

SEP 22 1998

ENGINEERING DATA TRANSMITTAL

Page 1 of 1
1. EDT 625058

2. To: (Receiving Organization) Distribution		3. From: (Originating Organization) Project W-211		4. Related EDT No.: N/A	
5. Proj./Prog./Dept./Div.: W-211		6. Design Authority/ Design Agent/Cog. Engr.: C.A. Rieck		7. Purchase Order No.: N/A	
8. Originator Remarks: This transmittal is for release of the Systems Engineering Management and Implementation Plan for Project W-211, "Initial Tank Retrieval Systems."				9. Equip./Component No.: N/A	
				10. System/Bldg./Facility: Tank Farms	
11. Receiver Remarks: 11A. Design Baseline Document? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				12. Major Assm. Dwg. No.: N/A	
				13. Permit/Permit Application No.: N/A	
				14. Required Response Date: N/A	

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	HNF-3310	41	0	Systems Engineering Management and Implementation Plan for Project W-211, "Initial Tank Retrieval Systems"	NA	1/2	1	1

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

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)											
(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
		Design Authority				3		D. J. Ashley			A3-03
		Design Agent				3		J. J. Davis			A0-21
1/2	1	Cog. Eng. C. A. Rieck	<i>C.A. Rieck</i>	9/18/98	S2-48	1/2	1	S. M. O'Toole	<i>S.M. O'Toole</i>		R2-89
1/2	1	Cog. Mgr. J. E. Van Beek	<i>J.E. Van Beek</i>	9/21/98	S2-48						
		QA									
		Safety						Project file			R1-29
		Env.									

18. <i>C.A. Rieck</i> C. A. Rieck Signature of EDT Date 9/21/98		19. N/A Authorized Representative Date for Receiving Organization		20. J. E. Van Beek <i>J.E. Van Beek</i> Design Authority/ Cognizant Manager Date 9/21/98		21. DOE APPROVAL (if required) Ctrl. No. <input type="checkbox"/> Approved <input type="checkbox"/> Approved w/comments <input type="checkbox"/> Disapproved w/comments	
--	--	---	--	--	--	---	--

Systems Engineering Management and Implementation Plan for Project W-211, "Initial Tank Retrieval Systems"

C. A. Rieck
 Numatec Hanford Corporation, Richland, WA 99352
 U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 625058 UC: 2030
 Org Code: 8C620 Charge Code: D3220
 B&R Code: 39EW31301 Total Pages: 41

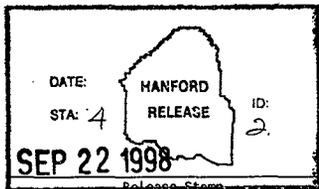
Key Words: Systems Engineering Management and Implementation Plan, Systems Engineering, SEMIP, Project W-211, Initial Tank Retrieval Systems

Abstract: This Systems Engineering Management and Implementation Plan (SEMIP) describes the Project W-211 implementation of the Tank Waste Remediation Systems Systems Engineering Management Plan (TWRS SEMP). The SEMIP defines the systems engineering products and processes used by the project to comply with the TWRS SEMP, and provides the basis for tailoring systems engineering processes by applying a graded approach to identify minimum necessary and sufficient systems engineering requirements for successful project execution.

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Printed in the United States of America. To obtain copies of this document, contact: Document Control Services, P.O. Box 950, Mailstop H6-08, Richland WA 99352, Phone (509) 372-2420; Fax (509) 376-4989.

[Signature] 9/22/98
 Release Approval Date



Approved for Public Release

Systems Engineering Management and Implementation Plan
For
Project W-211, "Initial Tank Retrieval Systems"

HNF-3310, Rev. 0

September 1998

LIST OF TERMS

AB	Authorization Basis
AGA	Alternatives Generation and Analysis
ABU	Acceptance for Beneficial Use
CAA	Clean Air Act
CDR	Conceptual Design Report
CMIP	Configuration Management Implementation Plan
CWA	Clean Water Act
DNFSB	Defense Nuclear Facility Safety Board
DOE	Department of Energy
DRD	Design Requirements Document
DST	Double-Shell Tank
EA	Environmental Assessment
ECN	Engineering Change Notice
EPA	Environmental Protection Agency
EQS	Environmental, Quality, Safety
F&Rs	Functions and Requirements
FDC	Functional Design Criteria
FDH	Fluor Daniel Hanford
FT	Functional Test
FSAR	Final Safety Analysis Report
HIS	Human Systems Integration
HSTD	Hanford Site Technical Database
ID	Interface Document
IP	Implementation Plan
ITRS	Initial Tank Retrieval Systems
JMN	Justification of Mission Need
JTA	Job Task Analysis
KD	Key Decision
LMHC	Lockheed Martin Hanford Company
LMSI	Lockheed Martin Services, Inc.
MAR	Mission Analysis Report
NEPA	National Environmental Policy Act
NOC	Notice of Construction
NRC	Nuclear Regulatory Commission
O&M	Operations and Maintenance
OAC	Official Acceptance of Construction
OJT	On-the-Job Training
OUP	Operations and Utilization Plan
P&IDs	Piping and instrumentation diagrams
PHMC	Project Hanford Management Contract
PSE	Preliminary Safety Evaluation
QA	Quality Assurance
QAPP	Quality Assurance Program Plan

QC	Quality Control
RAM	Reliability, Availability, and Maintainability
RCRA	Resource Conservation and Recovery Act
RL	DOE Richland Operations Office
RML	Risk Management List
SE	Systems Engineering
SEL	Safety Equipment List
SEIP	Systems Engineering Implementation Plan
SEMP	Systems Engineering Management Plan
SEMP	Systems Engineering Management and Implementation Plan
SSCs	Systems, Structures, and Components
T&E	Test and Evaluation
TENS	TWRS Engineering and Nuclear Safety
TSR	Technical Safety Requirements
TWRS	Tank Waste Remediation System
WFD	Waste Feed Delivery

TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 DOCUMENT SUMMARY	1
1.2 PROJECT MISSION STATEMENT	2
1.3 SCOPE AND APPLICABILITY	3
1.3.1 Present Stage of the Project	3
1.3.2 W-211 SEMIP Application	4
1.3.3 Project Risks.....	4
1.3.4 SE Graded Approach.....	5
1.3.5 Interface with Other Planning Documents.....	6
2.0 SYSTEMS ENGINEERING MANAGEMENT PROCESSES	7
2.1 RISK MANAGEMENT	7
2.2 DECISION MANAGEMENT	7
2.3 INTERFACE MANAGEMENT	8
2.4 CONFIGURATION MANAGEMENT	9
2.5 TECHNICAL PERFORMANCE MEASURES	10
2.6 TECHNICAL REVIEWS	10
2.7 TECHNICAL REQUIREMENTS TRACEABILITY	11
2.8 SYSTEMS ENGINEERING CULTURE	11
2.9 SYSTEMS ENGINEERING IN SUBCONTRACTS	11
2.10 SE MANAGEMENT PROCESS RESPONSIBILITIES	12
Table 2.1. Management Processes Responsibilities Matrix	12
3.0 SYSTEMS ENGINEERING PROCESS	13
3.1 SYSTEMS ENGINEERING APPLICATION TO PROJECT W-211	13
3.1.1 Requirements Traceability.....	13
3.1.2 Mission Analysis.....	13
3.1.3 Functions and Requirements/Specification Development	13
3.1.4 Alternative Analysis and Selection	14
3.1.5 Interface Analysis.....	14
3.1.6 Interface Control Documentation	14
3.1.7 Specialty Engineering Analysis and Integration	15
3.1.7.1 Human Systems Integration	15
3.1.7.2 Reliability, Availability, and Maintainability	15
3.1.7.3 Safety.....	15
3.1.7.4 Quality.....	15
3.1.7.5 Regulatory Compliance	15
3.1.7.6 Facility Startup.....	16
3.1.8 Operations and Maintenance Concept Development	16
3.1.9 Design Optimization.....	16
3.1.10 Physical System Test and Evaluation	17
3.1.11 Integrated Logistics Support	17
3.1.12 Decision Points	18

3.2 TECHNICAL BASELINE DEVELOPMENT	18
3.3 MAJOR REQUIREMENTS BASELINE PRODUCTS	18
Figure 3.1a Project W-211 Technical Baseline Development	19
Figure 3.1b Project W-211 Technical Baseline Development	20
Table 3.1. Processes/Products Required for Project Requirements Baseline Development	21
Table 3.2. TWRS SEMP Processes and Products Required for Design Baseline Development.	25
Table 3.3. TWRS SEMP Processes and Products Required for Operational Baseline	27
3.4 BASELINE PRODUCT ROLES AND RESPONSIBILITIES	29
Table 3.4. Roles and Responsibilities Matrix for Major Technical Baseline Products.	29
Table 3.5 Systems Engineering Graded Assessment of Mixing	32
Table 3.6. Systems Engineering Graded Assessment of Transfer	34

1.0 INTRODUCTION

1.1 DOCUMENT SUMMARY

This Project W-211 *Systems Engineering Management and Implementation Plan (SEMIP)*, HNF-3310, describes the Project W-211 implementation of the *Tank Waste Remediation System Systems Engineering Management Plan*, HNF-SD-WM-SEMP-002. The W-211 SEMIP defines the systems engineering (SE) products and processes used by the Project to comply with the TWRS SEMIP. It provides the basis for tailoring SE processes by applying a graded approach, considering both project maturity and risk/complexity, to identify the minimum necessary and sufficient SE requirements for successful project execution. The W-211 SEMIP will be maintained as the project progresses to construction and eventual turnover to the operating organization

In October 1995, RL TWRS issued a systems engineering policy. The intent of the policy was to provide guidance on establishing the basis for integrating the technical and management efforts in meeting the TWRS Program cost, schedule, and performance objectives. The policy was re-issued on April 9, 1997 in letter 97-MSD-193, with direction to use the policy for TWRS work. The April 1997 direction allowed the contractor to use recognized SE approaches in implementing the RL SE policy elements.

The previous M&O contractor issued the TWRS SEMIP, Revision 0, in February 1996 to describe TWRS implementation of the RL SE policy as provided in the October 31, 1995, letter 95-RT1-107. The current M&I contractor issued the PHMC SEMIP, signed by RL on June 2, 1997. This PHMC SEMIP provides FDH's commitment to using proven SE practices focused on the safe cleanup and management of the Site's legacy waste. The PHMC SEMIP further provides the requirement for the PHMC subcontractors to "continue the systems engineering process within their project(s) to the extent needed to ensure fulfillment of the project mission." The current TWRS contractor issued the *TWRS Systems Engineering Management Policy* (HNF-IP-0842, Volume 10, Section 2.2) in August 1997 and revised the TWRS SEMIP in January 1998 to capture modifications resulting from the award of the PHMC and because of two other factors: establishment of DOE O430.1 and development of the *Hanford Site Technical Database*.

As with its predecessor, Revision 1 of the TWRS SEMIP implements RL SE policy. It provides current requirements for "...tailoring the systems engineering applications to the development of the physical systems and processes necessary to achieve the desired end states of the program." The TWRS SEMIP describes implementation of SE throughout TWRS, both vertically from the top down and horizontally across the breath of TWRS. Included within the applicability of the TWRS SEMIP are ongoing construction projects, such as W-211, that are in various stages of the project life cycle.

The September 1994 Implementation Plan (IP) issued in response to Defense Nuclear Facility Safety Board (DNFSB) Recommendation 92-4 included commitments for introducing SE to ongoing construction projects. As with the DNFSB 92-4 IP, the TWRS SEMIP recognizes the appropriateness of applying SE using a graded approach with consideration of the stage the project is in as SE processes are introduced. The TWRS SEMIP requires that "...ongoing

projects migrate their SE practices to be consistent with the SEMP for Technical Baseline Development as necessary based on risk associated with the maturity of their systems and budget constraints." The TWRS SEMP requires ongoing projects to implement, at a minimum, the management disciplines of interface control, risk management, decision management, and configuration management.

Baseline requirements were developed long before issuance of the DNFSB 92-4 IP, RL SE policy, and the TWRS SEMP. As a result, for design criteria the Project uses the W-211 Functional Design Criteria (FDC) issued originally in 1993 and updated to the current revision: 3a. The process of migrating "top-down" technical requirements developed by the Program to a revision of the W-211 FDC is shown in Figure 3.1a, *Project W-211 Technical Baseline Development*. Since all project retrieval systems have completed Title I design and nearly 50% of the retrieval systems have completed Title II design, HNF-SD-W211-FDC-001, *Functional Design Criteria, Project W-211, Initial Tank Retrieval Systems*, will remain the technical baseline document throughout the life of the project.

This W-211 SEMIP applies the grading criteria defined in HNF-IP-0842, *TWRS Administration*, Volume IV, Section 1.2, *TWRS System Engineering Grading Guidelines*, to the two major elements of the Project: waste mixing and waste transfer. In addition, this W-211 SEMIP outlines the Project's current program for management of the integrated baseline, SEMP implementation, and SE process in accordance with the TWRS SEMP. Also, elements of the TWRS SEMP systems engineering program judged not applicable to Project W-211 as a result of the graded approach are documented. Finally, this W-211 SEMIP discusses those items in the TWRS SEMP judged applicable to the Project using a graded approach but which are not yet implemented on the Project. For these elements, the approach for migrating to the TWRS SEMP standards is presented.

1.2 PROJECT MISSION STATEMENT

Project W-211's mission is to provide systems for retrieval of radioactive wastes from double-shell tanks (DST) in order to provide feed for future processing plants, allow for consolidation of tank solids to manage space within existing DST storage capacity, and support continued safe storage of tank waste.

Project W-211, Initial Tank Retrieval Systems (Project), is a fiscal year 1994 Major Systems Acquisition that will provide systems for retrieval of radioactive wastes from selected double-shell tanks (DST). The contents of these tanks are a combination of supernatant liquids and settled solids. To retrieve waste from the tanks, it is first necessary to mix the liquid and solids prior to transferring the slurry to alternative storage or treatment facilities. The Project will provide systems to mobilize the settled solids and transfer the wastes out of the tanks. In so doing, the Project provides feed for future processing plants, allows for consolidation of tank solids to manage space within existing DST storage capacity, and supports continued safe storage of tank waste.

The current Project scope includes retrieval systems for tanks 102-AP, 104-AP, 105-AN, 104-AN, 102-AZ, 108-AP, 103-AN, 102-AY, and 102-SY. This tank selection and sequence provides retrieval systems supporting Privatized waste processing plants and sustains the ability to

provide final remediation of several watch list DSTs via treatment. As discussed in the Project W-211 *Justification for Mission Need*, the Project is configured to support changing program needs, as constrained by available budget, by maintaining the flexibility for exchanging tanks and shifting the retrieval sequence. Preliminary design has evolved such that an adequate basis exists for initiating Title II design on any DST.

1.3 SCOPE AND APPLICABILITY

Project W-211 supports the Waste Feed Delivery Program (Program) of Lockheed Martin Hanford Company's Tank Waste Remediation System. The Project provides tank modifications that will allow mixing DST wastes and transferring the resulting slurry to vitrification facilities or alternate storage.

The W-211 Project baseline provides for design and construction of retrieval systems for nine of Hanford's 28 DSTs. The W-211 SEMIP describes the process for meeting requirements of the TWRS SEMP and addresses the Project's SE program as the Title II design effort is completed and the Project progresses to the Construction and Startup phases.

1.3.1 Present Stage of the Project

The Project was started in the early 1990s prior to implementation of formal systems engineering at the Hanford Site and continues under many of the project management and engineering requirements in effect when the technical baseline was issued in 1993. Using a graded approach, the Project has migrated towards the TWRS SEMP, Rev. 1 requirements.

The Project status as of the end of FY1998 is shown in Table 1.1, *Status of W-211 Retrieval Systems*. Conceptual design of all the Project's retrieval systems was completed in 1993. Title I design of the Project's retrieval systems was completed in 1995. Title II design of the first retrieval system commenced in FY1996, followed by five more Title II design starts in FY1997 and FY1998. At the end of FY1998 all retrieval systems have completed conceptual design, all have completed Title I design, three have completed Title II design, and three additional systems are in progress. Also at the end of FY1998, procurement of major equipment has been completed for three retrieval systems and is in progress for two additional systems. The Project has received Key Decisions 0, 1, 2, and 2B.

From the Project's inception through FY1997, SE was accomplished in accordance with the SE requirements in RL-approved HNF-3333, *Project Management Plan for Initial Tank Retrieval Systems*.

Table 1.1 Status of Project W-211 Retrieval Systems

Retrieval System	Conceptual	Title I	Title II	Equipment Procurement
102-SY	Complete	Complete	Complete	Complete
102-AP	Complete	Complete	Complete	Complete
104-AP	Complete	Complete	Complete	Complete
105-AN	Complete	Complete	In Progress	In Progress
104-AN	Complete	Complete	In Progress	In Progress
102-AZ	Complete	Complete	In Progress	Future
108-AP	Complete	Complete	Future	Future
102-AY	Complete	Complete	Future	Future
103-AN	Complete	Complete	Future	Future

1.3.2 W-211 SEMIP Application

Systems engineering concepts were implemented by the Project during FY1997/1998 and were, therefore, implemented after development of the Project's technical baseline and relatively late in the project life cycle. The W-211 SEMIP provides a "road map" for systems engineering application throughout the remainder of the project life cycle, from completion of the last of the retrieval systems Title II design to turnover of the individual systems for operation at Critical Decision 4. Existing or planned SE-related products that support the Project are summarized.

1.3.3 Project Risks

W-211 Project risks have been documented at both the project and program levels, and will be managed according to the process described in Section 2.1, *Risk Management*. To minimize technical risk, the Project has designed the retrieval systems using commercially available equipment with proven application in similar usage at other DOE sites.

The Program includes Project-identified risks on the Waste Feed Delivery (WFD) prioritized Critical Risk Management List discussed in the Program SEIP, HNF-3384, Section 2.1, *Risk Management*, when the Project risk events have the potential of adversely impacting the Program's ability to deliver waste feed to the vitrification facility contractor.

1.3.4 SE Graded Approach

Application of systems engineering to Project W-211 employs a graded approach, as outlined in *TWRS Administration*, HNF-IP-0842 Vol. IV, Sec. 1.2, *TWRS Systems Engineering Grading Guidelines*. The grading process has been applied to the major project elements: waste mixing and waste transfer, in accordance with the guidance of the TWRS SEMP. A formal grading process was applied for each of the major project elements using a table of risk and complexity factors taken from HNF-IP-0842 Vol. IV, Sec 1.2, and are presented in Tables 3.5 and 3.6. The results of the grading process are used to determine the SE products and processes necessary to the subject systems, as outlined in the Grading Guidelines. The TWRS SEMP was also referenced to determine necessary baseline products. Section 2, *Systems Engineering Management Processes*, of this W-211 SEMIP addresses resulting management processes, and Section 3, *Systems Engineering Process*, addresses technical baseline products.

In addition to the risk/complexity based grading discussed above, application of the TWRS SEMP systems engineering elements are applied using a graded approach based on the maturity of the project. As discussed in Section 1.3.1 above, the project is at a relatively mature stage of its project life. The Project's technical requirements baseline, the W-211 FDC, has been in place for more than five years, guiding the project engineering effort through conceptual, Title I, and much of Title II design. Application of this maturity-based graded approach is discussed in applicable sections: 2.6, *Technical Reviews*; 2.7, *Technical Requirements Traceability*; 3.1.1, *Requirements Traceability*; 3.1.2, *Mission Analysis*; 3.1.7.2, *Reliability, Availability, and Maintainability*; 3.1.9, *Design Optimization*; and 3.2, *Technical Baseline Development*.

Mixing: The formal grading process presented in Table 3.5 results in a Category SE-2 application for Mixing, as described in the *TWRS Systems Engineering Grading Guidelines*. SE-2 systems require application of systems engineering, with a graded application of documentation and level of review. The risk and level of complexity for Mixing are low to moderate within the context of the overall TWRS program. The mixing systems involve commercially available architecture elements applied in similar applications at other DOE sites. Mixing has also been demonstrated at Hanford in tanks SY-101 and AP-102. NEPA and environmental permitting tasks involve low risk. Project interfaces are straightforward and well established in the Project's *Interface Document*, HNF-1507. While the retrieval systems are to be installed in tanks containing highly radioactive waste, the systems do not impact the containment capability of the tanks, and the type of contamination related to the Project is limited to potential small quantity spills during construction or operation. The only factor judged to have a High risk is funding, which in the case of W-211 is allocated over a ten-year time frame.

Transfer: The formal grading process presented in Table 3.6 results in a Category SE-2 application for Transfer, as described in the *TWRS Systems Engineering Grading Guidelines*. SE-2 systems require application of systems engineering, with a graded application of documentation and level of review. The risk and level of complexity for Transfer are low to

moderate within the context of the overall TWRS program. The transfer systems involve commercially available architecture elements applied in similar applications at Hanford and other DOE sites. NEPA and environmental permitting tasks involve low risk. Project interfaces are straightforward and well established in the Project's Interface Document. While the retrieval systems are to be installed in tanks containing highly radioactive waste, the systems do not impact the containment capability of the tanks, and the type of contamination related to the Project is limited to potential small quantity spills during construction or operation. The only factor judged to have a High risk is funding, which in the case of W-211 is allocated over a ten-year time frame.

1.3.5 Interface with Other Planning Documents

As depicted in Figure 3.1, *Project W-211 Technical Baseline Development*, the Project interfaces with upper-level planning documents through the Program-generated FDC. Detailed year-to-year scope, schedule, and budget planning is accomplished via the TWRS Multi-Year Work Plan.

2.0 SYSTEMS ENGINEERING MANAGEMENT PROCESSES

This section describes the processes that are used to control the elements of the Integrated Baseline.

2.1 RISK MANAGEMENT

Procedure Reference:

- HNF-IP-0842, Volume IV, Section 2.6, “Risk Management”

Risk Management for the Project involves creation of a work environment where risks are identified, understood, and managed. The primary tool for communicating Project risks is the Project W-211 risk list which identifies risk events; estimates their likelihood and consequences; and identifies mitigation actions, residual risk, and action plans.

The SE culture developed within Project W-211 provides an environment where risks are readily identified, effectively addressed, and in most cases promptly resolved. The risk management philosophy for the Project is one of reasonable risk minimization, rather than risk elimination. Risks within the Project’s authority as determined in the PMP, are managed within the Project, while others are transferred upward to the Program.

Risks are managed on a day-to-day basis and processed on an informal basis where risk values are subjectively determined to be very-low. Many of these risks are evident in the *Decision Management* element of the Project’s SE program, as a majority of decisions made on the Project are the result of the risk management process. Risk events of significance that are deserving of management attention outside the project, are formally identified and managed using the Project W-211 Risk List. The Project W-211 Risk List is managed on a “real-time” basis as risks and mitigation actions evolve, and it is reviewed and updated at least semi-annually.

Project-identified risks are included on the Waste Feed Delivery (WFD) prioritized *Critical Risk Management List*, HNF-2019, when the Project risk events have the potential of adversely impacting the Program’s ability to deliver waste feed to the vitrification facility contractor.

2.2 DECISION MANAGEMENT

Procedure Reference:

- HNF-IP-0842, Volume IV, Section 2.7, “Decision Management”

Decision Management for the Project provides a documented, methodical process, using a graded approach, for decision-making at each level of the Project.

A formal decision process is employed by Waste Feed Delivery (WFD) for decisions of major program importance. WFD Program formal decisions affecting the W-211 technical baseline are provided to the Project via modification of the Project W-211 FDC, as discussed in the Program’s SEIP and shown in Figure 3.1a, *Project W-211 Technical Baseline Development*.

A simplified process is used for decisions of lessor magnitude, those below the level requiring formal modification of the Project W-211 FDC. This simplified process for decision-making involves documentation of decisions at the project level using a graded approach. Significant project decisions are documented in Review Comment Records issued against the retrieval system designs, in formal reports, and in Letters of Instruction to the performing organizations. Day-to-day decisions are documented in meeting minutes and in electronic mail from the project management organization to the affected organization. These simplified decision documents are maintained in the *Decision Management* section of the Project's SE program reference books.

Change requests are another category of project-specific decision documents resulting from the Project's change control process. The Project's change control process is also an important aspect of *Configuration Management* and is addressed in Section 2.4, *Configuration Management*, of this W-211 SEMIP. While the simplified process for the above categories of project-specific decisions does not require the formality of a decision board, decisions of a sufficient magnitude to require the change control process do. For Project W-211 change requests, the decision board function is fulfilled by the Project W-211 Change Control Board (CCB), operating in accordance with the Project CCB procedure.

2.3 INTERFACE MANAGEMENT

Procedure Reference:

- HNF-PRO-243, "Interface Control Requirements"
- HNF-IP-0842, Volume IV, Section 2.8, "Interface Control"

Interface Management for the Project involves the identification and control of interfaces between the project and others.

HNF-1507, *Project W-211 Interface Document* has been prepared to provide a controlled process for recording agreed-upon interfaces between Project W-211 and the primary interfaces: Project W-314, Tank Farms, and Privatization. Each interface includes a description of those attributes necessary to maintain control and provide visibility to changes in scope. In addition, key assumptions effecting either the project or others are described and controlled. Finally, the interface document clarifies specific project actions being implemented to fulfill more broadly defined program needs.

Approval of the Engineering Data Transmittal by appropriate interfacing individuals constitutes agreement with the interfaces and assumptions identified in HNF-1507, *Project W-211 Interface Document*. Subsequent revisions will be implemented in accordance with HNF-PRO-440, "Engineering Document Change Control Requirements." The control mechanism for modifying the agreed upon interfaces will be the Engineering Change Notice, which will be prepared and released in accordance with the HNF-PRO-440 procedure.

2.4 CONFIGURATION MANAGEMENT

Procedure Reference:

- HNF-PRO-241, "Engineering Specification Requirements"
- HNF-PRO-244, "Engineering Data Transmittal Requirements"
- HNF-PRO-317, "Engineering Release and Approval Requirements"
- HNF-PRO-440, "Engineering Document Change Control Requirements"
- HNF-PRO-533, "Change Control"
- HNF-IP-0842, Volume VIII, Section 3.1, "Configuration Management Implementation"

Configuration Management for the Project is an integrated approach to control the technical, cost, schedule, and administrative information necessary to manage the W-211 baseline. For Project W-211, integration of the technical, cost, schedule, and administrative information is accomplished via HNF-3333, *Project Management Plan for Initial Tank Retrieval Systems* (PMP).

Configuration Management of the cost and schedule baseline is accomplished using a disciplined change control process in accordance with FDH, LMHC, and Project W-211 change control procedures. Cost and schedule changes are proposed and processed using the standard change request form, approved at the Project, FDH, or RL level depending on the significance of the change. Project W-211 change requests are recorded on the Project W-211 Change Control Log, maintained by the Project Manager. Project W-211 change requests document some of the most significant project-level decisions, and as such are also an important aspect of the *Decision Management* process.

Configuration Management of the technical baseline, the FDC, is accomplished in accordance with the requirements of procedures HNF-PRO-244, "Engineering Data Transmittal Requirements;" HNF-PRO-317, "Engineering Release and Approval Requirements;" and HNF-PRO-440, "Engineering Document Change Control Requirements." While the FDC serves as the overall technical baseline throughout the life of the project, development of the design by the Design Agent is controlled by other requirements documents supplementing the FDC, and are listed in Technical Data Checklists (TDC). *Configuration Management* of the TDCs is the responsibility of the Design Agent. The TDCs also provide traceability of technical requirements and are discussed in Section 2.7, *Technical Requirements Traceability*.

Configuration Management of the design during procurement and construction is accomplished in accordance with the requirements of procedures HNF-PRO-244, "Engineering Data Transmittal Requirements;" HNF-PRO-317, "Engineering Release and Approval Requirements;" HNF-PRO-440, "Engineering Document Change Control Requirements;" and HNF-PRO-241, "Engineering Specification Requirements."

Additionally, *Configuration Management* of the design at the end of construction is accomplished via appropriate field verification of the installed systems, structures, and components (SSC); as-building of the drawings and specifications; and releasing essential and support drawings into the engineering document system for use by the facility in *Configuration Management* of the facility's SSCs.

2.5 TECHNICAL PERFORMANCE MEASURES

Procedure Reference:

- HNF-IP-0842, Volume IV, Section 2.4, "Technical Performance Measures"

Technical performance measures are used to assess the evolving capability of the project to meet the established FDC requirements to accomplish the Waste Feed Delivery mission. The technical performance measurement process at the current design and procurement stage of the Project involves comparison of design parameters to the FDC, and measurement of equipment performance attributes against the design specification.

In FY1999, the Program plans to identify candidate performance measures in addition to those in the FDC. These Program performance measures will be included along with Project-specific performance measures and evaluation criteria in the Project's Testing and Evaluation plan as discussed in Section 3.1.10, *Physical System Test and Evaluation*.

2.6 TECHNICAL REVIEWS

Procedure Reference:

- HNF-PRO-445, "Design Verification Requirements"
- HNF-PRO-055, "Startup and Restart of Facilities"

Four project-specific reviews are discussed in the TWRS SEMP, although the first two, Project Mission Review and System Functional Review, are not applicable to Project W-211 as an "ongoing project" which obtained Key Decision 1 in May 1994, and Key Decision 2 in January 1996.

The third review required by the TWRS SEMP is the Detail Design Review (DDR), which for W-211 is performed for each of the retrieval system's Title II designs. The process for conducting DDRs is also shared with *Technical Requirements Traceability*, which uses the DDR for demonstrating traceability of the design output documents to the FDC and with *Decision Management* which uses Review Comment Records (RCR) from the DDR to document design-specific decisions.

Near the completion of each retrieval system design, the DDR is accomplished by expert review. This review involves qualified personnel in the areas of Operations, Project Management, the site Owner, Program Engineering, and Specialty Engineering functions such as Safety, Environmental, and Quality Assurance. Completion of each DDR is documented by approval signatures from members of the review team on the RCR. The RCRs for the DDRs are issued as the reviews are completed as discussed in Section 2.2, *Decision Management*.

The fourth review required by the TWRS SEMP is Operational Startup Review. These reviews will be held before turning over each of the retrieval systems to Tank Farm Operations and will be conducted in accordance with HNF-PRO-055, *Startup and Readiness of Facilities*, and HNF-IP-0842, *TWRS Administration*, implementing procedures for facility readiness. Start of the first retrieval system Operational Startup Review is presently planned for fiscal year 2003.

2.7 TECHNICAL REQUIREMENTS TRACEABILITY

Procedure Reference:

- None

Technical Requirements Traceability at the project level is essentially a binary process: demonstrating traceability of the design output documents to the FDC. Near the completion of each retrieval system design, traceability between the design and the FDC is determined by expert review as discussed in Section 2.6, *Technical Reviews*. Documentation of traceability of the design to the FDC is achieved by creation of a Requirements Traceability matrix for each retrieval system as the design is completed.

While the FDC serves as the overall technical baseline throughout the life of the project, development of the design by the Design Agent is controlled by other requirements documents supplementing the FDC, and are listed in Technical Data Checklists (TDC). Configuration management of the TDCs is the responsibility of the Design Agent. The TDCs also provide traceability of technical requirements and are issued at the start of design for each retrieval system. The Design Agent confirms traceability of the design to the TDC as part of the design verification process.

2.8 SYSTEMS ENGINEERING CULTURE

Procedure Reference:

- None

The SE approach for the Project is institutionalized by the TWRS SEMP, with implementation demonstrated by this Project W-211 SEMIP. Systems engineering is embraced by Project W-211 managers and engineers, within both the NHC Project Management and the Design Agent organizations. The *SE Culture* has created an environment in which the project team believes SE is simply one facet of Good Engineering.

2.9 SYSTEMS ENGINEERING IN SUBCONTRACTS

Procedure Reference:

- None

The Statement of Work issued June 30, 1997 for services provided by the Design Agent, Fluor Daniel Northwest, includes a requirement for accomplishing Project W-211 tasks "using a comprehensive systems engineering approach as documented in an NHC-approved FDNW project specific SE plan." The FDNW SE plan addresses each of the above elements required for W-211 systems engineering.

2.10 SE MANAGEMENT PROCESS RESPONSIBILITIES

Table 2.1, *Project W-211 Management Processes Responsibility Matrix*, provides a responsibility matrix of the organizations involved in the major management processes of *Risk Management*, *Decision Management*, *Configuration Management*, and *Interface Management*, as well as the two remaining *Technical Reviews* on the Project. The responsible organizations listed are those internal to the PHMC team. Additional detail on specific positions and responsibilities is found in the W-211 PMP.

Table 2.1. Project W-211 Management Processes Responsibilities Matrix

Organization	Management Process				Technical Reviews	
	Risk Management	Decision Management	Config. Management	Interface Management	Detailed Design Review	Operational Startup Review
Project	P	P	P	P	P	P
Program	A*	A*	N/A	A*	A	A
EQS	S	S	A	S	A	A
Systems Eng.	S	S	S	S	S	S
Operations	S	S	A*	A*	A	A
Sfty & Licensing	S	S	S	S	A	A
Design Agent	S	S	S	S	A	S

Legend:

A: Approve Agreement with process or document contents in areas affecting approving organization
P: Prepare Process performance or product preparation and approval
S: Support Support for process performance or product preparation
N/A Not Applicable

* Depending on applicability to the approving organization

3.0 SYSTEMS ENGINEERING PROCESS

This section provides details of how systems engineering is applied to Project W-211 Technical Baseline development. Descriptions of existing baseline products are given as well as an outline of the SE processes and products to be used to further define the baseline during the construction phase of the Project. Roles and responsibilities for major baseline product development are outlined in Section 3.3, *Major Technical Baseline Products*.

3.1 SYSTEMS ENGINEERING APPLICATION TO PROJECT W-211

This section provides a narrative of SE products and processes applied to the project. The text explains the products, processes, and decision points that are shown graphically in Figure 3.1, *Project W-211 Technical Baseline Development*.

3.1.1 Requirements Traceability

The upper level functions that the TWRS WFD program is required to provide are currently dictated by the HSTD and TWRS MAR. A planned revision to the *TWRS Operations and Utilization Plan* (OUP), HNF-SD-WM-SP-012, will incorporate private contractor data when it is released. As shown in Figure 3.1a, *Project W-211 Technical Baseline Development*, lower-level functions and performance requirements for the project are defined in the Project W-211 FDC.

Requirements Traceability at the project level is accomplished as discussed in Section 2.7, *Technical Requirements Traceability*.

3.1.2 Mission Analysis

Project W-211's mission is to provide systems for retrieval of radioactive wastes from selected double-shell tanks (DST) in order to provide feed for future processing plants, allow for consolidation of tank solids to manage space within existing DST storage capacity, and support continued safe storage of tank waste.

The mission and upper-level functions for the WFD program are defined in the TWRS MAR. The Project's mission is established, and confirmed by DOE-Headquarters, in the Project W-211 *Justification of Mission Need*. The TWRS MAR documents the mission on which the Project's technical baseline is built. Top-down technical baseline development is traceable by the Program from the TWRS MAR down to the Project W-211 FDC. The TWRS MAR provides the externally imposed system-level constraints to be applied to the Project via the W-211 FDC. A Project MAR will not be generated for Project W-211.

3.1.3 Functions and Requirements/Specification Development

The TWRS MAR upper level requirements are decomposed as shown in Figure 3.1a, *Project W-211 Technical Baseline Development*, resulting in technical requirements passed to the Project in the W-211 FDC.

The Project developed summary-level procurement and construction specifications during Title I design of each retrieval systems. During Title II design the specifications are fully developed, and are used for procurement of equipment and construction of the systems.

3.1.4 Alternative Analysis and Selection

Formal alternative analyses at the Program level have been conducted to determine the design basis for facilities required to stage waste feed to the processing plants. At the Project level, alternative analysis has been accomplished for the following:

- Permanent versus portable Instrument, Control, and Electrical buildings
- Above grade versus below grade power cables and transfer lines
- Electric versus oil fired hot water boilers
- Large transfer pump versus a combination of transfer and booster pumps
- Valving in pits
- Waste cooling options
- Slab versus pit mounting of mixer pumps
- Combining dilution system with Project W-058 versus providing W-211 specific system
- Using software capable of building logic diagrams from W-211 P&IDs
- Camera options
- Advanced design mixer pumps versus existing design
- New generation transfer pump versus existing design

3.1.5 Interface Analysis

As discussed in the Program SEIP, the Program will perform interface analysis to establish requirements for the interface between the Program and projects supporting the Program. These interfaces will be reflected in the Level 1 specifications and Interface Control Documents generated in accordance with HNF-IP-0842, *TWRS Administration*. Upper-level interfaces with Project W-211 will be identified in the Program's ICD.

As discussed below, Project W-211 has identified physical interfaces with Project W-314, Tank Farms, and the Privatization facility in the W-211 Interface Document, HNF-1507. Any changes or additions to the W-211 Interface Document identified by the WFD ICD will be incorporated in accordance with Section 2.4, *Configuration Management*, and as necessary, will be reflected in *Risk Management*, *Technical Requirements Traceability*, and *Decision Management* facets of the Project's SE program.

3.1.6 Interface Control Documentation

The W-211 Interface Document, HNF-1507, provides a controlled process for recording agreed-upon interfaces and key assumptions between W-211 and other entities which, if changed, could impact the design basis.

Each interface includes a description of those attributes necessary to maintain control and provide visibility to changes in scope. These attributes include various combinations of the following,

depending on the interface: component size, location (coordinates and elevation), material of construction, method of attachment, and computer-related communication protocol. As appropriate, sketch or drawing references, are included to supplement narrative descriptions.

3.1.7 Specialty Engineering Analysis and Integration

In addition to design engineering, and project and construction management, specialty engineering disciplines as listed in the TWRS SEMP are used as the Project progresses through Detailed Design, Construction, and Startup as shown in Figure 3.1b. Specialty engineering analyses is documented and traceable. Specialty Engineering is factored into the appropriate systems, structures, and components (SSC) specifications as follows:

- 3.1.7.1 Human Systems Integration:** Human systems integration (HSI) is used to reduce the potential for human error in system operation and ensure system safety, operational efficiency, ease of maintainability, and reliability. An HSI evaluation, PNNL-11442, *Human Factors Engineering Evaluation for Project W-211*, was completed in October 1996, for the first system's design and has guide HIS considerations on the subsequent design efforts. As the WFD Program develops the upper-level O&M Concept and RAM analysis, the Project will expand these to the project level and factor them into the remaining design tasks.
- 3.1.7.2 Reliability, Availability, and Maintainability:** The WFD O&M Concept will provide a basis for WFD RAM analysis, that will allow RAM considerations impacting future Project designs to be passed to the Project via a revision to the W-211 FDC in lieu of a project-level RAM.
- 3.1.7.3 Safety:** The project has followed the formal DOE safety analysis process as it has progressed from Conceptual Design, to Preliminary Design, to Detailed Design, and to Construction preparation. A Preliminary Safety Evaluation (PSE) was developed during the Conceptual Design. This PSE provided the safety analysis basis for Preliminary Design, Detailed Design, and equipment procurement. During Detailed Design, a Safety Assessment was developed by the Project. This Safety Assessment has been accepted by RL as the safety analysis basis for upcoming construction efforts, when used in conjunction with the USQ process against the tank farm safety authorization basis.

Prior to operation, HNF-SD-WM-BIO-001, *TWRS Basis of Interim Operation*, or the FSAR, whichever is the current tank farm safety authorization basis, will be amended to include operation of the Project-supplied retrieval systems.

- 3.1.7.4 Quality:** A Quality Assurance Program Plan (QAPP) was developed for the project in FY1994 and will be revised in FY1999 to reflect the current state of the Project and the PHMC organization. The Project Test and Evaluation Plan will identify other test and evaluation quality elements.
- 3.1.7.5 Regulatory Compliance:** In accordance with the W-211 permitting plan developed prior to Key Decision (KD)-1, the Project has completed actions to satisfy requirements for Cultural Resource Review and, via the TWRS EIS ROD, NEPA. A Clean Air Act

related NOC was issued by the State and EPA for 102-SY construction. Similar NOCs will be received from the regulators prior to construction of the remaining retrieval systems. RCRA considerations are accounted for by the DST permit application, to be submitted in FY1999, that will include retrieval system information.

3.1.7.6 Facility Startup: Following completion of W-211 construction and testing, and prior to waste retrieval operations, the project will complete operations readiness preparations to include operation and maintenance procedure validation and training, emergency preparedness, issuing as-built piping and instrument diagrams and essential drawings, spare parts procurement for initial operations, and operational staffing plans. A plan detailing the activities involved in moving from the construction phase to startup and operation will be issued by the Project near the half-way point of the construction task for each retrieval system

3.1.8 Operations and Maintenance Concept Development

Any additional or revised requirements resulting from the Program O&M document when it is issued will be passed to the project by the revision of the W-211 FDC. A Project W-211 specific O&M Concept document will be prepared to serve as the basis for developing operating and maintenance procedures. The objective of the W-211 O&M Concept will be to describe how the system will be operated, monitored, controlled, and maintained during normal, off-normal, and emergency conditions. The W-211 O&M Concept will also identify operations and maintenance functions, and requirements which must be satisfied by the system's technical and operational baselines to meet performance and safety requirements. The W-211 O&M Concept will be written to the level of information available at the time and will be updated as the project progresses through the construction phase.

3.1.9 Design Optimization

No further formal Design Optimization is planned for the Project that is well into the second half of its design phase. Conceptual design of all the Project's retrieval systems was completed in 1993. Title I design of the Project's retrieval systems was completed in 1995. Title II design of the first retrieval system commenced in FY1996, followed by five more Title II design starts in FY1997 and FY1998. At the end of FY1998 all retrieval systems have completed conceptual design, all have completed Title I design, three have completed Title II design, and three additional systems are in progress. Also at the end of FY1998, procurement of major equipment has been completed for three retrieval systems and is in progress for two additional systems.

During the prior design activity for the Project, alternative analyses were completed as discussed in Section 3.1.4, *Alternative Analysis and Selection*. The following analyses are also part of the *Design Optimization* process:

- Permanent versus portable Instrument, Control, and Electrical buildings
- Above grade versus below grade power cables and transfer lines
- Electric versus oil fired hot water boilers
- Large transfer pump versus a combination of transfer and booster pumps
- Valving in pits

- Waste cooling options
- Slab versus pit mounting of mixer pumps
- Combining dilution system with Project W-058 versus providing W-211 specific system
- Using software capable of building logic diagrams from W-211 P&IDs
- Camera options
- Advanced design mixer pumps versus existing design
- New generation transfer pump versus existing design

3.1.10 Physical System Test and Evaluation

Test and Evaluation (T&E) is addressed at a summary level for the Project in the W-211 PMP. A W-211 Project-specific plan will be developed in FY1999 to identify the complete set of T&E activities required prior to project turnover and in order to verify that the system will meet its technical and operational performance characteristics. The plan will cover the factory acceptance testing, construction acceptance testing, post-installation/preoperational acceptance testing, and operational testing phases. It will address management and organizational responsibilities, critical performance requirements (technical performance measures), test control and reporting methods, testing scope, boundaries, configurations, logical test sequence, test and evaluation methods, and acceptance criteria for verifying performance and safety requirements. A graded approach will be used to determine the degree to which T&E elements are applied to the W-211 systems.

Test and Evaluation requirements have been addressed in specifications for procurement of major Project equipment, such as mixer pumps and transfer pumps. Required test procedures for the installed equipment will be developed early in the Project's construction phase. The T&E Plan and test procedures used for the Project will be revised by a formal process if performance requirements or the associated test method or acceptance criteria are to be changed. The complete set of T&E results will be reviewed as part of the turnover process and identified issues will be formally resolved prior to the declaration of operational readiness.

Development and execution of T&E will be in accordance with HNF-2029, *Tank Waste Remediation System Test and Evaluation Management Plan* and the appropriate sections of HNF-IP-0842, *TWRS Administration*. The verification methods identified in the T&E Plan will be used to assess project performance against the Technical Performance Measures.

3.1.11 Integrated Logistics Support

As discussed in Section 3.1.8, *Operations and Maintenance Concept Development*, an upper-level Program Operations and Maintenance (O&M) Concept document will be issued that will allow a Project W-211 specific O&M Concept document to be prepared to serve as the basis for developing operating and maintenance procedures. The O&M Concept documents will include *Integrated Logistics Support* considerations for the Project-supplied retrieval systems.

3.1.12 Decision Points

The Project has received Key Decisions (KD) 0, 1, 2, and 2B. KD-0, issued by DOE-HQ in FY1993 approved the *Mission Need* and allowed conceptual design to commence. KD-1 was issued by DOE-HQ in FY1994, followed by preparation of a Title I design report and two supplements. KD-2 was issued by RL in January 1996, providing approval to commence Title II design and equipment procurement for the first three retrieval systems. In October 1997, RL approved a similar KD-2B for the remaining retrieval systems. The Project will support RL's Critical Decision (CD) 3 process for construction of each retrieval system. CD-4 will be issued by RL prior to operation of each retrieval system.

3.2 TECHNICAL BASELINE DEVELOPMENT

Figures 3.1a and 3.1b, *W-211 Technical Baseline Development*, illustrate development of the Project baseline. Supporting processes and documents including safety analysis, project reviews, and test and evaluation functions are shown as they relate to baseline development. This is a somewhat modified process compared to baseline development for a new project, given that Project W-211 is well into its project life cycle. The process depicted migrates the Technical Baseline towards that discussed in the TWRS SEMP, but maintains the FDC as the Project's Technical Baseline throughout the remaining phases of the Project.

3.3 MAJOR REQUIREMENTS BASELINE PRODUCTS

Table 3.1, *Processes/Products Required for Project Requirements Baseline Development*, identifies and describes major products that comprise the W-211 requirements baseline. Required products were determined according to the graded approach described in Section 1 and were derived from the TWRS SEMP and the *TWRS Systems Engineering Grading Guidelines* (HNF-IP-0842, Vol. IV, Sec 1.2).

Figure 3.1a Project W-211 Technical Baseline Development

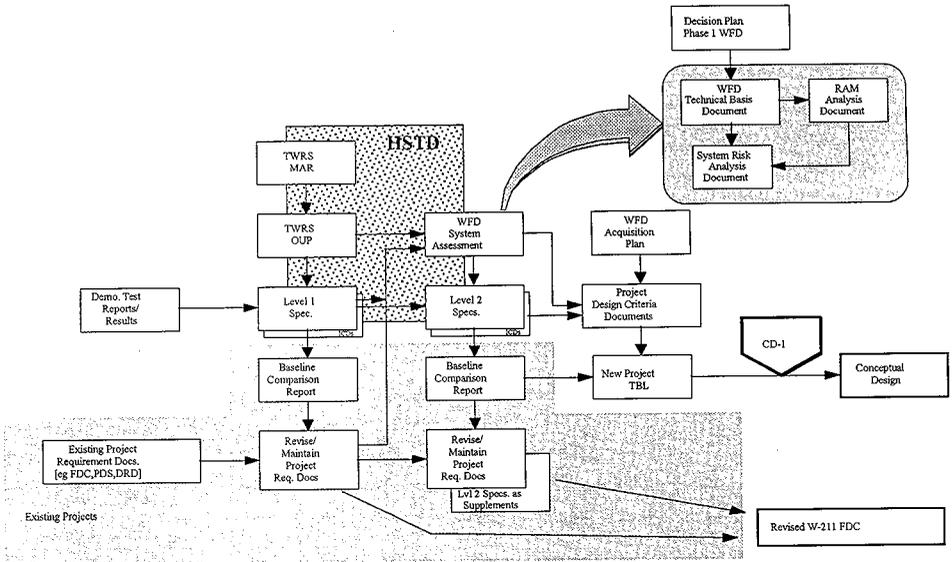


Figure 3.1b Project W-211 Technical Baseline Development

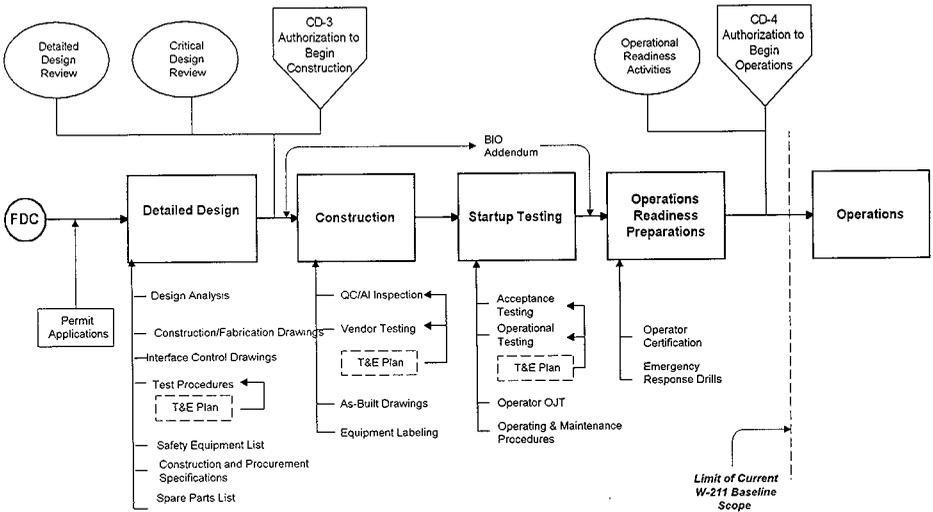


Table 3.1. Processes/Products Required for Project Requirements Baseline Development

TWRS SEMP Process Requirement	W-211 Deliverable	Description
Mission Analysis	<p>A project level MAR will not be generated for W-211. The following documents define the W-211 mission scope:</p> <ol style="list-style-type: none"> 1. TWRS Mission MAR* 2. W-211 Justification of Mission Need 3. W-211 Summary Project Plan 	<p>Includes retrieval program-level requirements and Phase I measures of success.</p> <p>Documents W-211 retrieval mission and goals.</p> <p>Documents W-211 mission need and objectives, facility description, and project baseline data.</p>
Functions and Requirements	<ol style="list-style-type: none"> 1. TWRS MAR: Program level F&R's* 2. System Specification for the Double-Shell Tank System* 3. W-211 Functional Design Criteria 4. Comparison of TWRS System Phase 1 Projects' Design Requirements Document With the Hanford Site Technical Database* 	<p>Outlines W-211 functions and ties to TWRS upper-level functional hierarchy.</p> <p>Includes DST retrieval in establishing the functional, performance, design, development, interface, and test requirements for the DST system.</p> <p>Identifies W-211 functional requirements and serves as the project technical baseline.</p> <p>Documents the results of a task to compare requirements of the W-211 Functional Design Criteria with the DST System Specification.</p>
Alternative Analysis	<ol style="list-style-type: none"> 1. AGA for the Phase 1 intermediate Waste Feed Staging System Design Requirements* 2. Alternatives Generation & Analysis for the Phase I High Level Waste Pretreatment Process Selection (HNF-SD-TWR-AGA-003, Rev. 0)* 	<p>W-211 is included in the analysis of alternatives for staging of low-activity waste feed to the Phase 1 processing plant.</p> <p>Report evaluates the effects of enhanced sludge washing and non-enhanced washing during the preparation of Phase I high-level waste feeds.</p>

TWRS SEMP Process Requirement	W-211 Deliverable	Description
O&M Concept and RAM Analysis	1. Future WFD O&M Concept (planned for FY 1999)* 2. WFD System Phase 1 Baseline RAM Assessment*	W-211 will be included in the Waste Feed Delivery O&M Concept that will be completed in FY 1999. O&M Concept will summarize WFD operations and maintenance activities, process flow productions/throughput requirements, etc. W-211 is included in the WFD analysis of system reliability, availability, and maintainability.
Decision Documents	1. Project W-211 Near Term Guidance (LMHC 2/97)* 2. DST Retrieval Equipment, Decision Board Meeting Minutes (7/11-8/28/97)* 3. Change Requests 4. RCRs, Formal Reports, Letters of Instruction, Meeting Minutes, Electronic Mail 5. Critical Decision 1 (Complete) 6. Project Validation Package and Decision 7. Critical Decision 2 (Complete) 8. Decision Document for Phase 1 Privatization Transfer System Needs*	Identified the tanks and the schedule for providing retrieval systems for each tank Using an AGA the board selected DST retrieval equipment from various equipment concepts. Utilized during the life of the project to document significant decisions/changes related to project cost/schedule/technical baselines. Changes evaluated and approved by the W-211 project file. Utilized to document day to day project specific decisions that do not impact the projects baseline. Documents are controlled within the W-211 project file. Provided authorization to initiate conceptual design. Basis for budget request. Authorization to begin definitive design. W-211 is included in the AGA evaluating infrastructure to support transfer to the HLW and LAW vendors.

TWRS SEMP Process Requirement	W-211 Deliverable	Description
ICD's	1. Project W-211 Interface Document, HNF-1507	Provides controlled process for recording interface agreements with other entities that, if changed, could impact design basis.
Specialty Engineering Analysis: Safety and QA/QC	1. QAPP (WHC-SD-W211-QAPP-001, Rev. 1). 2. Safety Assessment HNF-SD-W211-PSAD-001, Rev. 0) 3. Tank Waste Remediation System BIO. (HNF-SD-WM-BIO-001)*	Identifies QA/QC requirements for project. Evaluates and concludes retrieval can be performed safely. Final safety basis including accident analysis and Technical Safety Requirements. Analysis assumptions, required preventive and mitigating features, and TSR surveillance and action statement requirements must be incorporated into final design deliverables.
Specialty Engineering Analysis Reports: Regulatory	1. Permitting Plan for Project W-211 (WHC 88110-KAP-93-097)	Includes environmental permitting requirements for waste retrieval.
Risk Management	1. WFD Critical Risk List* 2. Project Risk Management List 3. Intermediate Decision Reviews	Interface vehicle between Program and Project for significant risks to the WFD Program. Project-specific risk tracking list, reviewed semi-annually. Reviews conducted at 30% and 60% stage of design completion. Minimize the probability and consequence of changes being required at Final design review.
Project Management	1. Life-Cycle Cost Estimate. (WHC-SD-W-211-CDR-001, Rev. 0, Appendix H) 2. Project Management Plan HNF-3333, Rev. 0 3. W-211 Systems Engineering Management Implementation Plan (HNF-3310)	Establishes project cost basis. Preliminary cost estimate is included in the AGA. Defines SE application to W-211, according to TWRS SEMP guidance. Identifies plans, interfaces, management control systems, and reporting requirements for W-211.

TWRS SEMP Process Requirement	W-211 Deliverable	Description
Level 1 and 2 Specifications	Project W-211 FDC provides technical baseline requirements in lieu of Level 1 and 2 specifications	Provides a link between the top-down developed Program technical baseline with the Project's technical baseline as shown in Figure 3.1.
Trade Studies	Miscellaneous trade studies developed during conceptual and detailed design	Evaluated trade-offs for transfer line locations, transfer pump options, base plate configuration, etc.
Design Criteria	1. W-211 FDC (WHC-SD-W211-FDC-001, Rev. 3a)	Defines project scope by identifying specific SSC's the project will develop and construct.
Project Conceptual Design	1. Conceptual Design Reports. (WHC-SD-W211-CDR-001 and -002)	Provides conceptual design of retrieval system.

* Program Documents

Table 3.2 identifies the SE products that demonstrate completion of the SE processes that the TWRS SEMP requires for development of a project Design Baseline. The processes or activities necessary for development of the baseline were taken directly from the TWRS SEMP with some minor editing and regrouping.

Table 3.2. TWRS SEMP Processes and Products Required for Design Baseline Development.

TWRS SEMP Process Requirement	W-211 Deliverable	Description
Preliminary and Detailed Design	<ol style="list-style-type: none"> <li data-bbox="348 353 652 414">1. Preliminary Design (Title I) WHC-SD-W211-TDR-001, Rev. 0b) <li data-bbox="348 436 652 459">2. Detailed Design (Title II) <li data-bbox="348 566 652 610">3. Fabrication and Construction Drawings <li data-bbox="348 696 652 740">4. Construction and Procurement Specifications. <li data-bbox="348 912 652 935">5. Design Analysis 	<p data-bbox="668 353 925 541">Preliminary and detailed designs advanced the conceptual design with input from specialty engineering, trade studies, PSE, PSAR, FSAR, etc. Completion of detailed design will satisfy all project performance requirements</p> <p data-bbox="668 566 925 672">Specify the physical geometry, material, and manufacturing requirements for SSC's. Used for fabrication and construction.</p> <p data-bbox="668 696 925 884">Construction Specs: Specify SSC construction (e.g., product delivery, handling and disposal, execution of work, etc.). Procurement Specs: Specify requirements for commercial off-the-shelf or catalog items or services.</p> <p data-bbox="668 912 925 1083">Design calculations and other analyses that were used to arrive at the design. Used to provide traceability of design and may be used to analytically demonstrate how the design complies with the specification.</p>

TWRS SEMP Process Requirement	W-211 Deliverable	Description
Test and Evaluation	1. Project T&E Plan (HNF-3333) 2. T&E Procedures 3. T&E Reports	Document the specific SSC test and evaluation methods, procedures used to verify SSC performance at various stages of baseline development. Also implements elements of QA/QC plan. Document the specific SSC test procedures required to verify SSC suitability at various stages of development. Document the results of tests performed under the T&E plan and T&E procedures.
Interface Control	Interface Document HNF-1507	Documents the interfaces and key assumptions between W-211 and other interfacing entities: TFO, Privatization and Project W-314
Design Baseline Review	Independent Detailed Design Review.	Detailed Design Review (DDR) performed on each Title II designs. DDR demonstrates traceability of decision documents to the FDC.
Design/Technical Reviews	Critical Design Reviews, Final Design Report (RCR)	Review comments documented and dispositioned on Record Comment Review Comment Record (RCR) forms.

Table 3.3 identifies the SE products that demonstrate completion of the SE processes that the TWRS SEMP requires for development of a project Operational Baseline. The processes or activities necessary for development of the baseline were taken directly from the TWRS SEMP with some minor editing and regrouping. The SE products identified in this table are future deliverables that W-211 will develop to satisfy corresponding process requirements.

Table 3.3. TWRS SEMP Processes and Products Required for Operational Baseline

TWRS SEMP Process Requirement	W-211 Deliverable	Description
As-Built Drawings and Equipment Labeling	P&IDs (One-line diagrams), and essential drawings as defined in ABU Checklist.	Specify the physical configuration, materials, and other information on the installed configuration of SSC's. Used for management and modification of SSC's.
O&M Procedures	POP's, ARP's, FT's, and other operations and preventive maintenance/calibration procedure.	Provided by project prior to operational testing.
Safety Equipment List	Safety Equipment List and ECN to TWRS SEL HNF-SD-WM-SEL-040 HNF-SD-W211-SEL-002	Identifies specific operations and maintenance SSC's that are designated as important to safety. Used to manage safety class equipment and as reference to Authorization Basis documents.
Authorization Basis and Implementation	BIO/FSAR/TSR implementation. USQ screening process. <i>BIO/FSAR updates and revisions.</i>	Provides analysis assumptions and required <i>preventive and mitigative</i> design features to safety and Authorization Basis documents.
Operations, Maintenance, Engineering and Support Staff Training	1. Job Task Analysis (JTA), classroom and on-the-job training (OJT) for certified operators. 2. Training Needs Analysis prepared for Maintenance, Engineering, Operations Support Personnel.	Documents that operators, craftsmen, and technicians have been trained to a required proficiency level for system operation and maintenance. Also includes training and certifications as required for management, engineers, and other staff.

TWRS SEMP Process Requirement	W-211 Deliverable	Description
Project Turnover	1. Acceptance for Beneficial Use (ABU). (HNF-SD-W211-ABU-001, Rev. 0, 102-104 AP Draft) 2. Official Acceptance of Construction (OAC).	Document identifies the items necessary at the turnover and completion of the projects Documents the Official Completion of Construction and turnover of responsibility for the new facility from the project to operations.
Operational Readiness	1. Emergency Preparedness Drills and Graded Exercise. 2. Operational Readiness Review and/or Readiness Assessment by Contractor and DOE. 3. Critical Decision 4	Prerequisite to CD-4. Third of three project reviews required by TWRS SEMP. Approval to commence operation.

3.4 BASELINE PRODUCT ROLES AND RESPONSIBILITIES

Table 3.4 provides a matrix of organizations/positions responsible for document approval, review, and preparation.

Table 3.4. Roles and Responsibilities Matrix for Major Project Technical Baseline Products.

Product	Approval	Review	Preparation Lead
Requirements Baseline Products			
Project O&M Concept	W-211 Operations WFD	Maintenance TENS EQS	W-211
Conceptual Design Report	Complete	Complete	Complete
Project Validation Package	N/A	N/A	W-211
QAPP	EQS W-211	N/A	EQS
Preliminary Safety Evaluation	Complete	Complete	Complete
Permitting Plan	Complete	Complete	Complete
RCRA Permit Applications	N/A	N/A	N/A
Interface Document	W-211 W-314 WFD Operations Privitization Interface	N/A	W-211

Design Baseline Products			
Project Management Plan	W-211 FDH RL	EQS	W-211
SA	Complete	Complete	Complete
Preliminary Design (Title I)	Complete	Complete	Complete
Detailed Design (Title II)	W-211	Operations Maintenance EQS TENS Design Auth WFD	W-211
P&IDs and Essential Drawings	Included in Title II	Included in Title II	Included in Title II
Construction & Procurement Specifications	Included in Title II	Included in Title II	Included in Title II
Test Procedures	Same as Title II	Same as Title II	Same as Title II
Test Reports	W-211	EQS	W-211

Operations Baseline Products			
TWRS Authorization Basis Amendment	TENS	EQS W-211 Operations WFD	TENS
Safety Equipment List	Included in AB	Included in AB	Included in AB
Job Task Analysis	W-211 Operations EQS	Radiation Protection	W-211
Training Certification Products	Operations	TWRS Training W-211	TWRS Training
O&M Manuals and Procedures	W-211 Operations Maintenance	EQS WFD	Operations
Permit and License Applications	W-211 FDH RL	EQS	EQS
As-Built Drawings	W-211 Operations Design Auth	EQS	W-211
Cross-Baseline Products			
T&E Plan	W-211 WFD Operations	EQS	W-211
W-211 SEMIP	W-211 WFD SE	N/A	W-211
Project Risk Management List	W-211	WFD	W-211

Legend:

TENS:	TWRS Engineering and Nuclear Safety
EQS:	Environmental, Quality, and Safety
SE:	Systems Engineering
Complete:	Product is complete and no revisions are planned
WFD:	Waste Feed Delivery Program
W-211:	Project Manager/Project Engineer

Table 3.5 Systems Engineering Graded Assessment of Mixing.

RISK/ COMPLEXITY FACTOR	ASSESSMENT	RISK			COMMENTS
		L	M	H	
Technology	Proven/state-of-the-art technology. Engineered equipment		X		Mixer pump technology demonstrated at Savannah River and West Valley
Time	Reasonable time to perform work (tight, but possible).		X		This risk has been reduced as the schedule has been extended several years.
Interfaces	Minor impact on site operations, other contractors, projects, programs, etc.		X		
Number of Key Participants	2-3		X		
Contractor Capabilities	Proven track record	X			
Magnitude and Type of Environmental Contamination	Hazardous or low-level waste, fully characterized	X			No contamination expected from construction or operation of project-supplied system. Project-supplied equipment does not impact DST containment function.
Regulatory Involvement	EPA, NRC, or States		X		
NEPA	None	X			TWRS-EIS complete and Record of Decision issued.
Environmental Permits (RCRA, CWA, CAA, etc.) or Licensing			X		CAA NOCs required prior to construction.
Number of Locations	1	X			
Site Ownership	DOE property	X			
Site Improvement/ Access	Minor improvements required and accessible.	X			
Labor Skills	Moderate or highly skilled labor		X		

RISK/ COMPLEXITY FACTOR	ASSESSMENT	RISK			COMMENTS
		L	M	H	
Availability	Readily available	X			
Staff Build-Up	Measured or phased		X		
Productivity	Low or average productivity assumed and moderate schedule risk		X		
Quality Requirements	Moderate quality tolerances and moderate productivity risk		X		
Funding	2 or more year duration. Line Item project size.			X	
Political Visibility	None	X			
Cost Sharing	None	X			
Public Involvement	None	X			
OVERALL COMPLEXITY	Low or moderate technology risk. Low or moderate schedule risk, 1-2 major subcontractors. 1-2 locations. Few interfaces or dependencies with other participants, projects programs, etc. Some regulatory involvement, EA, etc.		X		

Table 3.6 Systems Engineering Graded Assessment of Transfer.

RISK/ COMPLEXITY FACTOR	ASSESSMENT	RISK			COMMENTS
		L	M	H	
Technology	Proven/state-of-the-art technology. Engineered equipment		X		Transfer pumps commonly used at Hanford.
Time	Reasonable time to perform work (tight, but possible).		X		This risk has been reduced as the schedule has been extended several years.
Interfaces	Minor impact on site operations, other contractors, projects, programs, etc.		X		
Number of Key Participants	2-3		X		
Contractor Capabilities	Proven track record	X			
Magnitude and Type of Environmental Contamination	Hazardous or low-level waste, fully characterized	X			No contamination expected from construction or operation of project-supplied system. Project-supplied equipment does not impact DST containment function.
Regulatory Involvement	EPA, NRC, or States		X		
NEPA	None	X			EIS complete and Record of Decision issued.
Environmental Permits (RCRA, CWA, CAA, etc.) or Licensing			X		CAA NOCs required prior to construction.
Number of Locations	1	X			
Site Ownership	DOE property	X			
Site Improvement/ Access	Minor infrastructure/ improvements required and accessible.	X			
Labor Skills	Moderate or highly skilled labor		X		

RISK/ COMPLEXITY FACTOR	ASSESSMENT	RISK			COMMENTS
		L	M	H	
Availability	Readily available	X			
Staff Build-Up	Measured or phased		X		
Productivity	Low or average productivity assumed and moderate schedule risk		X		
Quality Requirements	Moderate quality tolerances and moderate productivity risk		X		
Funding	2 or more year duration. Line Item project size.			X	
Political Visibility	None	X			
Cost Sharing	None	X			
Public Involvement	None	X			
OVERALL COMPLEXITY	Low or moderate technology risk. Low or moderate schedule risk, 1-2 major subcontractors. 1-2 locations. Few interfaces or dependencies with other participants, projects programs, etc. Some regulatory involvement, EA, etc.		X		