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7. Abstract

The TWRS Risk Management List and it's subset of critical risks, the Critical Risk Management List, provide a tool to senior RL and WHC management (Level-1 and -2) to manage programmatic risks that may significantly impact the TWRS program. The programmatic risks include cost, schedule, and performance risks, Performance risk includes technical risk, supportability risk (such as maintainability and availability), and external risk (i.e., beyond program control, for example, changes in regulations).

The risk information includes a description, its impacts, an evaluation of the likelihood, consequences and risk value, possible mitigating actions, and responsible RL and WHC managers. The issues that typically form the basis for the risks are presented in a separate table and the affected functions are provided on the management lists.

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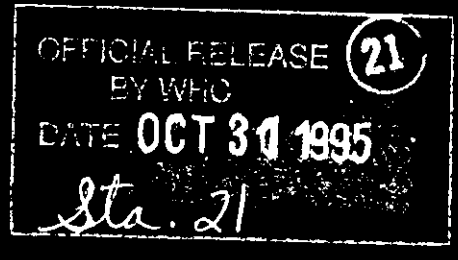

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REVISION 0

TANK WASTE REMEDIATION SYSTEM
RISK MANAGEMENT LIST

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LIST OF TERMS

AAS	alternative acquisition strategy
CRML	Critical Risk Management List
Cs	cesium
DNFSB	Defense Nuclear Facility Safety Board
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy Headquarters
RL	U.S. Department of Energy, Richland Operations Office
DST	double-shell tank
EIS	environmental impact statement
ER	environmental restoration
ER&WM	Environmental Restoration and Waste Management (DOE)
HLW	high-level waste
INSIGHT	INSIGHT computer model
LLW	low-level waste
MUST	miscellaneous underground storage tank
MWTF	Multi-Function Waste Tank Facility
MYPP	Multi-Year Program Plan
NRC	Nuclear Regulatory Commission
OCRWM	Office of Civilian Radioactive Waste Management
PA	performance assessment
PNL	Pacific Northwest Laboratory
PRL	Programmatic Risk List
RFP	Request for proposals
RM	risk management
RML	Risk Management List
Sr	strontium
SST	single-shell tank
TPA	Tri-Party Agreement
TRU	transuranic [waste]
TWRS	Tank Waste Remediation System
UO	unusual occurrence
USQ	unreviewed safety question
WAP	waste acceptance process
WBS	work breakdown structure
WHC	Westinghouse Hanford Company
WIPP	Waste Isolation Pilot Project

EXECUTIVE SUMMARY

This Westinghouse Hanford Company (WHC) report presents the current Tank Waste Remediation System (TWRS) Programmatic Risk List (PRL), which consists of a Risk Management List (RML) and a Critical Risk Management List (CRML). The purpose of the PRL is to provide a tool to senior U.S. Department of Energy, Richland Operations Office (DOE-RL) and WHC management (Level-1 and Level-2) to manage programmatic risks that may significantly impact the TWRS program.

Risks were identified, evaluated, and placed on the RML. Ten risks were placed on the CRML, because they have high to very high risk values and they satisfy other critical criteria specified in the risk management procedure (WHC 1995a). The RML should be used by all management levels to track major program risk. The CRML should be used by senior management to manage risks with the highest priority.

The PRL was prepared by collecting information from a series of senior to mid-level management and staff interviews and from document reviews. The risks addressed are programmatic; that is, cost, schedule, and performance. Performance risk includes technical risk, supportability risk (such as maintainability and availability), and external risk (that is, beyond program control; for example, changes in regulations).

A standard format was developed for collecting, evaluating, and reporting risk information for the PRL. The format contains 11 information elements, which are named by the column headings in the RML and the CRML and are defined as follows.

- **Event/Situation**: A description of the undesirable event or situation (what can go wrong)
- **Impacts**: A description of the impacts or consequences (if the event happens)
- **L**: The likelihood expressed as the probability of the event occurring (a point estimate)
- **C**: The consequence if the event occurs (a point estimate)
- **RV**: The risk value obtained by combining the likelihood and the consequence
- **Mitigating Actions**: Action which can mitigate the probability or the consequence
- **Action Status**: The status of the mitigation action (pending, ongoing, completed)
- **Responsible DOE/WHC**: Identification of the managers in U.S. Department of Energy (DOE) and WHC responsible for managing and controlling the risk
- **Review Date**: The date on which the next review will be held

- **Func.**: The functions affected by the risk from WHC (1995b), *TWRS Functions and Requirements Document*
- **Risk Status**: The risk status indicating the attention required that is shown by the quick reference traffic light chart (green, amber, or red).

Table ES-1 presents the current CRML and contains the information elements described above. The titles of the risk events selected for the current CRML are as follows:

- **INSUFFICIENT FUNDING**
- **TANK SAFETY ISSUES NOT RESOLVED IN TIME TO SUPPORT RETRIEVAL**
- **LLW PERFORMANCE REQUIREMENTS ARE NOT AVAILABLE OR ARE UNATTAINABLE**
- **PRIVATIZATION EXPECTATIONS FOR PHASE I NOT MET - A) RFP, B) NON-TECHNICAL, C) TECHNICAL**
- **MAJOR INCIDENT OCCURS ON SITE**
- **DURABLE DECISIONS FOR SYSTEMS ENGINEERING ARCHITECTURAL SELECTIONS, REQUIREMENTS, AND SCOPE ARE NOT MADE.**
- **END STATE OF 200 AREA CENTRAL PLATEAU UNDEFINED.**
- **DISAGREEMENT ON NEEDS AND SCOPE FOR WASTE CHARACTERIZATION INFORMATION**
- **DST CAPACITY IS NOT SUFFICIENT - CANNOT ACCEPT NEW WASTE**
- **TWRS SAFETY AUTHORIZATION BASIS UNAVAILABLE OR INADEQUATE**

The risks in the CRML address a full range of TWRS programmatic issues. "INSUFFICIENT FUNDING" is associated with cost risk. "PRIVATIZATION EXPECTATIONS FOR PHASE I NOT MET - A) RFP, B) NON-TECHNICAL" and "END STATE OF 200 AREA CENTRAL PLATEAU UNDEFINED" are primarily TWRS schedule risks. The remaining risks are all performance issues which include safety, operations, system architecture, and system availability.

Table ES-1. TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
1) INSUFFICIENT FUNDING DOE establishes a cost profile that is inconsistent with the remediation strategy - total life cycle funds for TWRS cleanup are too low or annual allocations are too low Currently no established TWRS cost baseline exists	Current remediation strategy cannot be achieved (e.g., not all waste can be retrieved) Loss of core competency (facilities and/or personnel) Extended program with higher life cycle costs and possible missed TPA (Ecology et al. 1994) milestones (these are common to all critical risks) Stakeholder lawsuits State fines DOE	H	H	VH	Establish site funding profile with allocation to the TWRS program Evaluate lower funding alternative profiles. Develop more aggressive, less conservative planning basis (e.g., delete development of contingency processes or pursue combined facility concepts). Improve cost estimates, especially as program evolves, and update MYPP (WHC 1995c) Renegotiate TPA (Ecology et al. 1994) milestone requirements or completion dates (common to all risks) to prevent fines (e.g., make scoping changes by modifying the existing strategy to retrieve only most critical waste and/or stretch out program)		Wagoner / Trego Kinzer / Bacon		4.2	
2) TANK SAFETY ISSUES NOT RESOLVED IN TIME TO SUPPORT RETRIEVAL Health and safety issues are not resolved in time to meet regulatory and project schedule requirements	Work stoppage or delay until safety issues are resolved (e.g., 106C retrieval delayed, cannot retrieve in time for privatization and characterization is delayed) Possible unsafe conditions in tank farms (e.g., hydrogen in tanks)	H	H	VH	Resolve interrelated tank safety issues that impede retrieval, treatment and disposal activities by completing ongoing safety issue studies (e.g. waste compatibilities) Work with stakeholders to revise planning scenarios to resolve health and safety issues Demonstrate critical technologies that allow work on tanks containing flammable gas Acquire equipment that can be used to retrieve waste from tanks containing flammable gas Reevaluate privatization schedule and planning		Bader / Umek		4.2.1.1 STORE 4.2.3.3 PRE-TREAT SUPER-NATENT	

Table ES-1. TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/DOC	Review Date	Func.	Risk Status
3) LLW PERFORMANCE REQUIREMENTS ARE NOT AVAILABLE OR ARE UNATTAINABLE Examples of missing data include: A) low level waste form specifications (e.g., leach rate, durability and dimensions) B) feed composition uncertainties due to incomplete characterization and processing knowledge C) LLW product retrievability D) LLW disposal system requirements	Process and disposal systems may be overdesigned to compensate for uncertainties LLW form requirements are made overly restrictive to compensate for durability uncertainty Overly conservative durability requirement causes increase in LLW volume	H	H	VH	Expedite decisions on land use for input to interim assessment of long term risks to public and environment Adhere to critical path schedule to define performance requirements (for disposal and pretreatment) and incorporate technology development in schedule to be able to meet performance requirements Expedite and integrate interim assessment of long term risks to public and environment and design of LLW disposal facility (iterative process) Reduce overconservatism by justifying parameters used in design of the LLW disposal facility and in assessment of long term risks to public and environment		Taylor / Honeyman		A) 4.2 B) 4.2.1.3 TRANS-FER 4.2.3.4 IMMOB. LLW C) 4.2.4.2 DISPOSE LLW D) 4.2	
4) PRIVATIZATION EXPECTATIONS FOR PHASE I NOT MET - A) RFP, B) NON-TECHNICAL, C) TECHNICAL 4A) PHASE 1 ALTERNATIVE ACQUISITION STRATEGY (AAS) PRIVATIZATION RFP NOT AWARDED An unacceptable outcome from the RFP is realized due to contract issues (e.g., bids are too high, or vendor risk is too high so no bids submitted) • Fee structure and mechanism to resolve differences in production estimates (using analytical results) between buyer and vendor not established	Missed milestones (e.g., M50, M51, and M60)	H	H	VH	Work with vendors to identify components of RFP which drive costs, to find ways to reduce costs, and to rescope RFP Develop a different alternative acquisition strategy		Kinzer / Bacon		4) 4.2.3 PROCESS 4.2.4 DISPOSE 4A) 4.2.3.2 & 4.2.3.3 PRE-TREAT	

Table ES-1. TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
4B) PROGRAMMATIC (NON-TECHNICAL) ISSUES - BENEFITS NOT REALIZED • NRC must provide nuclear safety oversight but is not properly staffed • Unanticipated events require extensive change notices or negotiations • Vendors unable to deliver product • Interface: storage, disposal, and support facilities are not available to vendor when desired (e.g., effluent treatment quantity unknown, so not yet able to determine requirements)	Maintenance and Operations (M&O) does not meet feed requirements, vendor cannot specify needs, or M&O cannot support operations, so vendor HLW vitrification plant cannot operate, yet vendor must be paid in some cases Cost increases Major program delays drive need to recover quickly	H	H	VH	• Have WHC or independent organization review design of demonstration plant and/or have joint design team • DOE works with NRC to develop phased transfer of regulatory authority • Maintain schedule for completing interface facility acquisitions • Understand and negotiate agreements on interface requirements • Transfer risk to seller by including support functions (interface facilities) in RFP; e.g., disposal and interim storage of LLW <u>Develop backup strategy to AAS</u> • Determine core competency needs • Retain key personnel in other funded programs • Keep vital facilities operating in minimal role by sharing other mission work • Have plan to return people and facilities to roles they performed before AAS occurred		Kinzer / Bacon		4B) 4.2	

Table ES-1. TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
4C) TECHNICAL ISSUES Plant does not operate with acceptable performance due to lack of special design and operating technical knowledge by private contractor Phase I does not provide technical information required for Phase II needs	Cannot pass operational readiness review Design requirements for Phase II are not resolved • Melter scale up • Retrieval equipment required • Melter flexibility to handle problem materials • DOE does not gain needed special design and operating knowledge Range of waste feed is not tested (composition and rates)	H	H	VH	• Retain core competency • Provide for extra long term interim storage of HLW • Select tanks with more difficult wastes to treat and increase funding appropriately for HLW demonstration plant • Extend Phase I schedule to better understand and resolve technical issues, both pre-construction and during operations • Reschedule AAS to match development of adequate product specifications		Kinzer / Bacon		4C) 4.2.3 PROCESS 4.2.4 DISPOSE	
5) MAJOR INCIDENT OCCURS ON SITE Incident occurs during tank farm, vendor, special nuclear facilities, or environmental restoration contractor operations New Unreviewed Safety Question (USQ), Unusual Occurrence (UO), or significant worker injury incurred	• Worker/public health and safety jeopardized • Lengthy work shutdown until resolution • Missed schedule • Funding gets diverted from baseline allocation • Fines • Future work put under closer scrutiny • Increased program cost	M	H	H	Ongoing mitigation action to enhance safety and Conduct of Operations programs (e.g. safety and evacuation drills) Anticipate things that can go wrong and prepare response actions (e.g. public communications, quick cleanup) Demonstrate importance of issue by keeping workers' awareness high through training and qualification		Sidpara / Wicks		4.2.1.3 TRANS-FER 4.2.2.3 RETRIE. MUST 4.2.3.5 IMMOB. HLW	

Table ES-1. TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
6) DURABLE DECISIONS FOR SYSTEMS ENGINEERING ARCHITECTURAL SELECTIONS, REQUIREMENTS AND SCOPE ARE NOT MADE	• Program proceeds without agreement on fundamental goals and scope • Goals are unstable, often inappropriate • Frequent baseline revisions • Work pathways are abandoned with increased costs • Schedule often renegotiated	H	H	VH	Get commitment by WHC and DOE-RL (possibly select a champion) Adopt and implement decision management procedures (e.g., • Identify decision makers • Base decisions on fully evaluated alternatives with expert reviews of studies and analyses • Track the need to make decisions and accomplish in timely manner • Conduct studies and analyses to validate selected architectures) • Develop and maintain multiple alternatives		Kinzer / Bacon		4.2 ENABL. ASSUMP.	
7) END STATE OF 200 AREA CENTRAL PLATEAU UNDEFINED Changes occur because of any of the following actions: • EIS results • Congressional action • Stakeholder action • "Compliance point" and means by which regulations are applied • Land-use designation Definition could be more restrictive (e.g., if nearby high density residential use is allowed) or less restrictive (e.g., if a large buffer zone is established)	• Definition or changes in the end state alters performance objectives and long-term environmental assessment scenarios • Inappropriate performance objectives • Inappropriate LLW disposal design • SST farms may be required to be clean closed rather than closed as a landfill (tanks must be removed and contaminated soil must be removed or cleaned) • Change in interface requirements with other on-site programs and contractors	H	H	VH	• Expedite decisions on long term land use end state • Maintain cognizance of land use planning • Keep stakeholders informed about what can be done practically, cost, schedule and importance of deciding on the end state • Obtain up-to-date stakeholder priorities • LLW program is rebaselined (with impacts on all other parts of TWRS program, e.g. tank closure requirements)		Wagoner / Trego Kinzer / Bacon		4.2	

Table ES-1. TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
8) DISAGREEMENT ON NEEDS AND SCOPE FOR WASTE CHARACTERIZATION INFORMATION Unable to gain agreement on objectives of characterization project among DNFSB, DOE, and WHC (Characterization information is expected to help resolve safety issues and to provide input for processing and disposal, e.g., better defining performance requirements for waste feed)	• Characterization products may not meet customer needs (timing and information), forcing planned activities dependent on characterization information (e.g., resolving safety issues) to be delayed • Responsibilities are not well defined, causing rework (e.g., reanalysis or resampling) • Technical basis assumptions may become invalid • Risk to private vendors is increased and is reflected in their bids	H	H	VH	• Produce mission analysis for characterization to promote top-down requirements allocation • Charter an Interface Control Working Group with all customers and appropriate program representatives • Plan for additional characterization to meet previously unspecified needs, reallocate funding, and have TWRS accept new risks from descoped activities • Assume risk of proceeding with baseline without concurrence of all stakeholders and regulators		Kinzer / Bacon		4.2	
9) DST CAPACITY IS NOT SUFFICIENT - CANNOT ACCEPT NEW WASTE • New waste incompatibilities with waste in storage tank • Volume: acceleration or increase of waste from generators above planned amounts, delays in other TWRS activities, e.g., evaporator failure • Leak in DST • Cannot fully use tank because of equipment or component failure (e.g., transfer lines, evaporator)	Reduced ability to safely manage waste and avoid environmental insult • Unable to accept new waste from generators, from retrieval, or interim stabilization wastes • Unable to provide space for emergency pumping • Other TWRS activities are unable to move forward (e.g., disposal)	H	H	VH	• Use the MWTF Path Forward Plan to plan for adequate DST space • Track available and needed waste volume • Use a dynamic model to support decision making by analyzing alternatives that include probable failure scenarios for system elements • Accept increased future operational risk of using evaporator process tanks as spares • Build new DSTs		Sidpara / Wicks		4.2	

Table ES-1. TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
10) TWRS SAFETY AUTHORIZATION BASIS UNAVAILABLE OR INADEQUATE The tank farms safety analysis report is not available The SST and MUST safety basis is not established	• Tank farms continues operating with Interim Safety Basis • Tank farms is not in compliance with DOE Order 5480.23 (DOE 1992) • Other TWRS operations delayed by lack of approved Safety Authorization Basis • Increased health and safety risks	H	H	VH	• Implement a systematic process to gain approval of a technically defensible Safety Authorization Basis, including completion of safety issue studies • Work with stakeholders to revise planning scenarios to resolve health and safety issues • Accelerate pretreatment, treatment, and disposal safety analysis reports		Bader / Umek Taylor / Honeyman		4.2.2.1 RETRIE. SST 4.2.2.3 RETRIE. MUST	

Notes:

In headings: L = Likelihood, C = Consequences, RV = Risk Value
In table text: L = Low, M = Medium, H = High, VH = Very High

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1.0 INTRODUCTION

The Tank Waste Remediation System (TWRS) Programmatic Risk List (PRL) was developed by collecting programmatic (cost, schedule, and technical performance) risk information from source documents, computer model results, questionnaires, and interviews with TWRS staff members. The PRL consists of two lists: a Risk Management List (RML) and a Critical Risk Management List (CRML). The CRML, which is a subset of the RML, requires the highest priority of TWRS Level-1 and Level-2 management. The risks and mitigating actions are grouped and presented in a manner to assist managers with their respective functional area responsibilities.

The risks described in this report are programmatic and include cost, schedule, and performance risks. Performance risk includes technical risk, supportability risk (such as maintainability and availability), and external risk (that is, beyond program control for example, changes in regulations).The general definitions of each risk type are as follows:

- Cost risk, that is, failing to meet cost requirements or constraints
- Schedule risk, that is, failing to meet major milestones
- Performance risk, that is, not attaining the required level of technical performance.

Programmatic risk includes environmental, safety, and health risks insofar as these risks affect program success. For example, if a required safety analysis report does not exist or is inadequate, then a major programmatic risk exists.

The PRL identifies current major risks. Risks not included on the PRL were not identified or are considered assumed risks meaning that management accepts the risk because its likelihood is considered low to very low or because its consequence is considered insignificant. Types of assumed risk are as follows:

- Risk that can be handled through normal system operation.
- Risk where the cost of any mitigating action outweighs expected benefits.
- Risk for which no funding is available and/or is required for mitigation action.

The *Risk Management Procedure (Interim)* (WHC 1995a) and the *Tank Waste Remediation System Programmatic Risk Management Plan* (WHC 1995d) were used to guide the development of the PRL. The interim procedure contains guidelines for developing RMLs and CRMLs using U.S. Department of Defense methods prepared by the Defense Systems Management College (DSMC 1989). The risk management plan provided the approach for managing risks in the TWRS program and for producing the RML, the work scope, and the expected products.

Risk data were collected from management and staff interviews and document reviews by Risk Management (RM) specialists. A cross-sampling of senior and upper-level U.S. Department of Energy (DOE) and Westinghouse Hanford Company (WHC) management were interviewed or asked to identify their key risks through means of a questionnaire. Level-4 function (e.g., 4.2.1.1 in WHC [1995b], *TWRS Functions and Requirements* Document) program managers were then interviewed about their key risks and also asked for a list of relevant source documents. Information from the Level-4 program managers, source documents, and the senior and upper-level management interviews was used as a basis for conducting group interviews and to initiate populating the RML.

Interviews were conducted with a group typically consisting of the Level-4 program manager, a U.S. Department of Energy, Richland Operations Office (DOE-RL) monitor, a line manager and one or more technical representatives for that function. These personnel were familiar with the systems engineering activities and many had been actively involved in developing the functional baseline and identifying its issues.

Interviewees were asked to comment on the initial RML, identify and describe any new risks, rate all risks, describe mitigating actions, and provide any additional relevant risk information. The interview data were then used to revise the RML.

Concurrent with the initial group interviews, the functions and requirements report (WHC 1995b), the system requirements review (Grumbly 1995), and other sources were reviewed to identify and confirm programmatic risks within the TWRS program. Major issues found in the functions and requirements report and the other sources, but not identified during the interviews, were addressed and evaluated in followup interviews whenever possible.

The followup interviews were also used to resolve any questions, acquire missing information, and discuss related issues raised during other functional interviews. The current RML (see Appendix A) was then completed and a CRML (see Appendix B) prepared. A meeting of personnel from all the groups was held to revise the prepared CRML.

Upon completion of the CRML, the issues from the functions and requirements document forming the basis for the critical risks were combined with the critical risks to form the table presented in Appendix C. That table includes the functions affected by the critical risks and provides the linkages between the TWRS program critical risks, the issues, and the affected functions.

Section 2.0 of this report provides a detailed description of the methodology used to collect risk data. Section 3.0 describes the structure of the RML and the CRML and contains a top-level analysis of their content. Section 4.0 describes planned enhancements for the RML/CRML. A reference list is provided in Section 5.0. The TWRS RML and TWRS CRML can be found in Appendices A and B, respectively.

2.0 RISK DATA COLLECTION

Data were collected through interviews, document reviews, analysis of computer model output, and a questionnaire. Most data were collected through document reviews and functional group interviews. Staff from the U.S. Department of Energy Headquarters (DOE-HQ), Richland Operations Office (DOE-RL), Westinghouse Hanford Company and Pacific Northwest Laboratory (PNL) participated in the interviews. To facilitate data collection and data management, these staff were grouped into three categories.

Category-1: Senior to Mid-Level Management (Level-1 and -2)
- WHC and DOE-RL senior to mid-level management
- DOE-HQ staff responsible for implementing systems engineering activities throughout the DOE complex

Category-2: Working-Level Management (Level-3 and -4) and Staff
- WHC program managers
- DOE monitors
- WHC line managers
- WHC and PNL technical representatives (engineers and scientists)

Category-3: Systems Engineers
- WHC systems engineering personnel.

Category-1 staff, consisting of WHC and DOE-RL senior to mid-level management and a DOE-HQ staff member, were individually interviewed to determine their set of top-level risks. Each top-level risk could become a "show-stopper" if the event posing the risk occurred. Category-1 personnel were asked to address the risks within their specific areas of responsibility; however, as time allowed they also addressed other program risks. Because Category-1 personnel were individually interviewed, any risk identified by more than one individual was considered to have additional significance.

Category-2 staff, consisting of working-level management and staff, addressed risk from the perspective of technical and managerial staff at an organizational level where the work encompassed by the Level-4 function was actually performed or managed. They were also asked to consider risk from the perspective of their senior management (Level-1 and Level-2), because the RML and the CRML were principally developed for those management levels.

To facilitate developing an integrated perspective about risk and to make the effort more efficient, six cross-functional Category-2 interview groups were established using the Level-3 and Level-4 Work Breakdown Structure (WBS) shown in Table 2-1. Figure 2-1 shows these functions expressed as an organization chart.

Table 2-1. Cross-Functional Category-2 Groups.

Level-4 Function	Level-3 Function
1. Characterize Waste	Manage
2. Store, Transfer, Concentrate Waste	Manage
3. Retrieve SST, DST, MUST Waste	Retrieve
4. Pretreat Sludges/Solids Pretreat Supernatents Store In-Process Waste	Process Process Process
5. Immobilize LLW Dispose LLW	Process Dispose
6. Immobilize HLW Interim Store Immobilize HLW Prepare Cs/Sr Capsules	Process Dispose Process

The Level-3 functions in the WBS have been revised several times. The Level-4 functions have been relatively stable since their development, and were therefore selected as the basis for collecting risk information.

Category-3 staff, consisting of WHC systems engineering personnel, were individually interviewed to determine risks from the systems engineering perspective (e.g., open issues, mission analysis risks). Category-3 personnel concentrated on enabling assumptions, policy issues and issues of concern to TWRS systems engineering integration and implementation that were generally not addressed by any of the other management and staff categories.

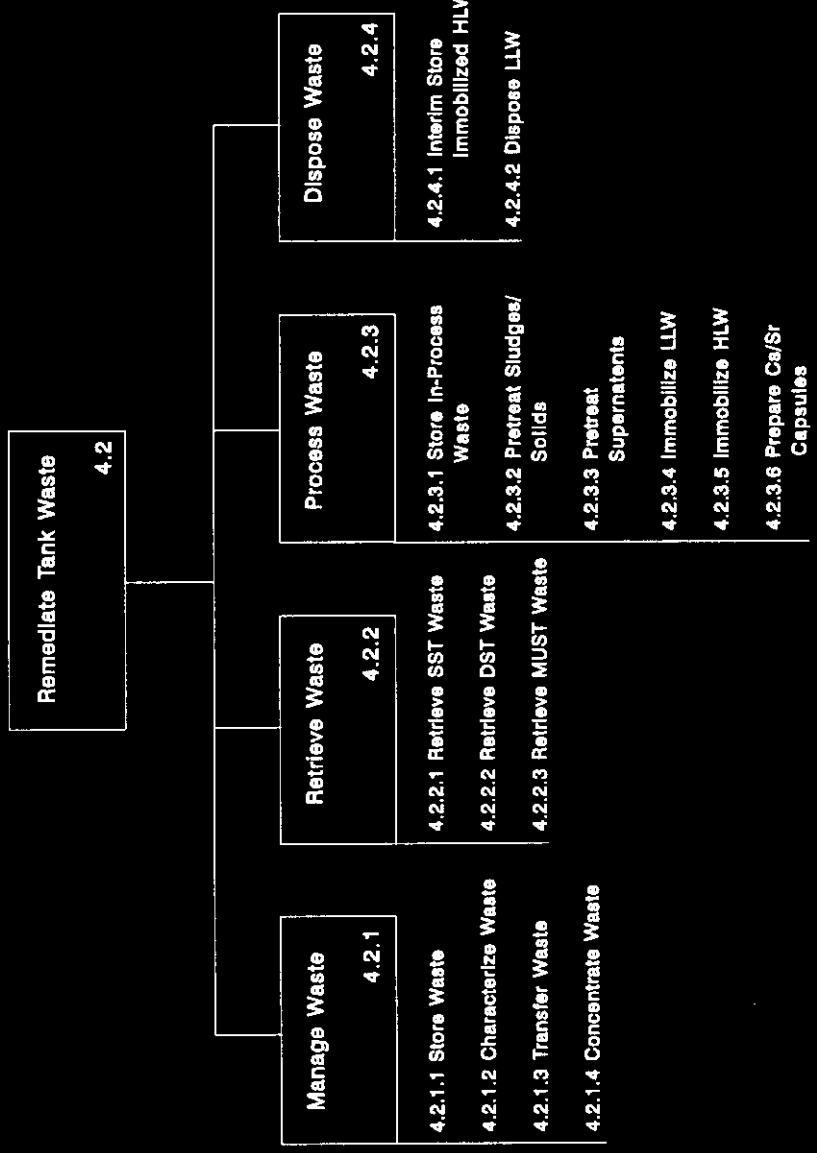
Documents containing key assumptions, issues, systems engineering information, or previous programmatic risk analysis were reviewed by the RM specialists. Risk-related data from these documents were extracted, evaluated, and entered into the initial RML. The reference list of the documents reviewed is provided in Section 5.0.

The critical risks were directly mapped to issues from *TWRS Functions and Requirements Document* (WHC 1995b). The functions that the issues affect are included in the CRML. The critical risks, issues and affected functions are presented together in Appendix C.

Output from the INSIGHT model, which is used to conduct sensitivity analyses for major risk areas, was evaluated for its risk events and to obtain additional background information. High-level waste (HLW) volume generation, cost, schedule, and material information have been produced by the INSIGHT model for various retrieval scenarios. Simple probability distributions were input to yield outputs expressed as uncertainties or sensitivities, depending on the application.

Questionnaires were used in two cases to collect information from staff. An electronic version of the questionnaire may later be updated for use at the program element and project level, or as a means for periodically surveying selected managers and staff to ensure that all major programmatic risks are considered.

Figure 2-1. TWRS Level -3 and -4 Functional Organization Chart.



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3.0 PROGRAMMATIC RISK LIST

As previously stated, the PRL consists of two lists, a risk management list (RML) and a critical risk management list (CRML). The RML contains all of the major (non-assumed) risks for the TWRS program. The CRML is a subset of the RML and contains risk information that requires attention by TWRS senior management (Level-1 and Level-2).

A standard format was developed for collecting, evaluating, and reporting risk information for the PRL. The format contains 11 information elements, which are named by the column headings in the RML and the CRML and are defined as follows.

- **Event/Situation**: A description of the undesirable event or situation (what can go wrong)
- **Impacts**: A description of the impacts or consequences (if the event happens)
- **L**: The likelihood expressed as the probability of the event occurring (a point estimate)
- **C**: The consequence if the event occurs (a point estimate)
- **RV**: The risk value obtained by combining the likelihood and the consequence
- **Mitigating Actions**: Action which can mitigate the probability or the consequence
- **Action Status**: The status of the mitigation action (pending, ongoing, completed)
- **Responsible DOE/WHC**: Identification of the managers in U.S. Department of Energy (DOE) and WHC responsible for managing and controlling the risk
- **Review Date**: The date on which the next review will be held
- **Func.**: The functions affected by the risk from WHC (1995b), *TWRS Functions and Requirements Document*
- **Risk Status**: The risk status indicating the attention required that is shown by the quick reference traffic light chart (green, amber, or red).

Six information elements were collected for the PRL during the interviews and document reviews. These elements are event/situation, impact, likelihood, consequence, mitigation action, and responsible party. One of the information elements, risk value, is an element computed by determining the appropriate intersection between likelihood and consequence. The function element was determined by reviewing the issues and affected functions presented in Appendix G of WHC (1995b), *TWRS Functions and Requirements Document*. The remaining three information elements (action status, next review date, and risk status) will be entered when the responsible party is finalized and status tracking begins.

A simplified approach was selected for determining the likelihood (probability of failure) and consequence (consequence of failure) of each major risk. Point estimates were used because of the difficulty and uncertainty in accurately estimating likelihood and consequence. Risk estimates can be improved, and a more sophisticated approach that treats risk as a spectrum may be considered as the TWRS program progresses, technical performance requirements are quantified, and more decisions are made or are validated.

For this current effort, likelihood is defined as, the probability, or odds, that a specified undesirable event will occur during the TWRS program lifetime, given that no new action is taken to prevent its occurrence. Low, medium and high likelihood ratings were established using the following probability ranges: Low = < 0.25, Medium = 0.25 to 0.75, and High = > 0.75.

Consequence is defined as the estimated magnitude of the negative effect (failure severity) should a specified undesirable event occur, given that no new action is taken to mitigate the action. It is recognized that risk consequences may vary depending on the project or phase of the TWRS program. Low, medium and high consequence ratings were also established using the following impact range descriptions.

- Low: Requires minor reallocation of resources, or schedule slippage is expected that does not compromise a critical milestone or budget goal.
- Medium: Requires significant reallocation of resources, or schedule slippage is expected that may jeopardize at least one critical milestone or budget goal.
- High: Critical milestones will not be met, or the allocated budget will be exceeded by an unacceptable amount.

Risk values are magnitude guidelines determined at the intersection between risk likelihood and consequence and are an interpretive measure of the likelihood of failure. Because the primary responsibility of risk management is to identify and quantify programmatic risk and then to formulate mitigation strategies using that information, risk values are a useful measure to use in accomplishing that quantification. For this reason, a set of risk values were developed and placed in a matrix at Table 3-1 from which the intersection values could be selected. The shaded areas in Table 3-1 are the risk values.

Table 3-1. Risk Value Matrix.

		Consequence		
		Low	Medium	High
Likelihood	Low	Very Low	Low	Medium
	Medium	Low	Medium	High
	High	Medium	High	Very High

In Table 3-1, the magnitude of an event with a low likelihood and a low consequence is very low, which means the event should not require intensive management. However, if the magnitude of an event is very high (due to a high likelihood and a high consequence) the event should be considered for placement on the CRML for senior management's attention and control. A risk that has been rated as very high does not automatically appear on the CRML, for example, if the event cannot occur for several years and an inexpensive mitigating action can easily be taken at any time, then management may decide that the risk presently belongs only on the RML.

Example conditions for placing a medium to high risk on the CRML include:

- Consequences of failure are very serious
- Immediate action is required to preclude the event from happening
- The event/situation is a top priority for stakeholders
- A high performance-based initiative is associated with the event/situation
- The required actions are difficult to coordinate
- Senior management decision making is required.

Risk mitigation is an essential aspect of risk management that comes after first identifying the likelihood and consequence of risk events. Risk mitigation (risk handling strategies) categories were developed to categorize what could be done to eliminate or at least reduce risk. Risk mitigation categories include avoidance, control, assumption, and transfer. Descriptions of each risk mitigation category follow.

- Avoidance: Reject an option because of potentially unfavorable results. Actions may be possible that completely eliminate a risk.

- Control: Continually monitor and correct the condition of a program or project. The likelihood of occurrence and the potential consequences are candidates for reduction.

- Assumption: Conscious decision to accept the consequences if a risk occurs.

- Transfer: Share risk through contractual agreements such as performance incentives, warranties and insurance.

After collecting the data, the RM specialists interpreted the data because they had conducted the interviews. This effort required comparing the data against results from other interviews, ensuring that the data were properly classified (e.g., that mitigation actions did not appear as impacts), and individually interacting with interviewees as needed to capture the true meaning and intent of the data.

The risks were grouped to obtain a manageable list for use by senior and mid-level management. Common wording was adopted and duplicate listings of the same risk were collapsed into one entry. Related risks were consolidated into one entry (using bullets for subparts), creating a single, higher-level risk.

Events/situations which, if they occur, could result in a benefit (called negative risk), were also considered for inclusion in the PRL. These risks might involve cases where a deviation from the current technical baseline could result in a benefit (e.g., if selective retrieval rather than retrieving 99 percent of the waste by volume could be justified and approved, then a major savings could be realized.)

The RML and the CRML are living documents that will require periodic review and updating. Risk values should change as changes are made to risk likelihood and consequence. Risks may move on or off the RML and the CRML. The main objectives of the reviews and updates are to recognize and effectively manage the most important risks and to keep the PRL manageable.

More systematic risk analysis work is recommended for the RML. The initial focus should be on current and near-term activities under the "Manage Waste" function to determine if there are unrecognized risks and to verify risk evaluations. In addition, some form of limited cost/utility assessment for the mitigating actions should be conducted to provide better support for prioritizing mitigating actions. Identifying the amount of money (percent of project) to allocate for risk mitigation efforts would help, both to determine which risks to mitigate and to control risk management costs. Separate accounts should be established to track all risk management costs, including staff interviews and management reviews.

PRLs should also be developed for lower-level functions such as program elements and projects. PRLs at level 5 and below should be more detailed, but the need to keep the list manageable still applies.

3.1 RISK MANAGEMENT LIST

The risk management list is used to track program risk and identify monitoring and handling efforts and responsibilities (WHC 1995d). For each risk event/situation, the current RML contains enough information to begin risk management planning. Appendix A contains the current RML for the TWRS program.

3.2 CRITICAL RISK MANAGEMENT LIST

The critical risk management list is a summary of the key risks extracted from the RML that require intensive management attention or should have the highest priority for evaluation and handling. Appendix B contains the current CRML for the TWRS program. Most of the events on the CRML have a risk value of "very high." The risk events selected for the current CRML are as follows:

- **INSUFFICIENT FUNDING**
- **TANK SAFETY ISSUES NOT RESOLVED IN TIME TO SUPPORT RETRIEVAL**
- **LLW PERFORMANCE REQUIREMENTS ARE NOT AVAILABLE OR ARE UNATTAINABLE**
- **PRIVATIZATION EXPECTATIONS FOR PHASE I NOT MET - A) RFP, B) NON-TECHNICAL, C) TECHNICAL**
- **MAJOR INCIDENT OCCURS ON SITE**
- **DURABLE DECISIONS FOR SYSTEMS ENGINEERING ARCHITECTURAL SELECTIONS, REQUIREMENTS, AND SCOPE ARE NOT MADE.**
- **END STATE OF 200 AREA CENTRAL PLATEAU UNDEFINED.**
- **DISAGREEMENT ON NEEDS AND SCOPE FOR WASTE CHARACTERIZATION INFORMATION**
- **DST CAPACITY IS NOT SUFFICIENT - CANNOT ACCEPT NEW WASTE**
- **TWRS SAFETY AUTHORIZATION BASIS UNAVAILABLE OR INADEQUATE**

The risks in the CRML address a full range of TWRS programmatic issues. "INSUFFICIENT FUNDING" is associated with cost risk. "PRIVATIZATION EXPECTATIONS FOR PHASE I NOT MET - A) RFP, B) NON-TECHNICAL" and "END STATE OF 200 AREA CENTRAL PLATEAU UNDEFINED" are primarily TWRS schedule risks. The remaining risks are all performance issues which include safety, operations, system architecture, and system availability.

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4.0 PLANNED ENHANCEMENTS

Risk management, including updating the RML/CRML, is a continuous ongoing process. This report is a snapshot of this process, early in its implementation. Thus, the information presented here is expected to evolve, as will the process by which risk is managed. Some specific enhancements can be identified now. Others will be identified as the RML/CRML is used by management.

Some of the specific plans for the RML/CRML are listed below.

- Regular review of the CRML by senior TWRS managers, and updates based on these reviews
- Regular review of project-specific risks from the RML by project management, and updates based on these reviews
- Updates based on reviews of this report
- Completion, where appropriate, of information missing from RML/CRML
- Enhancement of definition of what should be included on the CRML and of the interface between the CRML, the RML, and project-specific RMLs
- Enhancement of the descriptions of consequences in terms of cost, schedule, and technical performance impacts, including more quantification of impacts as such information becomes available
- Improved organization of the lists in terms of the events/situations producing the risks, and the types of risk management actions taken
- Improved processes for identifying, tracking, evaluating, and selecting the risk management actions.
- Placing the RML/CRML under configuration management
- Improved processes for communicating risk information (including lessons learned) and more fully integrating risk management actions
- Incorporate time information for risk and mitigating actions

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5.0 REFERENCES

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WHC, 1995c, *TWRS Fiscal Year 1996 Multi-year Program Plan* (MYPP), WHC-SP-1101, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1995d, *Tank Waste Remediation System Programmatic Risk Management Plan*, WHC-SD-WM-PMP-018, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX A

TWRS RISK MANAGEMENT LIST

The right-hand column, "Risk Status," currently only contains notes. The notes indicate that the risk has been elevated to the CRML, for example, "C-9" means that the risk is reflected in the ninth risk on the CRML. The wording on the two lists will not necessarily be identical, because the risk may have been combined with others for inclusion on the CRML. The notes sometimes indicate likely candidates for future inclusion on the CRML.

Store Waste (4.2.1.1)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
1) DST CAPACITY IS NOT SUFFICIENT - CANNOT ACCEPT NEW WASTE • New waste incompatibilities with waste in storage tank • Volume: acceleration or increase of waste from generators above planned amounts, delays in other TWRS activities, e.g., evaporator failure • Leak in receptor DST • Cannot fully use tank because of equipment or component failure (e.g., transfer lines)	Reduced ability to safely manage waste and avoid environmental insult • Unable to accept new waste from generators, from retrieval, or interim stabilization wastes • Unable to provide space for emergency pumping • Other TWRS activities are unable to move forward (e.g., disposal)	H	H	VH	Use the MWTF Path Forward Plan to plan for adequate DST space • Track available and needed waste volume • Use a dynamic model to analyze alternatives and support decision making • Accept increased future operational risk of using evaporator operating tanks as spares • Obtain permission to use SSTs for emergency pumping destination • Build new DSTs		Sidpara / Wicks			C-9
2) TWRS SAFETY AUTHORIZATION BASIS UNAVAILABLE OR INADEQUATE The tank farms safety analysis report is not available The SST and MUST safety basis is not established	• Tank farms continues operating with Interim Safety Basis • Tank farms is not in compliance with DOE Order 5480.23 (DOE 1992) • Other TWRS operations delayed by lack of approved Safety Authorization Basis • Increase health and safety risks	H	H	VH	• Implement a systematic process to gain approval of a technically defensible Safety Authorization Basis, including completion of safety issue studies • Resolve access and process limitation issues for Priority-1, USQ tanks		Bader / Umek			C-10
3) MULTIPLE TANK LEAKS EXCEED EMERGENCY PUMPING AND STORAGE CAPABILITIES More tanks leak than available resources are able to pump or receive on an emergency basis	Increased environmental damage Potential fines or penalties Unwanted media attention	-	-	-	• Prepare resource reallocation plan which can be initiated if the probability of this risk increases • Acquire extra pumping equipment • Improve monitoring of tanks to try to predetermine leakers • Accelerate interim stabilization		TBD			

Store Waste (4.2.1.1)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
4) INTERFACES WITH PRIVATE VENDORS Lack of a sound technical basis for determining which tanks to use for privatization Inability to provide private vendor with specified feed	• Pay fees to vendors • Phase I does not provide all needed information for Phase II	H	H	VH	• Apply a systematic process to improve AAS feed tank selection process • Focus and keep on schedule characterization activities to support selection		Kinzer, Bader / Bacon, Umek, Honeyman			C-4
5) ACCIDENTS/ INCIDENTS Major incident occurs in tank operations or on site. New Unreviewed Safety Question (USQ), Unusual Occurrence (UO), or significant worker injury incurred.	• Worker/public health and safety jeopardized • Lengthy work shutdown until resolution • Missed schedule • Funding gets diverted from baseline allocation • Fines • Future work put under closer scrutiny • increased program cost	H	H	VH	Ongoing mitigation action to enhance safety and Conduct of Operations programs (e.g. safety and evacuation drills) Anticipate things that can go wrong and prepare response actions (e.g. public communications, quick cleanup) Demonstrate importance of issue by keeping workers' awareness high		Sidpara / Wicks			C-5
6) FUNDING/PERSONNEL Funding and/or resources not available to meet cost/schedule baseline or current TPA (Ecology et al. 1994) milestones	Baseline not met TPA (Ecology et al. 1994) milestones missed	H	H	VH	• Prepare plan for renegotiation of TPA (Ecology et al. 1994) milestones • Improve cost estimates, especially as program evolves • Develop more aggressive, less conservative planning basis • Assume risk of fines		Wagoner / Trego			C-1

Store Waste (4.2.1.1)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
7) LOSS OF NEGOTIATED COMPLIANCE STATE State of Washington is no longer willing to accept conditions at tank farm facilities that do not strictly comply with all regulations • New regulations or interpretation of existing regulations • accelerated degradation of existing systems • delays in accomplishing negotiated milestones	Many tanks and ancillary systems reclassified as "non-compliant" with additional state forced actions being assigned to them Planned operations are delayed until unplanned upgrades accomplished and "negotiated compliance" reinstituted State fines DOE (likelihood is based on assumption that delays are incurred in accomplishing negotiated milestones)	M	H	H	• Strengthen technical basis for equipment upgrades to help ensure funding and timely installation • Keep state well informed about progress and issues, so surprises do not lead to removal of negotiated compliance status		Kinzer / Bacon			

Characterize Waste (4.2.1.2)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
1) OPERATIONAL: SYSTEM AND PERSONNEL AVAILABILITY AND APPROPRIATENESS Sampling and analysis systems (e.g., rotary mode core sampling) not maintained at planned availability. Personnel and systems not appropriate for needs (e.g., tanks cannot support existing sampling equipment).	Other functions dependent on characterization delayed Characterization information deemed inadequate Unable to meet sampling criteria	-	-	-	Have standby systems available Pursue aggressive maintenance schedule Require other functions to accept schedule slip Improve capabilities (equipment design, personnel training) Modify criteria and expectations		TBD			
2) PLANNING AND ADMINISTRATION ISSUES • The DQOs do not support the planning basis • Information management systems not integrated • Integrated schedule changes too often • Rigorous engineering principles not applied to testing	• Planning unsupported, resulting in delays and funding issues • Inconsistent data and lower quality products • Lack of direction and loss of schedule optimization capability • Testing does not support correcting sample bias	-	-	-	• Enhance DQO process to ensure approval by affected functions • Provide a single database of user information • Limit schedule changes • Redesign testing program to include rigorous engineering principles		TBD			

Notes:

In headings: L = Likelihood, C = Consequences, RV = Risk Value
In table text: L = Low, M = Medium, H = High, VH = Very High

Transfer Waste (4.2.1.3)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	func.	Risk Status
1) LOSS OF CROSS-SITE TRANSFER CAPABILITY Regulators or equipment failures stop use of existing line. New line not built in time to support functional need.	• Unable to support interim stabilization milestones • 200W Area complex waste issue remains unresolved • Unable to support emergency pumping needs if leak happens in 200W Area • Increased risk of fines from state	H	H	VH	• Renegotiate impacted TPA milestones • Sustain negotiated compliance state • Develop alternate cross-site transfer capabilities (e.g., trains and trucks) • Assume risk of fine from state		TBD			C-9
2) MISCELLANEOUS TRANSFERS Existing transfer lines from non-stabilized SSTs are deemed unusable More waste from generators than transfer system can pump. Transfer system unable to support emergency pumping.	• Interim stabilization prolonged • Generators forced to exceed temporary storage criteria • Aggravated environmental damage, fines and unwanted media attention	-	-	-	Develop alternative methods for moving waste Renegotiate TPA milestones Prepare to shut down non-emergency transfer if leak occurs		TBD			
3) FUNDING SHORTFALL Funding and/or resources not available to meet cost/schedule baseline for TPA (Ecology et al. 1994)	• Schedules delayed, baseline and TPA milestones not met • State fines DOE	H	H	VH	Prepare plan for renegotiation of TPA milestones Assume risk of fines		TBD			C-1

Concentrate Waste (4.2.1.4)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	func.	Risk Status

1) WASTE REDUCTION LESS THAN EXPECTED Feed delay, equipment failure, or new technical (e.g., waste compatibility or lack of DST free space) issue cause concentration inefficiencies	The evaporator cannot fully support waste management activities required for safe storage	H	H	VH	• Develop alternate waste concentration capabilities (new evaporator, use different technology, or restart other evaporators in existing facilities) • Resolve technical issues expediently • Use dynamic model to optimize storage and routing, so concentration not delayed		TBD			C-9
2) WASTE INFLOW INCREASE Acceleration of waste volume from non-TWRS generators	Evaporator unable to concentrate at desired rate	H	H	VH	• Force generators to store waste until evaporator able to process • Obtain additional evaporator capacity		TBD			C-9

Notes:

In headings: L = Likelihood, C = Consequences, RV = Risk Value
In table text: L = Low, M = Medium, H = High, VH = Very High

Combined Characterize Waste (4.2.1.2), Transfer Waste (4.2.1.3) Concentrate Waste (4.2.1.4)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
1) LACK OF AGREEMENT ON NEED AND SCOPE FOR ADDITIONAL WASTE CHARACTERIZATION INFORMATION Unable to gain agreement on overall scope of characterization project with DNFSB, DOE, and WHC. New regulatory changes create constraints or regulator has organizational change resulting in new philosophy. New regulatory changes create constraints	Characterization products deemed inadequate, forcing planned activities dependent on characterization information to be delayed Boundaries are not well defined, causing rework Technical basis assumptions may become invalid Systems could be deemed non-compliant with new regulations Unplanned upgrades required	H	H	VH	• Establish WHC panel for all of TWRS to review and validate characterization products • Plan additional characterization to meet all needs, and accept new risks from descoped activities • Assume risk of proceeding with baseline without concurrence of all stakeholders or regulators • Produce Mission Analysis to promote top-down requirements allocation • Develop attainable negotiated compliance state • Upgrade to meet new requirements • Keep informed about new regulations, maintain effective lobby, and provide comments during rulemaking		Kinzer / Bacon			C-8
2) MAJOR INCIDENT OCCURS IN TANK OPERATIONS OR ON SITE Worker injury, new USQ or UO, or other safety related incident occurs	Work stopped Accomplishments diminished Possible fines	H	H	VH	Enhance safety and Conduct of Operations programs		TBD			C-5

Retrieve Waste - 4.2.2.1 SST, 4.2.2.2 DST, 4.2.2.3 MUST

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
1) DST STORAGE NOT ADEQUATE DST storage not adequate enough to meet SST retrieval schedule	TPA (Ecology et al. 1994) Milestones may not be met Legal and regulatory agency implications	H	H	VH	Use the MWTF Path Forward Plan to plan for adequate DST space up to the year 2004. Beyond 2004 will require additional planning. Track available and needed waste volume Select proven retrieval technologies to keep retrieval on schedule Better characterize SST waste contents to improve blending Use a dynamic model to analyze alternatives and support decision making Construct equipment and facilities to ensure that retrieval can be performed safely and within cost and schedule		Kinzer / Bacon			C-9
2) SUFFICIENT PROJECT FUNDING NOT RECEIVED Sufficient funds not available to retrieve waste from SSTs/MUSTs by 2018, close them by 2024, or completely immobilize all DST waste by 2028	Unplanned delay in tank retrieval Unplanned delay in tank farm closure	H	H	VH	Get enough funding to meet the TPA milestones Renegotiate the three TPA milestone requirements or their completion dates Renegotiate program cost, schedule or scope		Wagoner / Trego			C-1
3) SST SLUICING RATE NOT SUSTAINED Waste retrieval, processing and storage functional processes cannot be maintained in balance	One or more function schedules may have to be slipped or their processes will have to be modified Current cost projections exceeded	L	M	L	Use a dynamic model to analyze alternatives and support decision making Reexamine the number of systems required for waste retrieval and if not adequate, construct new equipment and facilities to ensure that retrieval can be performed safely and within cost and schedule As experience is gained from early retrieval, reexamine the plan Perform a supportability analysis on ancillary equipment and other support systems to optimize system availability		Nicoll / Meyer			

Retrieve Waste - 4.2.2.1 SST, 4.2.2.2 DST, 4.2.2.3 MUST

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/MHC	Review Date	Func.	Risk Status
4) ALLOWABLE LEAKAGES EXCEEDED Unacceptable leakages may delay SST retrieval and tank farm closure	Current cost projections exceeded Workers exposed to unacceptable risk	M	L	L	Determine the likelihood of SST/MUST/DST leakage against expected magnitudes and impacts Test and evaluate leak mitigation and detection methodologies Install and operate improved leak detection equipment Place emphasis on tanks presenting the most risk for leakage Determine the amount of allowable leakage, Washington State Department of Ecology position, and negotiate for acceptance		Nicoll / Meyer			
5) PROCESS SAFETY ISSUES NOT RESOLVED Health and safety issues may not be resolved in a timely manner to meet regulatory and project schedule requirements • Work restrictions exist on tanks containing flammable gas • Priority-1 Unreviewed Safety Questions (USQ) tanks require DOE Secretary approval prior to work in their proximity	Work stoppage or delay	M	H	H	Resolve interrelated tank safety issues that impede retrieval, treatment and disposal activities by completing ongoing safety issue studies Demonstrate critical technologies that allow work on tanks containing flammable gas Resolve access and process limitation issues for Priority-1, USQ tanks Construct equipment that can be used to retrieve waste from tanks containing flammable gas		Bader / Umek			C-2

Retrieve Waste - 4.2.2.1 SST, 4.2.2.2 DST, 4.2.2.3 MUST

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
6) CANNOT COMPLY WITH RESIDUAL WASTE LIMITS Cannot remove, or is not practical to remove, enough waste to reduce the level of residual radionuclide and hazardous chemicals below established thresholds	Additional effort required to remove substances left in SSTs and MUSTs although all waste practical was removed Fines for not complying with TPA (Ecology et al. 1994) agreements	M	L	L	Change the requirement from percentage (99%) of waste removed from a SST to a radiological and chemical hazard or risk metric Use technologies that will retrieve as much waste as practical even though they may be more costly Better characterize waste tank contents to improve retrieval design Develop a full set of metrics for each contaminant and for each tank by which to determine when enough waste has been retrieved from a SST/MUST Gain approval from WA State DOE for waste not practical to retrieve		Nicoll / Meyer			
7) CLOSURE AS LANDFILL NOT ALLOWED Planned approach to close the SST farm as a landfill is changed to a clean close requirement • Changed to clean close after 99 percent waste removed • Changed to clean close when 99 percent waste cannot be removed	Effort wasted on wrong cleanup goal Tanks must be removed and the soil cleaned	L H	H H	M VH	Determine standards for closure with the NRC and state of Washington as soon as possible by defining the acceptable end state of all tanks (including residual waste), equipment and soil Provide defensible information on costs and risks as soon as possible Better characterize waste tank contents, ancillary equipment, and soil contamination Delay (as long as possible) acquisition of expensive assets that may change based on the type of closure as long as possible Perform engineering studies, sampling and characterization, modeling, and risk analysis to improve the ability to react to changes		Wagoner / Trego			C-7

Notes:

In headings: L = Likelihood, C = Consequences, RV = Risk Value
In table text: L = Low, M = Medium, H = High, VH = Very High

Store In-Process Waste (4.2.3.1), Pretreat Sludges/Solids (4.2.3.2), Pretreat Supernatents (4.2.3.3)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
1) REPOSITORY UNAVAILABLE The repository is not on-line when scheduled with sufficient capacity to contain all HLW	HLW canisters cannot be shipped, so they must be stored Program delays litigation fines	H	L	M	Petition DOE-HQ to ensure timely completion of repository Develop contingency plan to cover potential delay (long term on-site storage) Improve performance of separation and pretreatment to reduce HWL volume		Taylor / Honeyman			Poten CRML
2) RETRIEVAL DELAYS Retrieval schedule is not met (longer delays create greater consequences)	• Missed milestones • Costs are deferred • Potential for more leaks • Political involvement affecting funding and schedules	M	H	H	Retrieval function has control		Nicoll / Meyer			
3) PERFORMANCE REQUIREMENTS NOT QUANTIFIED Performance requirements have not been quantified (includes product composition and/or specifications)	goals are unstable, typically inappropriate schedule delays and higher costs	M	H	VH	1) Expedite decisions on land use 2) Expedite assessment of long-term risks to public and environment 3) Define disposal requirements 4) Define pretreatment requirements • Develop and initiate a critical path schedule to define performance measures • Incorporate technology development in schedule to be able to meet performance measures • Educate stakeholders on what can be accomplished, at what cost, and by what time. Keep them informed of progress. Have them reassess values.		Taylor / Honeyman			C-3 C-7

Store In-Process Waste (4.2.3.1), Pretreat Sludges/Solids (4.2.3.2), Pretreat Supernatents (4.2.3.3)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
4) NRC DECISION ON INCIDENTAL LIMITS RESIDUAL TANK WASTE NRC decision on tank residual LLW limits is far below DOE/WHC assumptions	• retrieval amounts increase • number of glass logs increases • retrieval methods change	M	H	H	• Accelerate and try to control decision process • Respond to NRC requests quickly (WHC can only provide support - DOE-RL must take lead)		Taylor / Honeyman			
5) FAILURE TO PROPERLY IMPLEMENT RCRA "Citizen's" lawsuit over failure to properly implement RCRA at Hanford leads to judicial action	• Most Hanford operations shut down for extended time period Large fines imposed	M	H	H	• Work with Hanford Advisory Board and stakeholders - keep them informed and involved • Work with general counsel		Kinzer, Wagoner / Bacon			
6) PRIVATIZATION EXPECTATIONS FOR PHASE I NOT MET - A) RFP, B) NON-TECHNICAL, C) TECHNICAL	Program delays, increased costs, need to recover quickly	H	H	VH	• Determine core competencies needs • Develop recovery plan - Retain key people by placing them in other funded programs - Have plan to return them to former TWRS organizations - Keep vital facilities operating in minimal role by sharing other mission work		Kinzer / Bacon			C-4
7) FEED SPECIFICATIONS Feed composition poorly defined, adequate melter feed specifications cannot be written	[if no privatization] -> [with privatization] -> • Waste at higher concentrations that specified is diluted, so volume increases • Engineering change notices issued	H H	L H	M VH	• Continue engineering studies to increase understanding of waste leading to improved specifications • Assume risk of engineering change notices • Loosen specifications and pay costs for overdesign		Sanders / Gasper			C-3
8) INSUFFICIENT FUNDING Insufficient funding (both short term and long term)	• Loss of core competency • Missed milestones	H	H	VH	• Change scope • Extend schedule		Wagoner / Trego			C-1

Store In-Process Waste (4.2.3.1), Pretreat Sludges/Solids (4.2.3.2), Pretreat Supernatents (4.2.3.3)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
9) LACK OF DURABLE DECISIONS Durable decisions for architectural selections do not exist. Many decisions have not been made yet. Previous decisions have often been reversed.	• Goals are unstable, often inappropriate • Frequent baseline revisions • Continued rework with increased costs • Schedule often renegotiated	H	H	VH	• Get commitment by WHC and DOE-RL (possibly select a champion) • Adopt and implement decision management procedures • Identify decision makers • Track decisions and accomplish in timely manner		Wagoner / Trego			C-6
10) MAJOR INCIDENT Major incident occurs in tank operations or on site (accident or safety condition resulting in Congressional and media attention) New Unreviewed Safety Question (USQ), Unusual Occurrence (UO), or significant worker injury incurred	• Lengthy work shutdown until resolution • Missed schedule • Funding becomes more tenuous • Fines • All future work put under closer scrutiny • Worker/public health and safety jeopardized	H	H	VH	Enhance safety and Conduct of Operations programs		Kinzer / Bacon			C-5
11) VITRIFICATION DELAYS Vitrification schedule is not met for HLW or LLW	• Pretreatment cannot proceed	M	H	H	• Build more tanks • immobilize high level waste has control		Sanders / Honeyman			

Notes:

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Risks Common to Immobilize LLW (4.2.3.4) and Dispose LLW (4.2.4.2)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Statu s
1) PREFERRED ALTERNATIVE CHANGES Technically defensible alternatives analysis not done for TWRS Baseline selection or move to privatize and another alternative is selected. For example, TWRS EIS/record of decision is inconsistent with current baseline and in situ vitrification or grout becomes preferred alternative.	Technical baseline is lost	H	H	VH	Redo program baseline		Kinzer, Thompson / Bacon			C-7
2) STAKEHOLDER VALUES NOT PROPERLY CONSIDERED Stakeholder values are not properly considered when selecting alternatives	Litigation from public or state Difficulty in obtaining permits	L	H	M	Review alternatives with respect to stakeholder values Maintain dialogue with stakeholders check for changing values		LaMont / Murkowski			
3) NRC DENIES DOE PETITION TO DESIGNATE SUPER NATENT LLW NRC denies DOE petition to designate supernatant LLW or cost to treat supernatant are prohibitive	All waste designated to be HLW Large disposal costs	L	H	M	Assure a complete and defendable basis for preferred supernatant treatment is presented Appeal decision		Wodrich / Honeyman			

Risks Common to Immobilize LLW (4.2.3.4) and Dispose LLW (4.2.4.2)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
4) PERFORMANCE ASSESSMENT (PA) NOT APPROVED ON SCHEDULE DUE TO TECHNICAL INADEQUACIES PA not approved in time for design of disposal system and setting of Phase II contract terms Material and natural properties of waste form and disposal system not adequately determined Insufficient design of system components:chemical matrices and barriers, or capillary breaks Waste form made during Phase I or waste form planned for Phase II does not match final PA requirements Volume of waste form increases significantly relative to program baseline (by more than 50%) Waste form performance test protocols underestimate or overestimate actual performance	Litigation by state or stakeholders Overdesign of treatment and disposal system. Glass volume increased to improve durability, increasing processing and disposal cost. Delay in deployment of treatment process. Disposal system deployed that will eventually fail Disposal Site may need to be remediated Basis for deployment of Phase II unsubstantiated	-	-	-	Allocate funding to characterize material, natural properties, additional detail to PA studies, and evaluate available test protocols Remove or obtain variance for legal requirement for PA Revise specification for Phase II product Add waste treatment to remove offending species Implement alternate treatment		Taylor, Brown / Moneyman, Williamson			
5) REGULATORY DRIVERS CHANGE Change in regulatory requirements, e.g., decrease/increase of the drinking water dose rate	Additional treatment required Change in disposal design needed	L	M	L	Provide comments during rule-making Obtain variance Early completion of disposal conceptual design		Brown / Williamson			

Risks Common to Immobilize LLW (4.2.3.4) and Dispose LLW (4.2.4.2)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Statu s
Immobilize LLW (4.2.3.4)										
1) TECHNICAL UNCERTAINTIES FOR PHASE I MELTER Melter Scale-up uncertainty Glass unable to incorporate all Cl, F, S, and P	Production rate requirement not met. More than two melters required. Formation of salt layer in melter resulting in inefficient operation	L M	H H	M H	Ensure that sufficient data is collected in Phase I to support Phase II design Define limits and feed blend strategy Include salt purge from melter or offgas		Taylor / Honeyman			C-4
2) SECONDARY LIQUID WASTE NOT COMPATIBLE WITH SITE INFRASTRUCTURE VOLUME OR COMPOSITION LIMITS	Additional treatment process may need to be developed	L	H	M	Maintain detailed TWRS process flowsheet, including basis and assumptions Maintain liaison with tank farm operations, etc.		Kinzer / Bacon			

Risks Common to Immobilize LLW (4.2.3.4) and Dispose LLW (4.2.4.2)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Statu s
Dispose of LLW (4.2.4.2)										
1) SITE WIDE DECISIONS ALTER TWRS DIRECTION Allocation of environmental safety and health limits (i.e., pollution limits) not made across site (Environmental Restoration (ER), TWRS, etc.) Site wide analysis establishes impact from disposal site plume overlap	Inappropriate PA requirements, can be either too high or too low Contribution from LLW disposal limited to A) < 0.4 Mr/yr B) < 1.0 Mr/yr	H L M	H H M	VH M M	Complete site wide analysis of impacts of proposed action to groundwater and air Ask for regulatory relief through variance process Move disposal site Add barriers to LLW site or to other confounding site Remediate interfering site		Kinzer / Bacon			C-7
2) OVERTREATMENT OF WASTE (CLASS A GLASS) INCURS UNNECESSARY COSTS	Unnecessary cost incurred by -disposal -program	MM	L H	L H	Determine proper degree of treatment		Taylor / Honeyman			

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TWRS Immobilize (4.2.3.5), Interim Store (4.2.4.1) HLW and Prepare Capsules (4.2.3.6)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible WHC/DOE	Review Date	Func.	Risk Status
1)PRIVATIZATION EXPECTATIONS FOR PHASE I NOT MET - A) RFP, B) NON-TECHNICAL, C) TECHNICAL 4A) PHASE 1 ALTERNATIVE ACQUISITION STRATEGY (AAS) PRIVATIZATION RFP NOT AWARDED An unacceptable outcome from the RFP is realized due to contract issues (e.g., bids are too high, or vendor risk is too high so no bids submitted)	Technical baseline lost	H	H	VH	Delay AAS until adequate product specifications are available Work with vendor to identify components of RFP which drive costs, to find ways to reduce costs, and rescope RFP Develop a different alternative acquisition strategy Allocate more of DOE budget to HLW demonstration plant in combination with selecting tanks that have more difficult wastes to treat Provide government backing for financing		Taylor / Honeyman			C-4
PROGRAMMATIC (NON-TECHNICAL) ISSUES • Benefits of privately-owned operation are not realized • Fee structure and mechanism to resolve differences production estimates between buyer and vendor not established • Self-regulation problems (DOE is not allowed to provide nuclear safety oversight and NRC is not prepared to take charge) • Unanticipated events requiring extensive change notices or negotiations • Vendors unable to deliver due to lack of special knowledge in financial or design and operating areas TECHNICAL ISSUES Plant does not operate with acceptable performance	LW vitrification plant cannot operate, yet vendor must be paid	H	H	VH	Extend Phase I schedule to better understand and resolve technical issues, both pre-construction and during operations Have WHC or independent organization review design of demonstration plant Develop a backup strategy to AAS Determine core competency needs, retain key personnel in other funded programs, keep vital facilities operating in minimal role by sharing mission work Have a plan to return people and facilities to roles they performed before AAS occurred		Taylor			C-4

TWRS Immobilize (4.2.3.5), Interim Store (4.2.4.1) HLW and Prepare Capsules (4.2.3.6)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible WHC/DOE	Review Date	Func.	Risk Status
Lack of special design and operating technical knowledge by private contractor. Interface issues with AAS: storage, disposal, and support facilities are not available to vendor when desired. Effluent treatment - quantity unknown.										
3) WASTE ACCEPTANCE PROCESS (WAP) DOE ER&WM need to negotiate new WAP and implementation schedule because they are now working with a vendor, not M & O company • Current standard form does not address new product forms (i.e., Cs loaded glass) • No WAP schedule to support Phase I privatization	No roadmap from step A to step B; creates an inability to meet schedule Program stalls, cost increases, TPA milestones are not met	H	H	VH	The WAP is a very flexible process, so once the issue is addressed it becomes a matter of DOE ER&WM creating or revising the WAP and an implementation schedule		Taylor			C-4
4) INTERIM DRY STORAGE OF Cs/Sr CAPSULES Capsules are unacceptable and cannot go to the repository Note: a long term issue is that the program won't adequately define what storage requirements are needed until the vitrification plant begins	Risks increase with time Costly and unplanned processing is required	M	M	M	Resolve the issue on schedule (i.e., match dry storage design with vitrification schedule) Maintain Waste Encapsulation and Storage Facility (wet storage)		LaMont / Murkowski			
5) HANDLING OF MISCELLANEOUS WASTE FORMS Form of TRU concentrates from HLW plant is undefined and may not be accepted at Waste Isolation Pilot Project (WIPP) Melter disposal (this has not been addressed at Savannah River either)	Significant cost increases, also schedule and operations impacts due to technically accommodating the undefined waste forms Addressing melter disposal; however, has less impact than addressing what remains in the burial grounds	M L	M L	M VL	Negotiate acceptable forms for HLW at WIPP or the Yucca Mountain Site Require vendor to package for offsite disposal		Taylor / Powell			Poss CRML

TWRS Immobilize (4.2.3.5), Interim Store (4.2.4.1) HLW and Prepare Capsules (4.2.3.6)

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible WHC/DOE	Review Date	Func.	Risk Status
6) SAFETY OVERSIGHT ISSUES NRC needs to license HLW process facility because DOE is no longer in an oversight role An independent safety review adds "unwritten" requirements	Costs increase and schedule becomes uncertain due to new requirements	H	H	VH	Continue with DOE in oversight role		TBD			C-4
7) LACK OF STAKEHOLDER ACCEPTANCE Stakeholders do not accept interim storage during Phase I	Phase I has no storage location	L	L	VL	Study & develop a plan for storage		TBD			

Systems Engineering Risk List

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
1) INSUFFICIENT FUNDING DOE establishes a cost profile that is inconsistent with the remediation strategy, causing a shortage of available funding (short term and long term effects)	• Not all waste can be retrieved • Current remediation strategy is not achieved • Stakeholder lawsuits lead to penalties	H	H	VH	• WHC and DOE-RL continue establishing a likely funding profile which will be issued to WHC as a decision memo • Modify the existing strategy to retrieve the most critical waste and/or stretch out program • Renegotiate TPA milestones		Wodrich / Shauss			C-1
2) NRC DECISION ON INCIDENTAL LIMITS FOR RESIDUAL TANK WASTE NRC classifies residual tank waste after retrieval as HLW	• An NRC license is required for on-site disposal of residual waste • Retrieval of 100 percent of tank waste is required	L	H	M	DOE-RL and DOE-HQ petition NRC for formal rule-making		Wodrich / Honeyman			
3) LLW CLASSIFICATION NRC decision on LLW limits is far below DOE/WHC assumptions; therefore, planned LLW stream (using baseline pretreatment processes) does not meet NRC Class C limits	• Retrieval amounts increase • Number of glass logs increase • Retrieval methods change • HLW volume may increase	H	H	VH	DOE-RL and DOE-HQ petition NRC for formal rule-making		Wodrich / Honeyman			C-3
4) LLW END STATE A decision is made for the 200 Area end state requirements to be greater for LLW tank waste and closed tanks, than for LLW solid waste, facility disposition. This may result from having non-negligible interaction between the TWRS disposal systems and other disposal actions in the 200 Areas.	• TWRS end-state requirements change • Requirements become more stringent than current requirements	H	H	VH	• Per DNFSB finding 94-2, complete a 200 Area PA for all planned disposal actions • Complete a comprehensive risk assessment to integrate requirements of DOE, NRC, EPA and the State of Washington; i.e., DOE Order 5820.2A (DOE 1988), CERCLA, WAC 173-340 (Model Toxics Control Act Cleanup Regulation)		Kinzer (TWRS), Piper (Site) / Grygiel (Site)			C-7
5) DOSE ALLOCATIONS Dose limits allocated to TWRS for onsite disposal are lower than planned	• TWRS end-state requirements change • Requirements become more stringent than current requirements	L	H	M	• Per DNFSB finding 94-2, complete a 200 Area PA for all planned disposal actions • Complete a comprehensive risk assessment to integrate requirements of DOE, NRC, EPA and the State of Washington; i.e., DOE Order 5820.2A (DOE 1988), CERCLA, WAC 173-340 (Model Toxics Control Act Cleanup Regulation)		Kinzer (TWRS), Piper (Site) / Grygiel (Site)			

Systems Engineering Risk List

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
6) SELECTIVE RETRIEVAL ALLOWED TWRS-EIS provides justification for overriding TPA (Ecology et al. 1994) requirement to retrieve 99% of tank waste	• Negative Risk to program • TWRS functional baseline invalidated • TWRS program redirected • TPA renegotiated	H	H	VH	• Complete EIS on schedule to allow the decision to be made as early as possible • Consider delaying non-critical, expensive activities until EIS is completed		Jacobs / Dunford			C-7
7) SST RETRIEVAL REQUIREMENTS INCREASED The decision is made to retrieve more than 99 percent of the SST wastes (e.g., to satisfy "limit of technology" in TPA [Ecology et al. 1994])	• The TWRS work scope increases • Improved retrieval methods must be developed • Cost increases • Schedule is delayed	H	H	VH	Keep single-shell tank closure work plan addressing this alternative on schedule		Jacobs / Dunford			C-7
8) DST CLOSURE RESPONSIBILITY TWRS is not responsible for DST closures, but ER contractor is responsible	• TWRS work scope is decreased • Extra programmatic interface required • TWRS baseline is replanned • TWRS costs are reduced	L	M	L	• Petition for memorandum of agreement between DOE-HQ EM30 and EM40 programs • Inform stakeholders of the transfer of responsibility		Wodrich / Honeyman, Shauss			
9) SST CLOSURE RESPONSIBILITY TWRS is not responsible for SST closures, but ER contractor is responsible	• TWRS work scope is decreased • Extra programmatic interface required • TWRS baseline is replanned • TWRS costs are reduced	L	M	L	• Obtain DOE-RL direction for existing agreement between DOE-HQ EM30 and EM40 programs • Inform stakeholders of the transfer of responsibility		Wodrich / Honeyman			
10) MUST CLOSURE RESPONSIBILITY TWRS is not responsible for all MUST closures - only 39 inactive tanks	• TWRS work scope is decreased • extra programmatic interface required • TWRS baseline is replanned • TWRS costs are reduced	L	M	L	• Petition for memorandum of agreement between DOE-HQ EM30 and EM40 programs • Inform stakeholders of the transfer of responsibility		Wodrich / Honeyman			

Systems Engineering Risk List

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
11) HLW LOADING HLW repository (Office of Civilian Radioactive Waste Management [OCRWM]) does not accept the current technical baseline loading of HLW (glass with ~ 45 percent oxide)	• HLW volume increases • More glass logs are produced • Repository capacity is insufficient to handle increase	L	H	M	• If not accepted, revise waste loading strategy • Negotiate with HLW repository to accept ~ 45 percent oxide loading		Wodrich / Honeyman			Poss CRML
12) HLW CONFIGURATION HLW repository (OCRWM) DOES NOT ACCEPT ~ 10- to 15-cubic-meter canisters	• HLW volume increases • More glass logs are produced • Repository capacity is insufficient to handle increase	L	H	M	• If not accepted, revise waste loading strategy • Negotiate with HLW repository to accept ~ 10- to 15-cubic-meter canisters		Wodrich / Honeyman			Poss CRML
13) HLW REPOSITORY CAPACITY HLW repository does not have sufficient planned capacity to handle all Hanford HLW	• A second HLW repository and long-term interim storage at Hanford would be required • Likely litigation	L	H	M	• Delay HLW processing operations until a second HLW repository is brought on line, or until the current repository is expanded • Store HLW at Hanford until a second HLW repository is brought on line or the current repository is expanded • Increase efforts to minimize HLW volume		Wodrich / Honeyman			Poss CRML
14) TRU WASTE NOT ACCEPTED AT WIPP TRU waste cannot be disposed of at WIPP	• TRU waste must be routed to the HLW repository • HLW volumes increase	M	L	L	• Delay TRU processing until a second TRU repository is brought on line, or until WIPP can increase its capacity • Store HLW at Hanford until a second HLW repository is brought on line or the current repository is expanded • Negotiate with HLW repository for acceptance of TRU		Wodrich / Honeyman			Poss CRML

Systems Engineering Risk List

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
15) Cs AND Sr CAPSULES Cesium and Strontium capsules do not meet HLW repository acceptance criteria	• Waste must be blended in with HLW • HLW volumes increase	M	M	M	• Delay Cs and Sr processing operations until a second HLW repository is brought on line, or until the current repository is expanded • Store Cs and Sr capsules at Hanford until a second HLW repository is brought on line or the current repository is expanded • Increase efforts to minimize Cs and Sr volume		Wodrich / Honeyman			Poss CRML
16) TOTAL OPERATING EFFICIENCY TWRS cannot attain the total operating efficiency goal of 60 percent	• System design reevaluated • Operating procedures reevaluated • Technical baseline becomes invalid	L	M	L	• Review operating performance measures and nominate those for which operating levels should be raised or lowered • Conduct a process improvement program under total quality management		Sanders / Umek			
17) PRIVATIZATION EXPECTATIONS FOR PHASE I NOT MET - A) RFP, B) NON-TECHNICAL, C) TECHNICAL • An unacceptable outcome from the RFP because of the following contract issues • Affordable financing is not attainable • Vendors are unwilling to bid fixed price • Bids for Phase I are unacceptably high • Inadequate definition of product specifications results in unsuccessful negotiations on technical requirements	Baseline schedule not attained	H	H	VH	• Delay privatization until adequate product specifications are available • Work with vendors to identify components of RFP which drive costs, to find ways to reduce costs, and to re-scope RFP • Search for another alternative acquisition strategy • Allocate more of DOE budget to HLW demonstration plant • Provide government backing for financing • Prepare contingency plan to continue developing TWRS technical baseline		Kinzer / Bacon			C-4

Systems Engineering Risk List

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
18) STAKEHOLDER VALUES NOT PROPERLY CONSIDERED Stakeholder are not all identified and their concerns (values) taken into consideration	• Stakeholders object to TWRS program and cause baseline changes to occur • Likely litigation	M	M	M	• Ensure that no TWRS decision affecting program outcome is made without considering stakeholder values • Confirm stakeholder values for TWRS decisions where the impact is uncertain through stakeholder involvement sessions • Maintain an open and honest attitude towards stakeholder values		Kinzer / Bacon			
19) INITIAL CONDITIONS NOT ADEQUATELY DEFINED Major differences are found to exist between currently defined conditions and actual conditions	• TWRS baseline made invalid • Schedule delays and cost increases • Loss of confidence in TWRS program planning management • Unable to technically execute TWRS program	M	M	M	• Continually validate the technical baseline • Prepare contingency plans that will facilitate redirection		Kinzer / Bacon			
20) SYSTEM LIFE CYCLE NOT PROPERLY DEFINED Operations, maintenance concept, reliability, maintainability, and availability are determined to be different from current conceptualization. They are also found to be inadequate for the mission.	• TWRS baseline made invalid • Cost projections exceeded • Revisions must be made to program plan	M	M	M	• Use life-cycle cost model with validate assumptions and accurate variables to make projections and track actual costs • Develop planning alternatives should any one of the assumptions or variables change		Kinzer / Bacon			

Systems Engineering Risk List

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
21) INADEQUATE EXTERNAL PROGRAM INTEGRATION Integration between TWRS and other Hanford site programs is insufficient to ensure coordination and cooperation	• TWRS baseline made invalid • Schedule delays and cost increases • Loss of confidence in TWRS program planning and management • Unable to technically execute TWRS program • External programs experience similar schedule delays and cost increases	H	H	VH	• Use an interface control program to ensure internal and external coordination • Conduct periodic joint-program milestone reviews • Develop planning alternatives should any aspect of an external interface not occur as anticipated		Kinzer / Bacon			
22) MISSION ANALYSIS NOT COMPLETE Mission analysis is incomplete, not accepted by TWRS program, or does not consider programmatic risk (cost, schedule, and technical performance)	• Not allowed to proceed with a functions and requirements analysis without an approved mission analysis • Functions and requirements that are done without a mission analysis are incomplete or invalid • System functions are over designed, or major requirements are taken into consideration	L	H	M	• Define acceptable and unacceptable end states • Define external and internal interfaces • Identify primary mission functions and requirements • Define technical performance measures • Develop enabling assumptions • Link systems engineering plan to program work breakdown structure • Define master systems engineering logic		Kinzer / Bacon			

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APPENDIX B

TWRS CRITICAL RISK MANAGEMENT LIST

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TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
1) INSUFFICIENT FUNDING DOE establishes a cost profile that is inconsistent with the remediation strategy - total life cycle funds for TWRS cleanup are too low or annual allocations are too low Currently no established TWRS cost baseline exists	Current remediation strategy cannot be achieved (e.g., not all waste can be retrieved) Loss of core competency (facilities and/or personnel) Extended program with higher life cycle costs and possible missed TPA (Ecology et al. 1994) milestones (these are common to all critical risks) Stakeholder lawsuits State fines DOE	H	H	VH	Establish site funding profile with allocation to the TWRS program Evaluate lower funding alternative profiles. Develop more aggressive, less conservative planning basis (e.g., delete development of contingency processes or pursue combined facility concepts). Improve cost estimates, especially as program evolves, and update MYPP (WHC 1995c) Renegotiate TPA (Ecology et al. 1994) milestone requirements or completion dates (common to all risks) to prevent fines (e.g., make scoping changes by modifying the existing strategy to retrieve only most critical waste and/or stretch out program)		Wagoner / Trego Kinzer / Bacon		4.2	
2) TANK SAFETY ISSUES NOT RESOLVED IN TIME TO SUPPORT RETRIEVAL Health and safety issues are not resolved in time to meet regulatory and project schedule requirements	Work stoppage or delay until safety issues are resolved (e.g., 106C retrieval delayed, cannot retrieve in time for privatization and characterization is delayed) Possible unsafe conditions in tank farms (e.g., hydrogen in tanks)	H	H	VH	Resolve interrelated tank safety issues that impede retrieval, treatment and disposal activities by completing ongoing safety issue studies (e.g. waste compatibilities) Work with stakeholders to revise planning scenarios to resolve health and safety issues Demonstrate critical technologies that allow work on tanks containing flammable gas Acquire equipment that can be used to retrieve waste from tanks containing flammable gas Reevaluate privatization schedule and planning		Bader / Umek		4.2.1.1 STORE 4.2.3.3 PRE-TREAT SUPER-NATENT	

TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
3) LLW PERFORMANCE REQUIREMENTS ARE NOT AVAILABLE OR ARE UNATTAINABLE Examples of missing data include: A) low level waste form specifications (e.g., leach rate, durability and dimensions) B) feed composition uncertainties due to incomplete characterization and processing knowledge C) LLW product retrievability D) LLW disposal system requirements	Process and disposal systems may be overdesigned to compensate for uncertainties LLW form requirements are made overly restrictive to compensate for durability uncertainty Overly conservative durability requirement causes increase in LLW volume	H	H	VH	Expedite decisions on land use for input to interim assessment of long term risks to public and environment Adhere to critical path schedule to define performance requirements (for disposal and pretreatment) and incorporate technology development in schedule to be able to meet performance requirements Expedite and integrate interim assessment of long term risks to public and environment and design of LLW disposal facility (iterative process) Reduce overconservatism by justifying parameters used in design of the LLW disposal facility and in assessment of long term risks to public and environment		Taylor / Honeyman		A) 4.2 B) 4.2.1.3 TRANS-FER 4.2.3.4 IMMOB. LLW C) 4.2.4.2 DISPOSE LLW D) 4.2	
4) PRIVATIZATION EXPECTATIONS FOR PHASE I NOT MET - A) RFP, B) NON-TECHNICAL, C) TECHNICAL 4A) PHASE 1 ALTERNATIVE ACQUISITION STRATEGY (AAS) PRIVATIZATION RFP NOT AWARDED An unacceptable outcome from the RFP is realized due to contract issues (e.g., bids are too high, or vendor risk is too high so no bids submitted) • Fee structure and mechanism to resolve differences in production estimates (using analytical results) between buyer and vendor not established	Missed milestones (e.g., M50, M51, and M60)	H	H	VH	Work with vendors to identify components of RFP which drive costs, to find ways to reduce costs, and to rescope RFP Develop a different alternative acquisition strategy		Kinzer / Bacon		4) 4.2.3 PROCESS 4.2.4 DISPOSE 4A) 4.2.3.2 & 4.2.3.3 PRE-TREAT	

TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
4B) PROGRAMMATIC (NON-TECHNICAL) ISSUES - BENEFITS NOT REALIZED • NRC must provide nuclear safety oversight but is not properly staffed • Unanticipated events require extensive change notices or negotiations • Vendors unable to deliver product • Interface: storage, disposal, and support facilities are not available to vendor when desired (e.g., effluent treatment quantity unknown, so not yet able to determine requirements)	Maintenance and Operations (M&O) does not meet feed requirements, vendor cannot specify needs, or M&O cannot support operations, so vendor HLW vitrification plant cannot operate, yet vendor must be paid in some cases Cost increases Major program delays drive need to recover quickly	H	H	VH	• Have WHC or independent organization review design of demonstration plant and/or have joint design team • DOE works with NRC to develop phased transfer of regulatory authority • Maintain schedule for completing interface facility acquisitions • Understand and negotiate agreements on interface requirements • Transfer risk to seller by including support functions (interface facilities) in RFP; e.g., disposal and interim storage of LLW Develop backup strategy to AAS • Determine core competency needs • Retain key personnel in other funded programs • Keep vital facilities operating in minimal role by sharing other mission work • Have plan to return people and facilities to roles they performed before AAS occurred		Kinzer / Bacon		4B) 4.2	

TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
4C) TECHNICAL ISSUES Plant does not operate with acceptable performance due to lack of special design and operating technical knowledge by private contractor Phase I does not provide technical information required for Phase II needs	Cannot pass operational readiness review Design requirements for Phase II are not resolved • Melter scale up • Retrieval equipment required • Melter flexibility to handle problem materials • DOE does not gain needed special design and operating knowledge Range of waste feed is not tested (composition and rates)	H	H	VH	• Retain core competency • Provide for extra long term interim storage of HLW • Select tanks with more difficult wastes to treat and increase funding appropriately for HLW demonstration plant • Extend Phase I schedule to better understand and resolve technical issues, both pre-construction and during operations • Reschedule AAS to match development of adequate product specifications		Kinzer / Bacon		4C) 4.2.3 PROCESS 4.2.4 DISPOSE	
5) MAJOR INCIDENT OCCURS ON SITE Incident occurs during tank farm, vendor, special nuclear facilities, or environmental restoration contractor operations New Unreviewed Safety Question (USQ), Unusual Occurrence (UO), or significant worker injury incurred	• Worker/public health and safety jeopardized • Lengthy work shutdown until resolution • Missed schedule • Funding gets diverted from baseline allocation • Fines • Future work put under closer scrutiny • Increased program cost	M	H	H	Ongoing mitigation action to enhance safety and Conduct of Operations programs (e.g. safety and evacuation drills) Anticipate things that can go wrong and prepare response actions (e.g. public communications, quick cleanup) Demonstrate importance of issue by keeping workers' awareness high through training and qualification		Sidpara / Wicks		4.2.1.3 TRANS-FER 4.2.2.3 RETRIE. MUST 4.2.3.5 IMMOB. HLW	

TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
6) DURABLE DECISIONS FOR SYSTEMS ENGINEERING ARCHITECTURAL SELECTIONS, REQUIREMENTS AND SCOPE ARE NOT MADE	• Program proceeds without agreement on fundamental goals and scope • Goals are unstable, often inappropriate • Frequent baseline revisions • Work pathways are abandoned with increased costs • Schedule often renegotiated	H	H	VH	Get commitment by WHC and DOE-RL (possibly select a champion) Adopt and implement decision management procedures (e.g., • Identify decision makers • Base decisions on fully evaluated alternatives with expert reviews of studies and analyses • Track the need to make decisions and accomplish in timely manner • Conduct studies and analyses to validate selected architectures) • Develop and maintain multiple alternatives		Kinzer / Bacon		4.2 ENABL. ASSUMP.	
7) END STATE OF 200 AREA CENTRAL PLATEAU UNDEFINED Changes occur because of any of the following actions: • EIS results • Congressional action • Stakeholder action • "Compliance point" and means by which regulations are applied • Land-use designation Definition could be more restrictive (e.g., if nearby high density residential use is allowed) or less restrictive (e.g., if a large buffer zone is established)	• Definition or changes in the end state alters performance objectives and long-term environmental assessment scenarios • Inappropriate performance objectives • Inappropriate LLW disposal design • SST farms may be required to be clean closed rather than closed as a landfill (tanks must be removed and contaminated soil must be removed or cleaned) • Change in interface requirements with other on-site programs and contractors	H	H	VH	• Expedite decisions on long term land use end state • Maintain cognizance of land use planning • Keep stakeholders informed about what can be done practically, cost, schedule and importance of deciding on the end state • Obtain up-to-date stakeholder priorities • LLW program is rebaselined (with impacts on all other parts of TWRS program, e.g. tank closure requirements)		Wagoner / Trego Kinzer / Bacon		4.2	

TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
8) DISAGREEMENT ON NEEDS AND SCOPE FOR WASTE CHARACTERIZATION INFORMATION Unable to gain agreement on objectives of characterization project among DNFSB, DOE, and WHC (Characterization information is expected to help resolve safety issues and to provide input for processing and disposal, e.g., better defining performance requirements for waste feed)	• Characterization products may not meet customer needs (timing and information), forcing planned activities dependent on characterization information (e.g., resolving safety issues) to be delayed • Responsibilities are not well defined, causing rework (e.g., reanalysis or resampling) • Technical basis assumptions may become invalid • Risk to private vendors is increased and is reflected in their bids	H	H	VH	• Produce mission analysis for characterization to promote top-down requirements allocation • Charter an Interface Control Working Group with all customers and appropriate program representatives • Plan for additional characterization to meet previously unspecified needs, reallocate funding, and have TWRS accept new risks from descoped activities • Assume risk of proceeding with baseline without concurrence of all stakeholders and regulators		Kinzer / Bacon		4.2	
9) DST CAPACITY IS NOT SUFFICIENT - CANNOT ACCEPT NEW WASTE • New waste incompatibilities with waste in storage tank • Volume: acceleration or increase of waste from generators above planned amounts, delays in other TWRS activities, e.g., evaporator failure • Leak in DST • Cannot fully use tank because of equipment or component failure (e.g., transfer lines, evaporator)	Reduced ability to safely manage waste and avoid environmental insult • Unable to accept new waste from generators, from retrieval, or interim stabilization wastes • Unable to provide space for emergency pumping • Other TWRS activities are unable to move forward (e.g., disposal)	H	H	VH	• Use the MWTF Path Forward Plan to plan for adequate DST space • Track available and needed waste volume • Use a dynamic model to support decision making by analyzing alternatives that include probable failure scenarios for system elements • Accept increased future operational risk of using evaporator process tanks as spares • Build new DSTs		Sidpara / Wicks		4.2	

TWRS Critical Risk Management List.

What can go wrong ... Event/Situation	If it happens ... Impacts	L	C	RV	What can be done ... Mitigation Actions	Action Status	Responsible DOE/WHC	Review Date	Func.	Risk Status
10) TWRS SAFETY AUTHORIZATION BASIS UNAVAILABLE OR INADEQUATE The tank farms safety analysis report is not available The SST and MUST safety basis is not established	• Tank farms continues operating with Interim Safety Basis • Tank farms is not in compliance with DOE Order 5480.23 (DOE 1992) • Other TWRS operations delayed by lack of approved Safety Authorization Basis • Increased health and safety risks	H	H	VH	• Implement a systematic process to gain approval of a technically defensible Safety Authorization Basis, including completion of safety issue studies • Work with stakeholders to revise planning scenarios to resolve health and safety issues • Accelerate pretreatment, treatment, and disposal safety analysis reports		Bader / Umek Taylor / Honeyman		4.2.2.1 RETRIE. SST 4.2.2.3 RETRIE. MUST	

Notes:

In headings: L = Likelihood, C = Consequences, RV = Risk Value
In table text: L = Low, M = Medium, H = High, VH = Very High

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APPENDIX C

BASES FOR CRITICAL RISKS

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Bases for Critical Risks

Critical Risk	BASIS: F&R Issues (unless otherwise specified)	Affected Functions
1) INSUFFICIENT FUNDING	Estimated TWRS Life Cycle Cost. TWRS LCC Analysis has not been completed. The enabling assumption for TWRS LCC is the validated and baselined MYPP budget. The budget will be validated and baselined by an Independent Cost Estimate review (ICE) which will form the basis for the TWRS LCC budget and allocation of design to cost values for level 3 functions. Near-term DST Capital Funding. A conservative projection of needed near-term capital funding for DST retrieval is needed to assure that the retrieval systems will be available when needed to support near-term safety issue resolution, startup of LLW waste pretreatment and immobilization, and initial SST waste retrieval. Near-term SST Capital Funding. A conservative projection of expected near term funding for SST Retrieval is needed to assure that the retrieval systems will be available.	4.2
2) TANK SAFETY ISSUES ARE NOT RESOLVED IN TIME TO SUPPORT RETRIEVAL	Applicable DOE Requirements Issue. Resolution of which DOE requirements apply to the feed tanks is needed, particularly if limited to only radiological safety, environmental safety and environmental regulations. Feed Tank Applicable DOE Orders Issue. A resolution of what DOE requirements apply to the feed tank is required? The initial feedback is that the only DOE orders that apply are those that pertain to radiological and environmental safety. Environmental safety/emissions regulations are being separately evaluated in the Air Emissions ICD (ICD WHC-SD-ICD-033). Radioactive Air Emissions. The allocation of 1 rm/yr of radionuclide release to all the functions has been conducted as an enabling assumption. Analysis for the allocation to retrieve and dispose functions has not been conducted and should be conducted.	4.2

Bases for Critical Risks

Critical Risk	BASIS: P&R Issues (unless otherwise specified)	Affected Functions
3) LLW PERFORMANCE REQUIREMENTS ARE NOT AVAILABLE OR ARE UNATTAINABLE Examples of missing data include: a) LLW form specifications b) Feed composition is uncertain due to incomplete characterization and processing knowledge c) LLW disposal system requirements d) LLW product retrievability	a) LLW form specifications Will vendor be given opportunity to refuse waste that does not meet their waste acceptance criteria? If so, what happens with this waste? Closed ILLW Sites. The acceptable range of formulations (i.e., radionuclides, hazardous materials, and glass forming additives) of the LLW form has not been established. Tc-99 removal requirements are unknown at this time due to no low level waste system performance assessment. Glass/Matrix Waste Form ISU2. Determine if a stated glass corrosion rate is required. b) Feed composition is uncertain due to incomplete characterization and processing knowledge New Tank Waste. Waste stream physical and chemical parameters important to tank farm system design also needs definition for these inputs. Examples include waste pH, organic content, radioactivity concentrations... and total volume. DOE noted in 58FR 12342 that based on limited availability analytical data the total cesium-137 could be as much as 20 million curies versus the 12-13 million estimate. If the inventories of key radionuclides are significantly higher than the current estimate the classification of the waste as agreed upon may need to be modified. Waste chemical composition/radionuclide inventories. These compositions are representative of the period shortly before the beginning of the evaporator campaign in 4/94 when the DST system was relatively stable. Since that time, there have been additions to the DST system. All of the additions have impacted the supernatant composition subset of the DSTs while the sludge has been largely unaffected. Further refinement of these compositions is required due to ongoing activities in the DST system. c) LLW disposal system requirements Public drinking water. No site wide performance assessment has been conducted for the tanks and the low level disposal facility. Disposal Facility. Disposal requirements in 5820.2A are being revised. Implementation of the revised order (5820.B) is expected to take place fall 1995. Cullet vs. Monolith waste form issue. Two waste forms are possible, and it has to be determined which is preferred.	a) 4.2 b) 4.2 c) 4.2
3) (cont)	d) LLW product LLW Glass Product Rework and Retrievability. Stakeholder groups expressed a desire to have the LLW form retrievable when potential hazards from the waste may require future retrieval and when retrievability does not cause inordinate delays in getting on with cleanup.	d) 4.2.4

Bases for Critical Risks

Critical Risk	BASIS: F&R Issues (unless otherwise specified)	Affected Functions
4) PRIVATIZATION EXPECTATIONS FOR PHASE 1 NOT MET a) RFP b) Non-Technical c) Technical	Applicable to All: Phase I Feed Transfer Schedule Issue. A schedule for transfer of Phase I Feed to the private contractor needs to be developed. The sequence of retrieval may affect vendors design or bidding strategies. Pretreated Sludge Transport Methods Issue. The most suitable method to transport the pretreated sludges to the privatizing contractor has not been determined. Vendor Right-of-Refusal Issue. Does the vendor have the "right to refuse" waste that does not meet their acceptance criteria? If so, will DOE be obligated to change the composition of the waste to meet these needs? Waste Acceptance Process Issue. The Waste Acceptance Process has not been developed. a) RFP Characterization data issue. The characterization data required by POC.C.3 to be provided by the Department to bidders is not presently available at peer review quality for all tank waste. b) Non-Technical Aqueous Waste Fee Structure. A fee structure needs to be developed for aqueous wastes generated by private vendors and transferred to DOE for disposal or reuse. Volume and compositional limits need to be established. Feed Tank Equality Issue. The two feed tanks may not be equal in all respects. The specification of the final state to which the site transferred to the vendor must be returned to the Department upon contract completion/termination may impact the design of the vendors facility and the cost of waste treatment in that facility. No clear Decontamination and Decommissioning standard exists at this time. For the purposes of specification development it has been assumed that the Department would like to minimize the legacy created by waste treatment and based on this desire will require return of the site to its original condition.	4.2 a) 4.2.3.2 4.2.3.3 b) 4.2
4 (cont)	c) Technical Feed Tank Current Waste Issue. How the feed tanks will be emptied of waste currently stored in them has not been decided. It is not known if it is possible. PW Treated Gaseous Effluents. There are some radioactive/hazardous components in waste streams which may not be readily incorporated into the immobilized wastes. The disposition of these components may effect gaseous emissions. Feed Tank Equality Issue. The two feed tanks may not be equal in all respects. The specification of the final state to which the site transferred to the vendor must be returned to the Department upon contract completion/termination may impact the design of the vendors facility and the cost of waste treatment in that facility. No clear Decontamination and Decommissioning standard exists at this time. For the purposes of specification development it has been assumed that the Department would like to minimize the legacy created by waste treatment and based on this desire will require return of the site to its original condition. Additives Issue. Private waste processing vendors are not required to disclose their processes. It is conceivable that their processes might add chemicals that, while optimizing waste processing, would increase the volume of immobilized fission products and High Level Waste, resulting in an overall negative effect on tank waste remediation. The Department of Energy has sponsored research into glass composition limits and that information needs to be made available to the private waste processing vendors.	c) 4.2.3 4.2.4

Bases for Critical Risks

Critical Risk	BASIS: F&R Issues (unless otherwise specified)	Affected Functions
5) MAJOR INCIDENT OCCURS ON SITE	Incidents not covered in the F&R, but based on previous occurrences on site.	
6) DURABLE DECISIONS FOR SYSTEMS ENGINEERING (SE) ARCHITECTURAL SELECTIONS, REQUIREMENTS AND SCOPE ARE NOT MADE.	Enabling assumptions identified by TWRS Program are subject to future change.	4.2
7) END STATE OF 200 AREA CENTRAL PLATEAU UNDEFINED.	Disposal Site Location. The disposal site location is currently being finalized through a WHC supporting document and in parallel with the site location information required for preparation of the Environmental Impact Statement. Land Use. HRAEIS is currently undergoing public comment and refinement of the land use alternatives. Completion of the HRAEIS will require the allocation of the available land to TWRS for further allocation to the manage, retrieve, process and dispose functions. The manage and retrieve functions should be consistent with the current tank farm areas.	4.2
8) DISAGREEMENT ON NEEDS AND SCOPE FOR WASTE CHARACTERIZATION INFORMATION	Characterization Information Accessibility. Characterization performance requirements are not well defined at this time. The number and types of samples and analyses as well as the precision, accuracy, and schedule requirements need to be determined in order to provide characterization capacities and capabilities which are adequate to meet the needs. Characterization Data Issue. The characterization data required by POC.C.3 to be provided by the Department to bidders is not presently available at peer review quality for all tank waste. Tank Characterization Reports. Characterization requirements have been determined using a bottom-up systems analysis process which may not identify all requirements applicable to the function.	4.2

Bases for Critical Risks

Critical Risk	BASIS: F&M Issues (unless otherwise specified)	Affected Functions
9) DST CAPACITY IS NOT SUFFICIENT - CANNOT ACCEPT NEW WASTE a) Incompatible wastes b) Volume c) Leaks d) Equipment fails e) Delays	a) Incompatible wastes DST Cleanness for Reuse. The requirement for the volume of waste that can remain in a DST following waste retrieval is uncertain. The optimum value will be based on compatibility of the residual waste with the retrieved (i.e., SST, DST, and MUST) and pretreated wastes that will be subsequently received in the tanks and may be driven by cost and schedule. The quantity of waste which can remain in the DSTs for turnover to closure is not addressed by this requirement. DSTs for Pretreated LLW. Specification of an allowable waste heel is needed for each double-shell tank which will receive pretreated LLW. b) Volume New Tank Waste - Issue 1. To perform a top-down allocation of requirements to 4.2 subfunctions, the interface requirements for the following inputs into function 4.2 must be quantified and reconciled with the Operational Waste Volume Projection (OWVP) (WHC-SD-WM-ER-029): (1) Tank Waste from Deactivation (2) Tank Waste from Solid Waste Cleanup (3) Tank Waste from Remedy/Restore (4) Tank Waste from Aqueous Waste Processing (5) Tank Waste from Infrastructure (6) Tank Waste from SNM/NM/NF Cleanup Waste stream physical and chemical parameters important to tank farm system design also needs definition for these inputs. Examples include waste pH, organic content, radioactivity concentrations, specific gravity, viscosity, solids content, particle size, temperature, and total volume. The timeline over which these transfers take place is also an important parameter in determining tank farm system design. New Tank Waste - Issue 2. Current operational waste volume projections go out to the year 2005 (WHC-SD-WM-ER-029). More waste may be coming into the tank farms from activities external to the Remediate Tank Waste function in the years beyond 2005. This leaves uncertainties in total volume, timeline and flow rate requirements for TWRS transfer systems accommodating transfers from external activities. Usage and operation of these external facilities must be determined to support requirements development that will encompass the entire lifecycle needs of the tank farms.	a) 4.2 b) 4.2.1.3 4.2.1.4

Bases for Critical Risks

Critical Risk	BASIS: P&R Issues (unless otherwise specified)	Affected Functions
9) (cont)	c) Leaks Feed Storage System Architecture. DSTs AP-102 and 104 have been specified as the feed storage tanks. It is not really known that this is the best architectural solution for the Phase I Feed Storage. Other tanks within AP tank farm are in better condition. Another DST farm could be chosen.	c) 4.2.1.1 4.2.3.3
	d) Equipment fails New Tank Waste. Current operational waste volume projections go out to the year 2005 (WHC-SD-WM-ER-029). More waste may be coming into the tank farms from activities external to the Remediate Tank Waste function in the years beyond 2005. This leaves uncertainties in total volume, timeline and flow rate requirements for TWRS transfer systems accommodating transfers from external activities. Usage and operation of these external facilities must be determined to support requirements development that will encompass the entire lifecycle needs of the tank farms. Tank farm Emergency Transfer Needs. Performance requirements and further functionality must be derived from TPA Milestone M-41-02, DOE Order 5820.2A, Chapter I, 3.b(4)(d); and 3.c(4) to identify current tank farm needs for emergency pumping capabilities.	d) 4.2.1.3
	e) Delays DOE/RW-0351P. rev 0, 3.2.3.2.2,C Issue1. The conversion of metric tons to HLW canisters is based on 0.5 metric tons of uranium per canister (DOE 1985, "An Evaluation of Commercial Repository Capacity for the Disposal of Defense High-Level Waste", DOE/DP/0020/1). The proposed tank waste pretreatment process, enhanced sludge washing, may result in less than 0.5 metric tons uranium or equivalent per HLW canister. Thus, the quantity of HLW canisters for repository disposal may exceed DOE/RW projections. DST Waste Retrieval Schedule. A schedule defining when DST waste needs to be retrieved has not been prepared to show how retrieval will support the disposal program needs. This schedule can be prepared either in conjunction with or subsequent to the Tank Waste Retrieval Schedule. This schedule will form a basis for the DST retrieval sequence and project definition.	e) 4.2.1.3 4.2.1.4 4.2.2.2 4.2.3 4.2.4
10) TWRS SAFETY AUTHORIZATION BASIS UNAVAILABLE OR INADEQUATE	Dose Limits Issue 2. The public dose rate for all site operations has not been allocated to TWRS and TWRS has not allocated this to Manage, Retrieve, Process or Dispose. Existing Tank Waste ISU1. The Remediate Tank Waste function includes removal, treatment and disposal of all high-level waste in the existing 177 SSTs/DSTs as well as other Hanford Site tanks. Tanks other than the 177 SSTs/DSTs are not specifically identified, but are assumed to be the catch tanks and special facilities as in the Mission analysis WHC-SD-WM-MAR-008. Dated 9/8/95	4.2