaining, organizing, and supplying tank characterization information as data and reports. The information is put into appropriate databases, which can be accessed by or supplied to on-site and off-site data users.

This requirement is derived from requirements DOE/RL 94-0001.6.1 THRU DOE/RL 94-0001.6.5

**SMTW Characterization Requirements.** WASTE sampling program shall be established to provided WASTE characterization. The program shall be sufficient to meet the requirements of the following administrative controls:
Nuclear Criticality
WATCH LIST TANKS
Corrosion Control
Compatibility
Heat Load
Hydrostatic Load
Spare Tankage
Flammable Gases

[WHC-SD-WM-OSR-004, Section 5.16]
[WHC-SD-WM-OSR-005, Section 1.11]

**Tank Vapor Sampling for Aging Waste Tanks.** The following limits and requirements shall be maintained: Stored WASTE generates gases, including H2 as described in the section B 3.4.1, "BASES". Integration of information on patterns of changes in physical parameters in a tank and/or insight regarding WASTE composition systems with gas generation potential is conducted by the process engineers.

Requirements: Tank vapor space sampling for non-WATCH LIST tanks will be based on an initial screening, completed in quarterly evaluations of the process parameters that can give an indication of gas generation and/or development of burping, and weekly monitoring if indications warrant. If flammable gas concentrations are found that equal or exceed 25% of the LFL, gas sampling will be done weekly; if values exceed 50% of the LFL, steps will be taken immediately to institute spark control measures and provide in-line gas monitoring to transition the tank to the WATCH LIST for flammable gases.

The current operating specifications for AWF tanks have the following threshold values for flammable gases and associated actions if the tank is determined to be a WATCH LIST flammable gas generating tank. The following controls shall be in place prior to, and during, work around or in tank: The riser or pit vapor space shall be sampled to VERIFY it is below limits for flammable gases. Use of a portable combustible gas meter with an extension is acceptable.

The vapor space shall be sampled to verify it is below 20% of the LFL prior to in-tank work activities. If the flammable gas concentration is > 10% of the LFL, but < 20% of the LFL, a sample will be taken to the lab to determine the type of flammable gases present. The gas sampling shall include: Hydrogen, Nitrogen dioxide, Hydrogen cyanide, Hydrazine, Ammonia, and Organic.

All tanks with active ventilation shall have the ventilation systems operational during activities in, or on, the tank. Physical restraints shall be in place to prevent dropping objects into the tank. All objects inserted into or connected to objects in the tank for work to be done shall be electrically grounded.

Equipment used for in-tank inspections must follow safety criteria outlined for TV cameras and light assemblies (Ref. 3). Hazardous Work Permit or Job Safety Analysis shall be completed prior to work in the primary tank vapor space.

If flammability reading is => 20% of the LFL or a tool causes a spark, stop all work to the tank and place tank in safe configuration. Immediately notify TFO and System Engineering.
[WHC-SD-WM-OSR-004, Rev 0, B 5.29 AC.]

**Flammable Gas Program for Aging Waste Tanks.** A program shall be established to identify and manage tanks that generate flammable gases where the potential exists for chronic or episodic releases that exceed 25% of the LFL. The limits and requirements for flammable gas build-up control are found in the BASES section B5.29. The program shall contain the following elements:

a. Evaluation of WASTE level changes, temperature inversions, pressurization events and vapor space composition changes for indications of releases.

b. Evaluation of WASTE composition changes associated with interfaces with the Evaporator, other tanks and other facilities.

c. Consideration of impacts of increasing density and radionuclide composition of WASTE as evaporation processes for volume reduction continue.

d. Hydrogen flammability considering the applicable generation rate and the effect of evaporation of the WASTE liquid.

[WHC-SD-WM-OSR-004, Rev 0, Sec.5.29.]

**Flammable Gas Administrative Controls.** Administrative Controls shall be established to manage flammable gas hazards related to the WASTE storage tanks that generate flammable gases. The Administrative Controls shall include not only tanks in which WASTE exhibits the potential to retain flammable gases and release them episodically but also tanks in which WASTE generates and releases flammable gases chronically. The program elements shall include as a minimum:

a. Flammable gas generation rates and ventilation effectiveness, as well as tank physical parameter information (e.g., WASTE level, pressure, temperature), shall be evaluated and compared with established criteria to (1) assign the proper NFPA classifications and (2) identify tanks in which WASTE exhibits the potential to retain flammable gases and release them episodically and thus comprise the Flammable Gas Watch List. The Flammable Gas Watch List is a subset of Watch List Tanks (AC 5.15).

b. Administrative Control elements for the tanks on the Flammable Gas Watch List are to include controls for work performed on or in the tanks to manage the risk of flammable gas ignition events within acceptance criteria.

c. For tanks not on the Flammable Gas Watch List, the flammable gas Administrative Controls shall include:

1. Providing adequate ventilation, actively or passively, to prevent vapor spaces reaching flammable concentrations, including establishing ventilation outage times.

2. Establishing the non-flammability of vapor spaces.

3. Until the vapor space is established to be non-flammable, work controls shall be in place to minimize ignition sources that might cause a gas ignition event.

[WHC-SD-WM-OSR-016, Rev 0, Sec.5.29.]

**Chemical Compatibility.** Interfacing waste sources shall be categorized according to the Waste Reactivity Group Compatibility Matrix documented in WHC-SD-WM-OCD-015, Rev. 1, and the potential chemical compatibility hazards identified prior to acceptance into a DST. Transfers shall be allowed if no potential hazards are identified for mixing of wastes in the identified reactivity groups with the receiver tank waste. If a potential hazard is identified, a technical justification explaining how the waste may be safely transferred and stored in light of the potential hazard will be required before allowing the transfer.

**Chemical Concentrations Limits.** Waste sources shall not exceed the following nitrate, nitrite, and hydroxide concentrations limits. These limits shall be met prior to initiating waste transfers.

The concentration limits prevent corrosion and stress corrosion cracking for waste sources, and transfer system. each waste storage facilities and transfer system controls the ion concentration and composition of the waste to inhibit corrosion rates. A general corrosion requirement was derived with application to all waste storage facilities transferring waste. Transfer system systems interfacing with the waste sources must be capable of handling waste with this type of chemical composition and makeup.

Note: Square brackets [ ] signify the mean concentration in moles per liter (M).

For operating temperatures of the receiving tank 100 C (212 F):
For [NO3-] 1.0M:
0.010M [OH-] 5.0M; and
0.011M [NO2-] 5.5M

For 1.0M < [NO3-] 3.0M:
0.1M x [NO3-] [OH-] < 10M; and
[OH-] + [NO2-] ≥ 0.4 x [NO3-]

For [NO3-] > 3.0M:
0.3M [OH-] < 10M; and
[OH-] + [NO2-] ≥ 1.2M; and
[NO3-] 5.5M

For tanks 102-AP, 104-AP and 106-AP the following limits shall apply:
For [NO2-] < 0.005M:
0.001M [OH-] 0.02M

Providing these conditions are met:

1) Only "Hanford Facility Wastes" (phosphate and/or sulfate decontamination wastes) may be added to tanks.
2) All liquids added to the tanks must be <0.005M [NO2-].
3) Temperature < 50 C (122 F).

For normal operating temperature of the receiving tank > 100 C (212 F), if the same limits apply with the exception the [OH-] < 4.0M in all cases, then the waste is acceptable.

For the Aging Waste Tanks:
The chemical concentrations specified in OSD-T-151-00017 apply when the waste contains neutralized current acid waste (NCAW).

Basis: These concentration limits are established to inhibit uniform corrosion rates and stress corrosion cracking in the primary tanks to which the waste will be transferred. This

requirement was derived based on the tanks having constraints with regard to waste composition. With these constraints on the storage facilities, the waste transfer system, at a minimum, should be capable of handling wastes with this composition and makeup.

[OSD-T-151-00007, Operating Specifications for the 241-AN, AP, AW, AY, AZ & SY Tank Farms; p. 4, Section 7.2.1, 7.2.1.A, 7.2.1.B, and 7.2.1.C]

**Complexant Waste Segregation.** Waste sources shall determine if the source is a complexant waste. Wastes with a mean [TOC] (total organic carbon concentration) > 10 g/L at double-shell slurry feed (DSSF) composition, shall be transferred to a complexant waste tank.

This requirement was derived to control operations of the source waste facilities. Segregating complexant waste prevents increase viscosity of the waste and changes to the wastes matrix. Before initiating a waste transfer, source waste facilities shall determine the apply the complexant waste segregation requirement to determine the type of the expected waste.

[WHC-SD-WM-OCD-015, Tank Farm Waste Transfer Compatibility Program; p. 12, Section 3.2.4 paragraph (1&2)]

**Energetics.** Transfers shall be allowed if the waste has no separable organic and the source and receiving wastes (individually) have an absolute value of the exotherm/endotherm ratio < 1.0 (i.e., no net exotherms) as evaluated from laboratory thermal analysis differential scanning calorimetry (DSC) and thermo-gravimetric analysis (TGA) conducted up to 500° C (932°F).

A technical evaluation which determines the conditions needed for safely receiving and storing the waste shall be required if the ratio is ≥ 1.

Basis: Wastes that exhibit exotherms indicate that potential for self-heating and could enter into a propagating chemical reaction. The net energy available for heating the waste from an exothermic chemical reaction is greatly diminished by endotherms resulting from water losses, phase changes, and other competing reactions Where the endotherms are greater, a propagating reaction would be inhibited. If exotherms are in excess, the potential for propagating self-heating must be assumed until demonstrated otherwise. If separable organic were allowed into the waste storage tanks and temperatures in the tank exceeded 75 °C (167°F), organic vapors or distillates could accumulate in the tanks, in overhead systems in condensate collection tanks. An organic liquid fire or vapor explosion could result from the accumulations.

Note: Waste for purposes of the energetics decision rule means representative sample of the source tank material slated for transfer and a representative sample of the supernate from the receiver tank

[WHC-SD-WM-OCD-015, Tank Farm Waste Transfer Compatibility program, p. 7, section 3.1.3]

**Heat Generation Limit.** The sum of the receiving tank waste and the source waste heat generation rate shall be the OSD limit for the receiving tank in order for the transfer to take place. A technical evaluation shall be required to verify the heat generation rate limit shall not be exceeded when the uncertainties associated with the sample analysis and calculations is unusually large. The tank farm heat generation limits are lists in the following table.

The technical basis originates as a design constraint to prevent localized boiling from occurring. The ventilation systems for AN, AP, AW, and SY were not designed for boiling and internal boiling could cause a release of contamination.

Table 3-5. Tank Farm Heat Generation Rate Limits.

| Tank Farm | Maximum Heat Generation Rate Per Tank (Btu/hr) |
|---|---|
| 241-AN<br>241-AP<br>241-AW | 70,000 |
| 241-AY<br>241-AZ | 700,000 |
| 241-SY | 50,000 |

This table details the heat generation limits as of October 13, 1995. The maximum Heat Generation limit in AP-106 and -108 will be determined by the ventilation upgrade as needed by the privatization contractors.

Basis: The technical basis is a design constraint to prevent localized boiling from occurring. The ventilation systems for AN, AP, AW, and SY were not designed for boiling and internal boiling could cause a release of contamination.

[WHC-SD-WM-OCD-015, Tank Farm Waste Transfer Compatibility Program, p.12, Section 3.2.3]

**High Phosphate Waste.** Waste shall comply with the following parameters:

Waste with [PO4-3] > 0.1 M shall not be mixed with:
waste with [Na+] > 8 M or
neutralized cladding removal waste (NCRW)

(NCRW is the solids portion of the PUREX Plant neutralized cladding removal waste stream; received in tank farms as a slurry. NCRW solids are classified as TRU waste.)

This requirement was derived so that interfacing waste sources could control phosphates of the incoming waste which could potentially increase viscosity of the waste, cause the waste to form a gel-like matrix , or solidify the waste to a hard mass.

[WHC-SD-WM-OCD-015, Tank Farm Waste Transfer Compatibility Program, p. 13, Section 3.2.6]

**Criticality Prevention Requirement.** Interfacing waste sources shall ensure that the criticality prevention limits are met prior to initiating waste transfers.

This requirement was derived based on the Criticality Prevention Specification, CPS-T-149-000010. Waste sources must comply with the criticality prevention limits to safely transfer waste.

If a DST will contain less than 10 Kg of plutonium (Pu) after completion of a transfer, the following limits may be used:

(1) Transfers may be made without consideration of the solids content provided at least one of the following conditions is met:

Total Pu in the transfer < 15 g.

Pu concentration in source waste < 0.013 g/L (0.05 g/gal).

An air lift circulator is operating in the receiver tank and the transfer contains 200 g Pu.

Transfer is made through a slurry distributor and the total Pu added to the waste at any single position does not exceed 200 g.

(2) If at least one of the requirements above is not met, transfers may be made in accordance with the requirements for tanks containing greater than 10 Kg. Pu (below).

If a DST contains greater than 10 Kg Pu after completion of the transfer, the solids/Pu mass ratio for the receiver tank contents shall be shown to be at least 1,000 before additional Pu may be added. The ratio is an average value determined by dividing the total solids mass by the total Pu mass.

(3) For all waste transfers to a DST, one of the following sets of limits (Set 1, Set 2 or Set 3) shall apply:

Set 1. For the solids/Pu mass ratio of the existing waste in the receiver tank which exceeds 1,000, the incoming waste shall:

a. contain less than 15 g of Pu;

OR

b. have a Pu concentration less than 0.013 g/L (0.05 g/gal);

OR

c. contain no more than 200 g Pu and the receiving tank shall have operating air lift circulator;

OR

d. not exceed 200 g for the total Pu added to the transfer at any single position and shall be required to go through a slurry distributor.

Set 2. The incoming waste shall:

a. have a solids/Pu ratio of at least 1,000 determined by analysis or predictive calculation.

AND

b. have a averaged Pu concentration (both liquid and solids volume per batch included) not exceeding 0.033 g/l (0.125 g/gal)

Set 3. Cadmium (Cd) may be added to the waste and the transfer continued under the following conditions:

a. Only tank 102-SY or 105-AW shall receive waste transfer of this type.

AND

b. Before transfer, the solids/Pu mass ratio in the receiver tank is at least 1,000.

AND

c. The Cd/Pu mass ratio is at least 0.33 (i.e., there is at least one gram of Cd for every three grams of Pu).

AND

d. The Pu concentration does not exceed 30 g/l in the precipitated (settled) solids.

Basis: This requirement was derived based on the Criticality Prevention Specification, CPS-T-149-000010. Waste sources must comply with the criticality prevention limits to safely transfer waste.

[WHC-SD-OCD-015, Rev.1, Tank Farm Waste Transfer Compatibility Program, p.6, Section 3.1.1, (1), (2), (Set 1), (Set 2), & (Set 3)]

**TRU Waste Segregation.** Waste sources shall provide segregated TRU waste, to the extent practicable, to the specified limits below.

This requirement was derived based on the DOE Order 5820.2A. The limits below comply with the segregation order and provide waste source facilities operational control of the TRU storage tanks. Before transfers are initiated, TRU waste segregation determinations according to the limits below must be done.

Waste sources with [TRU] $\geq$ 100 nCi/g shall be transferred to a TRU storage tank. Waste sources with [TRU] $<$ 100 nCi/g shall be transferred to a non-TRU tank or a technical evaluation shall be performed demonstrating that TRU segregation in a TRU storage tank will not be jeopardized.

Basis: This requirement is based on the DOE Order 5820.2A. The limits below comply with the segregation order and provide waste source facilities operational control of the TRU storage tanks. Before transfer are initiated, TRU waste segregation determinations according to the limits above must be done.

[WHC-SD-WM-OCD-015, Tank Farm Waste Transfer Compatibility Program, p. 12, Section 3.2.2, paragraph (1&2)]

**Transfer System Specific Gravity Limits.** Waste provided to the transfer managed tank waste system shall not exceed a specific gravity of at least 1.41 SpG. Transfers will be allowed for SpG of 1.41. If the SpG is > 1.41, then a detailed technical evaluation of potential for flammable gas accumulation in the commingled waste shall be performed.

Only transfers in compliance with the flammable gas accumulation decision rule shall be accepted.

A. If the specific gravity (SpG) of the is < 1.3, then the transfer may be allowed; otherwise, determine the weighted mean SpG of the commingled waste.
B. If the weighted mean SpG ≤ 1.41 for the commingled waste, the transfer may be allowed. If the weighted mean SpG> 1.41, perform a detailed technical evaluation of potential for flammable gas accumulation in the commingled waste to determine whether the waste may be transferred and stored safely.

Basis: The basis of the requirement is that the specific gravity of the source and receiving wastes will identify transfers that may lead to flammable gas accumulation. The concern is to safely transfer wastes from one source to the another. The transfer system should be capable of handling, at a minimum, wastes with this SpG. This requirement represents a lower bound for the transfer system.

**Transfer System Specific Gravity Limits Issue 1.** This requirement is derived from the Tank Farm Waste Compatibility Program document which lists the SpG limit at which waste can be safely transferred because of the concern for flammable gas accumulation. It does not represent the maximum SpG that the system shall be capable of handling. At a minimum, the transfer system should be capable of transferring waste with the SpG. This does not preclude the system from being capable of handling wastes with higher SpG but merely represents the lower bound for the system.

**Transfer System Specific Gravity Limits Required Analysis 1.** An analysis of a definitive SpG that the transfer system is capable of handling is required. The analysis should include other indicators of flammable gas accumulation.

**Waste Pumpability.** Waste provided to the transfer managed tank waste system shall comply with the following parameters:

Calculated Reynolds number ($N_{RE}$) for the waste transfer shall be ≥ 20,000;
Volume percent solids shall be ≤ 30%.

The waste pumpability rule is based on the Reynolds number ($N_{RE}$) for the transfer event.

If the $N_{RE} = \rho D v/\mu$ (calculated using density ($\rho$), viscosity ($\mu$), pipe diameter (D), and velocity ($v$) at the conditions of the transfer is $\geq$ 20,000, and the volume percent solids is $\leq$ 30, then the transfer may be allowed. If these conditions can not be met, technical evaluation shall be required to show that plugging of the line will not occur.

Volume percent solids (measured or estimated) and the cooling curve verification of precipitating solids as a function of temperature may also be used to aid in the determination of waste pumpability.

Basis: The requirement was derived based on criteria for waste storage facilities intending to transfer waste without plugging the transfer lines. Waste storage facilities should provide waste that have these characteristics. Transfer systems should be capable of handling waste that, at a minimum, meets the criteria.

**Waste Pumpability Issue 1.** Depending on the individual waste source that the manage transfer tank waste system shall interface with, the physical and chemical properties may differ from source to source.

**Waste Pumpability Required Analysis 1.** Future waste may not exhibit these physical properties. Therefore, an evaluation of the physical and chemical properties of the waste intended for transfer shall be conducted to establish the applicable performance requirement.

[WHC-SD-WM-OCD-015, Rev.1, Tank Farm Waste Transfer Compatibility Program, p. 13, Section 3.2.5, paragraph (1-3)]

**Tank Waste Type (DST Wastes).** Waste sources shall transfer waste in accordance with the following matrix to the extent practicable. Source and receiving waste type shall be evaluated to ensure that tank waste types are compatible prior to initiating waste transfers.

Table 3-6. NCRW Matrix (2 sheets).

| Source Waste Type | Receiver Waste Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | DN | DSSF | DC | CC | (PD) | PT | NCAW | | CP |
| DN | | X | X | | X | X | | X | X | X |
| DSSF | X | X | | | | | | | | |
| DC | | | | | X | X* | | | | |
| CC | | | | | X* | X | | | | |
| NCRW SOLIDS | X | | | | | X | | X | | |
| (PD) | | | | | | | | | | |
| PFP SOLIDS | X | | | | | X | | X | | |
| (PT) | | | | | | | | | | |
| NCAW | | | | | | | | | | X |
| CP | | | | | | | | | | X |

Table 3-6. NCRW Matrix (2 sheets).

| Source Waste Type | Receiver Waste Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | DN | DSSF | DC | CC | (PD) | PT | NCAW | CP |

Notes:

| | |
|---|---|
| DN | dilute non-complexant waste |
| DSSF | double-shell slurry feed |
| DC | dilute complexant waste |
| CC | concentrated complexant waste |
| PD | PUREX neutralized cladding removal waste |
| PT | TRU solids fraction from PFP Plant operations |
| NCAW | aging waste from PUREX |
| CP | concentrated phosphate waste |

X Indicated waste type mixing which has occurred historically without adverse effects.

* Adding CC to DC is permitted but would not ordinarily be done. The volume of combined waste which would need to be evaporated would be increased, resulting in increased evaporation costs.

[WHC-SD-WM-OCD-015, Tank Farm Waste Transfer Compatibility Program; p. 9, section 3.2.1, paragraph (1&2)]

**Cross-site Transfer Tank Operations Information.** Information with respect to tank storage status, routing configurations, and other operational data required to perform cross-site transfers shall be provided for the purposes of operating the cross-site transfer system. Information shall be obtained from the Manage System Information function 4.2.1.1.4 and shall be utilized to perform operations in accordance with DOE 5480.19, Conduct of Operations.

**Transfer System Flush.** Following a waste transfer through a transfer pipeline, the waste generator shall flush the transfer pipeline with a volume of water that is equal to the transfer pipeline volume. Flushing the transfer system achieves the following objectives:

1) Removes the waste in the line.
2) Reduces radiation dose rates of the transfer system.
3) Eliminates the need for a compatibility assessment of the transfer system for a subsequent transfer.
4) Eliminates solids that may have precipitated from a previous waste transfer.
5) Avoids pluggage of the transfer line.
6) Enables corrosion control that provides reliability of the transfer system.

[TWRS F&R Requirement - Transfer System Flush]

**Solution Temperatures Ranges.** The waste solutions shall be transferred to the store in-process waste system at a maximum waste temperatures of 82°C (180°F), if collected in the AP DST Farm, 93°C (200°F) if collected in the AN or AW DST Farms, or 149°C (300°F) if collected in AY or AZ DST Farms.

The primary tank waste temperature limits for each tank farm are limited to prevent excessive stress to the primary tank and vary depending on the particular DST in question.

**Transfer System Temperature Ranges Operations Information.** The waste storage facility shall transfer waste that does not exceed the temperature limits of at least 82.2°C (180°F) and up to 149°C (300°F). Maximum temperatures will vary based on the storage facility that the waste will be sent to.

The primary tank waste temperature limits for each tank are limited to prevent excessive stress to the primary tank and vary depending on the particular DST in question. It can be derived that the temperatures of the wastes to be transferred should not exceed these temperature limits.

Basis: The primary tank waste temperature limits for each tank are limited to prevent excessive stress to the primary tank and vary depending on the particular DST in question. It can be derived that the temperatures of the wastes to be transferred should not exceed these temperature limits.

[WHC-SD-WM-OSR-016, Double Shell Tank Farm IOSRs]
[WHC-SD-WM-OSR-004, Aging Waste Facility IOSRs]

**Waste Characterization Data.** For waste transfers made within the tank farms and transfers made to the tank farms from other sources, specific characterization data shall be required before the transfer is made. If the characterization data is not available, a sampling event, sampling regime and resultant analysis shall be required. Not every analyte is needed to make a transfer decision for a particular waste stream. Table 7-2 located in WHC-SD-WM-DQO-001, Rev.1, Data Quality Objectives for Tank Farms Waste Compatibility Program, shall be used to establish the specific data needs for the transfer event.

All analytical data generated shall be in accordance with the following:

1) 222S Laboratory Quality Assurance Plan
   WHC-SD-CP-QAPP-016, Rev.0
2) The Hanford Quality Assurance Control Manual,
   WHC-CM-4-2, Release 77.
3) TWRS Characterization Program Quality Assurance Program Plan,
   WHC-SD-WM-QAPP-025, Rev.0

**Tank Farms Waste Acceptance.** A Waste Acceptance Plan must be prepared by each waste generator prior to waste transfers into the DST System. Waste acceptance criteria must be established and approved by TWRS Engineering and TWRS Waste Tanks Environmental Compliance prior to returning materials to DSTs.

**Tank Farms Waste Acceptance Issue 1.** Documents regarding the Tank Farm capabilities and the effects of returning wastes (including any additives) must be evaluated to assess additional requirements for inclusion in the "Tank Farms Waste Acceptance" performance requirement.

[WHC-SD-WM-EV-053, Rev.2]

## VOLUME INVENTORY REQUIREMENTS

**DOE5820.2A, Chapter I. 3.b(2)(h).** (h) Engineering controls shall be incorporated to provide liquid volume inventory data and to prevent spills, leaks, and overflows from tanks or containment systems. Examples are level-sensing devices, liquid level alarms, and maintenance of sufficient freeboard. The high-level waste shall be stored at pressures lower than those of ancillary systems (e.g., cooling water).

**DOE 5820.2A, Chapter I, 3.b(4)(d).** (d) For emergency situations involving liquid high-level waste, spare capacity with adequate heat dissipation capability shall be maintained to receive the largest volume of liquid contained in any one tank. Adequate transfer pipelines also shall be maintained in operational condition. Interconnected tank farms with adequate transfer capabilities and spare capacity may be considered as a single tank farm for purposes of this requirement.

**DOE 5820.2A, Chapter I, 3.b (7)(c).** (b)(7)(c) The chemistry of liquid high-level waste shall be adjusted to control corrosion within design limits for the storage system.

**DOE 5820.2A, Chapter I, 3.b(7)(d).** (b)(7)(d) Treatment reagents shall not be placed in a tank system without proven effective mitigative action if they could cause the tank, its ancillary equipment, or the containment system to rupture, leak, or otherwise fail.

**Waste Volume Reduction.** Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Transuranic waste reduction efforts shall be based on the implementation of techniques such as process modification, process optimization, materials substitution, decontamination, assay of suspect waste, and new technology development. Volume reduction techniques, such as incineration, compaction, extraction, and shredding, shall be implemented wherever cost effective and practical. Treatment facilities shall be permitted by the appropriate regulatory authority.

[DOE5820.2A, Chapter II, 3.b(1)]

Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Waste reduction efforts shall include consideration of process modification, process optimization, materials substitution and decontamination.

[DOE5820.2A, Chapter III, 3.c(1)]

**Waste Generation.** Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Waste reduction efforts shall include consideration of process modification, process optimization, materials substitution and decontamination.

(2) Waste Generation Reduction. All DOE-low-level waste generators shall establish auditable programs (goals, incentives, procedures, and reports) to assure that the amount of low-level waste generated and/or shipped for disposal is minimized.

(3) Waste Segregation. Each DOE low-level waste generator shall separate uncontaminated waste from low-level waste to facilitate cost effective treatment and disposal.
(4) Waste Minimization. Each DOE-low-level waste generator preparing a design for a new process or process change shall incorporate principles into the design that will minimize the generation of low-level waste.

[DOE5820.2A, Chapter III, 3.c ]

**Tank Capacity.** The maximum storage capacity in an existing tank shall depend on the tank type. The waste level in the tanks shall be maintained between a maximum limit to prevent overfilling the tank and a minimum level to prevent bottom uplifting of the tanks steel liner.

**Leak/Spill Control.** The owner or operator must use appropriate controls and practices to prevent spills and overflows from tank or containment systems. These include at a minimum: (1) Spill prevention controls (e.g., check valves, dry disconnect couplings); (2) Overfill prevention controls (e.g., level sensing devices, high level alarms, automatic feed cutoff, or bypass to a standby tank); and (3) Maintenance of sufficient freeboard in uncovered tanks to prevent overtopping by wave or wind action or by precipitation.

[40CFR264.194(b)]

**Hazardous Wastes or Treatment Reagents.** Hazardous wastes or treatment reagents must not be placed in a tank system if they could cause the tank, its ancillary equipment, or the containment system to rupture, leak, corrode, or otherwise fail.

[40CFR264.194(a)]

**Static Dome Loading.** The static dome loading shall not exceed the equivalent maximum depth of soil above the tanks measured at the center (crown) of the tank dome and the live load shall not exceed the maximum value as described in Table 3-7 in order to prevent structural damage to tank domes.

Table 3-7. Maximum Soil Depth/Live Loads Above Tanks Double-Shell Waste Storage Tanks (241-AY, AZ Tank Farms).

| Tank Description | Max. Soil Depth | Live Load | Above Tank Max. |
|---|---|---|---|
| AY, AZ | 7 ft. | 100 lb/ft2 uniform load | 50 tons conc. load |

[OSD-T-151-00017, Section 17.2.5 ]

The static dome loading shall not exceed the equivalent maximum depth of soil above the tanks measured at the center (crown) of the tank dome and the live load shall not exceed the maximum value as described in Table 3-8 in order to prevent structural damage to tank domes.

**TRANSFER LEAK DETECTION**

| Variable | Specification Limit |
|---|---|
| Transfer System Leak Detection | Transfer system leak detection shall be verified as operable (not failed) before a transfer is initiated, or applicable diversion boxes/catch tanks shall be constantly surveyed with portable conductivity probes during the transfer. |

Technical Basis: Immediate detection of liquid which has leaked from primary piping to encasement, pits or diversion boxes allows corrective action to be taken promptly to minimize the risk of discharge of contaminants to the environment.

[OSD-T-151-00007, Operating Specifications for the 241-AN, AP, AW, AY, AZ, & SY Tank Farm, P. 19, section 7.2.10]

**Minimum Liquid Level**. A minimum liquid level is set to provide extra protection against any bottom uplifting of the tank's steel liner.

[OSD-T-151-00007, Section 7.2.2 ]

Hydrostatic Head. The minimum hydrostatic head is limited to prevent high stress to and possible uplifting of the tank bottom, jeopardizing tank integrity.

[OSD-T-151-00007, Section 7.2.3 ]

17.3 AGING-WASTE TRANSFER OPERATIONS

17.3.1 Waste Transfer Leak Detection

| Variable | Specification Limit |
|---|---|
| Transfer line leak detection | Transfer line leak detections shall be verified as operable (not failed) before a transfer is initiated, or applicable diversion boxes or catch tanks shall be constantly surveyed with portable conductivity probes during the transfer. |

Technical Basis: See SD-HS-SAR-010 OSR 11.8 Immediate detection of liquid which has leaked from primary piping to encasement, pits, or diversion boxes allows corrective action to be taken promptly to minimize the risk of discharge of radioactive material to the environment.

[OSD-T-151-00017, Operating Specifications for Aging-Waste Operations in 241-AY, and 241-AZ, P. 15, Section 17.3.1 ]

**Pump/Leak Detection Pits.** Annulus pump pits and leak detection pits drain into the associated primary tanks. The pit drains extend to within 5 ft of the primary tank bottoms (H-2-64400). The 64 in. minimum liquid level prevents these drains from being uncovered, thereby creating a path for contaminated vapor to be drawn into the annulus by the annulus ventilation system.

[OSD-T-151-00017, Section 17.2.1.1]

### 3.7.9 Ventilation & Cooling System

**Functional Description:** The ventilation and cooling system shall cool the tank, and maintain the tank at a negative pressure relative to atmosphere for the selected retrieval SSTs storage facilities and the SST Waste Retrieval System. The system must be continuously operational during all sluicing activities. This system shall interface with architectural infrastructure of Waste Storage Facilities, the SST Waste Retrieval System.

The subordinate functions shall be to control and monitor the waste temperature in SSTs to prevent excessive stresses to the primary tank and structural degradation of the concrete shell during the retrieval activities. Control and monitor vapor space pressure in SSTs to prevent over pressurization and under pressurization of the tank and to protect the tank against structural damage during to the retrieval activities.

Included in the system are the selected structures, systems and components necessary to control and mitigate the collection of hazardous gases within the waste retrieval activities, the discharge of hazardous gaseous effluents to the environment, and the effects of excessive heat generation within the selected retrieval tanks.

The discrete elements of the SST Ventilation and Cooling system shall be the monitor and

control instrumentation to measure the differential pressure indication and alarm for high-efficiency particulate air and adsorption filtration units; the tank pressure monitoring and tank ventilation system failure; the isokinetic sampling at the ventilation system exhaust stack; and the emissions monitoring at ventilation exhaust stack to meet 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," Subpart H, and referenced requirements.

**Tank Vapor Pressure**, Maintain the tank vapor space pressure between -0.8 and -15 cm (-0.3 and -5.9 in) water gauge relative to atmospheric pressure during the sluicing operations.

Basis: OSD-T-151-00013, Section 13.2F
The technical basis for this requirement is derived from WHC-SD-RE-TI-012, Single Shell Tank Load Sensitivity Study, pg.18 and WHC-SD-WM-SAR-006, Single Shell Tank Isolation Safety Analysis Report (OSR 11.4.1.1). Tank vapor space pressures are limited to prevent structural damage due to excess tension or compression. The minimum is set will within the Limiting Condition for operation -10 in. w.g.

**Pressure Systems**, the WRS shall provide the systems and equipment capable of maintaining a negative pressure in the SST and confining and filtering hazardous vapors and airborne radioactive particles.

Basis: DOE5820.2A, Chapter I, 3.b(2)(f) and I, 3.b(2)(e)

The pressure in each tank vapor space relative to atmosphere shall be maintained:

a For tanks with => 15 inches WASTE maintain pressure => -15 inches water gauge.

b. For tanks with < 15 but => 6 inches WASTE maintain pressure > the negative of the WASTE height in inches water gauge.

c. For tanks with < 6 inches WASTE maintain pressure > -6 inches water gauge.

[WHC-SD-WM-OSR-005, Rev 0, Sec.2.3]

**Tank Ventilation Confinement**. the WRS shall provide a tank ventilation system to maintain confinement during sluicing operations.

[DOE5820.2A, Chapter I, 3.b(2)(f)]
[DOE5820.2A, Chapter I, 3.c(2)(g)]

**Temperature - Aging Waste DST Waste**
For AY and AZ tanks, waste temperatures shall be less than 300°F.

[WHC-SD-WM-OSR-004, Section L.C.O. 3.2.2]

**Temperature - SST Waste**. For SSTs, the waste temperature shall be 300°F.

[OSD-T-151-00013, Section 13.2.1.E]

**Temperature - Tank Dome.** The maximum tank dome temperature is 250 °F for SSTs (OSD-T-151-00013, section 13.2.1.E) and 240 °F for aging waste DSTs (OSD-T-151-00017, section 17.2.7). The maximum tank dome temperature is not specified for non-aging waste DSTs because the primary tank waste temperatures are limited to 180 °F in AP Farm DSTs and 200 degrees F in AN, AW, and SY Farm DSTs (non-aging waste DSTs). These waste temperature limits preclude dome vapor space from reaching the previously specified non-aging waste tank dome temperature limit of 250 degrees °F.

**Continuous Monitoring and Alarm Requirements.** 1. Timeliness shall be considered when quantifying radionuclides in airborne emissions. The management responsible for the emissions shall determine whether potential offsite radiological impacts require continuous monitoring and alarm capability or if radionuclide record sampling and collection with periodic measurement (e.g., laboratory analysis) conducted according to 2.5.4 requirements is sufficient to quantify the radionuclide emissions.

The determination of monitoring and alarm requirements shall be based upon criteria provided in Table 3-8, Monitoring and Alarm Criteria, which follows, and the explanation of those criteria in items 2, 3, and 4 following. The determination shall be documented in the appropriate facility effluent monitoring plan (FEMP), following the guidance for FEMP preparation in the DOE Order 5400.1 and A Guide for Preparing Hanford Site FEMPs, WHC-EP-0438-01.

The applicable FEMP shall also include a detailed description of any installed continuous monitoring and alarm systems. The design of the monitoring equipment required by this paragraph shall meet the intent of the guidance provided in the ANSI N13.1 and in Chapter 3.0, Section 3.5.8, of DOE/EH-0173T.

Table 3-8. Monitoring and Alarm Criteria.

| Monitoring and Alarm Criteria | | |
|---|---|---|
| Category Projected offsite | effective dose equivalent | Monitoring Requirement |
| 1 | > 0.1 mrem/yr | Continuous monitoring with remote alarms (30 min. checks) |
| 2 | 0.01 - 0.1 | Continuous monitoring with remote alarms (4 hr. checks) |
| 3 | < 0.01 mrem/yr | Continuous sampling if required per Section 2.5.4 (Daily checks) |

Basis: DOE/EH-0173T, Chapter 3, Section 3.5.8 states that timeliness should be considered when quantifying radionuclides in gaseous emissions.

Basis: DOE/EH-0173T, Chapter 3, Section 3.6, states that continuous monitoring systems shall have alarms set to provide timely warnings when concentrations of radionuclides increase significantly.

Basis: WHC best management practice. The purpose of this requirement is to establish methods of identifying subtle changes in emissions concentrations that may precede more severe upset conditions, and conditions that require an immediate response as required by DOE/EP-0096, Section 2.2, page 2.6.

2. The theoretical annual emissions of radionuclides (used to calculate the projected offsite dose) are to include those expected from routine operations at maximum expected capacity combined with those expected from process upsets more likely than not to occur. The theoretical annual emissions are to include the further assumption that no pollution control equipment (e.g., final system of HEPA filters) is in place. The EDE estimate (projected offsite dose) must be calculated using an EPA-approved model. The results must either be approved by the Hanford Environmental Dose Overview Panel (HEDOP) or be based upon unit dose tables previously approved by HEDOP.

Basis: WHC best management practice. The definition of theoretical annual emissions is provided to be consistent with the EPA definition in 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants; Radionuclides," item II. EPA NESHAPs Policy.

3. Those points of airborne radioactive emissions qualifying as Category 1 above shall have a remote alarm permanently installed in an area occupied (or visited and providing alarm checks) at least every 30 minutes.

Basis: WHC best management practice.

4. Those points of airborne radioactive emissions qualifying as Category 2 above shall have a remote alarm permanently installed in an area occupied (or visited and providing alarm checks) at least every 4 hours.

Basis: See 2.5.3(1) bases.

5. Audible and visible indications shall be easily discernible to responsible personnel in continuously or frequently occupied areas described in items 3
and 4, above. These continuous alarm requirements do not apply to emergency backup instruments such as continuous air monitors (CAM) when used during periods of continuous monitor downtime. During such downtime, an inspection of the backup instrument every two hours will be acceptable. (Also, see item 12(c) following).

Basis: DOE/EP-0096, Section 4.3.1.2., states that alarms/annunciators should be located in normally occupied locations.

6. The monitoring systems described above shall be calibrated and maintained according to the requirements of DOE/EH-0173T, Chapter 3.0, Sections 3.3 and 3.5. (Without justification approved by Regulatory Support, all should that are followed by an asterisk (*) in the reference Chapter 3.0 shall be considered shall for the purposes of this section). System calibration for continuous monitoring systems shall be conducted before use, and any system shall be recalibrated any time it is subject to maintenance or modification that may affect equipment calibration. In addition, the system shall be recalibrated at least annually and routinely checked with known sources to determine that it is consistently functioning properly. To the extent allowable while still complying with the requirements of DOE/EH-0173T, calibration(s) should be performed in a manner consistent with manufacturer's instructions and specifications or engineering methods.

Basis: DOE/EH-0173T.

7. Continuous Monitoring Sensitivity.
a. Monitoring systems shall alarm at emission concentrations as low as possible without resulting in an excessive number of alarms due to normal fluctuations in background or normal fluctuations in emissions. The alarms are intended to provide timely warnings when the radionuclide concentration or content of emissions has increased significantly so that corrective actions are required to prevent their exceeding the discharge limits. The alarm settings for a specific facility may be selected by the cognizant engineer of the facility who has detailed knowledge of both its process design and its operating experience. Documentation of the various alarm settings and the bases for their selection shall be provided in the applicable FEMP.

Basis: DOE/EP-0096, Section 2.2, page 2.6, states that strategy for setting action levels must take into account the possibility for gross upset and the possibility for subtle changes in effluent concentration that may precede more severe upset conditions.

Basis: DOE/EH-0173T, Chapter 3.0, Section 3.3.

b. Monitoring systems shall, as a minimum, have the capability to alarm at less than or equal to the time-integrated equivalent concentration equal to a 4-hour release at 5,000 times the DCG-public value, as noted in Appendix C of this manual.

Basis: DOE/EP-0096, Section 2.2, page 2.6., as stated above.

Basis: DOE/EH-0173T, Chapter 3.0, Section 3.6, states that continuous monitoring systems shall have alarms set to provide timely warnings when concentrations of radionuclides increase significantly.

8. Systems for monitoring specific radionuclides (including tritium, C-14, radioiodine, or noble gases) shall follow the guidance of DOE/EH-0173T, Chapter 3.0, Section 3.5.8.

Basis: WHC best management practice. This requirement recognizes the limitations of practical monitoring equipment currently available for some specific radionuclides, while requiring application of reasonable technology as it becomes available.

Basis: 40 CFR 61, Subpart H, Section 61.93(b).

9. Each facility maintenance organization shall maintain access to a record of maintenance, calibrations, system anomalies, etc., for each continuous monitoring instrument at that facility for a period of at least two years. These records shall be maintained in accordance with the records retention requirements of DOE Order 5700.6C and WHC-CM-3-5, as applicable.

Basis: WHC best management practice to support maintenance records and performance trending.

10. Continuous monitoring systems shall be powered from a source that has the same or equivalent emergency capability as the air mover for the effluent stream being monitored.

Basis: DOE/EV/1830-T5, Section 5.4, states that key ventilation systems in a radiological facility must be provided with emergency power.

Basis: WHC best management practice in support of DOE/EH-0173T, Chapter 3.0, Section 3.3. This section states that the performance of airborne emission monitoring systems shall be sufficient to enable the DOE contractor to monitor the release of radioactive materials during accident situations in which the monitored pathway remains functional.

11. The detection portion of continuous emissions monitoring systems shall be inspected daily and source-checked monthly with known sources to ensure it is consistently functioning properly.

Basis: WHC best management practice in support of DOE/EH-0173T, Chapter 3.0, Section 3.3. This section states that the performance of airborne emissions monitoring systems shall be sufficient to enable the DOE contractor to determine whether the emissions of radioactive materials are within the limits specified in DOE Order 5400.5.12. Continuous Monitor Downtime.

a. Loss of required continuous emissions monitoring capabilities shall be corrected as soon as practicable, according to the provisions of this section. Operations with the potential to contribute airborne radionuclide emissions shall be discontinued to the maximum extent compatible with safe operation if continuous monitoring is not restored within 72 hours.

Basis: WHC best management practice in support of DOE/EH-0173T, Chapter 3.0, Section 3.3. This section states that the performance of airborne emissions monitoring systems shall be sufficient to enable the DOE contractor to determine whether the release of radioactive materials is within the limits specified in DOE Order 5400.5.

b. Monitoring system downtime as a result of scheduled maintenance shall be limited to 8 hours in each 24-hour period unless prior approval is obtained from WHC EEM and WHC Occupational Health and Safety.

Basis: WHC best management practice as discussed in item 12(a), above.

c. During periods of monitoring system maintenance or malfunction affecting the stacks listed in 2.5.2.3(1), or in Table 1, facility operations management and WHC Occupational Health and Safety shall be responsible for ensuring that the parameter concerned is analyzed at 2-hour intervals by using a temporary sampling method approved by WHC EEM. Analysis of samples by approved temporary method shall not constitute restoration of monitoring capabilities as required in item 12(a) above, without approval of WHC EEM.

Basis: WHC best management practice, as discussed in item 12(a), above.

[WHC-CM-7-5, CHAPTER 2, 2.5.3]

**Ventilation Point of Discharge Radionuclide Release Control.** Where active ventilation is required, systems shall be provided to maintain radionuclide releases at the point of discharge within the guidelines specified in applicable EH Orders for offsite concentrations and DOE 5480.1B for onsite dose commitment considerations.

[DOE5820.2A, Chapter I, 3.c(2)(e)]

**Emission Filtration and Treatment.** 1. Particulate filtration. a. High-efficiency particulate air (HEPA) filtration is required in all areas of facilities that contain radioactive materials in a dispersible form and in facilities, areas, or containment boundaries that contain unsealed, radioactive material. With WHC EEM concurrence, HEPA equivalent filters or process controls may be used in certain specialized installations. An installed HEPA or HEPA-equivalent filter shall have a leakage rate efficiency of 99.95 percent for removal of airborne particulate, as stated in 2.5.5.2, item 4(a).

Basis: DOE/EV/1830-T5, Section 5.4, states multistage HEPA filtration is required in all areas of facilities that contain radioactive materials in a dispersible form and in facilities, areas, or containment boundaries that contain unsealed, highly radioactive material.

Basis: The Nuclear Air Cleaning Handbook, Section 8.2, states that by definition a HEPA system must exhibit an installed decontamination factor of 2,000; an efficiency of 99.95 percent for aerosols having a nominal median diameter less than 1 micrometer.

b. The number of exhaust filtration stages shall be sufficient to limit concentrations of airborne radioactive particulate released to the environment to less than the limits in 2.5.2.2, and 2.5.2.3, as applicable, during normal conditions and up to, but not including, design basis accident conditions. Determination of the number of exhaust filtration stages shall be performed in accordance with ANSI/ASME N509.

Basis: WHC best management practice in support of the ALARA goals established in 2.5.2.2, and 2.5.2.3.

c. Plutonium processing and handling or storage facilities shall have ventilation systems that are designed to control radioactive air contaminants. Redundant equipment shall be provided in all exhaust systems servicing contaminated and potentially contaminated areas to ensure that failure of any single component or control function does not compromise minimally adequate ventilation. The system shall permit easy, safe access for servicing.

Basis: WHC best management practice to support ALARA.

d. Plutonium processing and handling or storage facilities shall have an additional HEPA filter installed as close as practical to the source of contamination to minimize the contamination of ductwork. This filter does not count as the first stage of the airborne contamination cleaning system.

Basis: WHC best management practice to support ALARA.

2. Radio-iodine treatment.

a. Stationary sources of airborne radioiodine shall use iodine removal systems (charcoal absorbers, silver reactors, etc.) of sufficient capability to ensure compliance with the limits of 2.5.2.

Basis: WHC best management practice in support of the ALARA goals established in 2.5.2.2, and 2.5.2.3.

b. Required charcoal adsorbent shall be located as near the source of radioiodine as practical and shall be located downstream of at least one stage of HEPA filtration or equivalent.

Basis: WHC best management practice established to minimize the contamination of ductwork while maximizing the life span of the charcoal media.

c. Charcoal adsorbent shall not be subjected to exhaust air containing perchlorates or other strong oxidizing agents.

Basis: WHC best management practice to prevent fire and explosion hazards and to prevent chemical flushing of the iodine from the absorbers that may result in exceeding the ALARA limits of 2.5.2.

3. ALARA

At a minimum, the control equipment of all emission units shall represent every reasonable effort to maintain radioactive materials in effluents to unrestricted areas ALARA.

Basis: WAC 173-480-050, "General Standards for Maximum Permissible Emissions."

Testing and Performance Criteria

1. All airborne filtration systems used by WHC other than those built in place (e.g., sand filters) shall be efficiency tested (batch tested) using a DOE-approved test aerosol and according to the applicable approved procedure (e.g., HPS-157-M through -160). Testing of safety class item containment systems shall be conducted according to ANSI/ASME N510 requirements.

Basis: WHC best management practice. This requirement is an internal WHC quality assurance component of the air filtration requirements contained in this section.

2. Scheduling tests

a. On-line effluent filter systems shall have an in-place, WHC-approved particulate filtration efficiency test before initial startup and after each filter change. With the exception of those systems for which an in-place, approved aerosol test frequency of every 18 months has been reviewed and approved by WHC EEM, systems shall be tested at least annually.

Those systems that handle high levels of radioactivity (as judged by the cognizant project engineer in consultation with WHC Occupational Health and Safety) and/or are exposed to extreme hostile environments (as judged by the cognizant engineer and/or designee) such as high moisture loadings, chemical fumes, or high temperatures shall be tested on a semiannual, quarterly, or monthly basis, as dictated by the operational requirements of the system and as approved by WHC Occupational Health and Safety. These conditions shall be documented in the applicable FEMP.

Basis: WHC best management practice based on the guidance in The Nuclear Air Cleaning Handbook, Section 8.3.5, which states that all effluent filter systems should be tested before system startup, following any major repair or modification, and following each filter (absorber) replacement. In addition, active ventilation systems shall be tested annually, and those systems that handle high levels of radioactivity and/or are exposed to moisture loadings or high temperature or chemical fumes shall be tested on a semiannual or quarterly basis.

b. The downstream stage of a set of close-coupled, tandem air filters shall be tested each time the upstream filter stage is replaced.

Basis: WHC best management practice based on the guidance in The Nuclear Air Cleaning Handbook, Section 8.3.5, which states that all effluent filter systems should be tested before system startup, following any major repair or modification, and following each filter (absorber) replacement.

c. The HEPA filter systems installed for use only under emergency conditions or during scheduled maintenance shall be leak tested immediately after installation or replacement and every five years thereafter.

Basis: WHC best management practice based on the guidance in The Nuclear Air Cleaning Handbook, Section 8.3.5, which states that all effluent filter systems should be tested before system startup, following any major repair or modification, and following each filter (absorber) replacement.

d. The schedule system for tests shall be approved by the facility manager. Scheduling actual tests shall be the responsibility of the facility manager and/or designee. All filter systems requiring testing shall be identified as such in the applicable FEMP.

Basis: WHC best management practice to support compliance with DOE Order 5400.5.

e. The facility manager responsible for the activities providing the air emissions shall be responsible for initiating and ensuring corrective actions regarding effluent filtration or treatment systems.

Basis: WHC best management practice to support compliance with DOE Order 5400.5.

f. Iodine removal systems shall demonstrate satisfactory efficiency annually in accordance with item 3(c), below.

Basis: WHC best management practice to support compliance with DOE Order 5400.5.

3. Performance of tests.

a. Each filter stage required by 2.5.5.1 shall be tested individually. Existing multi-stage HEPA filtration systems for which testing of individual stages is precluded by the design shall be tested under procedures and to standards approved in writing by WHC EEM.

Basis: WHC best management practice to support compliance with DOE Order 5400.5.

b. Filter systems required by 2.5.5.1 shall be leak tested in place at the operating flow rate utilizing a DOE-approved test aerosol.

Basis: WHC best management practice to support compliance with DOE Order 5480.10 and RLIP 5480.10.

c. The efficiency of a charcoal absorber or equivalent treatment installation shall be demonstrated by one of the following:

\183\ Annual testing using I-131.

\183\ Continued satisfactory service (e.g., demonstrable efficiencies of 99 percent or greater for absorber installations in facilities that routinely handle radio-iodine).

\183\ Radioiodine concentrations less than limits of 2.5.2 indicated by the stack charcoal cartridge method (or equivalent).

Basis: WHC best management practice to support compliance with DOE Order 5400.5.

4. Filter in-place performance requirements.

a. Filter in-place leak test requirements: All filters required under 2.5.5.1 shall remove at least 99.95 percent of Hanford approved aerosol particles (HPS-157-M) with particle size ranges and median diameter as specified by ASME/ANSI N510.

Basis: The Nuclear Air Cleaning Handbook, Section 8.2, states that by definition a HEPA system must exhibit an installed decontamination factor of 2000; that is, an efficiency of 99.95 percent for aerosols having a median diameter less than 1 micrometer.

b. The HEPA filter cartridges shall be replaced when continuous exposure rates exceed one R/h at six inches (as measured or extrapolated by WHC Occupational Health and Safety) or when the pressure drop across the filter exceeds five inches water gauge (w.g.). Remotely installed HEPA filters shall be replaced when the pressure drop across the filter exceeds five inches w.g. or exposure rates approach the criteria establishing a high radiation area, as defined by WHC Occupational Health and Safety in WHC-CM-4-10.

Basis: The exposure rate portion of this requirement is a best management practice to limit exposure to personnel performing filter changes.

Basis: The requirement for replacement at five inches w.g. is a best management practice consistent with the guidance of The Nuclear Air Cleaning Handbook, Section 2.3.5.

5. he HEPA filter aging should be recognized as sufficient cause for replacement. Filters subjected to extreme conditions should be considered for more frequent replacement.

Basis: DOE/U.S. Nuclear Regulatory Commission (NRC) Nuclear Air Cleaning Conference, "The Effect of Age on the Structural Integrity of HEPA Filters."

6. Automatic dampers, scrubbers, or other equipment that are part of the environmental protection system shall be tested annually, as a minimum, to demonstrate satisfactory performance.

Basis: WHC best management practice to support compliance with DOE Order 5400.5.
[WHC-CM-7-5, CHAPTER 2, 2.5.5]

**Flow Measurement Requirements.** 1. Each point of powered ventilation flow of radioactive air emissions (stack or vent), shall have its flow rate determined at the following times, as a minimum:
1. Prior to any hot startup.
2. Annually, unless experience has shown more frequent determinations to be necessary.
3. After any equipment or process modification that has the potential to significantly alter stack flow rates.
4. Upon completion of any facility in-place leak test.

For points of emission which meet the criteria for continuous emissions measurement as specified in 2.5.4(1), effluent flow rate measurements shall be made using methods specified in Reference Method 2 of 40 CFR 60, Appendix A, for stacks and large vents. Reference Method 2A or 2C, Appendix A, shall be used for small vents.

For all other emission points of powered ventilation flow, good engineering practice shall be used for flow measurement.

Basis: 40 CFR 61, Subpart H, Section 61.93.

Basis: DOE/EH-0173T, Section 3.5.6, "Air Flow Measurements," states that accurate and reliable measurement of the bulk effluent flows are to be obtained consistent with the requirements for sample flow measurement.

2. The manager responsible for the activity providing the emissions, or OMS or WTM (as applicable for each emissions unit) shall forward the flow rate measurement results to the appropriate plant engineering group and to WHC EEM for analysis. Such flow rate data shall be provided within 30 days of measurement to WHC Effluent Emission Monitoring, to support quarterly analysis and reporting by WHC EEM. The flow data shall also be documented in the facility operating log.

Basis: Total flow for each stack or vent is required by WHC EEM for the annual environmental reports to the DOE according to DOE Order 5400.1.
[WHC-CM-7-5, CHAPTER 2, 2.5.6]

**Filter Efficiency: Single HEPA Filter System and Multiple HEPA Filter system for DSTs.**
Filter Efficiency:
Single HEPA Filter System: 99.95% of particles between 0.1 um and 3.0 um, and of average size 0.5 um, are removed per filter.
Multiple HEPA Filter System: 99.95% of particles between 0.1 um and 3.0 um, and of average size 0.5 um, are removed per filter.

[OSD-T-151-00007, 7.3.1.C]

**Maximum Permissible Radionuclides Concentration in Gaseous Emissions.**
The maximum permissible concentration of radionuclides in gaseous emissions from the ventilation system shall be:
1) Annual Average Concentrations: Not to exceed 1 times the DCG-public value of WHC-CM-7-5, Appendix C, at point of release.*
2) Weekly Average Concentrations: Not to exceed 10 times the annual average ACV concentrations for that stack at point of release.*
3) Instantaneous Concentration: Not to exceed 5,000 times the DCG-public value of WHC-CM-7-5, Appendix C, averaged over any four hour period at point of release.
a. Exceptions
Stacks 296-A-17, 296-A-27, 296-A-29: Not to exceed 10 times the DCG value at point of release.*
(For other exceptions see compliance plans to WHC-CM-7-5.)

* Except for krypton-85: Not to exceed a combined release of 4 E+06 Ci/yr.

[OSD-T-151-00007, 7.3.1.E]

**Record Sampling Requirements.** 1. The 40 CFR 61, Subpart H criteria apply to any point of emissions that, if all pollution control equipment did not exist, could provide a maximum offsite exposure of greater than 0.1 mrem/year EDE. The theoretical annual emissions are to include those expected from routine operations at maximum expected capacity and those expected from process upsets more likely than not to occur. The EDE estimate must be made using EPA-approved offsite dose models. The quality assurance requirements of 40 CFR 61, Appendix D, Method 114, shall be addressed regarding the measurement of emissions.

Basis: 40 CFR 61, Subpart H, Section 61.93.

Basis: Quality Assurance Program Plan for Radionuclide Airborne Emission Monitoring Program, WHC-EP-0536.

2. Specific to the stationary sources of emissions which meet the criteria of item 1 above, a quality assurance program shall be conducted that adheres to the methods of 40 CFR 61 Subpart H, Appendix B, Method 114. The quality assurance programs of DOE 5400.1, Chapter IV, Section 10, and those of DOE/EH-0173T, Chapter 10, shall be contained in the "Quality Assurance Program Plan for Radionuclide Airborne Emissions Monitoring

Program" WHC-EP-0536, and any FEMP written to specifically address the stationary source. References by the DOE documents to the requirements of DOE 5700.6B should be replaced by the requirements of its succeeding Order, DOE 5700.6C.

Basis: 40 CFR 61.93(b)(2)(iv), DOE 5400.1, and DOE/EH-0173T item 3.7.

3. Record sampling systems meeting WHC design criteria shall be provided for all airborne emissions that have the potential to exceed 10 percent of any DCG-public value on an annual average, as noted in Appendix C of this manual. "Record sampling" as used in this section means either a continuous record sampler or a continuous monitor that is used for determining actual emissions. All record sampling systems shall be checked daily to ensure the continuous sampling equipment is operational.

For purposes of this section, an exhaust system is required to be record sampled if any feeder stream or any part of the exhaust upstream of the filtration system is contaminated in excess of 10 percent of the DCG-public value on an annual average.

It is the intent of this requirement to provide the means for accurate measurement of airborne emissions of radioactive materials to the environment. All new installation or removal of record sampling capability shall be documented in the applicable FEMP.

NOTE: Requirements for record sampling diffuse sources of airborne radioactivity are contained in Section 5.4 of this manual.

Basis: WHC best management practice in support of DOE/EH-0173T, Chapter 3.0, Section 3.3. This section states that the performance of airborne emissions monitoring systems shall be sufficient to enable the DOE contractor to determine whether the emissions of radioactive materials are within the limits specified in DOE Order 5400.5.

4. For any source of airborne emissions of radioactive materials for which any feeder stream or any part of the exhaust upstream of the filtration system contains airborne concentrations less than 10 percent of the DCG-public value on an annual average, periodic confirmatory measurements shall be made to verify the low emissions. The methods for such confirmatory measurement are not specified. Good engineering judgment should be used.

Basis: 40 CFR 61, Subpart H, Section 61.93(b)(iv)(I)

5. For emission points which meet the criteria of paragraph 3, but not paragraph 1, record sampling systems shall provide representative sampling. Standard error in proportional sampling flow rate shall not exceed applicable ranges referenced in DOE/EH-0173T, Chapter 3.0, Section 3.5. Standard error in any proportional sampling flow rate shall not exceed 20 percent on a continuous basis.

Basis: DOE/EH-0173T, Chapter 3.0, Section 3.5.

Basis: DOE/EP-0096, Section 4.2.1., page 4.6, states that the velocity of the sample at the intake port should be approximately equal (20 percent) to the expected velocity of the air stream being sampled.

6. Each record sampled airborne emission release point shall have a unique identification number, and each record sampler shall have a unique number. WHC EEM shall be responsible for assigning and/or concurrence with these numbers.

Basis: WHC best management practice supporting the annual reporting requirements of 40 CFR 61, Subpart H, and DOE Order 5400.1.

7. For emission points which meet the criteria of paragraph 3, but not paragraph 1, sample probes shall withdraw a representative sample, be downstream of all emissions abatement systems, be configured to minimize sample loss in the sampling system, and be located as close as practical to the point of emission. The design of all sample system components shall follow guidance of the DOE/EH-0173T, Chapter 3.0, Section 3.5. Either Method 1 or 1A of 40 CFR 60, Appendix A, is acceptable for selection of sample probe location dependent upon stack size applicability.

Basis: DOE/EH-0173T, Chapter 3.0.

8. For emission points which meet the criteria of paragraph 3, but not paragraph 1, stack record air samples shall be collected according to the guidance in DOE/EH-0173T, Chapter 3.0, Section 3.5.6. The sample flow rate and sample time shall be sufficient to achieve the analytical requirements of item 9 following. Unless otherwise directed, the samples should be collected at minimum flow rate of 0.06 cubic meters/minute (2 cfm) for a minimum of 1 week (168 hours running time). Any reduction in flow rate or sample collection period will cause a proportional decrease in the sample activity available for analysis.

The flow meter, or the flow volume totalizer when it is a part of the record sampling system, shall be routinely cleaned and calibrated. Unless extenuating circumstances dictate otherwise, this equipment shall be calibrated to within 10 percent of value at the normal operating flow rate at 95 percent confidence interval relative to a standard traceable to the National Institute of Standards and Technology (NIST), or other recognized standards organization. Such calibrations shall occur prior to installation and at least annually thereafter. The flow volume totalizer shall record total sample volume in units of cubic meters except when special arrangements are made with WHC EEM to use other volumetric units. Preventive maintenance on vacuum pumps shall be provided in accordance with the manufacturer's recommendations or maintenance procedures. The frequency shall be according to the manufacturer's recommendations or as determined by a documented evaluation of the system.

Basis: DOE/EH-0173T, Chapter 3.0, Section 3.5.6, states that air flow measurements should be accurate to +10 percent by calibration with NIST standards.

Basis: DOE/EH-0173T, Chapter 3.0, Section 3.5.5, states that pumps and other mechanical components should have scheduled preventative maintenance.

9. Record air sampling systems shall be calibrated when first installed and recalibrated at predetermined intervals dependent upon the accuracy requirements and operating conditions, as specified in the FEMP. However, recalibration shall be completed at least annually or whenever maintenance or modification may affect equipment calibration. Calibration should be to the manufacturer's or cognizant engineer's specifications and applicable portions of ANSI 42.18 standards. If these requirements are not applicable, documentation shall be completed that specifies and justifies any deviations from the FEMP. Calibration should also consider sampling capabilities, physical and operating limits, and reliability. The following requirements also apply.

a. System calibration should include devices in the sample train (flow meter, pressure indicator, volume totalizer, flow alarm switch) necessary for the system to perform its intended function.

b. All records of calibration, conditions of calibration, performance checks, and evaluation shall be maintained at the source for a minimum of two years, and in compliance with WHC record retention requirements. The conditions of calibration include, but are not limited to, number of calibration points, range, traceability to the NIST, and environmental conditions of the sampling location.

Basis: DOE/EH-0173T, Chapter 3.0, Section 3.3, states that sampling and monitoring systems shall be calibrated when installed, recalibrated annually at a minimum, and recalibrated any time they are subjected to maintenance or modification that may affect equipment calibration.

Basis: 40 CFR 61, Section 61.14(f), states that records of monitoring data, monitoring system calibration checks, and the occurrence and duration of any period during which the monitoring system is malfunctioning or inoperative shall be maintained at the source for a minimum of two years.

10. Specific radionuclide analysis shall be performed on quarterly composites of record samples in accordance with the criteria of 40 CFR 61, Appendix B, Method 114, and applicable guidance provided in DOE/EH-0173T, Chapters 6.0 and 7.0.

a. For stacks with the potential to provide 0.1 mrem EDE or greater offsite dose (as calculated by the methods described in 2.5.4, item 1), specific radionuclide analysis shall be required for all radionuclides that could contribute greater than 10 percent of the potential EDE from that release point. The measurements shall be made according to the collection and analysis methods specified in 40 CFR 61.93. With prior EPA approval, the emissions may be measured using alternative procedures.

Basis: 40 CFR 61, Subpart H, and DOE/EH-0173T, Chapter 3.0.

b. Gross alpha and beta measurement should not be used to characterize a sample. Sample

characterization should be done using radionuclide-specific analysis. For the purposes of reporting radiological data, gross radioactivity measurements are generally inadequate. They are appropriate only when one of the following conditions applies: (1) gross radioactivity releases associated with effluent stream provide a small fraction of the offsite dose and are of no health or environmental significance, (2) the relative concentrations of specific radionuclides are so well known by other means that gross radioactivity measurements are truly indicative of the activity being released, or (3) the activity of waste streams is so low as to preclude specific nuclide measurements.

Basis: DOE Order 5484.1, Chapter III, Section 5.c.

c. When the ratio of isotopes present in the discharge is unknown or changing, the isotope not known to be absent and with the most restrictive offsite dose potential, shall be the assumed isotope in any analysis of gross beta/gamma or gross alpha activity.

Basis: DOE Order 5484.1, Chapter III, Section 5.

11. Determine that the type and frequency of effluent sampling shall be adequate to characterize effluent streams.

Basis: DOE Order 5400.1, Chapter IV, paragraph 5.1(2)(b).

12. Record sampling system designs shall be reviewed and approved by WHC EEM prior to construction or modification. Record sampling systems should be installed to operate separately from monitoring systems.

Basis: WHC best management practice. WHC EEM has the primary responsibility for record sampling design oversight within WHC.

13. The WHC managers responsible for activities providing emissions to air shall be responsible for developing and maintaining record sampling schedules. Record sampling schedules shall be approved by WHC EEM. Changes to the record sampling schedule, including temporary or one-time deviations, shall be pre-approved by WHC EEM.

Basis: WHC best management practice. WHC EEM has the primary responsibility for environmental record sampling schedule oversight within WHC.

14. Record sampling system downtime.

a. Loss of emissions record sampling capabilities required by the provisions of this section shall be corrected as quickly and efficiently as practicable. Operations with the potential to contribute airborne radionuclide emissions shall be discontinued to the maximum extent compatible with safe operations if a WHC EEM-approved record sampling method is not operational within 8 hours and if continuous record sampling is not restored within 72 hours.

Basis: General Regulation 80-7, Section 400-120, states that a stationary source may be temporarily exempted from the sampling and reporting requirements during a period of

sampling system malfunctions, provided that the source owner or operator shows to the satisfaction of the local air authority that the malfunction was unavoidable and is being repaired as expeditiously as practicable.

Basis: DOE/EH-0173T, Chapter 3.0, states that the performance of airborne effluent sampling systems shall be sufficient to enable the DOE contractor to determine whether the release of radioactive materials is within the limits specified in DOE Order 5400.5.

Basis: The time periods allowed prior to the required actions reflect best management practice to support compliance.

b. The loss of record sampling capabilities as a result of scheduled maintenance shall be limited to 8 hours during any 24-hour period. This requirement does not preclude the use of alternative record sampling methods approved by WHC EEM.

Basis: WHC best management practice. The time period allowed above supports compliance with the basis requirements listed for item a, above.

[WHC-CM-7-5, CHAPTER 2, 2.5.4]

**Tank Ventilation System - Filtration System.** Tank ventilation system through which gaseous effluents are released to the environment shall adhere to the following filtration requirements:

| Variable | Specifications |
|---|---|
| 1. Gaseous Effluent Filtration | |
| a. HEPA Filter Stages | All tanks on active ventilators shall have two stages of High Efficiency Particulate Air (HEPA) filtration in the outlet stream.<br><br>Air inlets for active ventilation systems shall be HEPA filtered |
| b. Passive Ventilation | All SSTs shall be passively ventilated using HEPA breather filters even if active ventilation is temporarily installed |
| 2. Filter Differential Pressure | |
| a. First filter in a series | Maximum 5.9 in. wg<br>Minimum 0.05 in. wg |
| b. Other filter in a series | Maximum 4.0 in. wg<br>Minimum 0.05 in. wg |
| c. Total series of filters | Maximum 5.9 in. wg<br>Minimum 0.05 in. wg |

Differential pressure is defined as the drop in pressure from the inlet to outlet of a filter (or series of filters)

3. HEPA Filter Temperature Maximum 200 oF

4. HEPA Filter Testing and Efficiency

a. Efficiency Minimum 99.95% for 0.3 m particles

b. Testing Frequency The following conditions shall require that the filter system be aerosol tested:

1) System is low
2) System is moved
3) Filter(s) replaced
4) System has been off over 60 days
5) Every 12 +- 1 month during use (maybe tested more often)

[OSD-T-151-00013, Section 13.2.2]
[OSD-T-151-00011, Section 11.3.B]
[OSD-T-151-00008, Section 8.3]
[OSD-T-151-00015, Section 15.2.C]
[OSD-T-151-00007, Section 7.3.1]

**Discharge Radionuclides in Air.** 1. The emission of radionuclides in air from the combined discharge of all WHC-managed facilities and all other facilities on the Hanford Site shall not exceed those amounts that would cause an effective dose equivalent (EDE) of 10 mrem/year to any member of the public during any 12-month period. Doses due to Rn-220, Rn-222, and their respective decay products are excluded from these limits. Doses due to Rn-220, Rn-222, and their respective decay products are subject to DOE limits.
Basis: DOE/EH-0173T, page 3-3, Section 3.2, states that DOE facilities are subject to the regulations of the EPA and specifically names 40 CFR 61 as the primary regulation for control of atmospheric emissions.

Basis: 40 CFR 61.92 states that emissions of radionuclides to the ambient air from DOE facilities shall not cause an EDE greater than 10 mrem/yr to any member of the public. Doses due to Rn-220, Rn-222, and their respective decay products are excluded from these limits.

Basis: WAC 173-480 states that emissions of radionuclides to the ambient air shall not cause an EDE greater than 25 mrem/yr to any member of the public. It continues that the most stringent of a federal or state statute shall govern, so 40 CFR 61.92 is the enforced standard. Doses due to Rn-220, Rn-222, and their respective decay products are excluded from these limits.

Basis: DOE Order 5400.5, Chapter II, paragraph 1.b, states that doses due to Rn-220, Rn-222, and their respective decay products are subject to DOE limits. (See both Figure III-3 and paragraph IV.5b of DOE Order 5400.5).

2. Individual airborne emissions shall not result in the annual average concentration at any ground-level ambient location or other occupied area exceeding any DCG-public value specified in Appendix A of this manual. Facilities shall enforce appropriate administrative controls that consider atmospheric conditions relative to operations for the purpose of ensuring compliance with this requirement.

3. Noble Gases.

a. The annual discharge of Kr-85 from all 200 Area emissions units shall not exceed a combined release of 4 E+06 Ci/yr.
Basis: Kr-85 is released during fuel dissolution in the PUREX process. All the krypton produced in the process is released to the atmosphere. The limit of 4 E+06 Ci/yr is based on an offsite dose (CAP-88) calculation that assumes the krypton is released from the 291-A-1 PUREX main stack. The resulting offsite dose consequence is calculated to be 3.19 E-02 mrem EDE.

b. The discharge of radon (including thoron) and the resultant decay products shall be ALARA. The ALARA-based ACV limit for discharge of Rn-220 or Rn-222 from all WHC facilities combined should not exceed 5 E-06 _Ci/ml on an annual average basis.

Basis: The PUREX Plant is one of the primary sources of radon emissions at the Hanford Site. Operating experience has shown that during operation, Rn-220 emissions from PUREX reached 4 E-06 _Ci/ml as a maximum concentration, and averaged 1 E-07 _Ci/ml. Abatement of radon has not been considered a reasonable control technology, so to support an ALARA level of radon emissions, the maximum annual average concentration was established at 5 E-06 _Ci/ml. The limit of 5 E-06 _Ci/ml was compared with an assumed release of that amount from a 89-meter stack from the PUREX Plant at the average flow rate from the plant. The maximum estimated annual offsite dose, based upon a CAP-88 calculation, is 2.1 mrem EDE which represents less than 25% of the offsite dose standard.
[WHC-CM-7-5, 2.5.2.1(1-3)]

### 3.7.10 Monitor and Control

**Functional Description:** The Waste Retrieval System shall provide, monitor, and control the structures, systems, and components including software and personnel, necessary to monitor and display the physical parameters and the behavior of the select retrieval storage tank, the associating tank farm facilities, the designated DST storage tank and all transfer operations. Monitoring and control may be manually or automatically performed.

**3.7.10.1 Monitor and Control Requirements.** A schedule and procedure shall be developed for monitoring, surveillance, and calibration checks. The frequency of these activities shall be based on the potential rate of equipment deterioration and the possibility of an environmental or human health incident, assuming that a malfunction from equipment failure or human error is not detected between checks. Schedules, procedures, and performance requirements shall be documented in the operating and maintenance documentation

[DOE5820.2A, Chapter I, 3.b(4)(e)]

Monitoring and surveillance capability shall exist to provide liquid volume, waste inventory data, and identification of failed containment.

[DOE5820.2A, Chapter I, 3.c(3)(a)]

A method for periodically assessing waste storage tank integrity (e.g., coupons, photographic inspections, leak detectors, liquid level devices) shall be established and documented.

[DOE5820.2A, Chapter I, 3.c(3)(b)]

Engineering controls shall be incorporated to provide liquid volume inventory data and to prevent spills, leaks, and overflows from tanks or containment systems. Examples are level-sensing devices, liquid level alarms, and maintenance of sufficient freeboard. The high-level waste shall be stored at pressures lower than those of ancillary systems (e.g., cooling water).

[DOE5820.2A, Chapter I, 3.b(2)(h)]

### 3.7.11 Decontaminate ISSTRS Equipment

**Functional Description:** ISSTRS shall decontaminate equipment suitable for re-use. All ISSTRS equipment shall be relinquished to Tank Farm Operations.

**3.7.11.1 Decontaminate ISSTRS Equipment Requirements.** The ISSTRS equipment that has been contaminated with tank waste and /or radioactive materials. This equipment must be characterized, inventoried, and dispositioned as reusable equipment, or waste.

**Categorize the Out-of-Service, Reusable, and Inaccessible Out-of-Service Equipment.** The categorized equipment shall be dispositioned per the Management of Contaminated Equipment at the Hanford Site (DOE-RL, 1995); and the TWRS Abandoned Equipment Storage/Disposal Plan (WHC 1995d). Above ground, out-of-service contaminated equipment that is not reusable and is inaccessible or difficult to remove (based on the risk and cost involved) shall be sealed to prevent contamination spread.

All above- ground, out-of service contaminated equipment that is not reusable shall be inventoried and dispositioned. Dispositioning in most cases will require characterizing the waste constituents, removing and packaging the equipment as waste, and designating the waste containers in accordance WAC 173-303.

Reusable contaminated equipment shall be managed in accordance with as-low-as reasonably-

achievable (ALARA) guidelines and the WAC 173-303 requirements relevant tot he storage of dangerous wastes (Where appropriate).

[WHC-SD-WM-DRD-009, Rev.0, Controlled, Clean and Stable, pg. 3-11]

### 3.7.12 Stabilize Retrieved Single Shell Tank.

ISSTRS shall implement all applicable requirements to stabilizing the selected ISSTRS retrieval tanks. This includes intrusion prevention, flammable gas monitoring equipment and tank exhausters installed on all Watch List SSTs, safety assessments, corrective actions for mitigating and/or resolving the hazards to ensure stabilization is complete. ISSTRS shall provide an acceptable condition that is controlled, and stable environment for the retrieved SSTs. Controlled sub-elements shall be repair/upgrade the active and passive systems to operable by the basis authorization documents; and provide remote monitoring capability. Stable sub-elements shall be to remove pumpable interstitial liquid from SSTs; comply with the interim stabilization criteria; and comply with intrusion prevention criteria.

#### 3.7.12.1 Stabilize Retrieved Single Shell Tanks Requirements.

**Prevent Intrusion into ISSTRS Demonstration Tanks..** Intrusion Prevention includes disconnecting and blanking or capping pipelines from tank systems, and disconnecting, capping and sealing applicable risers and pipelines per the following criteria listed in the Tank WASte Remediation System Administration Manual, WHC-IP-0842, Volume IV, Section 4.2:

- Risers terminating above-grade or less than 3 ft below-grade shall be sealed; and
- Pits, cells, and vaults for tanks with riser/piping systems terminating in confined area shall have confinement covers installed and sealed.

**Interim Stabilize the ISSTRS Demonstration Tanks.** The ISSTRS demonstration tanks condition shall satisfy the acceptance criteria from the Tank Waste Remediation System Administration Manual, WHC-IP-0842, Volume IV, Section 4.1.

- Each tank contains less than 50,000 gallon of Drainable Interstitial Liquid, based on either a 45% porosity, or on the porosity determined during actual pumping;
- Each tank contains less than 5,000 gallon of supernatant; and
- The pumping rate has decreased to less than 0.05 gal/min, or inflow in the saltwell screen has decreased to less than 0.05 gal/min, and the tank has less than 50,000 gal of Drainable Interstitial Liquid remaining.

[WHC-SD-WM-DRD-009, Rev.0, Controlled, Clean and Stable, pg. 3-13]

## 3.8 PRECEDENCE

The hierarchical relationship among requirements specified in section 3 is provided in this section. This relationship among requirements specified in section 3 is as follows, except in those instances where Washington state has been granted regulatory authority by the U.S Government:

- Federal Laws (e.g., Code of Federal Regulations)
- Revised Code of Washington (RCW) as specified in Washington Administrative Code
- Local Ordinances
- U.S. Department of Energy Orders and Secretary of Energy directives
- National Consensus Codes and Standards

## 3.9 QUALIFICATION

[RESERVED].

## 3.10 STANDARD SAMPLE

[RESERVED].

## 3.11 PREPRODUCTION SAMPLE, PERIODIC PRODUCTION SAMPLE, PILOT LOT

[RESERVED].

This page intentionally left blank.

## 4.0 QUALITY ASSURANCE PROVISIONS

This function shall adhere to the applicable requirements of 10 CFR 830, "Nuclear Safety Management, Subpart A, General Provisions, Section 830.120, Quality Assurance Requirements," Code of Federal Regulations. In accordance with these requirements, the project shall develop a project specific Quality Assurance Program Plan (QAPP) encompassing the following program elements as applicable to the project:

Program
Personnel Training and Qualifications
Quality Improvement
Documents and Records
Work Processes
Design
Procurement
Inspection And Acceptance Testing
Management Assessment
Independent Assessment.

The QAPP shall be submitted to DOE for approval.

All subcontractors providing services for the function, such as: architect and engineering (A-E) services, Construction Management (CM) services, and testing services in support of technology development shall be required to have or develop a QAPP compatible with the requirements of 10 CFR 830.120, as specific to the subcontractors area of responsibility. As long as the program is compatible with the above referenced requirements, it's bases can be founded in existing consensus standards, such as: ASME NQA-1, 10 CFR 50 Appendix B, and the ISO 9000 series. All subcontractor QAPPs shall be submitted to the WHC for review and concurrence.

[TWRS F&R Requirement - Quality Assurance Plan]

Consistent with DOE Order -5700.6B, high-level waste operations shall be conducted in accordance with applicable requirements of the American National Standards Institute/American Society of Mechanical Engineers Nuclear Quality Assurance-1 and other appropriate national consensus standards. (See Attachment 1, page 5, paragraph 48).

[DOE5820.2A, Chapter I, 3.b(6)
DOE5820.2A, Chapter I, 3.c(6)]

## 4.1 RESPONSIBILITY FOR INSPECTION

At least weekly, the owner or operator must inspect areas where containers are stored, looking for leaking containers and for deterioration of containers and the containment system caused by corrosion, deterioration, or other factors.

[WAC173-303-630(6)]

The owner or operator must develop and follow a schedule and procedure for inspecting overfill controls. (b) The owner or operator must inspect at least once each operating day: (i) Above ground portions of the tank system, if any, to detect corrosion or releases of waste; (ii) Data gathered from monitoring any leak detection equipment (e.g., pressure or temperature gauges, monitoring wells) to ensure that the tank system is being operated according to its design; and (iii) The construction materials and the area immediately surrounding the externally accessible portion of the tank system, including the secondary containment system (e.g.,dikes) to detect erosion or signs of releases of dangerous waste (e.g., wet spots, dead vegetation).

[WAC 173-303-640(6)(a)]

## 4.2 SPECIAL TESTS AND EXAMINATIONS

Table 4-1 correlates the requirements of section 3.3.0 with the method to be used to comply with the requirements. Documentation of compliance will be accomplished through the use of detailed procedures to be developed and performed on all procured, constructed, and developed equipment, structures, and software.

The methods of compliance to be used are:

A. **Analysis.** Analysis is the process needed to verify a requirement by rational thinking, tradeoff studies, modeling, and processing test data and accumulated results to reach a conclusion. Analysis involves the processing of accumulated results and conclusions, intended to provide proof that verification of a requirement has been accomplished. The analytical results may be comprised of a compilation or interpretation of existing information or derived from lower level examinations, tests, demonstrations, or analyses.

B. **Examination.** Examination is the process of investigating a product to verify that required features are incorporated. Examination consists of investigation, without the use of special laboratory appliances, procedures, supplies, or services, to determine conformance to those specified requirements which can be determined by such investigations. Examination is generally nondestructive and includes, but is not limited to, visual, auditory, olfactory, tactile, and other investigations; simple physical manipulation; gauging; and measurement.

Table 4-1. Verification Matrix (6 sheets).

| Section 3.0 Paragraph | Title | N/A | A | E | T | D |
|---|---|---|---|---|---|---|
| 3.2.1 | Performance Characteristics | X | | | | |
| 3.2.1.1 | ISSTRS Tank Farm Retrieval Demonstration | | | | | X |
| 3.2.1.1.1 | ISSTRS Total Waste Volume | | X | | X | |
| 3.2.1.1.2 | ISSTRS Productivity Rate | | X | | X | |
| 3.2.1.1.3 | Tank-To-Tank Sluicing | | X | | X | |
| 3.2.1.1.4 | SST Selection | | X | | X | X |
| 3.2.2 | System Relationships | X | | | | |
| 3.2.3.1 | Physical Descriptions | X | | | | |
| 3.2.3.1.1 | ISSTRS Selected DST Receiving Storage Facility | | | X | | |
| 3.2.3.1.2 | ISSTRS Selected SST Retrieval Tank's Sluice and Pump Pits | | | X | | |
| 3.2.3.1.3 | ISSTRS and Existing Waste Transfer System | | X | | | X |
| 3.2.3.1.4 | ISSTRS and Existing Valve Pits/Diversion Boxes | | X | X | | |
| 3.2.3.1.5 | ISSTRS and Existing Power Systems | | X | X | | |
| 3.2.3.1.6 | ISSTRS and Existing Raw Water System | | | | X | |
| 3.2.3.1.7 | ISSTRS and Existing Fire Protection | | X | | | |
| 3.2.3.2.1 | Tank Operations Information | | X | | X | |
| 3.2.3.2.2 | Raw Materials for Retrieve SST Waste | | X | | | |
| 3.2.3.2.3 | Tank Waste Characterization Information | | X | | X | |
| 3.2.3.2.4 | ISSTRS Waste Characterization Requirements | | | | X | |
| 3.2.3.2.5 | ISSTRS Retrieved In-Tank Hardware | | | X | X | |
| 3.2.3.2.6 | ISSTRS Treated Gaseous Effluents | | | | X | |
| 3.2.3.2.7 | ISSTRS Treated Liquid Effluents | | | | X | |
| 3.2.3.2.8 | ISSTRS Retrieved Tank Waste | | X | | X | |
| 3.2.3.2.9 | ISSTRS Recycled Decant liquid for Retrieval | | X | | X | |
| 3.2.3.2.10 | ISSTRS Prepared Solid Waste | | | | X | |
| 3.2.3.2.11 | ISSTRS Excess Facilities | X | | | | |
| 3.2.4 | Physical Characteristics | X | | | | |

Table 4-1. Verification Matrix (6 sheets).

| | | | | | | |
|---|---|---|---|---|---|---|
| 3.2.4.1 | Protective Coatings | | X | X | X | |
| 3.2.4.2 | Site Boundary | | X | | | |
| 3.2.4.3 | Land Use | | X | X | | |
| 3.2.5 | Project Quality | X | | | | |
| 3.2.5.1 | Reliability | | | X | X | |
| 3.2.5.1.1 | Failure Mode and Effects | | X | | | |
| 3.2.5.1.2 | Fault Tree Analysis | | X | | | |
| 3.2.5.2 | Maintainability | | | X | X | |
| 3.2.5.3 | Availability | | X | X | X | |
| 3.2.5.4 | Operability and Maintainability | | X | | X | |
| 3.2.5.4.1 | Operations and Maintenance Considerations | | X | X | | |
| 3.2.5.4.2 | Contaminated Equipment Maintenance | | X | X | X | |
| 3.2.5.4.3 | High Dose-Rate Areas Equipment Maintenance | | X | X | X | |
| 3.2.5.4.4 | Remote Maintenance Equipment | | X | X | X | |
| 3.2.6 | Environmental Conditions | | X | | | |
| 3.2.6.1 | Natural Environments | | | | | X |
| 3.2.6.1.1 | Ashfall | | | X | | |
| 3.2.6.2 | Induced Environments | X | | | | |
| 3.2.6.2.1 | Radiation and Chemical | | X | | X | |
| 3.2.6.2.2 | Internal-Radionuclide | | | | X | |
| 3.2.6.2.3 | Internal-Waste Chemical Characteristics | | | | X | |
| 3.2.6.2.4 | Internal-Waste Physical Properties | | | | X | |
| 3.2.7 | Transportability | X | | | | |
| 3.2.7.1 | Packaging and Marking of Materials for Transportation | | | X | | |
| 3.2.8 | Flexibility and Expansion | | | | X | X |
| 3.2.9 | Portability (Reserved) | X | | | | |
| 3.3 | Design and Construction | | | | | X |
| 3.3.1 | Materials, Process and Design Practices | X | | | | |
| 3.3.1.1 | Facility Design and Shielding Criteria | | X | | X | X |
| 3.3.1.2 | Support Devices | | | | | X |
| 3.3.1.3 | Structural Supports | | | | | X |
| 3.3.1.4 | Air Control for Contaminated Areas | | | | | X |

Table 4-1. Verification Matrix (6 sheets).

| | | | | | | |
|---|---|---|---|---|---|---|
| 3.3.1.5 | Retrieval Construction and Operations Solid Waste | | X | X | | |
| 3.3.1.6 | Facility Fire Water System | | | X | X | |
| 3.3.1.7 | Fire Hazards Analysis | | X | | | |
| 3.3.1.8 | Power Systems | | X | X | | |
| 3.3.1.9 | Containment System Design | | | X | | X |
| 3.3.1.10 | Cathodic Protection | | | X | | |
| 3.3.1.11 | Corrosion Control | | | | X | |
| 3.3.1.12 | Monitoring and Control Systems | | | | X | |
| 3.3.1.13 | Monitor SST Waste Leakage during Retrieval | | | X | X | |
| 3.3.1.14 | Mitigate SST Waste Leakage during SST Waste Retrieval | | | | X | |
| 3.3.1.15 | Retrieval Ventilation System | | | X | X | |
| 3.3.1.16 | Materials | | | X | X | X |
| 3.3.1.17 | Toxic Products and Formulations | | | | X | X |
| 3.3.2. | Radiation | X | | | | |
| 3.3.3 | Name Plates and Product Markings | | X | | | |
| 3.3.4 | Workmanship | X | | | | |
| 3.3.5 | Interchangebility | X | | | | |
| 3.3.6 | Safety | X | | | | |
| 3.3.6.1 | Fire Protection | | X | | | |
| 3.3.6.2 | ALARA | | X | | | |
| 3.3.6.3 | Design for Safety | | X | | | X |
| 3.3.7 | Human Engineering | | | X | | X |
| 3.3.8 | Nuclear Control | X | | | | |
| 3.3.8.1 | Criticality | | X | | | |
| 3.3.9 | System Security | | X | X | | |
| 3.3.3.10 | Government Furnished Property Usage (Reserved) | X | | | | |
| 3.3.3.11 | Computer Resource Reserve Capacity (Reserved) | X | | | | |
| 3.4 | Information | | X | | | |
| 3.5 | Logistics | | | | | |
| 3.5.1 | Maintenance | | | X | X | |
| 3.5.2 | Transportation of Hazardous Materials | | | X | X | |

Table 4-1. Verification Matrix (6 sheets).

| | | | | | | |
|---|---|---|---|---|---|---|
| 3.5.3 | Waste Handling, Storage and Disposal | | | X | X | X |
| 3.6 | Personnel and Training | X | | | | |
| 3.6.1 | Personnel | | X | | | |
| 3.7 | Characteristics of Subordinate Elements | X | | | | |
| 3.7.1 | System Definition | X | | | | |
| 3.7.1.1 | Detect SST Waste Leakage During Retrieval | | | X | X | |
| 3.7.1.2 | Detect SST Waste Leakage During Retrieval Requirements | | | X | X | |
| 3.7.2 | Monitor SST Waste Leakage During Retrieval | | | | X | |
| 3.7.2.1 | Monitor SST Waste Leakage During Retrieval Requirements | | | | X | |
| 3.7.3 | Mitigate SST Waste Leakage During Retrieval | | X | | X | |
| 3.7.3.1 | Mitigate SST Waste Leakage During Retrieval Requirements | | X | | X | |
| 3.7.4 | Remove Limited SST Waste | | X | | | X |
| 3.7.4.1 | Remove Limited SST Waste Requirements | | X | | | X |
| 3.7.5 | Remove In-Tank Hardware | | X | | X | X |
| 3.7.5.1 | Remove In-Tank Hardware Requirements | | X | | X | X |
| 3.7.6 | Deploy Retrieval System | | | X | X | |
| 3.7.6.1 | Deploy Retrieval System Requirements (Reserved) | X | | | | |
| 3.7.7 | Mobilize Waste | | X | X | X | |
| 3.7.7.1 | Mobilize Waste Requirements | | X | X | X | |
| 3.7.8 | Convey and Transfer Waste | | X | | X | |
| 3.7.8.1 | Convey and Transfer Waste Requirements | | X | | X | |
| 3.7.9 | Ventilation and Cooling System | | | | X | X |
| 3.7.10 | Monitor and Control | | X | | X | |
| 3.7.10.1 | Monitor and Control Requirements | | X | | X | |
| 3.7.11 | Decontaminate ISSTRS Equipment | | | | X | |
| 3.7.11.1 | Decontaminate ISSTRS Equipment Requirements | | | X | X | |
| 3.7.12 | Stabilize Retrieved SST | | | X | X | |
| 3.7.12.1 | Stabilize Retrieved SST Requirements | | | X | X | |

Table 4-1. Verification Matrix (6 sheets).

| | | | | | | |
|---|---|---|---|---|---|---|
| 3.8 | Precedence | X | | | | |
| 3.9 | Qualification (Reserved) | X | | | | |
| 3.10 | Standard Sample (Reserved) | X | | | | |
| 3.11 | Preproduction Sample, Periodic Production Sample, Pilot Lot (Reserved) | X | | | | |
| 4.0 | Quality Assurance Provisions | | X | | | |
| 4.1 | Responsibility For Inspections | | X | X | X | |
| 4.2 | Special Tests and Examinations | X | | | | |
| 4.3 | Requirements Cross Reference | X | | | | |
| 5.0 | Preparation for Delivery or Operations (Reserved) | X | | | | |

N/A - Not applicable
A - Analysis
E - Examination
T - Testing
D - Demonstration

C. **Test.** Test is the quantitative process whereby data is collected over a specified time period, under controlled conditions, in order to document the as-built performance of a product. A test denotes the determination of the properties or elements of items (or components thereof) by technical means, including functional operation, the application of established principles and procedures and the collection of quantitative data. The analysis of data derived from testing is an integral part of the method.

D. **Demonstration.** Demonstration is the qualitative process of exercising a product to verify its operability, where data may or may not be collected. Demonstration differs from test by directness of approach in the verification of a requirement and is accomplished without the use of instrumentation or special equipment. Thus, operation of a representative item in or near its use environment would be defined as a Demonstration rather than a Test. Demonstration attempts to verify, qualitatively, the performance of a function, where as Test involves verifying performance within a specific range of measurement.

When more than one method of compliance is marked in Table 3-3, compliance must be verified by one or more of the methods marked.

## 4.3 REQUIREMENTS CROSS REFERENCE

Table 4-2 provides a cross reference matrix that describes the requirement, requirement source, and corresponding section paragraph.

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| **Performance Requirements** | | |
| 3.2.3.2.6 | 40 CFR 50.9 | Primary and Secondary Ambient Standards for Ozone |
| 3.2.3.2.6 | 40 CFR 50.8(a) | Primary Ambient Air Quality Standards for Carbon Monoxide |
| 3.2.3.2.6 | 40 CFR 50.6 | Primary and Secondary 24-hour Ambient Air Quality Standards for Particulate Matter |
| 3.2.3.2.6 | 40 CFR 50.5 | Primary and Secondary Ambient Standards for Sulphur Dioxide |
| 3.2.3.2.6 | 40 CFR 50.4 | Primary and Secondary Ambient Standards for Sulphur Dioxide |
| 3.2.3.2.6 | 40 CFR 50.12 | Primary and Secondary Ambient Standards for Lead |
| 3.2.3.2.6 | 40 CFR 50.11(a-b) | Primary Ambient Air Quality Standards for Nitrogen Dioxide. |
| 3.2.2.2 | WHC-SD-WM-FRD-020 | Raw Materials for Retrieve SST Waste |
| 3.2.2.3 | WHC-SD-WM-FRD-020 | Tank Waste Characterization Information |
| 3.2.2.4 | WHC-SD-WM-FRD-020 | Waste Characterization Requirements |
| 3.2.2.5 | WHC-SD-WM-FRD-020 | Retrieved In-Tank Hardware |
| 3.2.2.6 | WHC-SD-WM-FRD-020 | Treated Gaseous Effluents |
| 3.2.2.7 | WHC-SD-WM-FRD-020 | Treated Liquid Effluents |
| 3.2.2.8 | WHC-SD-WM-FRD-020 | Retrieved Tank Waste |
| 3.2.2.9 | WHC-SD-WM-FRD-020 | Recycled Decant Liquid for Retrieval |
| 3.2.3.1.1 | WHC-SD-WM-FRD-020 | Selected DST Receiving Storage Facility |
| 3.2.3.1.2 | WHC-SD-WM-FRD-020 | Selected SST Retrieval Tank's Sluice and Pump Pits |
| 3.2.3.1.3 | WHC-SD-WM-FRD-020 | Existing Waste Transfer System |
| 3.2.3.1.4 | WHC-SD-WM-FRD-020 | Existing Valve Pits/Diversion Boxes |
| 3.2.3.1.5 | WHC-SD-WM-FRD-020 | Existing Power Systems |
| 3.2.3.1.6 | WHC-SD-WM-FRD-020 | Existing Raw Water System |
| 3.2.3.1.7 | WHC-SD-WM-FRD-020 | Existing Fire Protection |
| 3.2.3.2.5 | WHC-CM-7-5, Chapter 7, 6.5.2 | Threshold Doses and/or Concentrations |
| 3.2.3.2.5 | WHC-SD-WM-FRD-020 | Solid Radioactive Waste Transfer |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.2.3.2.6 | 40 CFR 264.1032(a)(1) | Hazardous Waste Treatment of the Organic Concentrations |
| 3.2.3.2.6 | WAC-173-460 | Toxic Air Emission |
| 3.2.3.2.6 | DOE 5820.2A, chapter III, 3.e(4) | Waste Certification |
| 3.2.3.2.6 | WAC-173-400 | General Regulations for Air Pollution Sources |
| 3.2.3.2.7 | 200 Area TEDF Waste Acceptance Criteria | Treated Effluent Disposal Facility |
| 3.2.3.2.7 | SWDP Permit 4502 and Fact Sheet | 200 Area Treated Effluent Disposal Facility Permit Requirements from the State Waste Discharge Section. |
| 3.2.3.2.8 | WHC-SD-WM-FRD-020 | Quantity of Retrieved Tank Waste |
| 3.2.3.2.9 | WHC-SD-MAR-008 | HLW Constituents Limitations |
| 3.2.3.2.9 | E/B-SD-W236B-RPT-022, rev. 0 | Recycle of Water |
| 3.2.3.2.11 | DOE 5820.2A, Chapter V, 3.a | Program Development |
| 3.2.3.2.11<br>3.4<br>3.7.11.1 | DOE 5820.2A, Chapter V, 3.a(2) | Operation Records for Decommissioning |
| 3.2.3.2.11<br>3.7.11.1 | DOE 5820.2A, Chapter V, 3.a(5) | Transfer of Responsibility for Facilities |
| 3.2.3.2.11<br>3.5.1<br>3.7.11.1 | DOE 5820.2A, Chapter V, 3.b | Design for Decommissioning |
| 3.2.3.2.11<br>3.5.1<br>3.7.11.1 | DOE 5820.2A, Chapter V, 3.c | Post-Operation Activities |
| 3.2.4.2 | DOE / EIS -0189 Draft | Site Boundary |
| 3.2.4.3 | WHC-SD-WM-FRD-020 | Land Use |
| 3.2.5.1.1 | MIL-STD-1692A | Failure Mode and Effects |
| 3.2.5.1.2 | NUREG-0492 | Fault Tree Analysis |
| 3.2.5.2<br>3.5.1<br>3.7.9 | DOE 5820.2A, Chapter I,3.c(2)(g) | Maintenance |
| 3.2.5.2<br>3.7.10 | DOE 5820.2A, Chapter I,3.b(4)(e) | Maintenance of Equipment |
| 3.2.5.2 | DOE 5820.2A, Chapter I,3.b(2)(k) | Loss of Power |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.2.5.2<br>3.5.1 | DOE 5820.2A, Chapter I, 3.b(2)(j) | Maintenance |
| 3.2.5.2 | DOE 6430.1A, Section 1300-3.5 | Maintenance of Equipment |
| 3.2.5.2 | DOE 6430.1A,Sec 1300-12.4.10 | Maintenance of Equipment |
| 3.2.5.4 | WHC-SD-WM-ES-295, App.H | Maintenance and Operability |
| 3.2.5.4.1 | WHC-SD-WM-ES-295, App.H | Maintenance and Operability Considerations |
| 3.2.5.4.2<br>3.5.1 | DOE 6430.1A | Contaminated Equipment Maintenance |
| 3.2.5.4.3<br>3.5.1 | WHC-IP-1043 | High Dose-Rate Areas Equipment Maintenance |
| 3.2.5.4.4<br>3.5.1 | ODE/EV/1830-T5 | Remote Maintenance Equipment |
| 3.2.6 | WHC-SD-WM-FRD-020 | Environmental Conditions |
| 3.2.7.1 | DOE 1540.1, Chapter II, Section 2 | Packaging and Marking of Materials for Transportation |
| 3.2.7.1<br>3.3.3 | DOE 1540.1, Chapter II, Section 2 | Preparation of Materials for Transportation |
| 3.2.7.1 | WHC-CM-2-14 | Transportation of Hazardous Materials |
| 3.2.8 | DOE 6430.1A, 0110-3 | Design Flexibility |
| 3.2.2.11 | WHC-SD-WM-FRD-020 | Excess Facilities |
| 3.2.2.10 | WHC-SD-WM-FRD-020 | Prepared Solid Waste |
| 3.2.2.1 | WHC-SD-WM-FRD-020 | Tank Operations Information |
| 3.2.1.1.2 | WHC-SD-WM-FRD-020 | Productivity Rate |
| 3.2.1.1.1 | WHC-SD-WM-TI-613, Rev.1 | Total Waste Volume |
| 3.2.1.1.1 | WHC-SD-WM-ER-029, Rev. 21 | Total Waste Volume |
| 3.2.1.1 | TPA CCC M-45-04-T01 | Tank Farm Retrieval Demonstration |
| 3.2.3.2.5 | 40 CFR 268.42(a) | Organic and Waste Water Treatment |
| 3.2.3.2.5 | DOE 5820.2A, Chapter III,3.f(1-2) | Disposal Site Waste Treatment |
| 3.2.3.2.5 | DOE 5820.2A, Chapter III, 3.d | LLW Characterization |
| 3.2.3.2.5 | DOE 5820.2A, Chapter II, 3.a(3) | TRU Limits |
| 3.2.3.2.5 | 40 CFR 268.41(c) | Treatment Standards for Land Disposal |
| 3.2.3.2.5 | 40 CFR 268.41(b) | Treatment Standards for Land Disposal |
| 3.2.3.2.6 | WAC 173-460-010 | New Toxic Air Pollutants |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.2.3.2.6 | WAC 173-460-020 | New Toxic Air Pollutants |
| 3.2.3.2.6 | WAC 173-460-030 | New Toxic Air Pollutants |
| 3.2.3.2.6 | WAC 173-460-040 | New Toxic Air Pollutants |
| 3.2.3.2.6 | WAC 173-460-050 | New Toxic Air Pollutants |
| 3.2.3.2.6 | WAC 173-460-060 | Control Technology of Dry Cleaners |
| 3.2.3.2.6 | WAC 173-460-070 | New Toxic Air Pollutants |
| 3.2.3.2.6 | WAC 173-460-080 | Class A Toxic Air Pollutants |
| 3.2.3.2.6 | WAC 173-460-090 | Second Tier Analysis |
| 3.2.3.2.6 | WAC 173-460-100 | Request for Risk Management Decision |
| 3.2.3.2.6 | WAC 173-460-110 | Acceptable Source Impact Levels |
| 3.2.3.2.6 | WAC 173-460-120 | Scientific Review and Amendment |
| 3.2.3.2.6 | WAC 173-460-130 | Fee Requirements for Review of Construction, Plans and Specifications |
| 3.2.3.2.6 | WAC 173-460-140 | Remedies for Penalties Provisions |
| 3.2.3.2.6 | WAC 173-460-150-Table 1 | Class A Toxic Air Pollutants/Carcinogens |
| 3.2.3.2.6 | WAC 173-460-150-Table 2 | Class A Toxic Air Pollutants/Carcinogens |
| 3.2.3.2.6 | WAC-246-247-090 | Notification of Startup/ Shutdown |
| 3.2.3.2.6 | WAC 173-460-150-Table 3 | Class A Toxic Air Pollutants/Carcinogens |
| 3.2.3.2.6 | WAC 173-460-160 | Class B Toxic Air Pollutants |
| 3.2.3.2.5 | DOE 5820.2A, Chapter II, 3.d | TRU Waste Storage |
| 3.2.3.2.5 | DOE 5820.2A, Chapter II, 3.a(2) | TRU Concentration Limits |
| 3.2.3.2.6 | WAC 246-247-001 | Radioactive Air Emission License and Assure Compliance |
| 3.2.3.2.5 | 40 CFR 264.41(a) | Waste Restriction for Land Disposal |
| 3.2.3.2.6 | WAC 246-247-002 | Registration of Sources of Ionizing Radiation |
| 3.2.3.2.6 | WAC 246-247-010 | Facilities and Sources of Radiation Emissions |
| 3.2.3.2.6 | WAC 246-247-020 | Lists of Facilities and Conditions of Sources of Radiation which are Exempt |
| 3.2.3.2.6 | WAC 246-247-030 | Definitions |
| 3.2.3.2.6 | WAC 246-247-040 | Standards for Radioactive Emissions |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.2.3.2.6 | WAC 246-247-060 | Application, Registration, and Licensing to Operate Emissions Unit |
| 3.2.3.2.6 | WAC 246-247-065 | Fees for Applications to Operate Emission Units |
| 3.2.3.2.6 | WAC 246-247-075 | Monitoring, Testing, and Quality Assurance of all Radioactive Air Emission Units |
| 3.2.3.2.6 | WAC 246-247-080 | Inspection, Reporting, and Record-Keeping |
| 3.2.3.2.6 | WAC 246-247-085 | Compliance Determination for Existing Emission Units and Facilities |
| 3.3.1.14 | 40 CFR 264.97 - per DOE 5400.5, Chapter I, 3.c(3)(d) | Groundwater Monitoring |
| 3.3.1.14 | 40 CFR 141.16 - per DOE 5400.5, Chapter II, 1.d(3) | Beta Particles Maximum Contaminant Levels |
| 3.3.1.14 | 40 CFR 141.15 | **Maximum Contaminant Levels** |
| 3.3.1.14 | 40 CFR 302 - multiple entries | Designation, Reportable Quantities, and Notification |
| 3.3.1.14 | DOE 5820.2A, Chapter I,3.c(4)(a) | **Contingency Action Plan** |
| 3.3.1.14 | DOE 5820.2A, Chapter I,3.c(4)(c) | Singly Contained Tanks for Emergency Situations |
| 3.3.1.14 | WAC 173-303-640(4) | Containment and Detection of Releases |
| 3.3.1.14<br>3.7.3.1 | WAC 173-303-640(4)(e)(i) | **External Liner Systems** |
| 3.3.1.14<br>3.7.1.2 | WAC 173-303-640(7)(d) | **Environmental Surveillance** |
| 3.3.1.14<br>3.7.3.1 | WAC 173-303-640(4)(g) | Alternative Design in Prevention of Leaks |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.3.1.6<br>3.3.6.1 | DOE 5480.7A | Fire Protection |
| 3.3.1.5 | WHC-EP-0063-1 | Solid Waste Acceptance Criteria |
| 3.3.1.5<br>3.7.8.1 | DOE 5820.2A, Chapter III, 3.c | Reduction of Gross Volume of Waste Generated |
| 3.3.1.4 | WHC-SD-GN-DGS-30011 | Air Control for Contaminated Areas |
| 3.3.1.1 | WHC-SD-GN-DGS-30011 | Facility Design and Shielding Criteria |
| 3.3.1.1 | WHC-SD-WM-FRD-020 | Facility Design and Modification |
| 3.3.1.1 | WHC-SD-WM-FRD-020 | Facility Design and Modification |
| 3.3.1.15<br>3.7.9 | DOE 5820.2A, Chapter I,3.b(2)(f) | Ventilation Filtration Devices |
| 3.3.1.15<br>3.7.9 | WHC-CM-7-5, Chapter 2, 2.5.5 | Emission Filtration and Treatment |
| 3.3.1.15 | WAC 173-400-105 | Records, Monitoring and Reporting |
| 3.3.1.15 | WAC 173-400-040 | General Standards for Maximum Emissions |
| 3.3.1.17 | WAC 246-247-100 | Enforcement Actions |
| 3.3.1.14 | 40 CFR 265.193 | Containment and Detection of Releases |
| 3.3.1.14<br>3.7.1.2 | DOE 5400.5, Chapter II, 3.c(2) | Prohibition of Liquid Discharges |
| 3.3.1.14 | DOE 5400.5, Chapter II, 1.d(3) | **Liquid Effluents from DOE Activities** |
| 3.3.1.14<br>3.7.1.2 | 40 CFR 265.196 | Response to Leaks |
| 3.3.1.14 | **40 CFR 265, Sec 265.196(c)(1)** | **Prevent Further Migration of Leaks** |
| 3.3.1.13<br>3.7.1.2<br>4.1 | WAC 173-303-640(6)(a) | Schedule and Procedure for Inspecting Overfill Controls |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.3.1.13<br>3.3.6 | DOE 5820.2A, Chapter III, 3.k | Environmental Monitoring Program |
| 3.3.1.13 | DOE 5820.2A, Chapter I,3.c(4)(b) | Detection of Released Radioactive Materials |
| 3.3.1.13 | DOE 5820.2A, Chapter I,3.c(3)(d) | Ground Water Monitoring |
| 3.3.1.13 | WAC 173-160 | Monitoring Wells and Other Bore Holes |
| 3.3.6 | DOE 5400.1, Chapter IV, 5.b | Environmental Surveillance Design |
| 3.3.1.12 | DOE 5820.2A, Chapter I, 3.c(3)(a) | Monitoring and Surveillance |
| 3.3.1.12 | DOE 5820.2A, Chapter I, 3.c(2)(c) | Waste Inventory Monitoring |
| 3.3.1.12 | DOE 5820.2A, Chapter I,3.b(2)(h) | Control Instrument |
| 3.3.1.12 | DOE 5820.2A, Chapter I,3.b(3)(b) | Leak Detection Systems |
| 3.3.1.12 | DOE 5820.2A, Chapter I,3.b(3)(a) | Monitoring and Leak Detection Capability |
| 3.3.1.11 | WAC 173-303-640(3)(g) | Corrosion Protection for Tanks |
| 3.3.1.11 | DOE 5820.2A, Chapter I,3.c(3)(b) | Inspection/Corrosion Detect |
| 3.3.1.11 | DOE 5820.2A, Chapter I,3.b(7)(c) | Corrosion Control |
| 3.3.1.11 | DOE 5820.2A, Chapter I,3.b(3)(c) | Inspection/Corrosion Detection |
| 3.3.1.10 | WAC 173-303-640(3)(a)(iii) | Factors for Potential Corrosion Sources |
| 3.3.1.10 | DOE 5820.2A, Chapter I,3.b(2)(g) | Corrosion Prevention |
| 3.3.1.9 | WAC 173-303-640(4)(f) | Ancillary Equipment Requirements |
| 3.3.1.9 | WAC 173-303-640(3)(f) | New Ancillary Equipment |
| 3.3.1.9<br>3.3.1.14 | WAC 173-303-640(4)(c) | Tank Secondary Containment Systems |
| 3.3.1.9 | WAC 173-303-640(4)(b) | Tank Secondary Containment Systems |
| 3.3.1.9 | DOE 5820.2A, Chapter I,3.c(2)(d) | Singly Contained Pipelines |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.3.1.9 | DOE 5820.2A, Chapter I, 3.c(2)(a) | Singly Containment System |
| 3.3.1.9 | DOE 5820.2A, Chapter I,3.b(2)(d) | Containment/Recovery of Leaks |
| 3.3.1.9 | DOE 5820.2A, Chapter I,3.b(2)(b) | Singly Contained Pipelines |
| 3.3.1.16<br>3.7.5.1 | 40 CFR 264.177 | Waste Incompatibility |
| 3.3.1.16<br>3.7.5.1 | 40 CFR 264.172 | Hazardous Waste Container Liner Material |
| 3.3.1.17 | DOE 6420.1A, Section 0110-5.5 | Toxic Products and Formulations |
| 3.3.1.17 | DOE 6420.1A, Section 0110-5.5 | Asbestos-Containing Materials |
| 3.3.2 | DOE 5480.11, Chapter 0, 9.j | Radiation Exposure Rates |
| 3.3.2 | 10 CFR 20.1601 | Control of Access to High Radiation Areas |
| 3.3.2 | WHC-SD-WM-FRD-020 | DOE Sponsored Radiological Requirement |
| 3.3.2 | SEN-35-91 | Public Accidental Exposure |
| 3.3.3 | DOE 5480.3, Chapter 0, 11-14 | Safety Requirements for the Packaging and Transportation of Hazardous Materials |
| 3.3.3 | 29 CFR 1910.303(f) | Identification of Disconnecting means and Circuits. |
| 3.3.3 | DOE 5820.2A, Chapter III, 3.g(4) | Labelling |
| 3.3.3 | DOE 6430.1A, Sec 1300-12.4.11 | Labels |
| 3.3.6 | DOE 5480.4 | Environmental, Safety and Health |
| 3.3.6 | DOE 5480.21 | Unreviewed Safety Questions |
| 3.3.6 | DOE 5480.22 | Technical Safety Requirements |
| 3.3.6 | DOE 5480.23 | Safety Analysis |
| 3.3.6.1 | WAC 173-303-630(8) | Uniform Fire Codes |
| 3.3.6.2 | WHC-SD-WM-FRD-020 | ALARA |
| 3.3.6.2 | WAC 246-220-007 | Maintain Radiation Exposures |
| 3.3.6.3 | DOE 4330.4B | Maintenance Management Program |
| 3.3.6.3 | DOE 5820.2A, Chapter I, 3.a(1)(a) | Design for Safety |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.3.6.3 | DOE 5820.2A, Chapter I, 3.a(2) | Preparation of Safety Analysis Reports |
| 3.3.6.3 | WHC-SD-WM-FRD-020 | Worker Occupational Safety |
| 3.3.6.3 | DOE 6430.1A, Sec 1300-12.4.8 | Warning and Annunciator Systems |
| 3.3.6.3 | DOE 6430.1A, Sec 1300-12.4.3 | Lighting |
| 3.3.6.3 | DOE 6430.1A, Sec 1300-12.4.6 | Display Devices |
| 3.3.6.3 | WHC-CM-4-46 | Safety Class |
| 3.3.7 | DOE 6430.1A, Sec 1300-12.4.2 | Human Dimension Consideration |
| 3.3.8.1 | DOE 5820.2A, Chapter I, 3.b(2)(i) | Nuclear Criticality |
| 3.3.8.1 | DOE 5820.2A, Chapter I, 3.c(2)(f) | Criticality |
| 3.3.8.1 | WHC-SD-WM-FRD-020 | Safety/Hazard Classification for Nuclear Facilities and Operations |
| 3.3.8.1 | WHC-SD-WM-FRD-020 | Criticality |
| 3.3.9 | DOE 470.1 | Security |
| 3.3.1.9 | DOE 5820.2A, Chapter I,3.b(2)(a) | Double Containment Requirement |
| 3.3.1.9 | 40 CFR 264.196(a-c) | Secondary Containment and Leak Prevention |
| 3.3.1.8 | DOE 6430.1A, Sec 1630-5 | Lightning Protection Systems |
| 3.3.1.8 | DOE 6430.1A, Sec 1605-1 | Electrical System Design |
| 3.3.1.8 | DOE 6430.1A, Sec 1660 | Power Systems |
| 3.3.1.8 | DOE 6430.1A, Sec 1300-12.4.3 | Emergency Lighting |
| 3.4 | WAC 173-303-640(3)(c) | Handling Procedures |
| 3.4 | DOE 5480.19 | Conduct of Operations |
| 3.4 | DOE 5820.2A, Chapter I,3.b(1)(b) | Waste Characteristics and Compatibility Information |
| 3.4 | DOE 5820.2A, Chapter III, 3.m(2) | Waste Manifest Records |
| 3.4 | DOE 5820.2A, Chapter III, 3.m(1) | Record Control System |
| 3.4 | DOE 5820.2A, Chapter I, 3.b(4)(f) | Response Procedures |
| 3.5.3 | WHC-SD-GN-DGS-30011, Section 10.1 - 10.3 | Waste Handling, Storage and Disposal |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.6.1 | DOE 5820.2A, Chapter I, 3.b(5) | Personnel Qualification Standards |
| 3.6.1 | WHC-SD-WM-FRD-020 | Personnel and Training |
| 3.6.1 | DOE 5820.2A, Chapter I, 3.c(5) | Personnel Operation System Training |
| 3.7.4.1 | 40 CFR 264.13(a)(1) | Waste Analysis |
| 3.7.4.1 | DOE 5820.2A, Chapter I, 3.c(4) | Contingency Plan |
| 3.7.1.2 | PL 101-510 Section 3137, (a) | Identification and Monitoring of Tanks |
| 3.7.1.2 | PL 101-510 Section 3137, (b) | Action Plans for Safety Measures |
| 3.7.1.2 | PL 101-510 Section 3137, (d) | Report on Safety Measures |
| 3.7.4.1 | 40 CFR 264.1054 | Pressure Release Devices for Hazardous Waste Treatment |
| 3.7.5.1 | 40 CFR 264.171 | Hazardous Waste Containers |
| 3.7.3.1 | WAC 173-303-645 and WAC 173-340 | **Groundwater Protection Standards** |
| 3.7.2.1 | PL 101-510 Section 3137, (1-2) | Identification of Potential Release |
| 3.7.1.2 | DOE 5820.2A, Chapter I,3.c(3)(c) | Emergency Power |
| 3.7.1.2 | DOE 5400.1, Chapter IV, 5.b | Prohibition of Liquid Discharges |
| 3.7.1.2 | 40 CFR 265.195 (a)(3) | Inspections |
| 3.7.5.1 | 40 CFR 264.175 | Hazardous Waste Containers Storage Area and Containment System |
| 3.7.5.1 | 40 CFR 264.173 | Handling and Storing Hazardous Waste |
| 3.7.7.1 | OSD-T-151-00013, Sec 13.2.1.E | The Waste Temperature for SSTs |
| 3.7.7.1<br>3.7.9 | OSD-T-151-00013, sec 13.2.1.E<br>OSD-T-151-00017, sec 17.2.7 | Maximum Tank Dome Temperature |
| 3.7.7.1 | WHC-SD-WM-DQO-008 | SST Waste Characterization |
| 3.7.7.1 | DOE/RL 94-001 | Characterization Information Accessibility |
| 3.7.7.1 | OSD-T-151-00013, Sec 13.2.1C | Static Dome Loading |
| 3.7.7.1 | OSD-T-151-00030, P. 9, Section 30.2.A.3 (A & B) | Operating Specification for Watch List Tanks |
| 3.7.7.1 | OSD-T-151-00030, Sec 30.2.A.2 | Flammable Gases |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.7.7.1<br>3.7.8.1 | WHC-SD-WM-OSR-004, Rev 0, Sec.5.16 | SMTW Characterization Requirements |
| 3.7.7.1<br>3.7.8.1 | WHC-SD-WM-OSR-005, Rev 0, Sec.1.11 | SMTW Characterization Requirements |
| 3.7.7.1 | WHC-SD-WM-OSR-005, Rev 0, Sec.5.29 | Administrative Controls for Flammable Gases |
| 3.7.7.1 | WHC-SD-WM-OSR-005, Rev. 0, Table B-5.17-1 | Tank Corrosion Limits |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | TRU Waste Segregation |
| 3.7.8.1 | WHC-SD-WM-FRD-020 | Transfer System Flush |
| 3.7.8.1 | WHC-SD-WM-OSR-016<br>WHC-SD-WM-OSR-004 | Transfer System Temperature Ranges Operations Information |
| 3.7.8.1 | WHC-SD-WM-OSR-004, Rev 0, B 5.29 AC | Temperature - Aging Waste DST Waste |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | Tank Waste Type (DST Wastes) |
| 3.7.8.1 | WHC-SD-WM-EV-053, Rev 2 | Tank Farms Waste Acceptance |
| 3.7.8.1 | WHC-SD-WM-FRD-020 | Tank Capacity |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | Specific Gravity Limits |
| 3.7.8.1 | WHC-SD-WM-FRD-020 | Solution Temperatures Ranges |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | Chemical Compatibility |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | Complexant Waste Segregation |
| 3.7.8.1 | OSD-T-151-00017, Section 17.2.5 | Static Dome Loading |
| 3.7.8.1 | OSD-T-151-00017,Sec 17.2.1.1 | Annulus Pump and Leak Detection Pits |
| 3.7.8.1 | OSD-T-151-00017,Section 17.3.1 | Aging-Waste Transfer Operations for the Waste Transfer Leak Detection |
| 3.7.8.1 | OSD-T-151-00007, Section 7.2.3 | Minimum Hydrostatic Head |
| 3.7.8.1 | OSD-T-151-00007, Section 7.2.2 | Minimum Liquid Level |
| 3.7.8.1 | OSD-T-151-00007, section 7.2.10 | Transfer Leak Detection for DSTs |
| 3.7.8.1 | OSD-T-151-00007, 7.2 | Tank Composition for DST corrosion Control |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | High Phosphate Waste |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | Heat Generation Limit |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | Criticality Prevention Requirement |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | Energetics |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.7.8.1 | WHC-SD-WM-FRD-020 | Cross-site Transfer Tank Operations Information |
| 3.7.8.1 | DOE 5820.2A, Chapter II, 3.b(1) | Waste Volume Reduction |
| 3.7.8.1 | DOE 5820.2A, Chapter III, 3.c(1) | Reduction of Gross Volume of Waste Generated |
| 3.7.8.1 | DOE 5820.2A, Chapter I,3.b(4)(d) | Maintenance of Adequate Volume Capacity |
| 3.7.8.1 | DOE 5820.2A, Chapter I,3.b(7)(d) | Treatment Reagents |
| 3.7.8.1 | WHC-SD-WM-FRD-020 | Waste Characterization Data |
| 3.7.8.1 | WHC-SD-WM-OCD-015 | Waste Pumpability |
| 3.7.8.1 | 40 CFR 264.194(b) | Hazardous Waste Control, Spill and Overfill Prevention |
| 3.7.8.1 | 40 CFR 264.194(a) | Hazardous Waste Treatment Reagents |
| 3.7.8.1 | WHC-SD-WM-OSR-016, Rev 0, Sec. 5.29 | Flammable Gas Administrative Controls |
| 3.7.9 | OSD-T-151-00013, Sec 13.2.2<br>OSD-T-151-00011, Sec 11.3.B<br>OSD-T-151-00008, Sec 8.3<br>OSD-T-151-00015, Sec 15.2.C<br>OSD-T-151-00007, Sec 7.3.1 | Tank Ventilation System Filtration System |
| 3.7.9 | 40 CFR 61, Subpart H | Flow Measurement |
| 3.7.9 | OSD-T-151-00013, Section 13.2F | Pressure Specification Limits for Ventilation |
| 3.7.9 | OSD-T-151-00007, 7.3.1.E | The Maximum Permissible Concentration of Radionuclides |
| 3.7.9 | OSD-T-151-00007, 7.3.1.C | Filter Efficiency |
| 3.7.9 | DOE/EH-0173T | Continuous Monitoring and Alarm Requirements |
| 3.7.9 | DOE 5820.2A, Chapter I,3.b(2)(e) | Pressure System |
| 3.7.9 | DOE 5820.2A, Chapter I, 3.c(2)(e) | Ventilation |
| 3.7.9 | WHC-CM-7-5, Chapter 2, 2.5.6 | Flow Measurements |
| 3.7.9 | WHC-CM-7-5, 2.2.5.3 | Monitoring |
| 3.7.9 | WHC-CM-7-5, 2.2.5.4 | Record Sampling Capabilities |

Table 4-2. Cross Reference.

| Section 3.0 Paragraph | Requirement No. | Description |
|---|---|---|
| 3.7.9 | WHC-CM-7-5, 2.5.2.1(1-3) | Effective Dose Equivalent |
| 3.7.9 | WHC-SD-WM-OSR-004, Section L.C.O 3.2.2 | Temperature-Aging Waste DST Waste |
| 3.7.9 | WHC-SD-WM-OSR-005, Rev 0, Sec.2.3 | Tank Vapor Space |
| 3.7.11 | WHC-SD-WM-DRD-0009, Rev.0 | Decontaminate Equipment |
| 3.7.12 | WHC-SD-WM-DRD-0009, Rev.0 | Stabilize Retrieved SST |
| 4.0 | DOE 5820.2A, Chapter I, 3.c(6) | Quality Assurance |
| 4.0 | WHC-SD-WM-OCD-015 | Quality Assurance Plan |
| 4.0 | DOE 5820.2A, Chapter I, 3.b(6) | Operations Conducted in Accordance with ANSI/ASME |
| 4.1 | WAC 173-303-630(6) | Inspection |

This page intentionally left blank.

## 5.0 PREPARATION FOR DELIVERY (or OPERATIONS)

[RESERVED]

This page intentionally left blank.

## 6.0 REFERENCES

Tank Waste Remediation Systems Functions and Requirements Document, WHC-SD-WM-FRD-020 Draft Revision C, January 1996.

Initial Single-Shell Tank Retrieval System - Tank Selection, WHC-SD-WM-ES-367, Rev.0.

Bader, 1995, Letter, C.P.?????, *Tank Waste Remediation System (TWRS) Guidance for Update of the Multi-Year Program Plan (MYPP) - Supplemental Guidance for the Disposal Program*, 95-PRI-073, Department of Energy, Richland Operations Office, Richland Washington.

DOE-RL, 1995, Letter, J.E. Rasmussen, DOE-RL, to M. Gearheard and M. Wilson, Ecology, *Managment of Contaminated Equipment at the Hanford Site*, 95-PCA-337, June 9, 1995.

WHC, 1995, *Tank Waste Remediation System (TWRS) Abandoned Equipment Storage/Disposal Plan*, WHC-SD-WM-PLN-098, Rev.0, Westinghouse Hanford Company, Richland Washington.

This page intentionally left blank.

# APPENDIX A

## Test and Evaluation Scope Sheets

Table A-2. Single-Shell Tank 241-C-105 (2 Sheets).

| Solids Composite Inventory Estimate[1] | | | |
|---|---|---|---|
| **Physical Properties** | | | |
| Total Solid Waste | 8.20E+05 kg (150 kgal) | | |
| Heat Load | 1.03E-02 kW (35 Btu/hr) | | |
| Bulk Density | 1.44 (g/cc) | | |
| Void Fraction | 0.799 | | |
| Water wt% | 70.4 | | |
| TOC wt% | 0 | | |
| **Chemical Constituents** | **mole/L** | **ppm** | **kg** |
| $Na^{+1}$ | 2.04 | 3.26E+04 | 2.67E+04 |
| $Al^{+3}$ | 4.89 | 9.15E+04 | 7.50E+04 |
| $Fe^{+3}$ (total Fe) | 0.970 | 3.75E+04 | 3.08E+04 |
| $Cr^{+3}$ | 6.46E-03 | 233 | 191 |
| $Bi^{+3}$ | 0 | 0 | 0 |
| $La^{+3}$ | 0 | 0 | 0 |
| $Ce^{+3}$ | 0 | 0 | 0 |
| Zr (as $ZrO(OH)_2$) | 0 | 0 | 0 |
| $Pb^{+2}$ | 0 | 0 | 0 |
| $Ni^{+2}$ | 5.66E-02 | 2.10E+03 | 1.72E+03 |
| $Sr^{+2}$ | 0 | 0 | 0 |
| $Mn^{+4}$ | 0 | 0 | 0 |
| $Ca^{+2}$ | 0.107 | 2.98E+03 | 2.44E+03 |
| $K^{+1}$ | 0 | 0 | 0 |
| $OH^{-1}$ | 19.1 | 2.25E+05 | 1.85E+05 |
| $NO3^{-1}$ | 0.763 | 3.28E+04 | 2.69E+04 |
| $NO2^{-1}$ | 0.435 | 1.39E+04 | 1.14E+04 |
| $CO3^{-2}$ | 0.120 | 5.00E+03 | 4.10E+03 |
| $PO4^{-3}$ | 9.32E-02 | 613 | 503 |
| $SO4^{-2}$ | 0.101 | 6.70E+03 | 5.49E+03 |
| Si (as $SiO_3^{-2}$) | 1.08E-02 | 211 | 173 |
| $F^{1}$ | 0 | 0 | 0 |
| $Cl^{-1}$ | 1.48E-02 | 364 | 298 |
| $C_6H_5O_7^{-3}$ | 0 | 0 | 0 |
| $EDTA^{-4}$ | 0 | 0 | 0 |

Table A-2. Single-Shell Tank 241-C-105 (2 Sheets).

| Solids Composite Inventory Estimate[1] | | | |
|---|---|---|---|
| **Chemical Constituents** | **mole/L** | **ppm** | **kg** |
| $HEDTA^{-3}$ | 0 | 0 | 0 |
| $NTA^{-3}$ | 0 | 0 | 0 |
| $glycolate^{-1}$ | 0 | 0 | 0 |
| $acetate^{-1}$ | 0 | 0 | 0 |
| $oxalate^{-2}$ | 0 | 0 | 0 |
| DBP | 0 | 0 | 0 |
| NPH | 0 | 0 | 0 |
| $CCl_4$ | 0 | 0 | 0 |
| hexone | 0 | 0 | 0 |
| $Fe(CN)_6^{-4}$ | 0 | 0 | 0 |
| **Radiological Constituents** | | | |
| Pu | | 0.798 ($\mu$Ci/g) | 10.9 (kg) |
| U | 0.142 (M) | 2.34E+04 ($\mu$g/g) | 1.92E+04 (kg) |
| Cs | 1.77E-03 (Ci/L) | 1.23 ($\mu$Ci/g) | 1.01E+03 (Ci) |
| Sr | 1.47E-03 (Ci/L) | 1.02 ($\mu$Ci/g) | 835 (Ci) |

Note:

[1]Composite inventory excludes supernatant, diatomaccous earth, and cement. Unknowns in tank inventory are assigned by Tank Layering Model (TLM).

Table A-3. Single-Shell Tank 241-C-103 (2 Sheets).

| Solids Composite Inventory Estimate[1] | | | |
|---|---|---|---|
| **Physical Properties** | | | |
| Total Solid Waste | 3.27E+05 kg (62 kgal) | | |
| Heat Load | 8.30 kW (2.83E+04 Btu/hr) | | |
| Bulk Density | 1.39 (g/cc) | | |
| Void Fraction | 0.813 | | |
| Water wt% | 70.4 | | |
| TOC wt% | 0 | | |
| **Chemical Constituents** | **mole/L** | **ppm** | **kg** |
| $Na^{+1}$ | 2.31 | 3.82E+04 | 1.25E+04 |
| $Al^{+3}$ | 3.59 | 6.96E+04 | 2.27E+04 |
| $Fe^{+3}$ (total Fe) | 1.17 | 4.70E+04 | 1.54E+04 |
| $Cr^{+3}$ | 6.54E-03 | 244 | 79.8 |
| $Bi^{+3}$ | 0 | 0 | 0 |
| $La^{+3}$ | 0 | 0 | 0 |
| $Ce^{+3}$ | 0 | 0 | 0 |
| Zr (as $ZrO(OH)_2$) | 0 | 0 | 0 |
| $Pb^{+2}$ | 0 | 0 | 0 |
| $Ni^{+2}$ | 6.963E-02 | 2.93E+03 | 959 |
| $Sr^{+2}$ | 0 | 0 | 0 |
| $Mn^{+4}$ | 0 | 0 | 0 |
| $Ca^{+2}$ | 0.140 | 4.02E+03 | 1.31E+03 |
| $K^{+1}$ | 0 | 0 | 0 |
| $OH^{-1}$ | 15.6 | 1.90E+05 | 6.22E+04 |
| $NO3^{-1}$ | 0.584 | 2.60E+04 | 8.50E+03 |
| $NO2^{-1}$ | 0.133 | 4.39+03 | 1.43E+03 |
| $CO3^{-2}$ | 0.140 | 6.02E+03 | 1.97E+03 |
| $PO4^{-3}$ | 6.86E-03 | 468 | 153 |
| $SO4^{-2}$ | 1.01E-02 | 699 | 228 |
| Si (as $SiO_3^{-2}$) | 0.588 | 1.19E+04 | 3.88E+03 |
| $F^{1}$ | 0 | 0 | 0 |
| $Cl^{-1}$ | 1.26E-02 | 321 | 105 |
| $C_6H_5O_7^{-3}$ | 0 | 0 | 0 |
| $EDTA^{-4}$ | 0 | 0 | 0 |

Table A-3. Single-Shell Tank 241-C-103 (2 Sheets).

| Solids Composite Inventory Estimate[1] | | | |
|---|---|---|---|
| **Chemical Constituents (Cont'd)** | **mole/L** | **ppm** | **kg** |
| $HEDTA^{-3}$ | 0 | 0 | 0 |
| $NTA^{-3}$ | 0 | 0 | 0 |
| $glycolate^{-1}$ | 0 | 0 | 0 |
| $acetate^{-1}$ | 0 | 0 | 0 |
| $oxalate^{-2}$ | 0 | 0 | 0 |
| DBP | 0 | 0 | 0 |
| NPH | 0 | 0 | 0 |
| $CCl_4$ | 0 | 0 | 0 |
| hexone | 0 | 0 | 0 |
| $Fe(CN)_6^{-4}$ | 0 | 0 | 0 |
| **Radiological Constituents** | | | |
| Pu | | 2.73 ($\mu$Ci/g) | 14.9 (kg) |
| U | 0.127 (M) | 2.17E+04 ($\mu$g/g) | 7.09E+03 (kg) |
| Cs | 0.111 (Ci/L) | 79.6 ($\mu$Ci/g) | 2.60E+04 (Ci) |
| Sr | 5.18 (Ci/L) | 3.72E+03 ($\mu$Ci/g) | 1.21E+06 (Ci) |

Note:

[1]Composite inventory excludes supernatant, diatomaccous earth, and cement. Unknowns in tank inventory are assigned by Tank Layering Model (TLM).

Table A-4. Single-Shell Tank 241-AX-103 (2 Sheets).

| Solids Composite Inventory Estimate[1] | | | |
|---|---|---|---|
| **Physical Properties** | | | |
| Total Solid Waste | 6.71E+05 kg (112 kgal) | | |
| Heat Load | 6.21 kW (2.12E+04 Btu/hr) | | |
| Bulk Density | 1.58 (g/cc) | | |
| Void Fraction | 0.709 | | |
| Water wt% | 42.9 | | |
| TOC wt% | 0.309 | | |
| **Chemical Constituents** | **mole/L** | **ppm** | **kg** |
| $Na^{+1}$ | 10.4 | 1.51E+05 | 1.02E+05 |
| $Al^{+3}$ | 1.19 | 2.03E+04 | 1.36E+04 |
| $Fe^{+3}$ (total Fe) | 0.506 | 1.79E+04 | 1.20E+04 |
| $Cr^{+3}$ | 2.22E-02 | 729 | 489 |
| $Bi^{+3}$ | 7.37E-04 | 97.4 | 65.3 |
| $La^{+3}$ | 0 | 0 | 0 |
| $Ce^{+3}$ | 0 | 0 | 0 |
| Zr (as $ZrO(OH)_2$) | 1.63E-03 | 94.0 | 63.1 |
| $Pb^{+2}$ | 1.24E-04 | 16.3 | 10.9 |
| $Ni^{+2}$ | 1.43E-02 | 532 | 357 |
| $Sr^{+2}$ | 1.36E-04 | 7.52 | 5.05 |
| $Mn^{+4}$ | 1.40E-03 | 48.7 | 32.7 |
| $Ca^{+2}$ | 6.99E-02 | 1.77E+03 | 1.19E+03 |
| $K^{+1}$ | 3.63E-02 | 897 | 602 |
| $OH^{-1}$ | 7.10 | 7.63E+04 | 5.12E+04 |
| $NO3^{-1}$ | 4.48 | 1.75E+05 | 1.18E+05 |
| $NO2^{-1}$ | 1.20 | 3.50E+03 | 2.35E+04 |
| $CO3^{-2}$ | 0.329 | 1.25E+04 | 8.36E+03 |
| $PO4^{-3}$ | 8.38E-02 | 5.03E+03 | 3.38E+03 |
| $SO4^{-2}$ | 0.823 | 4.99E+04 | 3.35E+04 |
| Si (as $SiO_3^{-2}$) | 0.302 | 5.36E+03 | 3.60E+03 |
| $F^{1}$ | 0.109 | 1.31E+03 | 876 |
| $Cl^{-1}$ | 9.82E-02 | 2.20E+03 | 1.47E+03 |
| $C_6H_5O_7^{-3}$ | 2.02E-02 | 2.41E+03 | 1.62E+03 |
| $EDTA^{-4}$ | 3.84E-03 | 699 | 469 |

Table A-4. Single-Shell Tank 241-AX-103 (2 Sheets).

| Solids Composite Inventory Estimate[1] | | | |
|---|---|---|---|
| **Chemical Constituents (Cont'd)** | **mole/L** | **ppm** | **kg** |
| $HEDTA^{-3}$ | 1.72E-05 | 2.98 | 2.00 |
| $NTA^{-3}$ | 0 | 0 | 0 |
| $glycolate^{-1}$ | 7.79E-02 | 3.69E+03 | 2.48E+03 |
| $acetate^{-1}$ | 2.45E-02 | 913 | 613 |
| $oxalate^{-2}$ | 0 | 0 | 0 |
| DBP | 3.59E-03 | 604 | 405 |
| NPH | 0 | 0 | 0 |
| $CCl_4$ | 0 | 0 | 0 |
| hexone | 0 | 0 | 0 |
| $Fe(CN)_6^{-4}$ | 0 | 0 | 0 |
| **Radiological Constituents** | | | |
| Pu | | 0.167 ($\mu$Ci/g) | 1.86 (kg) |
| U | 8.69E-02 (M) | 1.31E+04 ($\mu$g/g) | 8.77E+03 (kg) |
| Cs | 0.454 (Ci/L) | 287 ($\mu$Ci/g) | 1.93E+05 (Ci) |
| Sr | 1.86 (Ci/L) | 1.17E+03 ($\mu$Ci/g) | 7.88E+05 (Ci) |

Note:

[1]Composite inventory excludes supernatant, diatomaccous earth, and cement. Unknowns in tank inventory are assigned by Tank Layering Model (TLM).

Table A-5. Single-Shell Tank 241-A-102 (2 Sheets).

| Solids Composite Inventory Estimate[1] | | | |
|---|---|---|---|
| **Physical Properties** | | | |
| Total Solid Waste | 2.11E+05 kg (37 kgal) | | |
| Heat Load | 0.870 kW (2.97E+03 Btu/hr) | | |
| Bulk Density | 1.51 (g/cc) | | |
| Void Fraction | 0.874 | | |
| Water wt% | 45.4 | | |
| TOC wt% | 0.758 | | |
| **Chemical Constituents** | **mole/L** | **ppm** | **kg** |
| $Na^{+1}$ | 10.1 | 1.54E+05 | 3.25E+04 |
| $Al^{+3}$ | 1.49 | 2.67E+04 | 5.64E+03 |
| $Fe^{+3}$ (total Fe) | 6.99E-02 | 2.59E+03 | 547 |
| $Cr^{+3}$ | 2.94E-02 | 1.01E+03 | 214 |
| $Bi^{+3}$ | 9.50E-04 | 132 | 27.8 |
| $La^{+3}$ | 0 | 0 | 0 |
| $Ce^{+3}$ | 0 | 0 | 0 |
| Zr (as $ZrO(OH)_2$) | 2.11E-03 | 127 | 26.9 |
| $Pb^{+2}$ | 1.59E-04 | 21.9 | 4.62 |
| $Ni^{+2}$ | 5.87E-03 | 229 | 48.3 |
| $Sr^{+2}$ | 0 | 0 | 0 |
| $Mn^{+4}$ | 1.58E-03 | 57.6 | 12.2 |
| $Ca^{+2}$ | 5.39E-02 | 1.43E+03 | 302 |
| $K^{+1}$ | 4.49E-02 | 1.16E+03 | 246 |
| $OH^{-1}$ | 6.64 | 7.47E+04 | 1.58E+04 |
| $NO3^{-1}$ | 4.21 | 1.763E+05 | 3.66E+04 |
| $NO2^{-1}$ | 1.53 | 4.67E+04 | 9.88E+03 |
| $CO3^{-2}$ | 0.392 | 1.56E+05 | 3.30E+03 |
| $PO4^{-3}$ | 0.108 | 6.77E+03 | 1.43E+03 |
| $SO4^{-2}$ | 0.358 | 2.28E+04 | 4.81E+03 |
| Si (as $SiO_3^{-2}$) | 0.152 | 2.84E+03 | 600 |
| $F^{1}$ | 0.137 | 1.72E+03 | 363 |
| $Cl^{-1}$ | 0.113 | 2.65E+03 | 560 |
| $C_6H_5O_7^{-3}$ | 3.01E-02 | 3.77E+03 | 798 |
| $EDTA^{-4}$ | 1.60E-02 | 3.05E+03 | 644 |

Table A-5. Single-Shell Tank 241-A-102 (2 Sheets).

| Solids Composite Inventory Estimate[1] | | | |
|---|---|---|---|
| **Chemical Constituents (Cont'd)** | **mole/L** | **ppm** | **kg** |
| $HEDTA^{-3}$ | 2.22E-02 | 4.02E+03 | 851 |
| $NTA^{-3}$ | 0 | 0 | 0 |
| $glycolate^{-1}$ | 0.110 | 5.47E+03 | 1.16E+03 |
| $acetate^{-1}$ | 3.13E-02 | 1.22E+03 | 259 |
| $oxalate^{-2}$ | 0 | 0 | 0 |
| DBP | 4.81E-03 | 849 | 179 |
| NPH | 0 | 0 | 0 |
| $CCl_4$ | 0 | 0 | 0 |
| hexone | 0 | 0 | 0 |
| $Fe(CN)_6^{-4}$ | 0 | 0 | 0 |
| **Radiological Constituents** | | | |
| Pu | | 0.154 ($\mu$Ci/g) | 0.544 (kg) |
| U | 1.07E-02 (M) | 1.69E+03 ($\mu$g/g) | 358 (kg) |
| Cs | 0.606 (Ci/L) | 402 ($\mu$Ci/g) | 8.49E+04 (Ci) |
| Sr | 0.501 (Ci/L) | 332 ($\mu$Ci/g) | 7.01E+04 (Ci) |

Note:

[1]Composite inventory excludes supernatant, diatomaccous earth, and cement. Unknowns in tank inventory are assigned by Tank Layering Model (TLM).