COMPLETE

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 164967

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	3a. USQ Required?	4. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	JS Hertzel, 73530, H5-61, 3-2616	[] Yes [X] No	3/8/96
	5. Project Title/No./Work Order No.: Initial Single-Shell Tank Retrieval System Mission Analysis Report	6. Bldg./Sys./Fac. No.: NA	7. Approval Designator: NA
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.): WHC-SD-WM-MAR-009, Rev. 0	9. Related ECN No(s).: NA	10. Related PO No.: NA

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

12. Description of Change

Replacing WHC-SD-WM-MAR-009, Rev. 0, "Initial Single-shell Tank Retrieval System Mission Analysis Report, with WHC-SD-WM-MAR-009, Rev. 1, same title.

13a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

13b. Justification Details

Incorporation of RL comments and general update/format improvement.

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

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

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

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

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

Document Number/Revision	Document Number/Revision	Document Number Revision
Na		

20. Approvals

Signature		Date	Signature	Date
OPERATIONS AND ENGINEERING			ARCHITECT-ENGINEER	
Cog. Eng. JS Hertzel	J.S. Hertzel	3-8-96	PE	
Cog. Mgr. EJ Kosiancic	EJ Kosiancic	3-8-96	QA	
QA			Safety	
Safety			Design	
Environ.			Environ.	
Other GL Crawford	GL Crawford	3-8-96	Other	
			DEPARTMENT OF ENERGY	
			Signature or a Control Number that tracks the Approval Signature	
			ADDITIONAL	

Initial Single-shell Tank Retrieval System Mission Analysis Report

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

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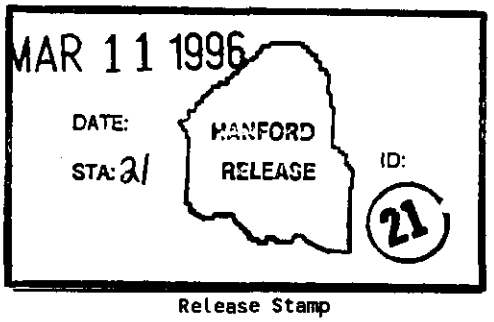
Key Words: mission analysis, leak, tank, SST, disposal

Abstract: This document provides the mission analysis for the Initial Single-shell Tank Retrieval System task, which supports the Single-shell Tank Waste Retrieval Program in its commitment to remove waste from single-shell tanks for treatment and final closure.



Karen L Noland 3/11/96
Release Approval Date

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RECORD OF REVISION	(1) Document Number WHC-SD-WM-MAR-009	Page 1

(2) Title
Initial Single-shell Tank Retrieval System Mission Analysis Report

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INITIAL SINGLE-SHELL TANK RETRIEVAL SYSTEM

TASK MISSION ANALYSIS REPORT

DOCUMENT NO.
WHC-SD-WM-MAR-009, Revision 1

Prepared By:

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For:

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February 1996

ABSTRACT

INITIAL SINGLE-SHELL TANK RETRIEVAL SYSTEM
TASK MISSION ANALYSIS REPORT

Mission analysis is an iterative process, which expands the mission statement, identifies needed information, and provides sufficient insight to proceed with the necessary, subsequent analysis. The Initial Single-Shell Tank Retrieval System (ISSTRS) task mission analysis establishes the ISSTRS problem statement: The Single Shell Tanks (SSTs) have exceeded their original design life. Sixty-seven of the 149 SSTs have been declared suspect leakers. Consequently, the waste must be removed from the tanks, processed, immobilized, and moved to acceptable storage. Equipment/systems for removing the waste from the SSTs does not exist and must be provided. The ISSTRS mission is to:

- *Satisfy the M-45-04 and M-45-08 series of the Tri-Party Agreement milestones,*
- *Provide the initial retrieval portion of the farm demonstration step of defining the limit of technology as defined in Figure 1, Attachment 1, TPA Change Form M-45-93-01, approved 1/25/95, and*
- *Demonstrate the feasibility of sluicing (as applied by Project W320) for salt cake retrieval.*

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CONTENTS

LIST OF TERMS

ACTR	Acquire Commercial Technologies for Retrieval
CENTRC	Capital Equipment not Related to Construction
DOE	U.S. Department of Energy
DOE/RL	Department of Energy, Richland Operations Office
DST	double-shell tank
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency
HLW	High Level Waste
ISSTRS	Initial Single-Shell Tank Retrieval System
MAR	Mission Analysis Report
NCR	Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
PACE	Plant and Capital Equipment
SRR	Systems Requirements Review
SST	single-shell tank
TPA	Tri-Party Agreement
TWRS	Tank Waste Remediation System
TRS	Technical Requirements Specification
WHC	Westinghouse Hanford Company

INITIAL SINGLE-SHELL TANK RETRIEVAL SYSTEM TASK MISSION ANALYSIS REPORT*

1.0 INTRODUCTION

1.1 PURPOSE

This Mission Analysis Report (MAR) provides the mission analysis for the Initial Single-Shell Tank Retrieval System (ISSTRS) task, which supports the Single-Shell Tank (SST) Waste Retrieval Program in its commitment to remove waste from SSTs for treatment and final closure.

The results of the ISSTRS will support the U.S. Department of Energy's (DOE) and privatization retrieval efforts. This report defines the ISSTRS task problem statement, the mission statement and mission boundaries, the known interfaces both programmatic and projects, the requirements and any needed information.

1.2 SCOPE

The goals of ISSTRS are to:

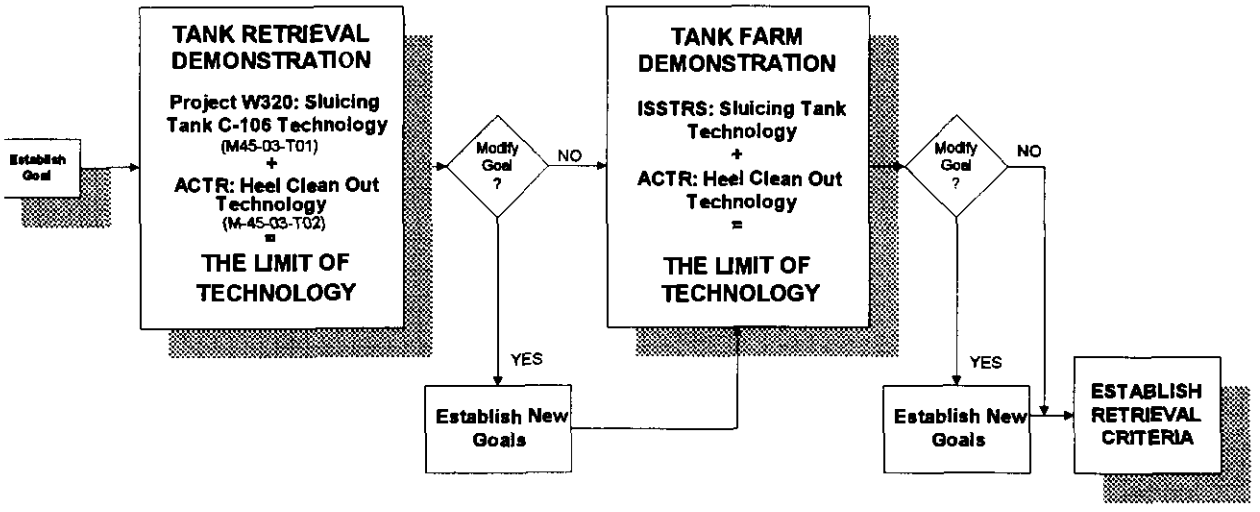
- Satisfy the 45-M-04 and M-45-08 series of the Tri-Party Agreement (TPA) milestone; Provide the initial retrieval portion of the farm demonstration step of defining the limit of technology as defined in Figure 1, Attachment 1, TPA Change Form M-45-93-01, approved 1/25/94; and
- Demonstrate the feasibility of sluicing as applied by Project W-320 for salt cake retrieval from a tank farm or the equivalent number of tanks.

As seen in Figure 1-1, the limit of technology is defined by the demonstration of sluicing, combined with Heel Clean Out technology supplied by Acquired Commercial Technology for Retrieval (ACTR). The fundamental planning and scope assumption is to use the sluicing retrieval method as applied by Project W-320 after the project has been descoped. The project will perform the installation design, fabrication, construction, and installation. This will include initial supply of spare parts, permits, approvals, procedures, and trained operators needed to operate in the selected tanks. The completion of the project is the relinquishing transaction of the retrieval system to tank farm operations.

The ISSTRS project will be accomplished in phases modified from the standard Systems Engineering process. They are defined as: System Definition Phase, Design Phase, Construction Phase, and Start

*This report is prepared in accordance with the TWRS Systems Engineering Manual, TSEP-01, Rev. 0, dated 08/01/95 (to be issued).

Figure 1-1. Components of the Retrieval Demonstrations that Define the Limit of Technology (based on Figure 1, Attachment 1, TPA Change Form M-45-93-01, approved 1/25/94).



Up Phase. Sluicing enhancements, lessons learned from Project W-320, and other information from ACTR will be incorporated at the beginning of the Design Phase.

TPA M-45-04-T01 states the following: This milestone will provide retrieval systems for an entire single-shell tank farm or an equivalent number of tanks. The tank farm with the minimum number of tanks is AX farm with four tanks. Therefore, the number of tanks chosen for ISSTRS is four.

ISSTRS's scope will include retrieving of four tanks with the first selected tank demonstrating salt cake retrieval by sluicing. DOE-RL has identified a SST salt cake demonstration to support the technical Objectives of Phase I Privatization in letter 95-PRI-073 to WHC (Bader 1995). The letter further defines DOE's responsibilities (as opposed to a private vendor), and has identified this as WHC's role in a workshop held in July 10-11, 1995. The other tanks will be selected based on waste compatibility and waste volumes corresponding to the available space in the designated DST storage facility.

Once the waste is retrieved from the selected SSTs, the interface requirements for transferring the waste to the receiving designated DST storage facility will meet the waste acceptance criteria of the receiving tank. Figure 1-2 shows the ISSTRS's boundaries for transferring the retrieved waste from the SSTs to the designated DST storage facilities. ISSTRS's interface responsibilities are with the receiving DST storage facility.

Figure 1-2. Retrieved SST Waste Transferred to the Designated DST Storage Facility

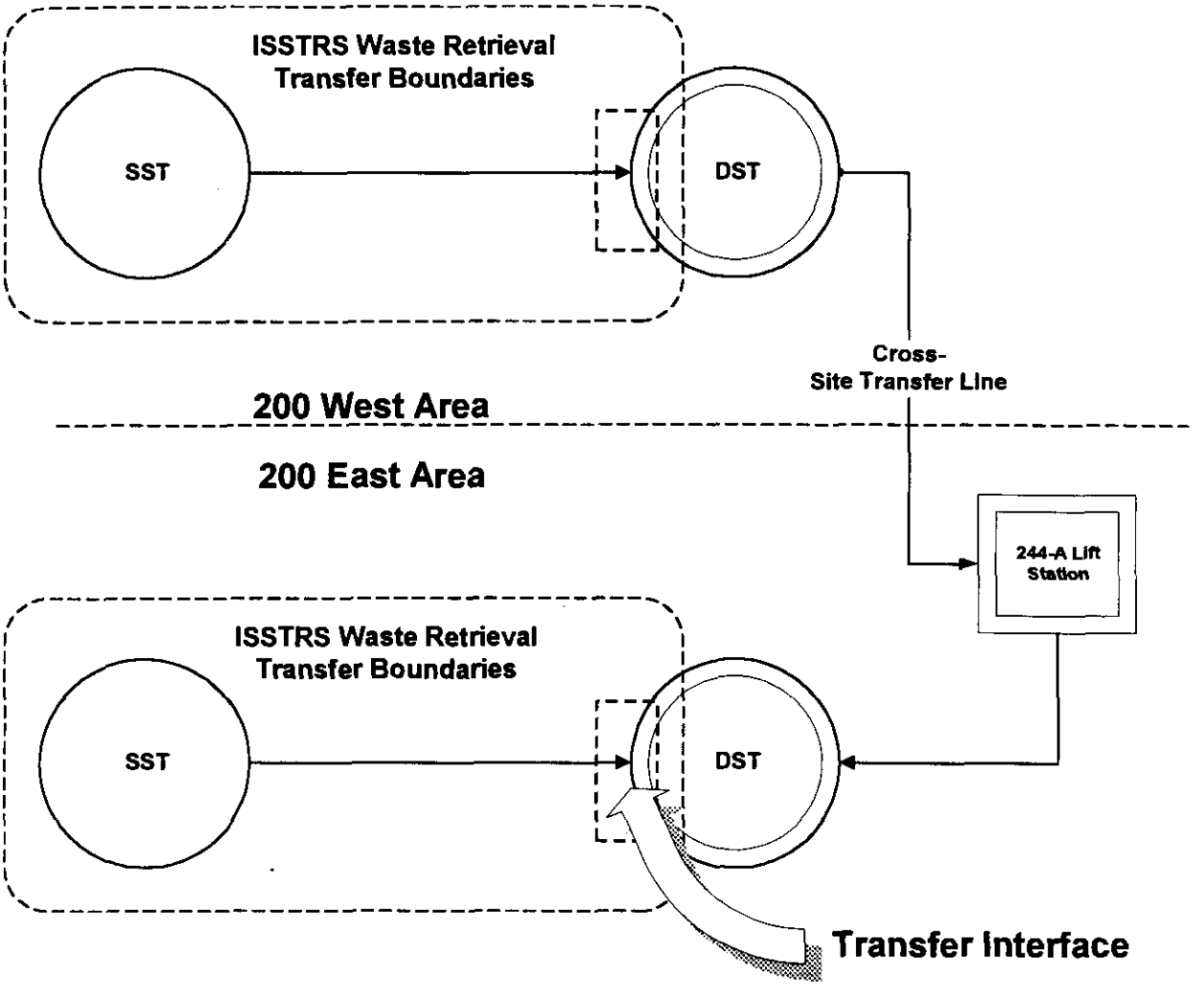
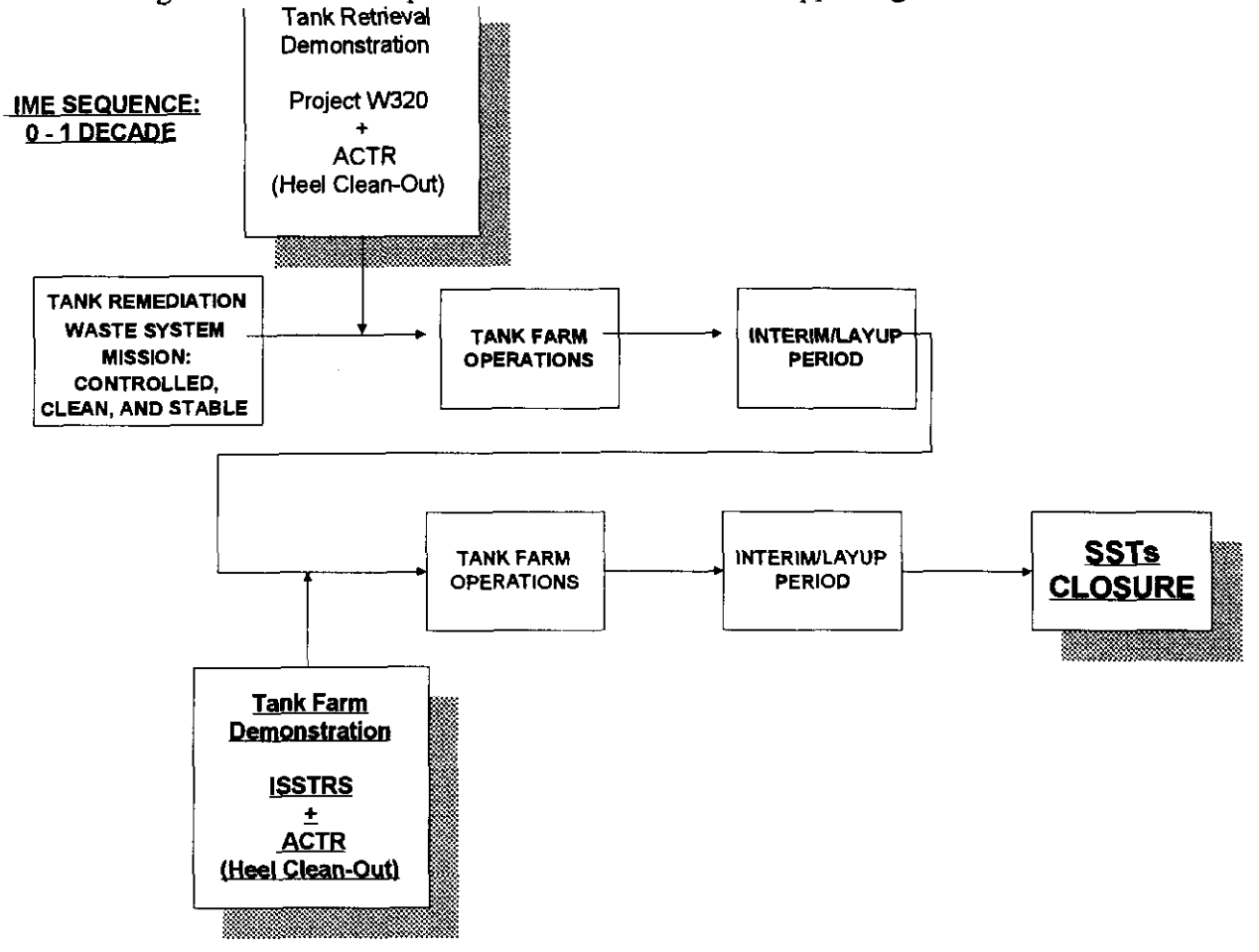


Figure 1-3 shows a time sequence (approximately 10 years) of how ISSTRS and Project W-320 supports a final condition of the TWRS's mission. ISSTRS's contribution to the mission of the TWRS is supporting the SST closure (WHC 1995a).

Figure 1-3. Time Sequence of ISSTRS & ACTR Supporting TWRS Mission.



1.3 FUNDAMENTAL ASSUMPTION

The fundamental assumption for ISSTRS is derived from the fact that the initial retrieval technology selection process was completed before the ISSTRS efforts began. WHC has recommended past practice sluicing as the "first choice reference retrieval technology where tank leakage is not a problem," (Gibbons et al. 1993). DOE-RL has concurred with that recommendation, directing that WHC "continue reference program for SST Retrieval (hydraulic sluicing)"as a "high risk, single point failure program" (Erickson 1995). This action fixed the fundamental technology for the ISSTRS activities. Therefore, ISSTRS will not evaluate alternate technologies (Hagmann 1995).

From Tank 241-C-106, Project W-320 will employ past practice sluicing to retrieve wastes. The design is complete, Key Decision-3 (KD-3) has been received, and construction activities are in progress. Operations are scheduled to begin in October 1996 and last approximately six months.

The fundamental assumption of the ISSTRS activities is to employ past practice sluicing, as applied

by W-320 (after the project was descoped) to other SSTs. Maximum advantage will be taken from the designs and lessons learned from Project W-320, and subsequent C-106 retrieval operation. It is further assumed that ISSTRS will use the Project W-320 designs, without significant modification.

The fundamental assumption leads to the conclusive limits of ISSTRS activities which are:

- Determining the basis and tanks to be included in the scope
- Providing systems as required, and fabrication identical to Project W-320 designs after the project was descoped
- Providing systems installation designs
- Installing the systems, and
- Pre-operational testing and final turnover for operation.

1.4 BACKGROUND

High-level radioactive waste has been stored at the Hanford Site since 1944 as a by-product of processing spent nuclear fuel for the recovery of plutonium, uranium, and neptunium. The first SST was completed and put into operation in 1944. Between 1943 and 1964, 149 SSTs were built for the storage of radioactive waste at the Hanford Site. These SSTs are in 12 tank farms, consisting of four to 18 tanks each, located in the 200 West and 200 East Areas of the Hanford Site. No waste has been added to the tanks since November 1980. Pumpable interstitial liquid and supernatant wastes are still being removed from SSTs and transferred to DST. Liquid waste accumulation and storage continued until 1980 when DSTs were completed and used exclusively for receiving new waste.

In 1968, the interim stabilization program, intended to reduce leak potential, removed pumpable liquid from the SSTs. The resulting waste in the tank is described as a semi-dry sludge and salt cake-type residue (Boomer et al. 1993).

Waste volumes vary from 5% to 95% of the tank capacities. The consistency of the waste varies from pumpable liquid, to sludge, to hard salt cake, including solid debris and contains both chemically hazardous and radioactive constituents. The actual mechanical properties of the waste vary considerably depending on the liquid content and chemical makeup of the waste.

The major chemical constituents of the wastes are nitrate and nitrite salts, hydrated metal oxide, phosphate precipitate, transuranic, and isotopes of cesium, strontium, iodine, and technetium. Inside the tank, the environment is highly radioactive (up to 1,000 R/h) and chemically harsh (WHC 1995a).

The SSTs are constructed of a carbon steel single shell housed in a concrete wall and dome. Corrosion, particularly stress corrosion cracking (SCC), may be common in the steel liners of the SSTs. SCC is cracking of a metal produced by the combined actions of corrosion and surface tensile stress (Lini 1975). SCC attack the heat affected zones surrounding the welds that join the steel plates of the liner because the welds were not stress-relieved. Therefore, any of the liner welds below the waste level are potential sites for leakage (Anantatmula et al. 1994).

The SSTs currently store approximately 132,475,000 L (35 million gal) of sludge and salt cake, and 18,925,000 L (5 million gal) of pumpable liquids. All of the SSTs have exceeded their design life. Of the 149 SSTs, 67 are known or assumed to have leaked radioactive waste to the surrounding soil (Hanlon 1995).

1.5 STRATEGY

Sluicing has been selected as the primary retrieval technology to be applied by ISSTRS, (see Section 1.3 Fundamental Assumption). Based on retrieval technology options studies, sluicing is an acceptable retrieval technology (Gibbons et al. 1993). Sluicing demonstrations will be preformed on a tank containing sludge waste by Project W-320 and the Safety Issue Resolution of tank C-106. ISSTRS will provide the demonstration of sluicing salt cake waste.

The following gives a brief outline and historical basis for implementing past practice sluicing to retrieve salt cake and sludge (Rodenhizer 1987).

PAST HISTORY

- 2.6 Mgal of sludge (solids volume) has been sluiced from 45 tanks in Farms B, C, T, U, TX, BX, & BY from 1952 - 1957.
- 1.2 Mgal of sludge (solid volume) has been sluiced from 10 tanks from Farms A, & AX from 1962 - 1978.
- No salt cake has ever been sluiced at Hanford, or in the DOE Complex. Current total solids volume is approximately 12Mgal of sludge and 23Mgal of salt cake, (Hanlon, 1995).
- Past sluicing campaign's targets were 1 to 2 inch waste residuals. One inch uniformly distributed waste residual coincides with the current TPA cleanliness requirement of 360 cu ft in the larger SSTs.
- Although production rates of past campaigns were lower than the production rates required under Tri-Party Agreement, no correlation between past campaigns and current required rates can be established.

ISSTRS TECHNICAL STRATEGY

- Sluicing as applied by Project W-320 will be employed as the primary technology will continue until a significant decline in productivity is encountered. This activity performs the Systems Engineering Function 4.2.2.1.1, Remove Limited SST Waste: " The removal of wastes from the SSTs using established technologies and the transfer of these wastes to the Store In-Process Waste function," (DOE 1996b).

- Outside of the ISSTRS scope, is removing the post sluicing heel to the required clean-out level. A post sluicing heel clean out technology is being identified, tested, and applied as part of ACTR. Completion of the heel removal satisfies the activities described by Systems Engineering Function 4.2.2.1.2 Remove Remaining SST Waste: "The removal of SST waste, not removed by the Remove Limited SST Waste function, uses established, enhanced, and/or alternative technologies and the transfer of the wastes to the Store In-Process Waste function. Wastes will be removed to the extent required for turnover of the tanks to closure" (DOE 1995b).

- The Systems Engineering function titles, and descriptions were taken from the TWRS SE data base, and were current as of 1/16/96, (WHC 1996b).

- Sluicing alone is not required to achieve the TPA clean or schedule requirements. It is the sequential combination of sluicing as applied by Project W-320 and a heel removal technology that defines the retrieval production rates and clean out levels. The optimal transition from sluicing to heel removal will be established as information is developed for both retrieval methods. This transition sequence will be developed as part of the ISSTRS definitive design effort and documented in the ISSTRS "Operations Description Document."

The ISSTRS Management and Systems Engineering Strategy will support ISSTRS's fundamental assumption (Section 1.3) derived from the source document: *Approach Plan for the Initial Single-Shell Tank Retrieval System Definition Effort* (Hagmann 1995). The following sections outlined below are the management and systems engineering approach for ISSTRS.

MANAGEMENT STRATEGY

- The ISSTRS activities will not be a Capital Line Item. Based on the fundamental assumption that ISSTRS will use Project W-320 designs, financing will be a mix of expense and CENRTC funds. The exception will be financing a training facility (if required) from PACE funding.

SYSTEMS ENGINEERING STRATEGY

- ISSTRS will use a graded approach in the application of System Engineering to expense, CENRTC, or General Plant Project-funded activities, similar to Project W-320. ISSTRS will comply with the intent of the Systems Engineering requirements, adapting them as appropriate to provide adequate value at a reasonable cost.

- The first ISSTRS adaptation of the full Systems Engineering process is combining the Pre-Conceptual and Conceptual Phases into one phase, called System Definition. The next are combining the Preliminary Design Phase and

the Detailed Design Phase into a single phase called the Design Phase. ISSTRS's fundamental designs have already been reviewed as a part of the Project W-320 Critical Design Reviews which reduces cost without appreciably increasing risk.

- The TWRS Systems Engineering architecture was defined in the TWRS's F&R, in draft form, through level four. The ISSTRS activities will provide the systems to perform function 4.2.2.1, Retrieve SST Waste (WHC 1995b).

- Ideally, TWRS Systems Engineering would have completed the approval process for the TWRS's F&R and TRS before the ISSTRS System Definition phase would begin. ISSTRS will meet its TPA milestones (see section 2.4) and continue in parallel with the accomplishment of the Systems Requirements Review Action Plan[1] (DOE 1995b).

- This situation creates an unavoidable risk. The risk is that ISSTRS will create its System Definition products based on the available architecture and process documented in the TWRS F&R. However, the SRR Action Plan accomplishment may alter those basis documents. At the end of the ISSTRS Systems Definition phase, the ISSTRS documents will be reviewed against the products of the completed SRR Action Plan. If a rework is required to align the ISSTRS System Definition documents with TWRS F&R's architecture or processes that will form the basis for a change request to modify the ISSTRS planning.

[1] The SRR of the TWRS F&R was held, and resulted in comments that lead to a TWRS System Requirements Review Action Plan (DOE 1995). This action plan defines the path and schedule for implementation of Systems Engineering.

2.0 MISSION ANALYSIS

2.1 STAKEHOLDERS

Dialogue between DOE and the stakeholder groups is a public involvement activity that integrates the stakeholder's views into DOE's decision-making. The stakeholder's issues, concerns, values are considered in the decision-making process. The stakeholder groups vary in size and interest.

They include:

- Public Action Groups - the Hanford Advisory Board and Native American Indian Tribes
- Federal Bodies - The Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and
- State Bodies - Washington State Department of Ecology (Ecology).

DOE, EPA and Ecology have entered the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement).

Listed below are nine of the twenty-three stakeholder values found in Appendix B, of the *Tank Waste Remediation System, Mission Analysis*, WHC-SD-WM-MAR-008, Rev. 0:

- Protect Public and Worker Health and Safety
- Protect the Environment
- Protect the Columbia River
- A cleanup to the Level Necessary to Enable Future Options to Occur
- Capture Economic Development Locally
- Ensure Compliance
- Reduce Costs
- Enhance Technology Development
- Protect rights of the Native American Indians
- Get on with the Cleanup to Achieve Substantive Progress in a Timely Manner

ISSTRS's contribution to the TWRS's mission objectives is to assist in meeting all nine of the stakeholder values listed above.

2.2 PROBLEM DEFINITION

The SSTs have exceeded their original design life. Sixty-seven of the 149 SSTs have been declared as suspect leakers. Consequently, the waste must be removed from the tanks, processed, immobilized, and moved to acceptable storage.

2.3 MISSION STATEMENT

The mission statement, developed from the problem statement, forms the basis for a system that will resolve the problem.

For ISSTRS, the mission is to:

- Satisfy the M-45-04 series of the Tri-Party Agreement (TPA) milestones;
- Provide the initial retrieval portion of the farm demonstration step of defining the limit of technology as defined in Figure 1, Attachment 1, TPA Change Form M-45-93-01, approved 1/25/94; and
- Demonstrate the feasibility of sluicing as applied by Project W-320 for salt cake retrieval.

The mission objectives include providing the systems, equipment, initial spare parts, permits, approvals, procedures, and trained operators needed to begin the retrieval operations.

The ISSTRS mission statement is consistent and supports the TWRS mission which includes retrieval, pretreatment, immobilization, interim storage, and disposal, and the TWRS Baseline Description which describes Phase I & II privatization efforts including retrieval of tank wastes, (Johnson 1996).

2.4 INITIAL SINGLE-SHELL TANK RETRIEVAL SYSTEM (ISSTRS) MISSION GOALS AND OBJECTIVES

Table 2-1. Initial Single-Shell Tank Retrieval System (ISSTRS) Mission Goals & Objectives.

GOAL	OBJECTIVES
"Tank waste from single shell tanks (SST) will be retrieved for immobilization and stable disposal." (WHC 1995a).	Provide systems to retrieve the waste from the SSTs consistent with the retrieval process described in the TWRS Baseline System Description (Johnson 1995). Provide a retrieval system (WHC 1995a). Provide the retrieval system to demonstrate SST salt cake retrieval, complying with direction received in DOE letter to Westinghouse Hanford Company: "SST salt cake retrieval demonstration (DOE(M&O) responsibility)." (Bader 1995). Provide the first tank for ISSTRS demonstration based on salt cake content.

Table 2-1. Initial Single-Shell Tank Retrieval System (ISSTRS) Mission Goals & Objectives.

GOAL	OBJECTIVES
Satisfy the following Tri-Party Agreement milestones: - M-45-04A: Complete conceptual design for the initial SST retrieval systems. 4/30/97 - M-45-04-T02: Complete design for the initial SST retrieval systems. 12/31/00 - M-45-04-T03: Complete construction for the initial SST retrieval systems. 6/30/03 - 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. 11/30/03 - M-45-08-T02: Establish the criteria through stakeholder, participation and ecology approval for: (1) Determining allowable leakage volumes, and (2) An acceptable leak monitoring/detection and mitigation measure 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. 4/30/97 - 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. 12/31/00 - M-45-08B: Complete demonstration and installation of leak monitoring and mitigation systems for initial SST retrieval. 6/30/03 - 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. 9/30/96 to 9/30/03 (Ecology, EPA, and DOE 1994)	Provide equipment/systems designed and fabricated to Project W-320 designs, installations of the systems that include spare parts, and prepare for operations with trained operators needed to retrieve waste from the selected SSTs.

Table 2-1. Initial Single-Shell Tank Retrieval System (ISSTRS) Mission Goals & Objectives.

GOAL	OBJECTIVES
Comply with the interfaces and goals provided in the TWRS Mission Analysis (WHC 1995a).	Follow regulations, guidance, and acceptance criteria of onsite programs; incorporate operational, administrative control requirements, and program guidance into procedures documents; provide retrieval systems in preparation for SST closure; provide initial retrieval systems to satisfy the TPA residual waste criteria.
Be fully integrated with the TWRS Process Flowsheet (Orme 1995), and the Retrieval Sequence and Blending Strategy (Certa 1995).	Retrieve wastes no faster than the Waste Volume Projections will allow for storage within the existing Double Shell Tanks. This will prevent the ISSTRS effort from becoming the driving need for the construction of new double shell tanks.
Provide a waste retrieval system at a minimum cost.	Employ sluicing as applied by Project W-320; incorporating lessons learned from Project W-320.

2.5 MISSION-LEVEL REQUIREMENTS

Mission-driven requirements are unique to the ISSTRS and are derived from the system mission. The internal requirements listed below describe the performance parameters of ISSTRS.

The ISSTRS will perform to the following:

- Conceptual, definitive design and product specifications that define the system characteristics by interfacing with:
  - Project upgrades for equipment such as pumps, sluicers, salt well screen;
  - Tank farm upgrades; and
  - TWRS retrieval sequence planning.
- ISSTRS planning strategy assumes the use of existing transfer lines. The validity of that assumption will be verified during a conceptual design phase.
- System characteristics will specify operational, administrative, and safety control limits for equipment such as:
  - Sluicers, and pumps
  - HVAC systems, exhauster, and stack monitoring
  - Control systems
  - Waste transfer activities

  - Seismic detection and shutdown response, and
  - Leak detection, monitoring and mitigation.

- Equipment and systems procurement, fabrication, and construction will follow standard WHC procedures.

- Testing and training activities will follow all WHC standards, federal and environmental regulations and program guidance before initiating retrieval operations for the following:
  - Testing equipment,
  - Obtaining permits and approvals,
  - Providing procedures, and
  - Training operators.

- Retrieval, preparation, and final disposal of task-generated and in-tank waste (i.e., pumps, thermocouple trees, and etc.) that obstructs the retrieval activities will be removed and disposed. All disposal activities will be in accordance with applicable solid waste acceptance criteria. ISSTRS will not remove all existing in-tank hardware, only hardware that interferes with the operation or installation of the sluicing systems.

- Assess the need and provide retrieval utilities when required such as substations, motor control centers, water, steam, electrical service, and etc. The retrieval utilities will satisfy requirements for clean, safe and stable. The retrieval utilities will remain for follow-on closure activities.

- Provide technical support to the Operational Readiness Review conducted by Tank Farm Operations after relinquishing the ISSTRS to Operations.

- Monitoring capabilities of the retrieved waste within the ISSTRS boundaries (Figure 1-2) will adhere to the all WHC standards and applicable guidance on administrative, operational and safety control limits.

2.5.1 External Requirements

External requirements include commitments, external interactions, laws, regulations, and policy positions. Listed in Appendix C are the applicable external requirements.

2.6 INITIAL UNACCEPTABLE STATE

No equipment/systems currently exist to remove the waste from the selected tanks.

2.7 ACCEPTABLE END STATE

The final acceptable end state of ISSTRS is to provide the TWRS Tank Farm Operations with the tank-to-tank retrieval system (equipment/systems), spares and trained operators to retrieve waste from the four tanks selected to be included in ISSTRS, on schedule and within budget.

This is consistent with and supports:

- The TWRS mission which includes retrieval, pretreatment, immobilization, interim storage, and disposal (WHC 1995a), and
- The TWRS Baseline Description which describes Phase I & II privatization efforts to include retrieval of tank wastes (Johnson 1996).

The ISSTRS supports the TWRS mission by providing the necessary equipment/system to:

- Mobilize the salt cake waste using past practice sluicing;
- Convey the waste out of the SST and transferring to a DST destination; and
- Monitor/control the retrieval system and the retrieved waste.

2.8 TECHNICAL PERFORMANCE MEASURES

The technical performance measures (TPM) are a selected subset of ISSTRS technical performance parameters that are critical to the ISSTRS mission's success.

The ISSTRS technical performance measures include the following:

- Successful pre-operational testing of retrieval equipment/systems equipment within the appropriate budget and schedules;
- Compliance with applicable laws and regulations for SST retrieval; and
- Meet all objectives specified in Section 2.3.

2.9 SYSTEM BOUNDARIES AND EXTERNAL INTERFACES

The preliminary task physical boundaries are as follows:

- The first SST to be retrieved will demonstrate salt cake retrieval.
- ISSTRS will duplicate tank-to-tank sluicing as applied by Project W-320.
- In accordance with TWRS Process Flowsheet (Orme, 1995) and TWRS Retrieval Sequence and Blending Strategy (Certa, 1995) the SSTs selected will be based upon cost, risks, meeting TPA milestones and DOE privatization objectives.
- The designated DST storage facility for the transferring the retrieved sluiced waste will be determined in the TWRS Retrieval Sequence and Blending Strategy (Certa, 1995).

- The ISSTRS demonstration contributes to the definition the limit of technology for retrieval which establishes the feasible production rate for retrieval while meeting the applicable TPA milestones.

- ISSTRS will assess the minimum achievable SST leak criteria and determine bounding condition during SST waste retrieval. Operational and safety responses to SST waste leakage detection will be developed.

The ISSTRS's organizational boundaries are as follows:

- Quality Assurance
- Management of tank farm waste (Operations)
- TWRS and Retrieval Project Office
- Safety Department
- Environmental
- East Tank Farm Operations.

Programmatic task constraints include the following:

- Funding limitations and milestones
- Compliance to all applicable requirements, rules, and regulations
- TWRS Systems Engineering.

The currently defined external interfaces are as follows:

- The designated DST storage facility
- Tank Farm Operations.
- Other tank farm enhancement projects such as, but not limited to, the following:
  - Project W-211, Initial Tank Retrieval Systems
  - Project W-314, Tank Farm Restoration and Safe Operations
  - Project W-315, Pilot Scale Retrieval System
  - Project W-320, Tank 241-C-106 Sluicing
- Waste transfers
- Retrieval construction and operations solid waste
- Retrieval operating emissions.
- TWRS's mission requirements in support of clean, safe, and stable.

2.10 SYSTEM LIFE CYCLE

The ISSTRS task starts upon receipt of an approved Mission Analysis and continues until occurrence of the following:

- The task has provided equipment and systems for salt cake waste retrieval for the four selected SSTs.

- The task has provided a waste retrieval system that is ready for waste retrieval operations.

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National Environmental Policy Act of 1969, 42 USC 4321, et seq.

Federal Facility Compliance Act of 1992, Public Law 102-386 (also see 42 USC 6901,et seq.).

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APPENDIX A

Definitions

Boundary	The border that establishes the interface for inputs and outputs of the system.
Constraints	Restrictions or limitations that must be met.
Conveyance	Transport waste out of tank.
Dislodging	Fragmenting/separating waste from its current location in a tank.
Disposal	Placement of waste in such a manner that ensures isolation from the environment.
Function	A specific action, activity, or process that achieves or supports the achievement of an objective. An operation that must be performed to accomplish the mission.
Goals	Statements describing the desired endpoints.
Interface	System boundary across which material, data, or energy pass.
Measure of Success	A set of attributes that, when compared to actual results, shows how well the mission was accomplished.
Mobilization	Mixing waste with air or water to form a slurry for conveyance.
Objectives	Discrete, measurable events that, if accomplished, will contribute to achieving a goal.
Problem statement	A declaration of needs and desired outcomes.
Program	An organized set of activities directed toward a common purpose. Programs typically comprise technology-based activities, projects, and supporting operations.
Task	A unique effort within a program that has a firmly scheduled beginning, intermediate, and ending date milestone.
Remediation	Action taken to safely store, maintain, treat, and dispose of waste.
Remediation System	An integrated solution for carrying out the specific functions associated with remediating tank waste.
Requirement	Describes either quantitatively, or qualitatively, the needs of a function.

Risk	Health and safety or environmental issues that may adversely impact the program's ability to meet regulatory requirements or accomplish program goals.
Strategy	A plan or approach to accomplish the mission.
System	A combination of related functions, processes, people, and end items integrated into a single activity.
Transfer	Physical movement of waste from retrieval to pretreatment.
Tri-Party Agreement	Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, 1992, Hanford Federal Facility Agreement and Consent Order, 2 vols., as amended.

APPENDIX B

Attachment 1, TPA Change Form M-45-93-01, Approved 1/25/94 Process for Determining the Limit of Technology for SST Retrieval

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APPENDIX TO CHANGE REQUEST M-45-93-01

Waste Retrieval Criteria Procedure

Introduction:

The purpose of this procedure is to establish a means to set, evaluate, and revise criteria for determining the allowable residual waste following waste retrieval operations on the Hanford single shell tanks (SST).

The format for this procedure is to progress through a series of steps as depicted in the generic logic diagram displayed as Figure 1. Each step is briefly outlined and includes elements that constitute completion of the step.

Definition of terms specific to Waste Retrieval Activities:

Residual Waste: Tank waste remaining the tank after all waste retrieval actions have been completed. Some material may be excluded from residual waste volume calculations, subject to approval in the closure plan.

Step 1 : Establish Goal

This initial step establishes the goal (the standard) for waste retrieval percentage and the method to be used to calculate the allowable residual waste volume following completion of retrieval operations The calculation method is dependent on the variable to be measured (total tank waste inventory), and closure criteria and strategy. The proposed residual waste volume calculation method is shown in Attachment 1. A retrieval goal has been established as defined in milestone M-45-00.

Step 2 : Evaluate Major Assessment Areas

Once the goal has been established, it is assessed against two major area, which are:

a) SST Demonstration: Demonstrate achievability of waste retrieval goal during tank 241-C-106 tank retrieval demonstrations. These demonstrations will include the reference SST retrieval technologies. The effectiveness of the retrieval operation will be determined with a topographical measurement of remaining waste in the tank, and a calculation of waste inventory. The inventory calculation will be based on calculated volume of the tank, waste topography measurements with appropriate surveying techniques, and include adjustments for any detectable deformities in the tank structure (i.e., liner bulges). This technique will be demonstrated and calibrated in this retrieval demonstration. Prepare input to the retrieval goal evaluation (step 3) to accommodate the retrieval operations and residual measurement demonstrations.

b) Evaluate requirements of high-level waste (HLW) disposal from DOE Orders and the Nuclear Waste Policy Act (NWPA). Establish an interface with the Nuclear Regulatory Commission (NRC), and reach formal agreement on the retrieval and closure actions for single shell tanks with respect to allowable waste residuals in the tank and soil column. Prepare input to the retrieval goal evaluation (step 3) to accommodate the agreements on allowable residuals.

Step 3 : Tank Retrieval Demonstration Goal Compliance

Perform a joint assessment by DOE, EPA, and Ecology of the retrieval goal, based on the inputs from Steps 1 and 2. Modify the retrieval goal to match the most restrictive case (i.e., the highest retrieval % requirement).

Step 4 : Tank Farm Retrieval Demonstration

Perform the Tank Farm Retrieval Demonstration on the selected tank farm or initial set of single-shell tanks to be retrieved. Repeat the residual inventory measurement steps identified in the tank retrieval demonstration. Calculate the residual inventory for each tank, based on the formula and procedure in Attachment 1.

Step 5 : Tank Farm Retrieval Demonstration Goal Compliance

Perform a joint assessment by DOE, EPA, and Ecology of the retrieval goal, based on the tank farm retrieval demonstration results. Modify the goal to match best available technology. Notify NRC as required for compliance with NWPA. Establish formal criteria for retrieval of waste from the remaining SST's. Finalize closure plans for tank farms and obtain concurrence from regulatory agencies.

Step 6 : SST Retrieval

Proceed with retrieval of waste from the remaining SSTs. The schedule reflects retrieval activities on a tank-by-tank basis. It also allows flexibility to retrieve tanks from various farms if desired to support safety issue resolution, pretreatment or disposal feed requirements, or other priorities. Completion of retrieval will be in accordance with approved closure plans.

Step 7 : Determine Residual Waste Percentage

The waste residuals are calculated for each tank.

Step 8 : Retrieval Compliance Evaluation

Compare residual waste in each tank with criteria. Document compliance with criteria via notification to appropriate regulatory agencies. If residual complies with criteria, proceed with final closure operations (step 14). If residuals do not comply with criteria, prepare a request for waiver to the appropriate regulatory agency (step 9).

Step 9 : Petition for Regulatory Waiver

An assessment is made as to the applicability of petitioning for regulatory waiver. This requires the review of relevant NRC license issues and possible closure plan modifications. Submit waivers to appropriate regulatory agencies.

Step 10 : Waiver Acceptance

If a waiver is accepted, closure operations for the tank farm is initiated (Step 14). If the waiver is not accepted, additional retrieval operations are required. New technology may be needed (step 11). The waiver evaluation will consider the points on Attachment 2.

Step 11 : Additional Technology Available

A review of alternate technologies will be performed relative to additional waste removal. If additional technologies are available, they will be deployed (step 12) and waste retrieval will resume. If additional technologies are not available, new technologies must be developed and deployed (steps 13 and 14). The tank farm will be held in interim status pending completion of the additional retrieval operations.

Step 12 : Deploy Technology and Perform Additional Retrieval

If additional retrieval technology is available, it is deployed and additional waste retrieval operations are performed. After retrieval operation, the waste residual is again determined (Step 7), followed by the tank goal compliance evaluation (step 8).

Step 13 : Develop New Technology

If additional retrieval technology is not available, new technology is to be developed for the residue waste followed by deployment of the technology and additional waste retrieval operations (step 12). After retrieval operation, the waste residual is again determined (step 7), followed by the tank goal compliance evaluation (step 8).

Step 14 : Closure Action

When the tank farm retrieval and waste residual assessment process if complete the closure operations will start. Completion of the retrieval operations will be documented in accordance with the closure plans.

Attachment 1

WASTE RESIDUAL CALCULATION PROCEDURE, STEP 1

Calculate Residual Waste Volume

1. Calculate Tank Volume
2. Measure/Calculate Waste Inventory via Topographical Mapping and Survey Techniques.
3. Retrieve Waste
4. Repeat Step 2.

Calculation Method:

For 75' Diameter Tanks (Full Diameter Tank (x))

xbar gal = (100-A)% (Total Volume of Waste/133 Tanks) = Allowable Average Residual
in full diameter tanks Per Tank

where A% * = Goal or criteria for waste retrieval percentage.

For Small Diameter Tank (y)

ybar gal = (100-A)% Total Volume of Waste/16 Tanks) = Allowable Average Residual
in small diameter tanks Per Tank

where A% * = Goal or criteria for waste retrieval percentage.

* Goal is 99% waste retrieval as defined in M-45-00 in equivalent volumetric measures.

Attachment 2

EXCEPTION TO RETRIEVAL CRITERIA FOR SINGLE-SHELL TANKS

The DOE shall retrieve waste in accordance with criteria defined in milestone M-45-00. This recovery criteria will be applied to each tank on a tank-by-tank basis. If the DOE does not believe that this criteria is achievable for a specific tank, DOE shall submit a request for an exception to RPA and Ecology. The request shall include, at minimum, the following information:

1. The reason DOE does not believe the retrieval criteria can be met.

2. The schedule, using existing technology, the complete retrieval to the criteria - if possible.

3. The potential for future retrieval technology developments that could achieve the criteria, including estimated schedules and costs for development and deployment.

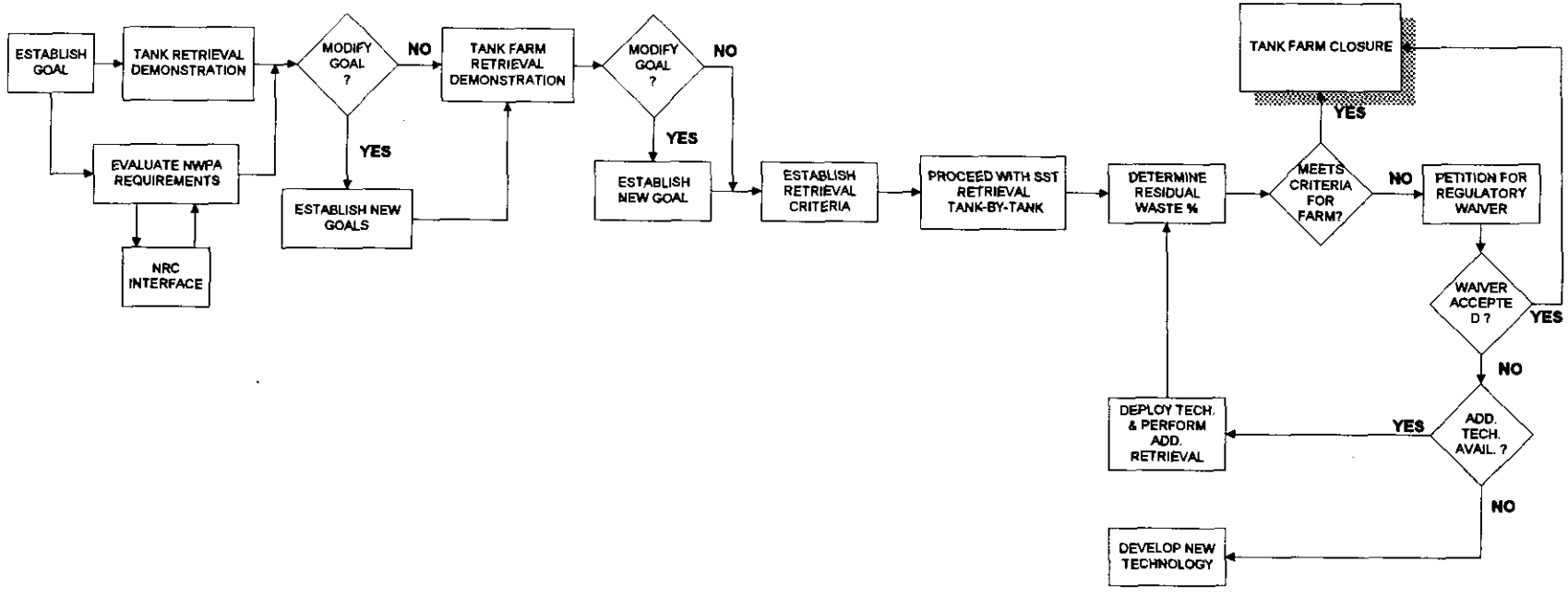
4. The volume of waste proposed to be left in place, and its chemical and radiological characteristics.

5. Expected impacts to human health and the environment if the residual waste is left in place.

6. Additional information as required by EPA and/or Ecology.

The above information shall be submitted within 120 days of the decision by DOE that continued retrieval actions will not result in further waste removal. Upon receipt, EPA and Ecology shall provide a response within 60 days, in which they will either approve the exception to the criteria, in which case retrieval will be considered compete for the tanks in question, or they will deny the request. If the request is denied, the DOE must continue to attempt to retrieve the tank wastes until the criteria is met for the tank, or they may chose to enter into the RCRA dispute resolution procedures of the Agreement. If an exception to the criteria is approved, the closure plan for the SSTs must be modified to address the remaining residual waste.

Figure 1. Process for Assessing Percentage of Waste Retrieved from Waste Retrieval Operations



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APPENDIX C

External Constraints and Requirements for ISSTRS

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Document Identifier	Title
29 CFR 1910.120	*Hazardous Waste Operations and Emergency Response*
40 CFR 60	*Standards of Performance for New Stationary Sources*
40 CFR 61	*National Emission Standards for Hazardous Air Pollutants*
40 CFR 191	*Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes*
40 CFR 261	*Identification and Listing of Hazardous Waste*
40 CFR 262	*Standards Applicable to Generators of Hazardous Waste*
40 CFR 264	*Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*
40 CFR 265	*Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*
Public Law 101-510	*Safety Measures for Waste Tanks at Hanford Nuclear Reservation,* Section 3137.
DOE Order 5484.1	*Environmental Protection, Safety and Health Protection Information Reporting Requirements,* Chapter III, "Effluent and Environmental Monitoring Program Requirements".
DOE Order 5400.1	*General Environmental Protection Program,* Chapter IV, "Environmental Monitoring Requirements".
DOE Order 5820.2A	*Radioactive Waste Management,* Chapter I, Section 3, "High-Level Waste;" Chapter III, Section 3, "Management of Low-Level Waste".
DOE Order 5480.11	*Radiation Protection for Occupational Workers*
DOE Order 6430.1A	*General Design Criteria*
DOE Order 5400.5	*Radiation Protection of the Public and the Environment*
DOE Order 5480.19	*Conduct of Operations Requirements for DOE Facilities*
DOE/EH-0135	*Performance Objectives and Criteria for Technical Safety Appraisals at Department of Energy Facilities and Sites*

Document Identifier	Title
DOE/EH-0173T	*Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*
DOE Order 5480.31	*Startup and Restart of Nuclear Facilities*
DOE/RL-92-58	*Tank Waste Remediation Systems Program Plan*
NRC Guide 4.15	"Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment," *Regulatory Guide 4.15*
WAC 173-303	*Dangerous Waste Regulations*
WAC 173-360	*Underground Storage Tank Regulations*
WAC 173-400	*General Regulations for Air Pollution Sources*
WAC 173-470	*Ambient Air Quality Standards for Particulate Matter*
WAC 173-480	*Ambient Air Quality Standards and Emission Limits for Radionuclides*
WAC 246-247	*Radiation Protection--Air Emissions*
WHC-CM-7-5	*Environmental Compliance*