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Revision 0

Tank Waste Remediation System Mission Analysis

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Prepared for the U.S. Department of Energy
Office of Environmental Restoration and
Waste Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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Date Published
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TANK WASTE REMEDIATION SYSTEM MISSION ANALYSIS

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ABSTRACT

Mission analysis is an iterative process that expands the mission statement, identifies needed information, and provides sufficient insight to proceed with the necessary, subsequent analyses. The Tank Waste Remediation System (TWRS) mission analysis expands the TWRS Program problem statement: "remediate tank waste." It also and the mission statement: "store, treat, and immobilize highly radioactive Hanford waste in an environmentally sound, safe, and cost effective manner."*

**"Current and future tank waste and the Sr/Cs capsules."*

The mission analysis expands the problem and mission statements to accomplish four primary tasks. First, it defines the mission in enough detail to provide any follow-on work with a consistent foundation. Second, it defines the TWRS boundaries. Third, it identifies the following for TWRS: (1) current conditions, (2) acceptable final conditions, (3) requirement sources for the final product and the necessary systems, (4) organizations authorized to issue requirements, and (5) the criteria to determine when the problem is solved. Finally, it documents the goals to be achieved.

This document concludes that tank safety issues should be resolved quickly and tank waste should be treated and immobilized quickly because of the hazardous nature of the tank waste and the age and condition of the existing tanks. In addition, more information is needed (e.g., waste acceptance criteria, condition of existing waste) to complete the TWRS mission analysis.

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1 Tank Waste Remediation System Boundaries. 1-3

LIST OF TERMS

ALARA	as low as reasonably achievable
CC	complexant concentrate
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy-Headquarters
DSSF	double-shell slurry feed
DST	double-shell tank
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
ER	Environmental Restoration
HDW-EIS	*Final Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington*
HLDW	high-level defense waste
HLW	high-level radioactive waste
HRA-EIS	Hanford remedial action-environmental impact statement
LLW	low-level radioactive waste
MRP	Management Requirements and Policies
NCAW	neutralized current acid waste
NCRW	neutralized cladding removal waste
NEPA	*National Environmental Policy Act of 1969*
NRC	U.S. Nuclear Regulatory Commission
OCRWM	Office of Civilian Radioactive Waste Management
PFP	Plutonium Finishing Plant
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Field Office
ROD	record of decision
SST	single-shell tank
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
TWRS	Tank Waste Remediation System
WIPP	Waste Isolation Pilot Plant

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TANK WASTE REMEDIATION SYSTEM MISSION ANALYSIS

1.0 INTRODUCTION

The Tank Waste Remediation System (TWRS) Program is a mission area (subsystem) of the Hanford Site cleanup mission. The TWRS Program has been tasked with remediating Hanford Site tank waste. The TWRS Program Leadership Council has defined the TWRS Program problem statement as follows:

"Remediate tank waste."

The leadership council has also defined the TWRS Program mission statement as follows:

"Store, treat, and immobilize highly radioactive Hanford waste* in an environmentally sound, safe, and cost-effective manner."

***"Current and future tank waste and the Sr/Cs capsules."**

This mission analysis expands the problem statement and the mission statement to do the following.

- Define the TWRS Program's mission in enough detail that subsequent work has a consistent basis from which to proceed.
- Define the TWRS boundaries (e.g., the scope of the problem TWRS is to solve and the interfaces with other onsite and offsite physical systems).
- Identify current conditions and specify acceptable final conditions.
- Establish criteria to determine the extent to which the problem will be solved.
- Identify the sources of requirements that govern the final conditions and the system for reaching the final conditions.
- Identify the organizations authorized to issue governing requirements.
- Document goals or objectives to be achieved and the associated measures of success.

The analysis provides information that will form the technical basis for the TWRS design, construction, operation, and decommissioning. The information from this analysis will be incorporated into the TWRS configuration for the TWRS Program.

Figure 1 shows the TWRS boundaries, the waste that is included in TWRS, the waste products from TWRS, and the environment in which TWRS must operate. Tables 1 through 5 in Section 5.0 contain the following, more detailed information:

Table 1. Initial State: The wastes included in the TWRS Program mission and a high-level, qualitative description of the current waste condition

Table 2. Final State: The final waste forms that will be produced by TWRS and the documents that contain the acceptance criteria for these waste forms

Table 3. Programmatic Interfaces: The agencies with authority to impose constraints on the TWRS configuration, and the final waste forms released from TWRS

Table 4. System Interfaces: Interfaces through which the TWRS receives or transfers system information, materials, or energy to or from other Hanford Site mission areas, external systems [e.g., U.S. Department of Energy (DOE) geologic repository], or the environment

Table 5. Measures of Success: Quantifiable measures of how well the system performs that can be used to compare system alternative strategies (e.g., risk, safety, compliance, cost, schedule) and measure how well the selected technical strategy achieves mission objectives.

Section 2.0 provides background information about the Hanford Site and the tank wastes. Section 3.0 describes the mission analysis process and how it was applied to TWRS. Section 4.0 presents the conclusions and recommendations from the mission analysis. Section 5.0 presents the data tables. Section 6.0 contains definitions of key terms. Section 7.0 lists the references.

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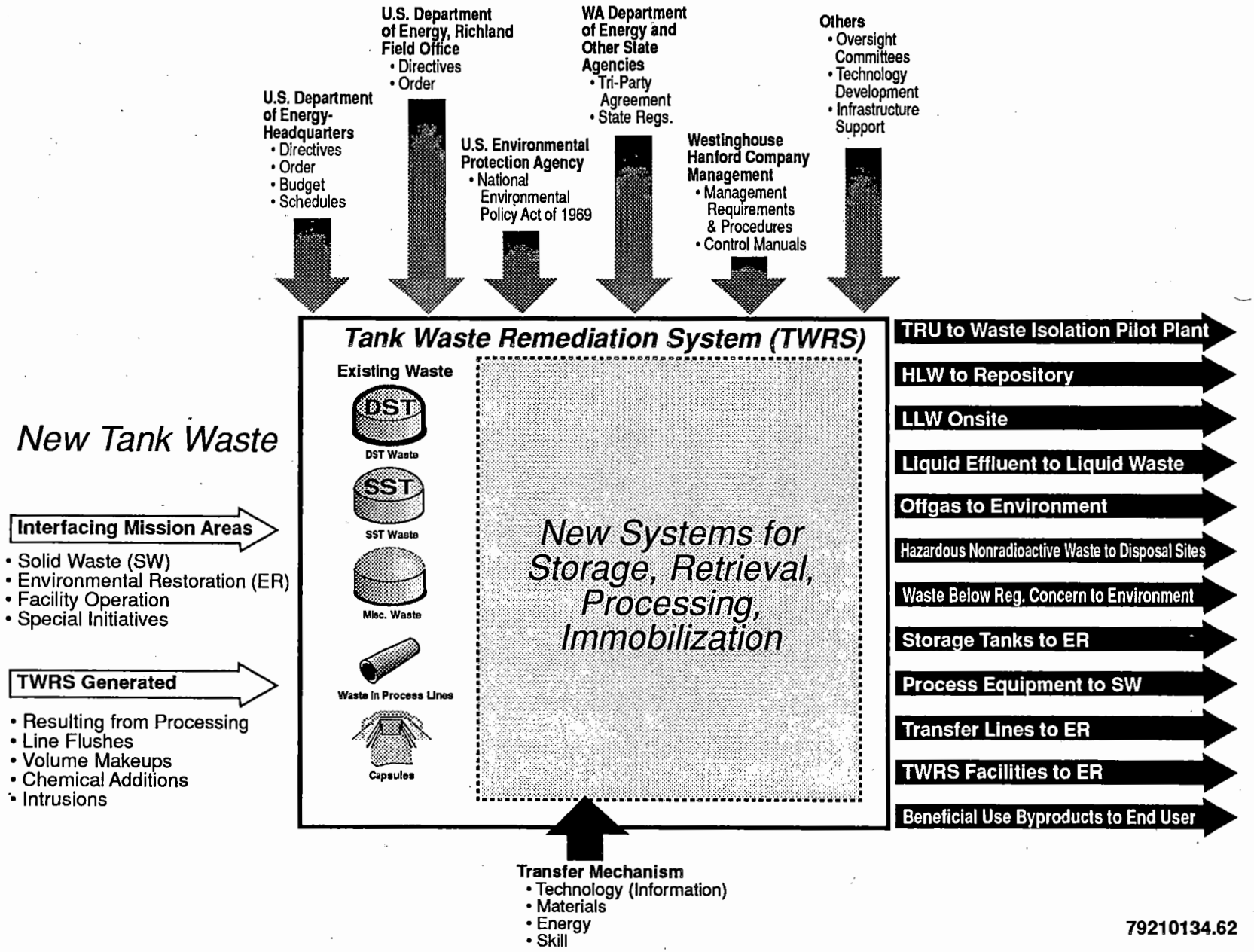

Figure 1. Tank Waste Remediation System Boundaries.

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2.0 BACKGROUND

Currently, approximately 137,000 m^3 (36 Mgal) of highly radioactive waste is stored in 149 single-shell tanks (SST), and approximately 95,000 m^3 (25 Mgal) is stored in 28 double-shell tanks (DST). In many cases, the waste has been stored in tanks that have exceeded their design life, and 67 of the SSTs have or are assumed to have leaked waste to the soil. The DOE has directed that the primary mission of the Hanford Site is to clean up the Site and eliminate potential risks to the public.

In March 1943, construction began on the Hanford Site, where the original mission was to produce plutonium for the world's first atomic weapons. Over the last 50 years, numerous activities related to the production of weapons-grade plutonium, various defense missions, and research and development generated radioactive waste on the Site. This waste was put in SSTs (built between 1943 and 1964) and DSTs (built between 1968 and 1986).

Because the tanks have leaked and the actual waste contents are in some cases unknown (many different chemical processes were used), the DOE assessed several methods for disposing of the tank waste. These methods are published in the *Final Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington* (HDW-EIS) (DOE 1987). The subsequent record of decision (53 FR 12449) associated with the HDW-EIS found the following.

<u>For the 28 DSTs</u>

- The high-level radioactive waste (HLW) fraction in the DSTs should be processed into a solid vitrified material similar to glass to await disposal in a geologic repository.
- The low-level radioactive waste (LLW) fraction in the DSTs should be mixed with a cement-like material to form grout and the grout allowed to harden in near-surface vaults onsite.
- The cesium and strontium waste should continue to be stored safely until a geologic repository is ready to receive the waste for disposal. Before shipment to the repository, the waste will be packaged in accordance with waste repository acceptance criteria.

<u>For the 149 SSTs</u>

- A sufficient technical basis was not available at the time to make a decision on the appropriate disposal technology. After additional development and evaluation, a supplemental environmental impact statement would be issued for the SSTs.

At the time of the record of decision, insufficient information existed to make a decision on the SSTs. This decision, however, became very important

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when the U.S. Congress passed Public Law 101-510 on November 5, 1990. Section 3137 of this law addresses safety issues concerning the handling of HLW in tanks at the Hanford Site. The law required that DOE identify tanks with a serious potential to release HLW because of uncontrolled increases in temperature or pressure. The majority of these safety issues revolve around SSTs (e.g., the tank waste generating flammable gases). Since 1990, other safety issues have been identified; currently, 18 safety issues and 9 system deficiencies exist regarding the tanks and the waste they contain.

In December 1991, the Secretary of Energy (Admiral Watkins) released a letter of decision (Anttonen 1991) regarding TWRS. From this letter and the resulting decision plan (Roecker 1992), the following major assumptions were made.

- TWRS would process SSTs, DSTs, and strontium and cesium capsules.
- TWRS would resolve or mitigate tank safety issues.
- Watch list tanks[1] will receive first priority for sampling and characterization.

Because the DOE is now working on remediating SST waste (which is different than the record of decision), a TWRS environmental impact statement will be prepared that incorporates SST disposal in lieu of the HDW-EIS supplemental environmental impact statement. The notice of intent will be issued in 1993.

[1]A watch list tank is an underground storage tank containing waste that requires special safety precautions because it may have a serious potential for release of HLW because of uncontrolled increases in temperature or pressure. Special restrictions have been placed on these tanks by Public Law 101-510, Section 3137, "Safety Measures for Waste Tanks at Hanford Nuclear Reservation."

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3.0 MISSION ANALYSIS

Mission analysis comprises the following elements:

- Identifies the TWRS objectives, system boundaries and interfaces, and measures of system effectiveness
- Identifies relevant information pertinent to input conditions and desired output conditions
- Provides sufficient information to proceed with the functional, requirements, and parametric analyses
- Addresses only the boundaries, NOT the attributes of the system itself
- Identifies any additional studies that are needed to complete the analysis and provide the missing information.

3.1 SCOPE

This report defines five classes of the TWRS boundary attributes. These are as follows:

1. System scope and initial conditions (initial state) (Table 1)
2. Final conditions to be achieved (final state) (Table 2)
3. Programmatic interfaces (Table 3)
4. System interfaces (Table 4)
5. Measures of success (Table 5).

The mission analysis identifies studies or actions required to provide necessary information where it is not defined or defined on an interim basis. Also, the analysis documents programmatic working positions and goals as interim bases for continuing current efforts until the mission analysis and supporting studies can be completed and the analysis is issued in final form.

3.2 APPROACH

The TWRS scope, programmatic and system interfaces, major constraints, goals, objectives, initial and final conditions, and working positions were identified through workshops with selected TWRS Program managers. The results and recommendations based on the workshops were presented to the TWRS Program Leadership Council on November 18, 1992. The TWRS Program Leadership Council revised and issued this information as direction for the program. This direction was further developed by key TWRS Program managers at a series of meetings in Seattle, Washington, during the week of November 30, 1992.

The programmatic interfaces were identified based on the entities with authority to impose constraints on the TWRS. These entities include Federal, State, and local agencies; DOE and Westinghouse Hanford Company management; and advisory and oversight committees. The programmatic interfaces also

include items such as availability and dissemination of technology, and interactions with the public in receiving and responding to requests for information.

Interfaces with external organizations and the constraints the organizations impose on TWRS were identified based principally on information in the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1992).

The information obtained during preparation of the mission analysis is in Tables 1 through 5 (in Section 5.0). A key to explain the information contained in the tables is included.

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4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the data in Tables 1 through 5, the following conclusions and recommendations have been developed.

4.1 INITIAL STATE (SEE TABLE 1)

4.1.1 Conclusions On Scope and Initial Conditions

Scope: The TWRS scope includes dispositioning or disposing of all tank waste, including cesium and strontium capsules, as well as all facilities, systems, and components currently used for storing or maintaining the waste until final disposition. It also includes all additional structures, systems, components, skills, and processes necessary to execute the mission. Highly radioactive liquid wastes generated by other mission areas are included in the scope and will be dispositioned through TWRS. Highly radioactive solid wastes (e.g., spent nuclear fuel assemblies, buried equipment) are excluded and will be dispositioned by the Solid Waste, Environmental Restoration, or other Hanford Site mission areas. Exceptions to this will be evaluated and handled on a case-by-case basis.

Initial Conditions: The Hanford Site tank waste is currently stored in 149 SSTs [with capacities ranging from 210 m^3 (55,000 gal) to 3,800 m^3 (1 Mgal)] and 28 DSTs [with capacities ranging from 3,785 m^3 (1 Mgal) to 4,315 m^3 (1.14 Mgal)]. Sixty-seven of the SSTs have or are assumed to have leaked. Some of the SSTs are beyond their original design life. The safety issues associated with the tank waste must be addressed quickly.

4.1.2 Recommendations on Scope and Initial Conditions

Scope: A mission analysis for the entire Hanford Site cleanup task should be prepared. It should identify the subsystems, define their scope, and establish the subsystem interfaces and interrelationships.

Initial Conditions: The current condition of all items in the TWRS scope has not been formally documented. Physical changes necessary to achieve acceptable interim conditions and final conditions should be identified. This information will be the basis to place the existing tank waste in a safe condition. Also, this information will be used to develop a system to transform these interim safe conditions into the final conditions for disposal.

4.2 FINAL STATE (SEE TABLE 2)

4.2.1 Conclusions

Acceptance criteria for turnover or disposal of waste, tanks, lines, equipment, or facilities are not fully defined.

4.2.2 Recommendations

Acceptance criteria for release of HLW to the geologic repository and disposal of LLW and hazardous waste should be established, documented, and put under change control. A plan should be developed for interfacing with appropriate regulatory agencies and HLW repository organizations to establish these criteria.

The acceptance criteria for transfer of waste items between the TWRS Program and other Hanford Site mission areas should be established, documented, and put under change control. These interface criteria are essential bases for proceeding with TWRS design.

4.3 PROGRAMMATIC INTERFACES (SEE TABLE 3)

4.3.1 Conclusions

The types and specifics of information passing through TWRS Program interfaces with external entities are still being identified.

The external programmatic sources of requirements governing the TWRS Program are as follows:

- DOE-Headquarters
- DOE, Richland Field Office
- Waste Isolation Pilot Plant
- Office of Civilian Radioactive Waste Management
- U.S. Environmental Protection Agency
- U.S. Nuclear Regulatory Commission
- Washington State Department of Ecology
- Other State agencies.

4.3.2 Recommendations

The TWRS Program and the management systems, plans, and schedules for executing that program should be defined. Within the TWRS Program, a set of success and effectiveness measures for evaluating the system performance should be established. The TWRS Program should be integrated with the overall Hanford Site cleanup mission.

External requirements common to all mission areas [e.g., Federal laws (*National Environmental Policy Act of 1969*, *Comprehensive Environmental, Response, Compensation, and Liability Act of 1980*, *Resource Conservation and Recovery Act of 1976*), State laws (*Washington Administrative Code*), commitments (Tri-Party Agreement), DOE orders] should be coordinated with other Hanford Site programs. All mission areas should come from a common interpretation, strategy, and set of requirements.

4.4 SYSTEM INTERFACES (SEE TABLE 4)

4.4.1 Conclusions

System Interfaces with Hanford Site Mission Areas. The TWRS Program has system interfaces with the following Hanford Site mission areas:

- Liquid Waste
- Environmental Restoration
- Solid Waste
- Nuclear Facilities
- Special Initiatives
- Site Support.

TWRS will receive highly radioactive tank waste generated by most of these mission areas. Also, TWRS will transfer solid and liquid waste to some of these mission areas for final disposition.

During operation, TWRS liquid effluents will be turned over to the Liquid Waste mission area, gaseous effluents will be cleaned to acceptable limits and discharged to the air, and failed process equipment will be cleaned to acceptable limits and turned over to the Solid Waste mission area. After dispositioning all tank waste, the TWRS physical system structures and components will be prepared to acceptable criteria and turned over to other Hanford Site mission areas for final disposition.

TWRS will turn over immobilized HLW to the Office of Civilian Radioactive Waste Management or DOE transuranic systems for transport to and disposal at a geologic repository. TWRS will immobilize and dispose of LLW near surface on the Hanford Site.

System Interfaces with Offsite Organizations. The TWRS Program interfaces with the DOE repository system and Waste Isolation Pilot Plant are still being developed.

4.4.2 Recommendations

System Interfaces with Hanford Site Mission Areas. The TWRS physical, functional, and operational criteria should be established and integrated with interfacing mission area requirements. These criteria include initiation and completion dates, quantities, rates, configuration, and characteristics of wastes transferred across the mission area.

The Hanford Site cleanup mission and the system to accomplish it should be defined. This information forms the basis for developing and integrating the individual subsystem mission areas. This would resolve most of the study area interface issues identified (in Section 4.0) for TWRS.

System Interfaces with Offsite Organizations. The TWRS and DOE repositories' physical, functional, and operational interfaces and acceptance criteria should be incorporated into the technical interface criteria and requirements documents. This information should be incorporated into the overall program plan and schedules for TWRS.

4.5 MEASURES OF SUCCESS (SEE TABLE 5)

4.5.1 Conclusions

TWRS measures of success and relative values (decision criteria) have not been formally established. Measures of success are the basic quantifiable attributes by which the success of the TWRS Program mission can be measured and compared (e.g., cost, schedule). These measures and their associated values form the fundamental basis for determining the success of the mission and for selecting from alternative system designs.

Measures of success should be related to system objectives to determine how well the objectives are being achieved and to provide a basis for tradeoffs to optimize the system. Based on the current mission statement, the TWRS measures of success are as follows:

1. **Public and worker health and safety effects:** Adverse impacts on human health resulting from radioactive or hazardous waste and the condition of being free from harm or injury resulting from accidents or off-normal events

2. **Environmental impacts:** Adverse effects on the physical landscape, flora, or fauna for a given region and the degree to which the system meets regulator-imposed laws and regulations

3. **Risk (technology assurance):** The probability of meeting a measure of success plus the consequence of not meeting that measure (this includes technical and programmatic risks)

4. **Schedule:** The amount of time expended to accomplish the entire mission

5. **Cost:** The amount of resources, preferably measured in dollars, expended to accomplish the entire mission, including final system decommissioning.

The measures of success form a basis for (1) decision making for the program and (2) conducting the parametric and requirements analyses. The measures of success also provide a basis for identifying which system attributes should be characterized.

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5.0 DATA TABLES

The key to the tables is on page 5-2. Tables 1 through 5 follow.

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Key To Tables 1 Through 5. (2 sheets)

Table Number and Description	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Table 1 Initial State	Topic Number Provides an easy reference to topic description	Topic Description Identifies the wastes that were considered part of the mission analysis	Include/Exclude Identifies which of the topics (each topic was evaluated) were included or excluded in the TWRS Program mission and the basis for the decision Any topic that was questionable was addressed along with the decision to include or exclude the topic in the TWRS Program mission: this was done to clearly show that these topics are not being addressed by the TWRS Program mission: this was also done to provide a basis for review and negotiation of interfaces with other Hanford Site mission areas	Initial Conditions Defines, in high-level qualitative terms, the condition of the wastes identified in column 2	TWRS Program Working Position Identifies the current working positions This information is included to provide a consistent working basis for continuing the current effort. NOTE: These working positions may be replaced by the results from the mission, functional, requirements, and parametric analyses; subsequent development of the TWRS specification, program, and engineering management plans; and the operations and development plans and schedules prepared for program execution	Actions Identifies actions to provide the necessary information
Table 2 Final State	Topic Number See above	Topic Description Identifies the waste forms that will be produced by TWRS	Final Conditions Identifies the documents that contain the acceptance criteria that the waste products must meet before being transferred to the interfacing program responsible for final disposition	TWRS Program Working Position See above	Actions See above	N/A

Key To Tables 1 Through 5. (2 sheets)

Table Number and Description	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Table 3 Programmatic Interfaces	Topic Number See above	Topic Description Identifies the programs or outside entities with which TWRS Program interfaces	Constraint Sources Identifies the documents that describe the detailed constraints	Constrains Identifies which part of the TWRS Program is constrained by other programs or outside entities	TWRS Program Working Position See above	Actions See above
Table 4 System Interfaces	Topic Number See above	Topic Description Identifies the physical systems or other mission areas with which TWRS Program interfaces	Constraint Sources See above	Constrains Identifies which part of the TWRS Program is constrained by the interfacing systems or other mission areas	TWRS Program Working Position See above	Actions See above
Table 5 Measures of Success	Topic Number See above	Topic Description Identifies the categories used to determine if and how well the mission was met	Limits Identifies acceptable limits that the TWRS products must satisfy	TWRS Program Working Position See above	Actions See above	N/A

N/A = Not applicable
TWRS = Tank Waste Remediation System.

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.1	Waste materials		The waste materials, lines, tanks, equipment, and facilities to be included in the TWRS are identified in this table: the initial characteristics of these items are not yet determined		Study: Determine initial state of the TWRS: identify, quantify, and describe the initial conditions of waste materials, lines, tanks, equipment, and facilities included in TWRS
1.1.1	Tank waste (radioactive and hazardous waste contained in or that will be received into TWRS tanks, lines, equipment, or facilities)		Contained in DSTs, SSTs, and about 47 miscellaneous tanks	Retrieve and process waste from all DSTs and SSTs (DOE policy) [HDW-EIS record of decision (53 FR 12449)]	
1.1.1.1	DST waste	Include	• Open safety issues • Not fully characterized • Liquid • Sludge • Highly radioactive • Mixed waste • High sodium content • NCRW, NCAW, CC, PFP • DSSF (low level) • Contained in 28 DSTs	Remove 99% of radionuclide and hazardous waste content from DSTs (assumption)	
1.1.1.2	SST waste	Include per Secretary Decision Letter (Anttonen 1991) and TWRS EIS notice of intent (assumed)	• Open safety issues • Not fully characterized • Mostly sludge and salt cake with some liquid • Highly radioactive • Mixed waste • High sodium content • Partially stabilized • Contained in 149 SSTs		
1.1.1.3	Miscellaneous tank waste (approximately 47 tanks)	Exclude per TWRS Program Leadership Council meeting	• Not characterized • Highly radioactive • Mixed waste • Liquid • Sludge • Solids		Study: Identify tanks that contain waste that should be included in TWRS on a case-by-case basis
1.1.2	Line waste	Include	• Solidified in plugged transfer lines • Highly radioactive • Not characterized	Retrieve and process waste	

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.1.3	Capsules		Onsite capsules are currently stored in the Waste Encapsulation and Storage Facility		Study: Determine final disposition of all strontium and cesium capsules
1.1.3.1	Strontium (onsite and offsite capsules)	Include	• SrF • 24.8 MCi onsite • 0.5 MCi offsite	Continue safe storage	Study: Determine final disposition of all strontium and cesium capsules
1.1.3.2	Cesium (onsite and offsite capsules)	Include	• CsCl • 41.7 MCi onsite • 15.8 MCi offsite • Had 1 leaking capsule offsite • 14 capsules are suspect	Continue safe storage	Study: Determine final disposition of all strontium and cesium capsules, including the 14 suspect capsules
1.1.4	New liquid tank waste		• Ongoing additions to tank system • Not acceptable for discharge as a liquid effluent	Include liquid tank waste resulting from execution of other Hanford Site mission areas	Study: Obtain waste volume projections from the sources of this waste and integrate with the TWRS Program

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.1.4.1	Liquid tank waste generated by interfacing Hanford Site mission areas, e.g., • ER from cleanup of - Contaminated soils - Contaminated groundwater - Solid waste contained in past-practice units • Solid Waste from cleanup of - Solid materials stored in facilities or burial trenches • Liquid Waste from cleanup of - Waste materials resulting from not discharging liquid effluents to the soil • Nuclear Facilities waste from ongoing processing, operations, laboratory analyses, and cleanup • Special Initiatives (to be determined)	Include	• Ongoing additions to tank system • Not acceptable for discharge as a liquid effluent	Include liquid tank waste resulting from execution of other Hanford Site mission areas	
1.1.4.2	TWRS generated waste • Line flushes • Volume makeups	Include	• Ongoing additions to tank system • Not acceptable for discharge as a liquid effluent	Include liquid tank waste resulting from execution of TWRS Program mission	

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.1.5	Production reactor fuel assemblies	Exclude			Study: Evaluate on a case-by-case basis to determine disposition of materials Study: Determine if TWRS should accept special nuclear materials from the Nuclear Facilities mission area for temporary storage
1.1.6	Radioactive waste materials remaining at nuclear facilities	Exclude			Study: Evaluate on a case-by-case basis to determine disposition of materials Study: Determine if TWRS should accept special nuclear materials from the Nuclear Facilities mission area for temporary storage
1.1.6.1	Plutonium-Uranium Extraction (PUREX) Facilities	Exclude			Study: Evaluate on a case-by-case basis to determine disposition of materials Study: Determine if TWRS should accept special nuclear materials from the Nuclear Facilities mission area for temporary storage
1.1.6.2	PFP Facilities	Exclude			Study: Evaluate on a case-by-case basis to determine disposition of materials Study: Determine if TWRS should accept special nuclear materials from the Nuclear Facilities mission area for temporary storage

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.1.6.3	T Plant	Exclude			Study: Evaluate on a case-by-case basis to determine disposition of materials Study: Determine if TWRS should accept special nuclear materials from the Nuclear Facilities mission area for temporary storage
1.1.6.4	N Reactor	Exclude			Study: Evaluate on a case-by-case basis to determine disposition of materials Study: Determine if TWRS should accept special nuclear materials from the Nuclear Facilities mission area for temporary storage
1.1.6.5	K Basins	Exclude			Study: Evaluate on a case-by-case basis to determine disposition of materials Study: Determine if TWRS should accept special nuclear materials from the Nuclear Facilities mission area for temporary storage
1.1.6.6	300 Area Fuel Storage Facility	Exclude			Study: Evaluate on a case-by-case basis to determine disposition of materials Study: Determine if TWRS should accept special nuclear materials from the Nuclear Facilities mission area for temporary storage

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.1.6.7	Fast Flux Test Facility	Exclude			Study: Evaluate on a case-by-case basis to determine disposition of materials Study: Determine if TWRS should accept special nuclear materials from the Nuclear Facilities mission area for temporary storage
1.1.7	TWRS liquid effluents	• Exclude final discharge • Include treatment to acceptable limits	• Phase I effluents contained in Liquid Effluent Retention Facility • Phase II effluents discharged to B Pond	Treated liquid effluents will be transferred to Liquid Effluent mission area for final disposition	Study: Define criteria for interfacing systems to accept effluents
1.1.8	Contaminated soils	Exclude			
1.1.9	Buried waste	Exclude			
1.1.10	Special project materials	Exclude			
1.2	TWRS equipment	Exclude disposal		TWRS will use the equipment for operations, then clean it to reach acceptance criteria for Solid Waste	
1.2.1	Underground storage tanks	Exclude disposal		<u>Retrieve tank waste to prepare tanks for transfer and closure (Seattle)</u> Include for TWRS operations Turnover tanks to ER mission area for final disposition	

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.2.1.1	DSTs	Exclude disposal	Some tanks are approaching end of design life, most are not	Retrieve tank waste to prepare tanks for transfer and closure (Seattle) Include for TWRS operations Turnover tanks to ER mission area for final disposition	
1.2.1.2	SSTs	Exclude disposal	• Beyond design life • Some tanks leak • Continue to deteriorate	Retrieve tank waste to prepare tanks for transfer and closure (Seattle) Include for TWRS operations Turnover tanks to ER mission area for final disposition	
1.2.1.3	Miscellaneous tanks (47)	Exclude disposal	To be determined	To be determined	Evaluate 47 tanks and determine TWRS Program working position for each tank
1.2.2	Process equipment, e.g., • Process vessels - Tanks - Ion exchange columns - Melter - Associated equipment • Pumps, jets, etc. • Process piping - Valves - Pipes - Jumpers • Low-level radioactive waste - Tools - Clothing	Exclude disposal	To be determined	TWRS will use the equipment for operations, then clean it to reach acceptance criteria of Solid Waste	

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.2.3	Transfer lines • Within tank farms • Between facilities and tank farms • Cross-site	Exclude disposal	To be determined	TWRS will use the equipment for operations, then clean it to reach acceptance criteria for Solid Waste	
1.3	TWRS facilities	Exclude disposal		Transfer excess facilities and equipment to ER Program to minimize number of active facilities and reduce operational liabilities. (Seattle) TWRS facilities will be transferred to surplus facilities (ER) mission area per established acceptance criteria	Study: Define criteria for interfacing programs to accept items.
1.3.1	Existing facilities, e.g., • 242-A • 242-T • 242-S • 244-AR	Exclude disposal	• Poorly maintained • Aging, some beyond initial design life	Existing facilities will be used to extent practical TWRS facilities will be transferred to surplus facilities (ER) mission area per established acceptance criteria	Study: Define criteria for interfacing programs to accept items
1.3.2	New facilities	Exclude disposal		TWRS facilities will be transferred to surplus facilities (ER) mission area per established acceptance criteria	Study: Define criteria for interfacing programs to accept items Verify that TWRS is adequately defined to proceed with subsystem design

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.3.2.1	Hanford Waste Vitrification Plant	Exclude disposal	In final design	Proceed to meet Tri-Party Agreement milestone TWRS facilities will be transferred to surplus facilities (ER) mission area per established acceptance criteria	Study: Define criteria for interfacing programs to accept items
1.3.2.2	Initial Pretreatment Module		In conceptual design	To be determined TWRS facilities will be transferred to surplus facilities (ER) mission area per established acceptance criteria	Study: Define criteria for interfacing programs to accept items
1.3.2.3	Canister Storage Building	Exclude disposal	In final design	Proceed to meet Tri-Party Agreement TWRS facilities will be transferred to surplus facilities (ER) mission area per established acceptance criteria Accelerate the design of Multi-Purpose Storage Complex as close to current schedule as possible using proven technology	Study: Define criteria for interfacing programs to accept items
1.3.3	Cribs, ponds, ditches	Exclude	Contaminated with radioactive and hazardous waste		

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.4	Current waste tank operations	Include for ongoing operations		Resolve safety issues and upgrade facilities to provide environmentally sound and safe storage (Seattle) Operate and maintain facilities to provide continued environmentally sound and safe storage (Seattle) Adopt a balance between tank farm safety, operations, infrastructure upgrades, and disposal priorities Tank farm storage, operations, and surveillance will be required for 30 to 50 years	Define a minimum acceptable initial state of operations necessary to support the TWRS Study: Develop an integrated set of alternatives for current operations: • Resolve safety issues • Upgrade facilities • Restore facilities • Build new facilities • Restore infrastructure • Upgrade infrastructure • Upgrade conduct of operations
1.4.1	Tank systems and instrumentation		• Poorly maintained • Inadequate	Construct new tank farms as necessary to remediate safety issues and support waste pretreatment on an expedited basis (Anttonen 1991)	

Table 1. Initial State. (11 sheets)

Topic Number	Topic Description	Include/ Exclude	Initial Conditions	TWRS Program Working Position	Actions
1.4.3	Conduct of operations • Training • Procedures • Timeliness and adequacy of maintenance • Resources • Planning • Schedules • Performance measurement	Include for ongoing operations	• Noncompliant • Inadequate • Unsafe state(s) relative to present DOE authorization basis	Characterize watch list tanks requiring sampling and analysis first Retrieve watch list tanks that cannot be resolved in present tank as highest priority items (Anttonen 1991) Stabilize and isolate SSTs to mitigate impact of future leaks Mitigate unsafe waste conditions in tank sufficiently to allow safe storage until retrieval for disposal Integrate pretreatment with mitigation of safety concerns and requirements. Ensure resolution of safety issues does not preclude disposition choices.	Negotiate a compliance agreement with regulators and establish a graded compliance with DOE orders

NOTE: See Section 7.0 for references.
The underlined items in the "TWRS Program Working Position" column are from the TWRS Program meetings in Seattle, Washington.

CC = Complexant concentrate
DOE = U.S. Department of Energy
DSSF = Double-shell slurry feed
DST = Double-shell tank
EIS = Environmental impact statement
ER = Environmental Restoration
HDW-EIS = Final Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington
NCAW = Neutralized current acid waste
NCRW = Neutralized cladding removal waste
PFP = Plutonium Finishing Plant
SST = Single-shell tank
Tri-Party Agreement = Hanford Federal Facility Agreement and Consent Order
TWRS = Tank Waste Remediation System.

Table 2. Final State. (5 sheets)

Topic Number	Topic Description	Final Conditions	TWRS Program Working Position	Actions
2.1	TWRS waste products	The types of waste to be addressed and the laws governing acceptability of their final state are identified in this table	Minimize waste volume disposed to lessen impact on repository and Hanford Site land use (Seattle) Minimize total TWRS waste; separate the waste into fractions to optimize total system life-cycle costs	
2.1.1	TRU	DOE/WIPP-069, Rev. 4, Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP 1991) TRU acceptably immobilized and packaged for shipment and disposal in a DOE repository	Prepare TRU waste for disposal at the WIPP repository per DOE-WIPP waste acceptance criteria Maintain the ability to package and ship TRU waste to the WIPP Convert all TRU fractions to glass for disposal and ultimate shipment to a Federal repository (EIS record of decision)	Study: Determine final disposition method for TRU. Consider if TRU is to be separated and processed for disposal at the WIPP repository or mixed with the HLW and processed for disposal at the OCRWM repository. Develop final TRU waste acceptance criteria with WIPP (both radionuclide and hazardous chemical content)
2.1.2	HLW	Repository waste acceptance system requirements HLW acceptably immobilized and packaged for shipment to OCRWM repository	Prepare for disposal at the OCRWM repository per OCRWM waste acceptance criteria Immobilize high-level and TRU constituents of waste to minimize environmental and safety risk and enable permanent disposal (Seattle) Retrieve all waste required for tank closure (i.e., ER will not have to retrieve wastes for closure) (DOE-HQ directive)	Develop final HLDW acceptance criteria with OCRWM (both radionuclide and hazardous chemical content)

Table 2. Final State. (5 sheets)

Topic Number	Topic Description	Final Conditions	TWRS Program Working Position	Actions
2.1.3	LLW	LLW acceptably immobilized and disposed onsite [HDW-EIS record of decision (53 FR 12449)] WHC-SD-WM-CSD-003, Rev 0, Grout Formulation Standard Criteria Document (Riebling and Fadeff 1991)	Immobilize and dispose of any remaining mixed or low-activity wastes to minimize environmental and safety risk (Seattle) Waste is suitable for onsite disposal if • Not declared HLW by NRC • Not TRU as determined by DOE • Class C or less as defined by 10 CFR 61 • Meets Ecology (WAC 173-303) requirements (DOE-HQ directive) Radionuclide and hazardous material content for the LLW will be ALARA (DOE-HQ directive) LLW will be disposed near surface onsite (HDW-EIS)	Develop final waste acceptance criteria for onsite disposal of LLW from TWRS waste processing operations (both radionuclide and hazardous chemical content) Develop closure requirements (Anttonen 1991)
2.1.4	Below regulatory concern	To be determined	Dispose of waste whose radionuclide and hazardous chemical content is below regulatory concern in accordance with other governing requirements	Develop criteria to declare waste below regulatory concern. Negotiate agreement with applicable regulatory agencies.
2.1.5	Hazardous nonradioactive waste	• Resource Conservation and Recovery Act of 1976 • WAC	Dispose of hazardous nonradioactive wastes in accordance with Washington Administrative Code, e.g., WAC 173	
2.1.6	TWRS effluents		Minimize generation of secondary waste and effluents to reduce cost and/or environmental impact (Seattle) Secondary waste will be disposed either within the TWRS boundaries or by interfacing systems	
2.1.6.1	Liquid	To be determined	Liquid effluents will meet Treated Effluent Disposal Facility acceptance criteria	

Table 2. Final State. (5 sheets)

Topic Number	Topic Description	Final Conditions	TWRS Program Working Position	Actions
2.1.6.2	Gaseous	To be determined	Gaseous effluents will be managed to meet discharge limits	Study: Document acceptance criteria for release of gaseous effluents to the atmosphere Formalize acceptance criteria for gaseous effluent
2.2	TWRS equipment	Waste retrieved and radioactive and hazardous waste removed	Equipment will be prepared to acceptance criteria of interfacing mission areas	
2.2.1	Underground storage tanks	To be determined	Equipment will be prepared to acceptance criteria of interfacing mission areas Turnover tanks to ER mission area for final disposition Closure plan will define turnover acceptance requirements for underground storage tanks and transfer lines (DOE-HQ directive)	Complete HRA-EIS and closure plan Formalize acceptance criteria and operational interface with ER mission area (e.g., levels of contamination, total volume, packaging, shipment, schedule, throughput rate, payment, pedigree)
2.2.1.1	Double-shell tanks	To be determined	Equipment will be prepared to meet acceptance criteria of interfacing mission areas Final DST retrieval requires 99% removal of radionuclide and hazardous contents	
2.2.1.2	Single-shell tanks	To be determined	Equipment will be prepared to acceptance criteria of interfacing mission areas	Develop both 95% and 99% retrieval technologies for SSTs. Determine if these technologies meet SST closure plan acceptance criteria.
2.2.1.3	Miscellaneous tanks (47)	To be determined	Equipment will be prepared to acceptance criteria of interfacing mission areas	

Table 2. Final State. (5 sheets)

Topic Number	Topic Description	Final Conditions	TWRS Program Working Position	Actions
2.2.2	Process equipment • Process vessels and associated equipment • Pumps, jets, etc. • Process piping • Instrumentation and controls	WHC-EP-0063-3, Hanford Site Solid Waste Acceptance Criteria (Willis and Triner 1991)	Equipment will be prepared for transfer to Solid Waste mission area	Formalize acceptance criteria and operational interface with Solid Waste mission area (e.g., levels of contamination, total volume, packaging, shipment, schedule, throughput rate, payment, pedigree)
2.2.3	Transfer lines	To be determined	Closure plan will define turnover acceptance criteria for transfer lines Use the HRA-EIS as a basis for defining the amount of material allowed to remain in the lines at conclusion of retrieval (DOE-HQ directive)	Complete HRA-EIS and closure plans Formalize acceptance criteria and operational interface with ER mission area (e.g., levels of contamination, total volume, packaging, shipment, schedule, throughput rate, payment, pedigree)
2.3	TWRS facilities	MRP 6.15, "Facility Shutdown, Standby, and Transfer"	Turnover facilities to ER mission area for final disposition Decontamination, decommissioning, and disposing of existing TWRS facilities are not included in TWRS scope	Comply with DOE turnover criteria

Table 2. Final State. (5 sheets)

Topic Number	Topic Description	Final Conditions	TWRS Program Working Position	Actions
2.4	Beneficial use byproducts • Plutonium • Cesium • Strontium • Chemicals	Packaged in a form suitable for beneficial use	Maximize beneficial byproducts	Determine feasibility of separating products that could be put to beneficial use. Include determination of costs, value, and potential markets.

NOTE: See Section 7.0 for references.
The underlined items in the "TWRS Program Working Position" column are from the TWRS Program meetings in Seattle, Washington.

ALARA = As low as reasonably achievable
CFR = Code of Federal Regulations
DOE = U.S. Department of Energy
DOE-HQ = U.S. Department of Energy-Headquarters
Ecology = Washington State Department of Ecology
EIS = Environmental impact statement
ER = Environmental Restoration
HDW-EIS = Final Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington
HLDW = High-level defense waste
HLW = High-level radioactive waste
HRA-EIS = Hanford remedial action-environmental impact statement
LLW = Low-level radioactive waste
NRC = U.S. Nuclear Regulatory Commission
OCRWM = Office of Civilian Radioactive Waste Management
SST = Single-shell tank
TRU = Transuranic
TWRS = Tank Waste Remediation System
WAC = Washington Administrative Code
WIPP = Waste Isolation Pilot Plant.

Table 3. Programmatic Interfaces. (3 sheets)

Topic Number	Topic Description	Constraint Sources	Constrains	TWRS Program Working Position	Actions
3.1	Federal agencies				
3.1.1	U.S. Department of Energy-Headquarters	Directives (Secretary of Energy Notice; Anttonen 1991)	Execution and control of TWRS Program		
		DOE Order 4700.1	Execution and control of TWRS Program	Consolidate TWRS Program into super major system acquisition	Establish a graded compliance with DOE orders
		DOE Order 5480 series	Operational safety for storage and processing of radioactive and hazardous wastes	Execute the TWRS Program in accordance with Systems Engineering principles	
		DOE Order 5600 series	Safeguards & Security		
		DOE Order 5700 series	Quality Assurance Program		
		Budget	Program funding profile and total cost	Use existing pricing structure as a basis for selecting disposal strategy	
		Schedule	Time of initiation, sequence, and duration of execution	Establish priorities consistent with legal requirements of protecting human health, safety, and the environment	Develop Hanford Site restoration schedule. Integrate schedules for TWRS and interfacing Hanford Site mission areas as well as for TWRS-OCRWM and DOE-WIPP repositories.
		Commitments Tri-Party Agreement	Technical solutions, schedules, and program execution	Comply with Tri-Party Agreement until formally changed	
3.1.2	RL	RL orders Hanford integrated planning process	Execution and control of TWRS Program		

Table 3. Programmatic Interfaces. (3 sheets)

Topic Number	Topic Description	Constraint Sources	Constrains	TWRS Program Working Position	Actions
3.1.3	U.S. Environmental Protection Agency	NEPA	Technical solutions and schedule	SST disposal actions will not proceed beyond Title 1 design without TWRS EIS ROD, except for specific actions All DST disposal actions defined in HDW-EIS ROD (53 FR 12449) can proceed Specific action (e.g., retrieval of tank 241-C-106) will be covered by separate NEPA documentation (e.g., environmental assessment)	Study: Develop comprehensive TWRS EIS plan. Integrate with other mission areas.
		Clean Air Act RCRA Clean Water Act	• Gaseous effluent discharge • Hazardous waste management • Liquid effluent discharge	TWRS will comply with Federal regulations	To be determined
3.1.4	NRC	To be determined	To be determined	To be determined	Determine applicability of NRC regulations to TWRS processes and outputs
3.2	State agencies				Negotiate compliance agreements with regulators
3.2.1	Washington State Department of Ecology	Washington Administrative Code	Technical solutions, schedules, and program execution	Comply where technically feasible. Negotiate deviations where necessary.	
3.2.2	Other State agencies	Washington Administrative Code	Technical solutions, schedules, and program execution	Comply where technically feasible. Negotiate deviations where necessary.	
3.3	Local permitting agencies	To be determined	To be determined	Comply where technically feasible. Negotiate deviations where necessary.	Study: Identify and evaluate applicability of local ordinances
3.4	Advisory and oversight committees	Influence and advice	Technical solutions, schedules, and program execution	Consider advisory and oversight committee guidance as strong recommendations. Provide justification if alternative positions are taken.	

Table 3. Programmatic Interfaces. (3 sheets)

Topic Number	Topic Description	Constraint Sources	Constrains	TWRS Program Working Position	Actions
3.5	Indian Nations	Public involvement cycles	Technical solutions, schedules, and program execution	Involve affected Indian Nations	
3.6	Public	Public involvement cycles	Technical solutions, schedules, and program execution	Involve public	
3.7	Westinghouse Hanford Company management	MRPs WHC-CM- (control manuals)	Execution and control of the TWRS Program	Comply where possible	
3.8	Environmental Restoration Management Contract	Contract	To be determined	To be determined	To be determined

NOTE: See Section 7.0 for references.
The underlined items in the "TWRS Program Working Position" column are from the TWRS Program meetings in Seattle, Washington.

DOE = U.S. Department of Energy
EIS = Environmental impact statement
HDW-EIS = Final Environmental Impact Statement, Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes, Hanford Site, Richland, Washington
MRP = Management Requirements and Policies (sections in Westinghouse Hanford Company controlled manuals)
NEPA = National Environmental Policy Act of 1969
NRC = U.S. Nuclear Regulatory Commission
OCRWM = Office of Civilian Radioactive Waste Management
RCRA = Resource Conservation and Recovery Act of 1976
RL = U.S. Department of Energy, Richland Field Office
ROD = record of decision
SST = Single-shell tank
Tri-Party Agreement = Hanford Federal Facility Agreement and Consent Order
TWRS = Tank Waste Remediation System
WIPP = Waste Isolation Pilot Plant.

Table 4. System Interfaces. (4 sheets)

Topic Number	Topic Description	Constraint Sources	Constrains	TWRS Program Working Position	Actions
4.1	Hanford Site mission area system interfaces			Accept new tank waste from interfacing mission areas	Define, document, and control TWRS system interfaces with all mission areas
4.1.1	Solid Waste mission area	• Solid waste acceptance criteria • Operational readiness and turnover acceptance profile	• Turnover of process equipment, low-level solid waste resulting from operations for disposal • TWRS schedule and operations profile	Comply with acceptance criteria	
4.1.2	Liquid Waste mission area	• Liquid waste turnover acceptance criteria • Operational readiness and turnover acceptance profile • Waste acceptance criteria • WHC-CM-7-5	• Effluent discharge rate and treatment requirements • TWRS schedule and operations profile	Comply with permit requirements	
4.1.3	Environmental Restoration mission area				
4.1.3.1	Outgoing	Facilities and equipment turnover acceptance criteria	• Tank and transfer line closure, facility transfer to surplus facilities • TWRS schedule and operations profile	Comply with acceptance criteria	Formalize acceptance criteria and operational interface with ER mission area (e.g., levels of contamination, total volume, packaging, shipment, schedule, throughput rate, payment, pedigree)
4.1.3.2	Incoming	• Waste volume projections, acceptance criteria • TWRS waste	• TWRS Program constrains ER Program • ER Program constrains TWRS Program mission completion	TWRS Program will support ER mission area throughout duration of its mission	

Table 4. System Interfaces. (4 sheets)

Topic Number	Topic Description	Constraint Sources	Constrains	TWRS Program Working Position	Actions
4.1.4	Nuclear Facilities mission area (incoming)	• Waste volume projections, acceptance criteria • TWRS waste	• TWRS Program constrains ER Program • ER Program constrains TWRS Program mission completion	TWRS will support facility operations through duration of mission	Formalize acceptance criteria and operational interface with Nuclear Facility (e.g., levels of contamination, total volume, packaging, shipment, schedule, throughput rate, payment, pedigree)
4.1.5	Special Initiatives mission area (incoming)	• Waste volume projections, acceptance criteria • TWRS waste	• TWRS Program constrains ER Program • ER Program constrains TWRS Program mission completion	TWRS Program will support Special Initiatives mission area through duration of mission	Formalize acceptance criteria and operational interface with Special Initiatives (e.g., levels of contamination, total volume, packaging, shipment, schedule, throughput rate, payment, pedigree)
4.1.6	Infrastructure (office space, roads, utilities, maintenance shops, living space)	Limits of infrastructure	Operations, construction, and transport		Define infrastructure needs and limitations
4.1.7	Laboratories	Capacity	Characterization and analyses		Identify laboratory needs, both volume and analysis
4.2	Repository system interfaces	To be determined	Total program cost		
4.2.1	OCRWM HLW repository	To be determined			Formalize acceptance criteria and operational interface with OCRWM (e.g., levels of contamination, total volume, packaging, shipment, schedule, throughput rate, payment, pedigree)
4.2.1.1	HLDW acceptance criteria	• Waste acceptance criteria • Repository waste acceptance system requirements	HLW form characteristics	Use the draft waste acceptance criteria as a design basis until the repository waste acceptance criteria is finalized (DOE-HQ directive)	Finalize waste acceptance criteria with OCRWM

Table 4. System Interfaces. (4 sheets)

Topic Number	Topic Description	Constraint Sources	Constrains	TWRS Program Working Position	Actions
4.2.1.2	HLDW transport	Cask availability	• Mission completion • Interim storage requirements		
4.2.1.3	TWRS-OCRWM repository operations	Ability of OCRWM repository to accept TWRS waste initiation of shipment and waste shipment profile	• Mission initiation • TWRS throughput rate • Mission completion	Provide interim storage capability for all immobilized tank HLW produced at Hanford (DOE-HQ directive)	Study: Develop integrated TWRS-OCRWM repository operation plan
4.2.2	WIPP TRU repository			Provide interim storage capability for all immobilized TRU	Formalize acceptance criteria and operational interface with WIPP (e.g., levels of contamination, total volume packaging, shipment, schedule, throughput rate, payment, pedigree)
4.2.2.1	TRU waste acceptance criteria	DOE/WIPP-069, Rev. 4, Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP 1991)	TRU waste form characteristics		Finalize waste acceptance criteria with WIPP
4.2.2.2	TRU waste acceptance criteria transport	Cask availability	• Mission completion • Interim storage requirements		
4.2.2.3	TWRS and DOE-WIPP repository operations	• Ability of DOE-WIPP repository to accept TWRS TRU waste • Initiation of shipment and waste shipment profile	• Mission initiation • Mission completion • TWRS throughput rate	TWRS will provide capability to interim store all immobilized TRU waste produced at the Hanford Site	Study: Develop integrated TWRS and DOE-WIPP repository operations plan
4.3	Direct interfaces with the environment	Regulations	Gaseous effluent discharges	TWRS will comply with applicable regulations and permits	

Table 4. System Interfaces. (4 sheets)

Topic Number	Topic Description	Constraint Sources	Constrains	TWRS Program Working Position	Actions
4.4	Technology development	Technology availability	Technical solution and schedule	Transfer technology and communicate lessons learned to enhance waste management practices of government and the competitiveness of U.S. industry (Seattle) Use existing technology to maximum extent practical. Develop emerging or new technologies as needed.	

NOTE: See Section 7.0 for references.
The underlined items in the "TWRS Program Working Position" column are from the TWRS Program meetings in Seattle, Washington.
DOE = U.S. Department of Energy
DOE-HQ = U.S. Department of Energy-Headquarters
ER = Environmental Restoration
HLDW = High-level defense waste
HLW = High-level radioactive waste
OCRWM = Office of Civilian Radioactive Waste Management
TRU = Transuranic
TWRS = Tank Waste Remediation System
WIPP = Waste Isolation Pilot Plant.

Table 5. Measures of Success. (2 sheets)

Topic Number	Topic Description	Limits	TWRS Program Working Position	Actions
5.1	Public and worker health and safety effects • Minimize worker radiological exposure • Minimize worker industrial hazards • Minimize public radiological exposure • Minimize public transportation hazards	To be determined	• Health effects will be as low as reasonably achievable • Worker and public safety will be protected	Quantify health effects, i.e., source and form of hazard (quantity, specific chemical, specific radionuclide) and consequence of exposure (chronic, acute) for initial and final states Quantify safety effects to the public and workers
5.2	Environmental impacts • Minimize long-term environmental contamination • Maximize unrestricted land availability by minimizing onsite LLW volume • Minimize offsite waste volume (HLW) • Minimize volume of other system generated wastes	To be determined	• Environmental effects will be as low as reasonably achievable • TWRS will comply with regulations where practical, and negotiate graded compliance where necessary • Establish priorities consistent with legal requirements of protecting human health, safety, and the environment	Quantify environmental effects, i.e., source and form of hazard (quantity, specific chemical, specific radionuclide) and consequences of release for initial and final states Quantify measures of compliance
5.3	Risk (technology assurance) • Maximize operability and reliability • Maximize use of mature processes • Maximize flexibility (adaptability for new technology) • Avoid regulatory uncertainty	To be determined	Risk will be analyzed and proactively managed on a continual basis	Quantify measure of programmatic risk

Table 5. Measures of Success. (2 sheets)

Topic Number	Topic Description	Limits	TWRS Program Working Position	Actions
5.4	Schedule • Minimize time duration for resolving environmental concerns • Minimize campaign duration • Minimize time duration for resolving safety issues • Maximize early immobilization for disposal progress	To be determined	Meet schedule	
5.5	Cost • Total life-cycle cost • Discounted cost basis	To be determined	Be cost effective	

HLW = High-level radioactive waste
LLW = Low-level radioactive waste.

6.0 DEFINITIONS AND STANDARD TERMINOLOGY

Alternative (used as adjective only)	Offering or expressing a choice between two or more things.
Alternative system	An alternative strategy that is different from the reference system and could impact or become the reference system.
Attribute	A measurable description of a system characteristic; e.g., if a system's function is 'to fly,' an attribute describing it could be speed. An attribute without an assigned value is a variable.
Boundary	The border that establishes the interface for inputs and outputs of the system.
Closure	Process by which a hazardous waste treatment, storage, or disposal facility, which has discontinued operation, is dispositioned in accordance with a Washington State-approved closure plan.
Configuration	The functional and/or physical characteristics of hardware, firmware, software, or any other items as described in technical documentation and achieved in a product.
Constraints	Restrictions or limitations that must be met. Constraints are used to screen alternative strategies and are always nontradable by the designer (as opposed to requirements which are tradable).
Disposal	Placement of waste in a manner that ensures isolation from the biosphere for the foreseeable future with no intent of retrieval and requires deliberate action to regain access to the waste.
Dispose	To place waste in a manner that ensures isolation from the biosphere for the foreseeable future with no intent of retrieval and requires deliberate action to regain access to the waste.
Environment	(1) The land, water, and atmosphere of a specific area; (2) the circumstances or conditions in which a system exists. External environments are unaffected by the system; internal environments are created by the system and may be affected by it.
Function	A specific action, activity, or process that achieves or supports the achievement of an objective (e.g., an operation that a system must perform to accomplish its mission).

Goals	Statements describing the desired end points.
High-level radioactive waste (see DOE Order 5820.2A)	"The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation."
Immobilization	A process that prepares waste for disposal.
Interface	System boundary across which material, data, or energy passes.
Low-level radioactive waste (see DOE Order 5820.2A)	"Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel, or byproduct material as defined by 5820.2a. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic is less than 100 nCi/g."
Measure of success	A set of attributes that, when compared to actual results, show how well the mission was accomplished.
Mitigation	Reduction of the severity of a tank safety issue.
Objectives	Discrete, measurable events that, if accomplished, will contribute to achieving a goal.
Pretreatment	Chemical treatment process or a series of processes used to prepare waste for immobilization.
Problem statement	A declaration of what is wrong and needs to be corrected to improve a situation.
Program	An organized set of activities directed toward a common purpose. Programs are typically made up of technology base activities, projects, and supporting operations.
Project	A unique major effort within a program that has a firmly scheduled beginning, intermediate, and ending date milestones.

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Public involvement	A process by which the stakeholders' views are integrated into the U.S. Department of Energy's (DOE) decision-making process. The stakeholders' issues, concerns, and values will be understood and considered when making decisions. Public involvement is a dialogue between DOE and the stakeholders. This interaction goes beyond the public receiving information and providing comments after the decision is made.
Reference system	The selected and approved function (or functions) for managing and disposing of TWRS waste.
Remediation	Action taken to safely store, maintain, treat, and dispose of tank waste. **NOTE:** Waste is remediated, not safety issues; however, waste remediation may resolve a safety issue.
Requirement	How well the system needs to perform a function. Requirements are always tradable by the system designer (as opposed to constraints which are not tradable).
Resolution	Elimination of a tank safety issue by physical, chemical, analytical, and/or administrative methods.
Restoration	Return to the operating condition for which something was originally designed.
Restricted use	Limits are placed on the use of the land area (surface, subsurface, and groundwater), in terms of the hours of occupancy and/or the activities allowed. Institutional controls are required to define and enforce the limits.
Risk	Health and safety or environmental issues that may adversely impact the program's ability to meet regulatory requirements.
Secondary waste	The waste generated as a result of contact with high-level and low-level radioactive waste (e.g., liquid effluents, failed equipment, clothing, tools, facilities, tanks).
Stakeholder	Any person or group that is potentially affected by actions at the Hanford Site.
Store (Storage)	The activity necessary for the safe holding of tank waste, capsules, and any other radioactive or hazardous materials.
Strategy	A plan or approach to accomplish the mission.

System	A combination of related functions or equipment integrated into a single activity.
Tank safety issue	A potentially unsafe condition associated with high-level radioactive tank waste and/or operating tank farm facilities. Tank waste safety issues are a subset of tank safety issues.
Tank waste	Waste currently contained in single-shell tanks (SST), double-shell tanks (DST), all new waste added to DSTs, and cesium and strontium stored in capsules.
Tank Waste Remediation System	An integrated solution for carrying out the specific functions associated with remediating tank waste.
Tank Waste Remediation System Program	An integrated program for carrying out the specific functions associated with remediating tank waste.
Tank Waste Remediation System Program Leadership Council	A group consisting of a single, senior manager from the U.S. Department of Energy-Headquarters; U.S. Department of Energy, Richland Field Office; Westinghouse Hanford Company; and Pacific Northwest Laboratory with the authority to make decisions and provide direction to the Tank Waste Remediation System Program. The leadership council was chartered by the Assistant Secretary for Environmental Restoration and Waste Management.
Tank Waste Remediation System Program mission statement	To store, treat, and immobilize highly radioactive Hanford waste (current and future tank waste and the Sr/Cs capsules) in an environmentally sound, safe, and cost effective manner.
Tank waste safety issue	A potentially unsafe condition associated directly with the high-level radioactive waste within a waste storage tank. Tank waste safety issues are a subset of tank safety issues.
Tradable	A function, requirement, or design solution that may be changed, typically within the context of a trade study. Those that are not tradable are referred to as 'nontradable.'
Trade study	(1) The process of comparing or trading the strengths and weaknesses of alternative approaches or attributes; (2) a feedback process for resolving inconsistencies between steps or levels; (3) the analysis of the ability of a design solution to meet its stated objectives as inputs are varied.

Transuranic waste (see DOE Order 5820.2A)	"Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lifes greater that 20 years and concentrations greater than 100 nCi/g at the time of assay."
Treatment	Process or processes that change waste in preparation for disposal.
Unrestricted use	No limits are placed on the use of the land area (surface, subsurface, and groundwater) because of residual materials after cleanup. Past uses, related to the defense mission at the Hanford Site, of the area no longer impact land-use planning. Unrestricted public access or ownership could occur. However, they may be other reasons to limit access, such as cultural features or wildlife habitat.
Upgrade	Place in an operating condition that is superior to the condition for which it was originally designed.
Value	The measure assigned to an attribute; e.g., for the attribute 'air speed' the value assigned could be a 1,000 ft/s.
Watch list tank	An underground storage tank containing waste that requires special safety precautions because it may have a serious potential for release of high-level radioactive waste because of uncontrolled increases in temperature or pressure. Special restrictions have been placed on these tanks by Public Law 101-510, Section 3137, "Safety Measures for Waste Tanks at Hanford Nuclear Reservation" (also known as the Wyden Amendment).

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