SECTION C

STATEMENT OF WORK

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SECTION C

STATEMENT OF WORK

C.1 INTRODUCTION

Hanford tank waste consists of approximately 190 million curies in 53 million gallons of highly radioactive and mixed hazardous waste stored in underground storage tanks at the Hanford Site. The tank waste includes solids (sludge), liquids (supernatant), and salt cake (dried salts that will dissolve in water forming supernatant). The tank waste will be remediated through treatment and immobilization to protect the environment and meet regulatory requirements.

The U.S. Department of Energy (DOE) determined that the preferred alternative to remediate the Hanford tank waste is to:

- Pretreat the waste to separate it into two fractions, Low-Activity Waste (LAW) and High-Level Waste (HLW);
- Immobilize the LAW for on-site disposal; and
- Immobilize the HLW for ultimate disposal in the national repository.

The first tank waste fraction, LAW, is comprised of the tank waste liquids (and dissolved salt cake) and contains the bulk of the tank waste chemicals and certain radionuclides (e.g., cesium [Cs], strontium [Sr], and transuranics [TRU]) that must be mitigated prior to immobilizing the waste. LAW is a mixed, characteristic, and listed waste regulated under the *Resource Conservation and Recovery Act of 1976* (RCRA), and must meet certain treatment standards and performance standards for on-site disposal of the final waste form in accordance with the specific requirements of the Contract.

The second tank waste fraction, HLW, is comprised of the long half-life radioactive tank waste solids (as well as other non-radioactive solids) and the radionuclides separated from the LAW fraction. HLW is a mixed, characteristic, and listed waste regulated under RCRA, and must meet specific treatment and performance standards for storage and repository disposal of the final waste form in accordance with the specific requirements of the Contract.

The Waste Treatment and Immobilization Plant (WTP) is comprised of five major facilities: Pretreatment (PT), LAW Vitrification, HLW Vitrification, Analytical Laboratory, and the Balance of [Plant] Facilities (BOF). The WTP facilities shall be designed in accordance with the specific requirements of the Contract.

The Hanford tank waste treatment mission is defined by the assumptions presented in the *Tank Farm Contractor Operation and Utilization Plan* (HNF-SD-WM-SP-012, Revision 6, January 2007) in terms of the tank waste quantities and compositions to be treated and immobilized. The WTP facilities, combined with additional support from supplemental LAW and TRU treatment facilities, will be used to treat and immobilize the entire inventory of the Hanford tank waste.

To perform the activities necessary to remediate the Hanford tank waste, DOE assigned responsibility to the Office of River Protection (ORP) in Richland, Washington. Through this Contract, ORP will manage and oversee the design, construction, and commissioning of the WTP that will treat and immobilize a portion of the waste for ultimate disposal.

The DOE Office of River Protection may choose to start the Hanford tank waste treatment mission in phases, starting with the treatment of the LAW waste fraction prior to completion of the PT and HLW Facilities. If such an alternative is implemented, the pretreatment to separate the LAW waste fraction would be accomplished in the Hanford tank farms, and the LAW waste fraction would be provided directly to the LAW Facility for vitrification. This alternative is referred to as Direct Feed LAW (DFLAW). Secondary waste generated during the LAW vitrification process would be managed within the WTP facilities with a fraction recycled back to the tank farms until such time as the PT Facility is fully operational. The Laboratory and BOF would need to be completed and operational to the extent necessary to operate the LAW Facility in isolation from the PT and HLW Facilities. Contract Line Item (CLIN) 2 is included in the Contract to implement a permanent DFLAW capability in the WTP should the decision be made to proceed with a phased startup of the WTP. **(350)**

The Statement of Work for this Contract is divided into nine sections: (1) introduction; (2) summary of contract approach; (3) summary of interactions with the Contractor; (4) summary of environment, safety, quality, and health requirements; (5) description of Contract requirements and deliverables; (6) detailed identification of standards/requirements; (7) description of facility design specification; (8) detailed operational specifications; and (9) summary of the Interface Control Documents (ICD).

C.2 CONTRACT APPROACH

To accomplish the ORP mission, DOE established the River Protection Project (RPP). RPP consists of two main contractors responsible for performing work necessary to complete the mission. The first is the current Tank Farm Contractor, responsible for ensuring safe storage, retrieval, and disposal of the immobilized waste; decontamination and decommissioning; and initiation of post-closure monitoring of the tank farms. The second is the WTP Contractor (hereafter referred to as the "*Contractor*") responsible for designing, constructing, commissioning, and supporting the transition of the WTP to the WTP Operating Contractor (hereafter referred to as the "*Operations Contractor*") to be selected by DOE.

The Contractor has full responsibility for the WTP from the transition of an existing Conceptual Design through the completion of transition to the future Operations Contractor. The WTP Contract will focus on an initial Contract award for design and construction of the WTP. Schedule performance is an important consideration for RPP, and, specifically, the WTP. After successful hot commissioning by the Contractor, DOE will, under a separate contract, operate the WTP and treat and immobilize the balance of the Hanford tank waste.

The WTP Conceptual Design and supporting information are provided to the Contractor. In the interim period prior to Contract award, the Tank Farm Contractor will maintain the WTP Conceptual Design and supporting information, conduct limited additional design and optimization, and transition the WTP Conceptual Design to the Contractor. Additional information developed for the WTP Conceptual Design will be transitioned from the Tank Farm Contractor to the Contractor subsequent to Contract award.

The Contractor will review the WTP Conceptual Design and supporting information, complete process and facility design, manage construction and procurement, conduct acceptance testing, select and integrate a subcontractor into the project team to provide the necessary operability and commissioning capability, and conduct all required environmental, safety, quality, and health actions. From Contract Award, the Contractor will be the design authority responsible for the WTP design. DOE will expect full Contractor accountability for performance, cost, and schedule throughout the Contract period of performance.

The WTP Conceptual Design provides a reference solution that appears to meet project requirements, but has significant potential for optimization. DOE will seek to improve the WTP by incentivizing the Contractor to optimize life-cycle performance, cost, and schedule of the WTP, including the process design, facility design, and technologies. DOE will evaluate Contractor performance against Contract requirements and review Contractor proposed changes to Contract requirements, but will not accept performance or approve changes that adversely impact overall system-level performance, life-cycle cost, or schedule. DOE reserves the unilateral right to disapprove any adverse change.

(a) Scope Summary

As defined in Section B of the contract, it is anticipated the contract will incorporate a CLIN structure. CLIN 2.1 is established as of Modification 350.

CLIN 2.1: Direct Feed Low-Activity Waste (DFLAW) Facility Design.

CLIN 2.1 completes modifications of the LBL design to incorporate a permanent capability to operate LBL in the DFLAW configuration – with pretreated LAW feed delivered from the Hanford tank farms and liquid effluent returns back to the tank farms. Work scope includes the design, and unique permitting and licensing activities associated with the DFLAW capability in WTP. This CLIN also includes design of any additional needed facilities, establishment of new operating or security boundaries, modifications to BOF or LAB to enable operational flexibility for DFLAW, and similar requirements. **(350)**

C.3 INTERACTIONS WITH THE WASTE TREATMENT AND IMMOBILIZATION CONTRACTOR

(a) DOE, the Tank Farm Contractor, and the Operating Contractor have specific responsibilities and defined interactions with the Contractor. DOE will use a partnering approach to manage interactions among DOE, the Contractor, the Operating Contractor, the Tank Farm Contractor, and other Hanford Site contractors. This approach will: encourage a common vision with supporting goals and missions for each participant; promote the principles of teamwork, mutual respect, openness, honesty, trust, professionalism, and understanding; and include joint commitments to:

(1) Maintain high safety performance;

(2) Complete the WTP on schedule and within cost;

(3) Complete the RPP mission to treat and immobilize the Hanford tank waste;

(4) Eliminate barriers to an efficient and more cost-effective project;

(5) Promote innovation;

(6) Improve communication and understanding;

(7) Provide early identification and recovery from performance problems;

(8) Resolve conflicts through a coordinated work effort that avoids adversarial relationships;

(9) Reinforce the partnered relationship through honest feedback and continual improvement; and

(10) Collaboratively prepare the WTP systems, personnel, and procedures for plant operations.

The Contractor shall provide the resources necessary to establish and implement the partnering approach, including the requirements of Section H Clause 34, *Alternative Dispute Resolution*, throughout the Contract period of performance. The Contractor shall be responsible for actively participating in the partnering approach in a constructive manner.

(b) DOE is responsible as the "*Owner*" and "*Regulator*" of the WTP.

(1) As the Owner, DOE will:

(i) Establish requirements, administer the Contract, and confirm that the Contractor meets Contract requirements;

(ii) Integrate the WTP into the overall RPP mission;

(iii) Approve all changes to the RPP system-level flowsheet, interface control documents, feed and product specifications, design basis, safety basis, and the future WTP operations baseline (269);

(iv) Perform design, construction, safety and reliability/availability/ maintainability/inspectability (RAMI), and operability oversight of the WTP; where required, engage other contractors to provide design, construction, RAMI, and operability oversight of the WTP;

(v) Perform review (and where required, engage other contractors) of Contractor environmental, safety, quality, and health actions for compatibility and integration with site-wide Environment, Safety, Quality, and Health (ESQ&H) activities;

(vi) Provide oversight and approval of the Contractor's operational readiness reviews **(M196)** process per DOE Order 425.1D, *Verification of Readiness to Start Up or Restart Nuclear Facilities* (A190);

(vii) Inspect and accept the WTP, including a determination that it is ready for safe operations with radioactive wastes;

(viii) Certify that the immobilized high-level waste (IHLW), immobilized low-activity waste (ILAW), and secondary wastes products meet DOE and regulatory requirements for additional treatment or disposal;

(ix) Manage project progression through the critical decision process (DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, CRD) (M076) (271);

(x) Provide Quality Assurance (QA) oversight; and

(xi) Require compatibility of reporting and management systems.

DOE may utilize an Owners Agent to perform some of the functions identified above.

(2) As the Regulator, DOE will regulate radiological, nuclear, and process safety, as well as non-radiological worker safety and health.

(c) The Tank Farm Contractor will transition the WTP Conceptual Design to the Contractor upon Contract award.

(d) DOE, the Tank Farm Contractor, and other Hanford Site contractors provide site services to the Contractor as directed by DOE (see Section C.9, *Interface Control Documents*).

(e) The DOE will provide an Operating Contractor to support facility transition and subsequent operations and maintenance of the WTP following Contract completion.

(f) The Contractor shall:

(1) Perform the requirements of this Contract, integrating activities with DOE, the Tank Farm Contractor, Operating Contractor, and other Hanford Site contractors, as needed.

(2) Be the design authority for the design and engineering of the WTP process and facilities. As such, the Contractor shall have authority and responsibility to ensure that:

(i) The design of the WTP facilities complies with all requirements in the Contract, and design requirements identified in approved deliverables and work products specified in Sections C.6, *Standards,* C.7, *Facility Specification,* C.8, *Operational Specifications*, and C.9, *Interface Control Documents.*

(ii) The planned operation of the WTP can achieve the capacity requirements specified in Section C.6, Standard 5, *Commissioning*.

(iii) The Contractor shall identify, quantify, and manage process and facility equipment sizing, technical operating performance, environmental permitting and the safety authorization basis to achieve the Contract specified requirements of the WTP.

(3) The WTP Contractor shall construct the WTP in accordance with the detailed design, safety basis, pertinent regulations, approved regulatory permits, Section C.6, *Standards*, specified in the Contract, and other approved industry standards, as applicable.

(4) In cooperation with DOE (as lead), Tank Farm Contractor, and the other Hanford Site contractors, establish an interface management process to assure effective control of technical, administrative, and regulatory interfaces.

(5) Support DOE in external communications on the WTP Project with stakeholders, regulators, Tribal Nations, and other special interest groups.

(6) Train commissioning staff to operate and maintain the WTP in accordance with DOE Order 426.2, CRD, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*. (M152)(321)

(7) Transition the successfully commissioned WTP to the Operations Contractor.

(8) Provide DOE or its designee(s) access to, and the right to, conduct assessments, audits, and/or surveillance of the Contractor (and its subcontractors/suppliers, at any level) records, premises, activities, and of radioactive materials in possession or use related to the WTP, as necessary to effectuate the responsibilities of DOE.

(g) The Operating Contractor shall:

(1) Participate in the development of, and concur with, the Facility Transition Plan.

(2) Assume management of the WTP facilities following the completion of the Contractor's Contract.

C.4 ENVIRONMENT, SAFETY, QUALITY, AND HEALTH

(a) The Contractor will provide a WTP that processes DOE-owned highly radioactive and dangerous waste. In order to deliver the WTP within the appropriate level of controls consistent with the hazards to be encountered, the Contractor shall establish and maintain an Integrated Safety Management System (ISMS).

The Contractor shall be responsible for protecting human health and the environment from radioactive chemicals, hazardous materials, and dangerous waste contamination, as well as non-radiological worker safety and health from conventional, construction, industrial, and occupational hazards. The Contractor shall also provide safe and healthful working conditions for employees, subcontractors, and all other personnel under the Contractor's control who work in the general vicinity of the Contractor site and facilities.

The Contractor shall comply with applicable Federal, DOE, State, and local regulations and requirements for:

(1) Non-radiological worker safety and health;

(2) Radiological, nuclear, and process safety;

(3) QA; and

(4) Environmental protection.

(b) DOE will provide existing ESQ&H documentation with the WTP Conceptual Design and supporting information to allow the Contractor to review, modify, and implement required ESQ&H actions under this Contract.

(c) The regulatory environment for this Contract is structured into four principal areas of responsibility and requirements on Contractor performance. Detailed Contractor performance requirements are provided in Section C.6, Standard 7, *Environment, Safety, Quality, and Health*.

(1) Non-Radiological Worker Safety and Health: DOE will regulate non-radiological worker safety and health. The Contractor shall develop and implement the WTP-specific worker safety and health program.

(2) Radiological, Nuclear, and Process Safety: DOE will regulate radiological, nuclear, and process safety to ensure that the Contractor provides for and operates within the required levels of public and worker protection.
The Contractor shall develop and implement a WTP-specific radiological, nuclear, and process safety program.

(3) Quality Assurance: DOE will oversee all Contractor performance in accordance with a Contractor-developed, DOE-approved program. The Contractor shall develop and implement an integrated WTP-specific QA Program, supported by documentation that describes overall implementation of QA requirements.

(4) Environmental Protection: The Contractor shall develop and implement a WTP-specific environmental protection program, prepare all required permit applications, and obtain, in conjunction with DOE, all necessary permits for the WTP.

(A) DOE is responsible for meeting compliance obligations under the *National Environmental Policy Act of 1969* (NEPA). If proposed Contractor actions are outside the analysis performed for the *Final Environmental Impact Statement for the Tank Waste Remediation System* (April 1996), *Record of Decision for the Tank Waste Remediation System*, and/or related supplement analyses, then the Contractor shall provide technical information and support to DOE for NEPA compliance on the proposed Contractor actions.

(B) The U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), and/or the Washington State Department of Health (WDOH) will regulate radioactive and non-radioactive air emissions. The Contractor shall support integration within the Hanford Site-wide air compliance framework, including the Hanford Air Operating Permit.

(C) EPA and Ecology will regulate and administer all permits for treatment and storage operations under the RCRA and the *State of Washington Hazardous Waste Management Act* (HWMA). Contractor actions shall support integration with the Hanford RCRA Permit (WA7890008967).

(D) Ecology, WDOH, and/or local agencies will regulate liquid effluent and solid waste. The Contractor shall provide technical and regulatory support for all required permitting and compliance activities associated with WTP liquid effluent and solid waste.

(E) EPA regulates certain substances under the *Toxic Substances Control Act of 1976* (TSCA). TSCA regulations are applicable to Hanford tank waste. Portions of the Hanford tank waste contain polychlorinated biphenyls (PCB) at concentrations below 50 parts per million (ppm) which are regulated under TSCA as PCB bulk remediation waste.
The presence of PCBs may be concurrently regulated under other environmental regulations including RCRA, *Clean Air Act*, and *Clean Water Act*. Certain vitrification secondary waste stream disposal activities (e.g., waste water discharges to the Effluent Treatment Facility) may be subject to existing PCB discharge limitations.

DOE is pursuing a PCB regulatory strategy with EPA, Region 10, and Ecology under risk-based disposal pathway in accordance with 40 CFR 761.61(c). DOE has established an initial engineering basis of 50 ppm total PCBs as PCB bulk remediation waste for the WTP waste feed envelope. DOE is also pursuing a radiological exemption for waste under 40 CFR 761.50.

The Contractor shall provide technical and regulatory support for WTP activities, and product and secondary waste disposition related to TSCA regulation.

(d) The Defense Nuclear Facilities Safety Board (DNFSB) is responsible for nuclear safety oversight authority of DOE and its activities related to the WTP. As directed by the Contracting Officer, the Contractor shall conduct activities in accordance with DOE

commitments to the DNFSB, which are contained in implementation plans and other DOE correspondence to the DNFSB. The Contractor shall support preparation of DOE responses to DNFSB issues and recommendations that affect Contract scope.
As directed by the Contracting Officer, the Contractor shall fully cooperate with DNFSB and provide access to work areas, personnel, and information, as necessary.
The Contractor shall maintain a document process consistent with the DOE Manual on interface with the DNFSB (DOE Manual 140.1-1B, *Interface with the Defense Nuclear Facilities Safety Board*) and shall ensure that these requirements flow down to the lowest-tier subcontractors.

C.5 DESCRIPTION OF CONTRACT REQUIREMENTS AND DELIVERABLES

The Contractor shall perform five major activities: (1) Design Transition; (2) Facility and Process Design; (3) Construction Management and Procurement; (4) Acceptance Testing; and (5) Facility Commissioning. Summary-level requirements for each of these activities are provided in this section, with additional requirements provided in Sections C.6, *Standards*; C.7, *Facility Specification*, C.8, *Operational Specifications*; and C.9, *Interface Control Documents*. Best commercial practices shall apply when a Standard, Specification, or Interface Control Document (ICD) is not provided.

(a) Design Transition: The Contractor shall update the plan for transition submitted as part of the Contractor's proposal, install Contractor management systems, and evaluate the WTP Conceptual Design and supporting information.

(1) Plan for Transition: The Contractor shall submit a plan for transition to DOE in accordance with Standard 1, *Management Products and Controls*.

(2) Receive the Waste Treatment and Immobilization Plant Conceptual Design: The Contractor shall receive the WTP Conceptual Design and supporting information from the Tank Farm Contractor as described in Section J, Attachment K, *Listing of WTP Conceptual Design and Supporting Information*; additional information shall also be provided.

(3) Due-diligence Reviews: The Contractor shall evaluate the WTP Conceptual Design and supporting information as part of the Contractor's responsibility as design authority. Key areas of review include:

(i) All process and facility design documentation and analyses;

(ii) Technology planning and testing information;

(iii) Waste form qualification strategies;

(iv) Environmental permitting documentation (e.g., Dangerous Waste Permit Application [DWPA], Air Permits);

(v) ISMS, hazards and safety analysis information, authorization basis, and safety standards;

(vi) Limited Construction Authorization Request;

(vii) Safeguards and Security (SAS) requirements;

(viii) ICDs; and

(ix) Cost and schedule baseline.

(4) The Contractor shall select and integrate a subcontractor into the WTP Project team to provide the necessary operability and commissioning capability. Selection of the subcontractor shall be completed by April 15, 2001, (Table C.5-1.1, Deliverable C5.1) and is subject to DOE approval. This deliverable shall describe the basis for selection, including the subcontractor's qualifications and experience.

(5) Project Baseline: The Contractor shall use the WTP Project Baseline information provided as part of the WTP Conceptual Design and supporting information and provide a WTP baseline in accordance with requirements in Standard 1, *Management Products and Controls*.

(b) Facility and Process Design: The Contractor shall prepare all design documents and required supporting information.

(1) Design Process: The Contractor shall prepare all design documents and required supporting information.

(2) Design Requirements: The Contractor shall ensure that the facility is designed to meet all requirements, and that these requirements are captured in the Design Criteria Database (DCD).

(3) Design Documents: The Contractor shall design the WTP (Pretreatment, HLW Vitrification, LAW Vitrification, Analytical Laboratory, and Balance of [Plant] Facilities [BOF]) consistent with the functional requirements identified in Standard 2, *Research, Technology, and Modeling*, Standard 3, *Design*, Section C.7, *Facility Specifications*, Section C.8, *Operational Specifications*, and Section C.9, *Interface Control Documents*.

(4) Waste Treatment and Immobilization Plant Optimization: The Contractor shall perform optimization as described in Standard 3, *Design*.

(5) Design Reviews: The Contractor shall conduct periodic design, constructability, and operability reviews to status the design activities, and resolve design oversight comments from DOE in accordance with Standard 3, *Design*.

Additional requirements are provided in Standard 3, *Design*.

(c) Construction Management and Procurement: The Contractor shall plan and execute all construction, procurement, and acceptance testing.

(1) Provide a Construction, Procurement, and Acceptance Testing Plan;

(2) Identify all long lead procurement actions and describe the contracting approach and method of performance;

(3) Procure all required material and equipment;

(4) Prepare bid and work packages;

(5) Manage or perform all required construction; and

(6) Manage the construction site and provide all required construction support services.

Additional requirements are provided in Standard 4, *Construction, Procurement, and Acceptance Testing*.

(d) Acceptance Testing: The Contractor shall provide integrated construction acceptance test plans and procedures for DOE approval. Additional requirements are provided in Standard 4, *Construction, Procurement, and Acceptance Testing*.

(e) Facility Commissioning: The Contractor shall commission, demonstrate operational performance, and transition the WTP to the Operations Contractor. Additional requirements are provided in Standard 5, *Commissioning*.

(f) Objectives for the amount of Contractor self-performed work are contained in Section H, Clause H.13, *Self Performed Work.*

(g) Table C.5-1.1, Deliverables, summarizes the specific deliverables the Contractor shall provide to DOE and the subsequent DOE actions. Neither the DOE review of the deliverables nor the decision of DOE to proceed with construction or commissioning shall impose any responsibility on the DOE for adequacy, quality, or completeness of the deliverables. The Contractor remains solely responsible for the adequacy, quality, and completeness of such work and the performance of the WTP under this Contract.

Unless otherwise specified, DOE will provide written comments to the Contractor within 30 days of receipt of the deliverable identified in Section C, *Statement of Work*.

If requested in writing by DOE, the Contractor shall address all DOE mandatory comments and resubmit the deliverable within 30 days after receipt of DOE comments.

The contractor shall not proceed with implementation of changes to deliverable 3.3(a) of Table C.5-1.1 until 5 working days after DOE receives notification of the change. (M171)

Table C.5-1.1, Deliverables

Item No.	Deliverable	Reference	Action Required	DOE Action Party	Point of Delivery	Contract Due Date
C5.1	Select a Commissioning Contractor	Section C.5 [C.5(a)(4)]	A	D	COR (M131)	4/15/2001
1.1	Plan for Transition	Section C.5 [C.5(a)(1)]	A	D	COR (M131)	2/15/2001
1.2	Project Execution Plan	Standard 1 [Std. 1 (b)(2)]	A	D	COR (M131)	12/15/2006 with updates as required
1.3	Earned Value Management System Description	Standard 1 [Std. 1 (a) & (b)(3)]	A	D	COR (M131)	4/15/2001 with updates as required
1.4	Interface Management Plan	Standard 1 [Std. 1 (b)(1) and C.9(b)]	A	D	COR (M131)	6/29/2001 with updates as required
1.5	WTP Project Baseline	Standard 1 [Std. 1 (d)(3)]	A	D	COR (M131)	4/15/2001 with updates as required
1.6	Baseline Risk Plan	Standard 1 [Std.1 (c)(1)]	A	D	COR (M131)	7/1/2001 with annual updates as required

Table C.5-1.1, Deliverables

Item No.	Deliverable	Reference	Action Required	DOE Action Party	Point of Delivery	Contract Due Date
1.7	Monthly Status Report	Standard 1 [Std. 1 (c)(4), (a)(2)(i)(d) & (d)(1), Std 3 (g)(3), and Std 4 (f)(2)]	I	D	COR (M131)	First Wednesday of the second month
1.8	Occurrence Reporting	Standard 1 [Std. 1 (d)(5)] (M147)	A	D	COR (M131)	as required
1.9	ES&H Reporting	Standard 1 [Std. 1 (d)(6)] (M147)	A	D	COR (M131)	as required
1.10	Contract Performance Report	Standard 1 [Std. 1 (d)(2)	I	D	COR (M131)	Last Wednesday of each month (M147)
1.11	Change Control Program Procedure	Standard 1 [Std. 1 (a) & (a)(4)]	A	D	COR (M131)	05/15/03 with updates as required Delivery 30 days after contract modification – implementation 60 days after Approval
1.12	Electronic Data	Standard 1 (d)(3) & (4)	I	D	COR (M131)	Last Wednesday of each month (M147)
2.1	Updated Research and Technology Program Plan	Standard 2 [Std. 2 (a)(1)(ii) & C.7 Table C.7-1.1 Note 1]	A	D	COR (M131)	4/15/2001 with annual updates through 2004 and with updates as needed from 6/30/2008 through the initiation of cold commissioning
2.2	R&T Test Plans	Standard 2 [Std. 2 (a)(2)(i) & (a)(3)(ix)]	I	D	COR (M131)	as required
2.3	R&T Test Reports	Standard 2 [Std. 2 (a)(2)(ii) & (a)(3)(ix)]	C	D	COR (M131)	as required
2.4	Regulatory Data Quality Objective (DQO)	Standard 2 [Std. 2 (a)(3)(i)(D)]	A	D	COR (M131)	TBD as negotiated

Table C.5-1.1, Deliverables

Item No.	Deliverable	Reference	Action Required	DOE Action Party	Point of Delivery	Contract Due Date
2.5	Operations Research Assessment	Standard 2 [Std. 2 (b)(1) & Std 3 (c)(6)(ii)(A)]	C	D	COR (M131)	12/19/2008, 6/19/2010, FEBRUARY of 2012, MAY of (310) 2014 and 2016 and after completion of Cold Commissioning and completion of Hot Commissioning (239)
2.6	WTP Tank Utilization Assessment	Standard 2 [Std. 2 (b)(2)]	C	D	COR (M131)	12/19/2008, 6/19/2010, FEBRUARY 2012, AUGUST 2014 (310), NOVEMBER 2016 (310), and after completion of Cold Commissioning and completion of Hot Commissioning (239)
2.7	DELETED (230)					
2.8	Technical Report on Oxidative Leaching	Standard 2 [Std. 2 (a)(3)(ix)]	C	D	COR (M131)	TBD
2.9	Test Report on Oxidative Leaching	Standard 2 [Std. 2 (a)(3)(ix); Std 5 (e)(3)(ii)]	C	D	COR (M131)	TBD
2.10	Proposed Process Steps for Sludge Treatment	Standard 2 [Std. 2 (a)(3)(iii) & C.7(d)(1)(vii)]	A	D	COR (M131)	one year before the start of cold commissioning for the Pretreatment Facility **(255)**
2.11	Proposed Deminimus Organic Concentration in Received Tank Waste	Standard 2 [Std. 2 (a)(3)(viii)]	A	D	COR (M131)	12/31/2012 **(255)**
3.1	Design Process	Standard 3 [Std. 3 (a)(2)]	I	D	COR (M131)	2/15/2001 1/15/2004
3.2	Functional Specification	Standard 3 [Std. 3 (b)(1)]	I	D	COR (M131)	8/20/2001 with updates as required
3.3 (a)	Basis of Design	Standard 3 [Std. 3 (b)(2) & C.7(b)(1)]	C (M171)	D	COR (M131)	8/20/2001 with updates as required
3.3 (b)	Design Criteria Database	Standard 3 [Std. 3 (b)(3)]	M	D	COR (M131)	30 days after issue of Basis of Design, with updates as required

Table C.5-1.1, Deliverables

Item No.	Deliverable	Reference	Action Required	DOE Action Party	Point of Delivery	Contract Due Date
3.4	Operations Requirements Document	Standard 3 [Std. 3 (b)(4)]	A for bolded document text and M for non-bolded document text	D	COR (M131)	8/20/2001
3.5	Master Equipment List	Standard 3 [Std. 3 (c)(6)(i)]	C	D	COR (M131)	Prior to ORR completion
3.6	Analytical Laboratory Design Requirements	Standard 3 [Std. 3 (c)(18) & C.7(a)(9)] **(350)**	A	D	COR (M131)	10/1/2001 and as required thereafter
3.7	Site Layout Drawings	Standard 3 [Std. 3 (c)(19)]	A	D	COR (M131)	4/15/2001 and as required thereafter
3.8	Optimization Studies	Standard 3 [Std. 3 (d)]	A	D	COR (M131)	3/15/2001
3.9	Spare Parts List	Standard 3 [Std. 3 (c)(6)(ii, iii, & iv)]	C	D	COR (M131)	Prior to Completion of the Operational Readiness Reviews **(M196)**
3.10	Deleted					
4.1	Construction, Procurement, and Acceptance Testing Plan	Standard 4 [Std. 4(a), (f)(3) & (i)]	A on initial Deliverable and I for any subsequent updates	D	COR (M131)	As required
4.2	Purchasing System	Standard 4 [Std. 4 (b)(2)]	A	D	COR (M131)	As required
4.3	Construction Bid and Work Packages	Standard 4 [Std. 4(c)]	I	D	COR (M131)	As required
4.4	Construction and Acceptance Testing Program	Standard 4 [Std. 4(f)(1)]	A	D	COR (M131)	Prior to start of construction
4.5	Construction Overview Meetings	Standard 4 [Std. 4(h)]	M	D	COR (M131)	Ongoing
4.6	Construction Emergency Response Plan	Standard 4 [Std. 4(j)]	I	D	COR (M131)	Prior to Start of Limited Construction
4.7	As-built Program Description	Standard 4 [Std. 4(f)(5)	C	D	COR (M131)	June 2009
5.1	Commissioning Plan	Standard 5 [Std. 5(c)]	A	D	COR (M131)	12 months prior to start of cold commissioning, as required thereafter
5.2	Deleted					

Table C.5-1.1, Deliverables

Item No.	Deliverable	Reference	Action Required	DOE Action Party	Point of Delivery	Contract Due Date
5.3	Waste Form Qualification Tests	Standard 5 [Std. 5 (e)(3)(i)]	P	D	COR (M131)	during cold commissioning
5.4	Cold Commissioning Capacity Tests	Standard 5 [Std. 5 (e)(3)(ii)]	A	D	COR (M131)	during cold commissioning
5.5	DELETED (A029)					
5.6	Resultant Products from Cold Commissioning	Standard 5 [Std. 5 (e)(1)]	P	D	COR (M131)	during cold commissioning
5.7	Environmental Performance Test	Standard 5 [Std. 5 (e)(3)(v)]	A	D	COR (M131)	during cold commissioning
5.8	Cold Commissioning Results	Standard 5 [Std. 5 (e)(5)]	A	D	COR (M131)	prior to hot commissioning
5.9	Certification of Completion of Cold Commissioning	Standard 5 [Std. 5 (e)(6)]	A	D	COR (M131)	when complete
5.10	Certification of Readiness for Hot Commissioning Start	Standard 5 [Std. 5 (g)(1)]	A	D	COR (M131)	prior to hot commissioning
5.11	Certification of Hot Commissioning Start	Standard 5 [Std. 5 (g)(3)]	A	D	COR (M131)	Upon receipt of Tank Farm waste feed
5.12	Hot Commissioning Capacity Tests	Standard 5 [Std. 5(g)(5)]	A	D	COR (M131)	during hot commissioning
5.13	Resultant Products from Hot Commissioning	Standard 5 [Std. 5 (g)(iii & iv)]	P	D	COR (M131)	during hot commissioning
5.14	Hot Commissioning Results and Documentation	Standard 5 [Std. 5 (g)(6)]	A	D	COR (M131)	upon completion of hot commissioning
5.15	Certification of Completion of Hot Commissioning	Standard 5 [Std. 5 (g)(7) & 5(m)(1, 3 & 4)] **(350)**	A	D	COR (M131)	when complete
5.16	Facility Turnover	Standard 5 [Std. 5(m)(7)]	A	D	COR (M131)	after successful commissioning
5.17	Deleted					
5.18	Cold Commissioning Simulant Definition	Standard 5 [Std. 5 (b) & Table C.6-5.1 Note 1.]	A	D	COR (M131)	24 months prior to the initiation of cold commissioning
5.19	WTP Facility Transition Plan	Standard 5 [Std. 5 (i); (j); & (m)(7)]	A	D	COR (M131)	12 months prior to the initiation of hot commissioning
5.20	Cold Commissioning Capacity Test Criteria	Standard 5 [Std. 5(e)(3)(ii) & Table C.6-5.1 Note 2]	A	D	COR (M131)	Prior to completion of Deliverable 5.8

Table C.5-1.1, Deliverables

Item No.	Deliverable	Reference	Action Required	DOE Action Party	Point of Delivery	Contract Due Date
5.21	Hot Commissioning Capacity Test Criteria	Standard 5 (Std. 5(g)(4) & Table C.6-5.2 Note 1))	A	D	COR (M131)	Prior to completion of Deliverable 5.14
5.22	WTP Operational Readiness Support Plan (Jointly submitted with Tank Farms Operating Contractor (TOC) as TOC deliverable C.2.3.2-1) (**257**)	Standard 5 [Std, 5 (f) (i)]	A	D	COR	9/30/2013 with annual updates thereafter **(285)**
6.1	Secondary Wastes Compliance Plan	Standard 6 [Std. 5 (e)(1)(i) & (e)(3)(i & ii), Std. 6(b), (c)(3 & 4), C.8 Spec. 9.2.2.5]	A	D	COR (M131)	2004, 2006, 2008, and as required thereafter
6.2	IHLW Waste Form Compliance Plan	Standard 6 [Std. 2 (a) (3)(vii)(B); Std 5 (e)(1)(i) & (e)(3)(i & ii); Std. 6 (b), (c)(2 & 4), C.7(d)(2)(i), C.8 (Spec. 1 (1.4) & Spec. 13 (13.3.2))]	A	D	COR (M131)	2004, 2005, 2007, 2009, and as required thereafter
6.3	ILAW Product Compliance Plan	Standard 6 [Std. 2 (a)(3)(v)(B),Std. 5 (e)(1)(i) & (e)(3)(i & ii); Std. 6(b) & (c)(1 & 4), C.7(d)(3)(i); C.8 Spec. 2, 2.2.2.11, & 2.4]	A	D	COR (M131)	2004, 2006, 2008, and as required thereafter
6.4	IHLW Product Qualification Report	Standard 6 [Std. 6 (c) (5) & (6)]	C/A	D	COR (M131)	Plan in 2004, report in 2008 and as required thereafter
6.5	Production Documentation for IHLW Product	Standard 6 [Std 6 (c)(9)]	A	D	COR (M131)	at time of production
6.6	ILAW Product Qualification Report	Standard 6 [Std. 6(c)(5) Spec. 2 (2.2.7.1)]	C/A	D	COR (M131)	Plan in 2004, report in 2007 and as required thereafter
6.7	Production Documentation for ILAW Product	Standard 6 [Std 6(c)(9); C.8 Spec. 2, 2.2.2.6.2 & 2.2.2.7.2]	C/A	D	COR (M131)	at time of production

Table C.5-1.1, Deliverables

Item No.	Deliverable	Reference	Action Required	DOE Action Party	Point of Delivery	Contract Due Date
6.8	Deleted					
6.9	Reserved					
6.10	Secondary Wastes Production Documentation	Standard 6 [Std. 6 (c)(9)]	C/A	D	COR (M131)	at time of production
6.11	Deleted					
7.0	Non-radiological Worker Safety and Health	Standard 7 [Std 7 (e)(1)]	R	D	COR (M131)	per Standard 7.a(1)
7.1	Deleted (M166)					
7.2	Quality Assurance	Standard 7 [Std 7 (e)(3); C.8 Spec 2, 2.3 and Spec 12, 12.3]	A/R	D	COR (M131)	4/15/2001
7.3	Environmental Plan	Standard 7 [Std 7 (e)(4) & (e)(4)(vi)(A)]	A	D	COR (M131)	3/15/2001 and as required thereafter
7.4	Deleted					
7.5	Dangerous Waste Permit Application	Standard 7 [Std 7 (e)(4)(vi)(B)]	A	D	COR (M131)	as required
7.6	Risk Assessment Work Plan	Standard 7 [Std 7 (e)(4)(vi)(C) & Std 5 (e)(3)(v)]	A	D	COR (M131)	as required
7.7	Notice(s) of Construction	Standard 7 [Std 7 (e)(4)(vi)(D)]	A	D	COR (M131)	150 days prior to submission to the regulators
7.8	Prevention of Significant Deterioration (PSD) Permit Application	Standard 7 [Std 7 (e)(4)(vi)(E)]	A	D	COR (M131)	150 days prior to submission to the regulators
7.9	Petition for Exemption or Exclusion for IHLW	Standard 7 [Std 6(c)(7), Std 7 (e)(4)(vi)(F)]	A	D	COR (M131)	06/2005
7.10	Petition for a New Treatment Standard	Standard 7 [Std 6 (c)(8), Std 7 (e)(4)(vi)(G)]	A	D	COR (M131)	08/2003
8.0	Safeguards and Security	Standard 8 [Table S8-1]	A	D	COR (M131)	see Table S8-1
9.1	Radiological, Nuclear and Process Safety (M166)	Standard 9 [Std 9]	R	D	COR (M131)	Various (**303**)

Table C.5-1.1, Deliverables

Item No.	Deliverable	Reference	Action Required	DOE Action Party	Point of Delivery	Contract Due Date
C.7-1	Procedure to Determine the Waste Feed Treatment Approach	C.7(d) (1)(vii) Spec. 12	A	D	COR (M131)	one year before the start of cold commissioning for the Pretreament Facility **(255)**
C.8-1 **(350)**	Compositional and radionuclide limits for Envelope E	C.8 Spec 7 (7.2.2.1)	C	D	COR	TBD
C.9.1	Interface Control Documents	Section C.9	J	D	COR (M131)	7/15/2001, 3/15/2002, and as required
H.1	Environmental Permits	Clause H.26 (d)(**M152**)	A	D	COR (M131)	ongoing
H.2	Litigation Management Plan	Clause H.33	A	D	COR (M131)	4/15/2001
H.3	Deleted					
H.4	Property Management System (M120)	Clause H.51	A	D	COR (M131)	10/1/2008, with annual updates thereafter

Legend Definitions:

A Approval — The deliverable shall be provided to DOE for review and approval. DOE will review the deliverable and provide comments in writing. Comments will be discussed through the partnering process and the Contractor is required to provide written responses using Review Comment Records. Documents shall be re-written to incorporate all DOE mandatory comments. Once a deliverable or document has been approved by DOE, it shall be placed under change control and no changes to that document shall be made without DOE approval. All documents and deliverables that previously had a “K” designation and that were concurred upon by DOE shall be deemed “approved” by DOE.

C Review and Comment — The deliverable shall be provided to DOE for review and comment. DOE will have the option for reviewing the information and providing comment. The Contractor shall respond to all written comments in Review Comment Records form. DOE comments that cannot be resolved in the appropriate partnering team shall be elevated to the Project Management Team for resolution.

D U.S. Department of Energy, Office of River Protection.

COR Contracting Officer’s Representative (M131)

I Information — The deliverable shall be provided for information purposes only. DOE will have the option of reviewing the information and providing comments through the partnering process. Such comments do not require resolution under the Contract.

J Jointly Developed, Review and Comment — The ICDs shall be jointly developed with DOE, the Tank Farm Contractor, and Hanford Site contractors. The deliverable shall be provided to DOE for review and comment. DOE will have the option for reviewing the information and providing comment. The Contractor shall respond to all written comments. DOE comments that cannot be resolved in the appropriate partnering team shall be elevated to the senior management for resolution.

M Monitor — The deliverable shall be developed with input from DOE. DOE will be highly involved as the deliverable is developed, and will monitor the progress of the deliverable. DOE comments shall be discussed in the partnering teams as the deliverable develops. If DOE direction is determined to be appropriate, DOE shall provide such direction in writing.

P Product Acceptance — As defined in Specification 13.

R Regulatory Deliverable Approval — Will be performed in accordance with Standard 7 or Standard 9, as appropriate.

C.6 STANDARDS

This Section consists of the following Standards, which describe requirements for managing, constructing, and commissioning the WTP, and related activities:

Standard 1: Management Products and Controls
Standard 2: Research, Technology, and Modeling
Standard 3: Design
Standard 4: Construction, Procurement, and Acceptance Testing
Standard 5: Commissioning
Standard 6: Product Qualification, Characterization, and Certification
Standard 7: Environment, Safety, Quality, and Health
Standard 8: Safeguards and Security
Standard 9: Radiological, Nuclear, and Process Safety

1.0 References

The following listed References are not included in Section J, Attachment E - List of Applicable Directives (List B-DEAR 970.5204-78)

1.1 HNF-3638. Revision 1. *Standard Electronic Format Specification for Tank Waste Characterization Data Loader: Version 2.4*

1.2 PNNL-12040. Revision 0. *Regulatory Data Quality Objectives Supporting Tank Waste Remediation System Privatization Project*. K.D. Wiemers, et al. Dated December 1998.

1.3 PL-W375-EN00003. Revision 1. *Environmental Performance Demonstration Plan*, J.R. Markillie. Dated April 28, 2000

1.4 HNF-SD-WM-SP-012. Revision 6. *Tank Farm Contractor Operation and Utilization Plan*. Dated January 2007.

1.5 Washington Administrative Code (WAC) 173-303. “Dangerous Waste Regulations”

1.6 SW-846. *Test Methods for Evaluating Solid Waste*, *Physical/Chemical Methods*. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

1.7 ASME/NQA-1. 2000. *National Consensus Standard* (M066) (A143) (M152)

Standard 1: Management Products and Controls

This Standard describes the required management products and controls. The Contractor shall provide all necessary management and technical information and support necessary to meet the requirements of U.S. Department of Energy (DOE) Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, CRD, to enable DOE to meet the data requirements of the Integrated Planning, Accountability, and Budgeting System (IPABS), and to ensure transparency in project performance and efficiency in project execution. The Contractor shall also support the DOE Office of River Protection (ORP) in developing and maintaining the integrated River Protection Project (RPP) Baseline.
All management and technical information developed under this Contract shall be accessible electronically by the Government (271).

(a) Baseline Description and Requirements:

The Contractor shall develop and maintain a contract-compliant integrated and traceable technical scope, schedule, and cost baseline for the Waste Treatment and Immobilization Plant (WTP) Project. The baseline shall be managed in accordance with the process documented in the Earned Value Managment System Description (Table C.5-1.1, Deliverable 1.3) and the Baseline Change Control Program Procedure (Table C.5-1.1, Deliverable 1.11) consistent with the below concepts and provisions:

Variances will be managed and approved through the Contractor's Trend Process as defined in Deliverables 1.3 and 1.11. Variances are accrued following the realization of circumstances that could have plausibly been anticipated or mitigated by the responsible control account manager(s).

Baseline Change Proposals (BCPs) will be managed and approved through the Contractor's processes as defined in Deliverables 1.3 and 1.11. BCPs are processed when circumstances could not have plausibly been anticipated or mitigated by the responsible control account manager(s). BCPs are generated and approved at the Contractor's discretion with the below exceptions:

- BCPs generated to convert project variances to budget, effectively reconciling a variance to enable improved manageability.
- BCPs generated to support the cost and schedule impacts from a Request for Equitable Adjustment. These BCPs (for REAs) will change the Total Estimated Contract Cost and may become the basis for earning additional fee.

The baseline and management thereof shall comply with this standard; ANSI/EIA-748A-1998, *Earned Value Management Systems* (EVMS); and DOE Order 413.3B, CRD.
The baseline shall include (271):

- WTP Project technical requirements as delineated in (a)(1);
- Schedule to implement project work scope as described in (a)(2); and
- Project cost to implement project work scope on the schedule as described in (a)(3).

The technical scope, schedule, and cost baseline (WTP baseline) shall be maintained using a baseline change control process as further described in (a)(4).

(1) Technical Baseline: The Contract technical baseline is represented by a series of documents which define the basis for current cost or schedule estimates. Changes to these documents shall be evaluated for impact to project cost and/or schedule and captured by a baseline change proposal where necessary.
The following documents shall be viewed collectively as the baseline technical scope for the cost/schedule control system:

(i) Contract Statement of Work;

(ii) Approved Functional Specification pursuant to Contract Standard 3, paragraph (b)(1);

(iii) Approved Basis of Design pursuant to Contract Standard 3, paragraph (b)(2);

(iv) Approved Authorization Basis pursuant to 10 CFR 830;

(v) Approved Operations Requirements Document (bolded text);

(vi) Approved Interface Control Documents;

(vii) Permit Requirements; and

(viii) Approved Level 2 Work Breakdown Structure (WBS) Dictionary Sheets.

(2) Schedule Baseline: The WTP baseline schedule shall be an activity-based, logic-driven schedule. The schedule logic shall be integrated with a networked hierarchy containing detailed tasks necessary to ensure successful project execution. The schedule shall support networked summarization at Level 1, Project Summary Schedule, Level 2, Executive Level Schedule, Level 3, Project Intermediate Schedule, to the Level 4, Detailed Working Schedule.
The scheduled activities shall be vertically traceable to the RPP Integrated Master Plan (IMP), the WBS, and EVMS control accounts. The WTP schedule shall be used to verify attainability of the contract level milestone defined in Contract Section F.1(b), to evaluate progress toward meeting program objectives through tracking Activity and Facility Milestones as outlined in Section B.4(c), and to integrate the program schedule activities with all related work activities and milestones.

The following requirements shall be addressed at the appropriate level within the schedule hierarchy:

(i) Scheduling Requirements: The WTP schedule shall be developed using a 24-month rolling schedule concept which is statused monthly and extended semi-annually. The near-term schedule shall be more detailed than activities past the 24-month cutoff.

a. The schedule shall include all significant external interfaces and critical items from suppliers, teammates, or other detailed schedules that depict significant and/or critical elements and Government furnished equipment or information dependencies. The determination of significant and critical Government interface requirements shall be mutually defined and documented.

b. The schedule shall be updated according to the Contractor's management control system and shall be submitted no less frequently than monthly. The schedule may reflect data either as of the end of the calendar month or as of the Contractor's accounting period cutoff date, provided it is consistent and traceable to the Monthly Status Report.

c. The schedule shall contain discrete tasks/activities through contract completion including Contract milestones contained in Section B, Attachment B-2-C.

d. Monthly schedule analysis shall be performed to assess schedule progress to date and included as part of the monthly status report (see paragraph (d)(2)(v)b). The analysis shall include changes to

schedule assumptions, variances above agreed thresholds to the baseline schedule, causes for the variances, potential impacts, and recommended corrective actions to minimize schedule delays. The analysis shall also identify potential problems and an assessment of the critical path and near-critical paths for the five subprojects and the overall contract.

e. The schedule shall be created using a Critical Path Method (CPM), network capable Commercially Off-The-Shelf (COTS) scheduling software application. The schedule shall be delivered electronically in the native digital format (i.e., an electronic file produced within the Contractor's scheduling tool) as part of the monthly report.

f. The level of detail in the schedule (including number and duration of tasks/activities) shall follow the Contractor's Project Controls System Description, program directives, etc. A sequence of discrete tasks/activities in the network that has the longest total duration through each subproject and the overall WTP Contract shall be identified as the subproject and project critical paths, respectively.

(ii) In addition, the Contractor shall develop the necessary modeling capability at a rough order of magnitude (ROM) level of accuracy to support "what-if" evaluations within five (5) working days of request. This modeling system shall provide model by dollars and reasonably represent planned expenditures by month for the first fiscal year and each fiscal year thereafter. Level of effort activities shall be added to the model as well as undistributed budget in planning packages so that each fiscal year can balance against known funding.

(3) Cost Baseline: The WTP cost baseline is the latest DOE-approved Performance Measurement Baseline (PMB) and Total Allocated Budget (TAB) including any negotiated or directed changes and approved baseline change proposals, together with the following PMB supporting documentation:

(i) Total contract cost and subproject costs including a summary description of facility design, process design, operational concept, and schedule.

(ii) Status of facility design, construction, and related procurements.

(iii) Description of the methodology of how the estimate was developed.

(iv) A WBS dictionary which includes a detailed technical description of the scope to be performed at the WBS Level 2, as defined in paragraph (b)(3)(ii).

(v) Backup materials necessary to understand the estimate shall be agreed to prior to submittal of the estimate. Examples include quantity takeoffs, equipment lists, detailed specifications, plans and drawings, calculations, databases used, historical data, cost estimating relationships, and actual quotes.

(vi) Details of distributable costs, methods of allocation, and a description of the work covered by distributable costs and how they were estimated and developed.

(vii) Explanation and description of Defense Contract Audit Agency (DCAA)-validated overhead and general and administrative rates used.

(viii) Examples of how standard base rates are burdened to arrive at estimated hourly rates.

(ix) Definitions and delineation for and categorization of costs into labor, material, equipment, travel, taxes, contingency, and other.

(x) Full delineation of any use of productivity or related factors that clearly identifies when and where used and basis for the utilization.

(xi) Written analysis of how cost and schedule contingency was determined. This includes all pertinent information necessary to understand and perform the calculations.

(xii) Estimate history; if the current estimate is a revision to an earlier estimate, provide reconciliation between estimates.

(xiii) Basis of escalation.

(xiv) Subcontractor cost estimates, traceable to the WTP cost estimate and WBS, if available, shall be provided upon request.

(xv) Risk mitigation plans and activities.

(4) Baseline Change Control Process: The baseline change control process will be rigorous and disciplined to ensure that the scope, schedule and cost baseline is accurate, up-to-date, and capable of providing meaningful data and information. In concert with DOE, the Contractor shall develop and implement a Change Control Program Procedure (Table C.5-1.1, Deliverable 1.11). The procedure shall be submitted to DOE for approval prior to implementation and shall address:

(i) Establishing and maintaining a WTP change control board (CCB).

(ii) Authority levels and processes for approving variances and baseline change proposals.

(iii) Minimum BCP documentation requirements.

(iv) Cost and schedule estimate requirements.

(v) Advance Work authorization process.

(vi) Incorporating changes into the baseline EVMS cost and/or schedule modules.

(vii) Budget source and impact on project risk.

(viii) BCP impact on facility BCWS profiles.

(ix) Categorization methods for BCPs that clearly differentiate between in-scope and out-of-scope changes and variances.

(5) Spending at Variance: In some circumstances, the Contractor may exceed authorized budget levels for a specific control account when a baseline change is not warranted, such as cost overruns. The Contractor's change control system shall track and manage changes in estimates at completion (EAC) as a separate but integrated part of the overall change control process. Change control records shall maintain clear distinction between approved baseline and EACs.

(6) Reserved (A192)

(7) Project Funding:

The Contractor shall use the DOE-approved WTP Project cost baseline as the basis for the subproject and total project funding profile that is required to complete the Contract scope. The WTP funding profile shall comply with Congressional appropriations. The funding profile shall include engineering, procurement, construction, and commissioning baseline costs (including management reserve as well as DOE contingency), and estimated fees that will be paid. The Contractor shall provide on a monthly basis, Form DD 1586, Aug 96, DID-MGMT-81268, Contract Funds Status Report (CFSR), or approved equal for each control point (Table C.5-1.1, Deliverable 1.10)

Identification of management reserve shall be reported monthly and shall include the impact on the life cycle of the Contract.

(b) Controlled Management Documents: The following documents shall be submitted for approval by DOE in accordance with the schedule in Table C.5-1-1, Deliverables:

(1) Interface Management Plan: DOE (as lead), the Tank Farm Contractor, and the WTP Contractor shall develop and implement an interface management plan (Table C.5-1.1, Deliverable 1.4). The interface management plan shall:

(i) Recognize the DOE role as the owner of the WTP and as the final decision authority for any interface issues that are not resolved between the other parties.

(ii) Define the scope of each interface and provide a brief description of the required deliverables (products, documents, procedures, services, etc.) through interface control documents (ICD).

(iii) Define organizational points of contact for participants.

(iv) Define interface requirements, controls, and applicable source documents for each interface.

(v) Involve appropriate RPP organizations and Hanford Site contractors in the integration, review, and approval process of ICDs and implement changes to ICDs through the appropriate change control process and, if necessary, contract changes.

(vi) Involve individuals with the appropriate level of organizational responsibility and authority to ensure the interface is implemented and functioning. DOE/ORP will identify points of contact for each interface document.

(vii) Identify, track, and elevate issues for management review in the Monthly Status Report.

(2) Project Execution Plan (PEP): The Contractor shall prepare a PEP that describes the approach for managing and controlling the project at the Contractor level. The PEP shall be approved by DOE (Table C.5-1.1, Deliverable 1.2), and shall focus on Contractor policies, methods, and approaches for the integration of project scope, schedule, and cost information in ensuring compliance with Contract and regulatory requirements. The Contractor PEP shall address the approach the Contractor will use to implement the requirements pertaining to project control processes including:

(i) Management structure, responsibilities, and authorities;

(ii) Integrated safety management;

(iii) Quality assurance;

(iv) Safeguards and security;

(v) Permitting;

(vi) Construction acceptance, test, and evaluation;

(vii) Acquisition planning;

(viii) Contract management;

(ix) Systems engineering;

(x) Configuration management;

(xi) Waste Treatment process change control;

(xii) Information management and reporting;

(xiii) External Interface management;

(xiv) Work management;

(xv) Risk management;

(xvi) Construction project management; and

(xvii) Communications and stakeholder involvement.

(3) Control System Description: The Contractor shall provide for DOE approval a Earned Value Management System Description meeting the requirements of DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, CRD; and ANSI/EIA-748-A-1998, *Earned Value Management Systems* (EVMS) (Table C.5-1.1, Deliverable 1.3). The system description shall describe the management processes and controls that will be utilized to manage and control work and complete contract requirements. Upon approval by the Contracting Officer, the Contractor shall fully implement the project control system. The Contractor shall obtain Contracting Officer approval prior to implementing materially significant changes to the system description. The Contracting Officer may direct compliance reviews to determine whether the Contractor is operating in accordance with the approved system description and producing accurate planning, budgeting, reporting, and change control data. The Contractor shall provide the Contracting Officer or designated representatives with access to all pertinent records, data, and plans for purposes of initial approval, approval of proposed changes, and the ongoing operation of the project control system (271).

The Earned Value Management System Description shall, at a minimum, include:

(i) A Work Breakdown Structure (WBS) including companion "*dictionary*" descriptions of work for each Level 2 WBS element. The WBS shall provide the basis for all project control system components, including estimating, scheduling, budgeting, performing, managing, and reporting, as required under this Contract.

(ii) The authorized contract Level 2 WBS for this project is as follows:

WBS	TITLE
1	WTP Contract DE-AC27-01RL14136
1.01	Pretreatment
1.02	Low-Activity Waste
1.03	High-Level Waste
1.05	Balance of Facilities
1.06	Analytical Laboratory
1.07 (336)	Direct Feed of LAW (DFLAW) (336)
1.10 (336)	LBL Facility Services (336)
1.15 (336)	Project Services – effective begin date of 10/01/2014 (336)
1.90	Shared Services – effective end date 09/30/2014 (336)

(iii) The organizational breakdown structure with identification of key management positions. A control account shall be assigned to a manager with responsibility and authority to plan and budget the work, and control the resources and work activities within the approved technical, schedule, and cost baselines. The Contractor is also responsible to report status to allow complete rollup of technical, schedule, and cost performance for current reporting periods, cumulative to-date, and at-completion. The Contractor shall maintain and provide a current list of Control Account Managers.

(iv) A description of the technical scope, cost, and schedule baseline development process, and the hierarchy of documents that will be used to describe and maintain that baseline.

(v) Documentation of the process the Contractor intends to use for document control, configuration control, and change control.

(vi) A brief summary of any supporting project control procedures that will be used.

(c) Risk Management:

(1) The Contractor shall implement the risk management process defined in the Contractor's PEP, and DOE Order 413.3B, CRD. The Contractor shall provide a Baseline Risk Plan (Table C.5-1.1 Deliverable 1.6) documenting Contractor budget base risks (scope, schedule, and cost) for DOE approval. The Baseline Risk Plan shall identify the major risks to completing the project within the approved contract baseline, the Contractor's risk management strategies, and mitigation action plans. The Contractor shall submit annual updates of the status of the WTP Baseline Risk Plan. The Baseline Risk Plan shall meet the following requirements (271):

(i) Project risks shall be identified along with their probabilities and consequences.

(ii) Risks identified as Critical (Critical Risk List) shall be evaluated with each submittal for change in the unmitigated and residual risk levels.

(iii) Project risks shall be identified by facility. (A151)

(2) The Contractor shall provide a monthly status of work scope actions directly attributed to DOE-owned risks (Technology, Programmatic, and Operational). The Contractor shall also support the identification, categorization, and development of risk-handling strategies for newly identified DOE-owned risks,

and support the annual update to the RPP Risk Management Plan as requested by DOE.

(3) Risk and decision management activities, for DOE owned risks, shall be coordinated on a continuing basis with DOE (as lead), Tank Farm Contractor, and Hanford Site contractors. Contractor risk analysis information pertaining to "cross-cutting" decisions shall be communicated to DOE, the Tank Farm Contractor, and Hanford Site contractors, including recommendations as to who should have the lead for managing each risk. The Contractor shall document risks associated with ICDs and prepare issue resolution plans for DOE approval.

(4) The Contractor shall include forecasts of expected changes to risk assessment status in the Monthly Status Report (Table C.5-1.1, Deliverable 1.7).

(d) Project Reporting: The Contractor shall develop a reporting system that reports project performance on the technical scope, schedule, and cost profile. The requirements and procedures for this system shall be defined in the Earned Value Management Systems Description. The following routine reports are required:

(1) Monthly Status Report: The Contractor shall prepare a monthly status report representing the prior month's performance and transmit it to DOE by the first Wednesday (M147) of the second month following data cutoff (Table C.5-1.1, Deliverable 1.7). The Monthly Status Report shall be a written report that includes, but is not limited to, the following:

(i) Project manager narrative assessment;

(ii) Safety statistics;

(iii) Quality issues;

(iv) Significant accomplishments and progress towards completion of project milestones and objectives;

(v) Monthly summarized earned value analysis for WBS Level 1;

(vi) Reserved (A192)

(vii) Potential problems, impacts, and alternative courses of action; for example staffing issues, assessment of the effectiveness of actions taken previously for significant issues, or the monitoring results of recovery plan implementation;

(viii) Status of decisions, including DOE decisions, and information requirements for those decisions;

(ix) Change control section that summarizes the scope, technical, schedule and cost impacts resulting from approved and implemented as well as proposed baseline change actions;

(x) Project and subproject cost avoidance actions taken;

(xi) Forecasted changes to last risk assessment;

(xii) Six (6)-month critical path look-ahead and milestone (Activity, Facility, and Contract level milestones) at Level 2 WBS;

(xiii) Report of proposed changes that impact DOE, site interfaces, or Contract level milestones; and

(xiv) Single driving critical path analysis derived from Level 4 Schedule for WBS 1 and 2.

(2) Contract Performance Report: The Contractor shall prepare monthly EVMS information reports by WTP Project and subproject in the listed Office of Management and Budget (OMB) Contract Status Report formats (DID-MGMT-81466) or equivalents,representing the prior month's performance and transmit the report to DOE by the last Wednesday of the month following data cutoff (Table C.5-1.1, Deliverable 1.10). Reporting requirements below shall be reviewed on an annual basis and necessary adjustments will be authorized by the Contract Officer.

(i) Format 1, DD Form 2734/1, Mar 05, Work Breakdown Structure (WBS);

a. At Level 2 WBS, Control Account Level (CA)

(ii) Format 2, DD Form 2734/2, Mar 05, Organizational Categories;

a. At Level 2 Organizational Breakdown Structure (OBS), Level 3 OBS, CA

(iii) Format 3, DD Form 2734/3, Mar 05, Baseline;

a. At the Control Account Level by Contract changes, management reserve application, and internal replanning categories

(iv) Format 4, DD Form 2734/4, Mar 05, Staffing;

a. At Level 2 Organizational Breakdown Structure (OBS), Level 3 OBS, CA

(v) Format 5, DD Form 2734/5, Mar 05, Explanations and Problem Analysis;

a. Variance Analysis in accordance with the following thresholds:

i. At the Control Account Level

(a) Current Period Variance: $250K

(b) Cumulative Variance: +/- 10 percent or $1,000K, whichever is less

(c) Variance at Completion: +/- 10 percent or $5,000K, whichever is less

b. Schedule analysis in accordance with Data Item Description DI-MGMT-81650, Integrated Master Schedule:

i. WBS Level 2 critical paths against construction completion: < 0 days total float; critical paths addressed through the monthly report (paragraph (1)(xiv)) do not have to be duplicated in Format 5.

ii. Progress against milestones; performance against milestones addressed through the monthly report (paragraph (1)(viii)) do not have to be duplicated in Format 5.

iii. Performance against planned system turnover and startup sequence

iv. Provide analysis native files of the following:

1. The schedule activities that have slipped six (6) months (relative to their corresponding baseline activity) OR lost 50 percent of their float from the current baseline schedule.

2. An analysis of the activities meeting the above criteria AND have less than or equal to 100 days of float in the current schedule will be provided in the CPR format 5 as well as electronically.
3. An Early Start and Early Finish stepchart metrics will be provided that shows the number of activities in the current schedule that have moved outside their baseline schedule completion year, the number of activities that have remained in their baseline schedule completion year, and the metrics from paragraph 1 above.
4. Graphical presentation of the number of activities with less than 100 days float in the current schedule compared to the number of activities with less than 100 days float in the baseline through completion of the project.
5. All graphical data shall be provided in tabular form.
6. Graphical presentation of cumulative number of baseline activities scheduled to be complete and number of those activities that did not complete.

(vi) DD Form 1586, Aug 96, DID MGMT-81268, Contract Funds Status Report or approved equal for each control point.

(3) Baseline Revisions and Data Maintenance Report: The Contractor shall prepare monthly reports that document and reconcile the current baseline (scope, schedule and budget elements) with the project baseline established through the May 2006 submittal of the WTP Project Baseline update (Table C.5-1.1, Deliverable 1.5) and transmit it electronically to DOE by the last Wednesday of the month following data cutoff (Table C.5-1.1, Deliverable 1.12). At a minimum, this report shall include logs and metrics that track and trend change activity by WBS Level 2 and OBS Level 3, Control Account. Include CPR Format 3 detail, Contract Budget Base Log; Performance Measurement Baseline Log; and Baseline Change Proposal Log.

(4) Electronic Data: Earned value data provided via compact disc for the following: (a) Engineering Performance and Progress Report data files; (b) Quantity Unit Rate Report data files; (c) COBRA data files and reports; (d) baseline schedule; (e) current schedules; (f) Cost and Commitment Log; (g) Equipment Management System database; (h) Inception to Date Report for Permanent Plant Equipment Awards; (i) Bechtel Estimating Tool Kit (BETK); (j) Commodity Curves; (k) Special Purpose Charge Code Activity Log for all Not to Exceed Contracting Officer Authorizations; (l) Earned Purchase Order Value (EPOV) data; (m) Engineering Job Hour Variance Analysis Reports; (n) Work Package variance analyses, as available; and (o) Area and Project Review presentation packages. Earned value data is to be provided on the last Wednesday of the month following the data cutoff to the Contracting Officer and the Contracting Officer's Representative (Table C.5-1.1, Deliverable 1.12). (A151)

(5) Occurrence Reporting: The Contractor shall adhere to DOE Order 232.2, *Occurrence Reporting and Processing of Operations Information,* Supplemental Contractor Requirements Documents (SCRD), with Hanford Site-specific requirements and methods for notification (Table C.5-1.1, Deliverable 1.8). The Contractor shall also adhere to the requirements of the ORP Supplemental (S) CRD to DOE Order 232.2 **(256).**

(6) Environment, Safety, and Health Reporting: In addition to the *Occupational Safety and Health Act of 1970* and the *Price Anderson Amendments Act of 1988* (10 CFR 820) reporting requirements, the Contractor shall report all information specified in DOE Order 231.1B (310). The Contractor process will specify this requirement in contracts down to the lowest-tier subcontractor. The Contractor process will accumulate and provide a single report responding to requirement information for both the Contractor and all subcontractors (Table C.5-1.1, Deliverable 1.9). For occurrence reporting the Contractor shall adhere to the requirements of the Supplemental Contractor Requirements Document (SCRD) of DOE Order 232.2 **(256)**.

(7) Accident Investigation: The Contractor and, as necessary, all subcontractors shall support accident investigations for accidents that may occur during Contractor activities. The Contractor and all its subcontractors shall establish and maintain readiness to respond to accidents, mitigate potential consequences, assist in collecting and processing evidence, and assist with the accident investigation. This shall include preserving the accident scene and providing support to the accident investigation board.

(8) Reserved (A192)

(9) Electronic Data Upload to PARS II: Each month the contractor shall upload WTP performance data to the new DOE Project Assessment and Reporting System (PARS II), using a DOE-provided data extractor for cost and schedule data, by the last workday of the month following the fiscal month end, for the fiscal month period. Change Control and variance analysis data will be provided to PARS II by an upload of a Portable Document Format (PDF) of the appropriate monthly reports for the fiscal month period as well.

Standard 2: Research, Technology, and Modeling

This Standard describes the Research and Technology (R&T) Testing Program requirements as well as process and facility modeling requirements.

(a) Research and Technology Testing Program:

(1) Research and Technology Program Plan:

(i) The Contractor shall maintain and update an R&T Program Plan that describes the research and testing work activities that will be conducted to support process and facility design, determine plant process operating limits, support qualification testing of the waste forms (IHLW and ILAW) and secondary wastes, and provide information to support environmental permitting and the authorization basis.

(ii) The Contractor shall submit for DOE approval, the revised R&T Program Plan (Table C.5-1.1, Deliverable 2.1). All Contractor-proposed changes shall be clearly identified. The R&T Program Plan activities will be logically tied to the project baseline and baseline risk assessment described in Standard 1, *Management Products and Controls*. For each testing activity, the R&T Program Plan shall identify the following summary-level information: the purpose and scope of the test, including the extent of information known at the time the plan is issued; the performing organization; and the method(s) to test and analyze information used to support the design process, determination of operating limits, permitting, operations, and/or waste qualification activities.

(iii) The R&T Program Plan will be updated as needed to close out technical risks. All Contractor-proposed changes to the R&T Program Plan shall be traceable to the driver for the change; for example, if an optimization change in Standard 3, *Design*, results in the need to change planned research and technology, the driver for the change shall be identified in the revised R&T Program Plan.

(2) Research and Technology Requirements:

(i) The Contractor shall provide DOE copies for information of the Contractor-approved draft test plans for all process verification, including the determination of process operating limits and product qualification testing, at least fifteen (15) calendar days in advance of conducting the test(s). Approved test plans shall be provided to DOE (Table C.5.-1.1 Deliverable 2.2).

(ii) DOE will be provided draft copies of test reports for comment during the Contractor report review period, and the Contractor shall provide to DOE completed test reports for process verification testing and product qualification within two (2) months after the approval by R&T Program Manager (Table C.5-1.1, Deliverable 2.3). At DOE's request, for tests lasting more than six (6) months, an interim report or update via presentations shall be provided at approximately the halfway point of the test. When a test is run with simulants rather than actual tank waste, the report shall compare the results to work performed with tank waste, if data is available.

(iii) The Contractor shall utilize the results of completed and ongoing testing activities performed as part of the WTP Conceptual Design and supporting documentation in estimating facility and unit operations performance. The Contractor shall not reinitiate or repeat a test unless the scope of the test plan is presented to DOE in writing, and DOE agrees to the conduct of the testing.

(iv) The integrated process flowsheet and material balances shall be supported by the process verification test results. All process verification and product qualification tasks shall be conducted in accordance with the DOE-concurred upon QA Program.

(v) All IHLW qualification work shall be conducted in accordance with a DOE-concurred upon QA Program that complies with the requirements of the *Quality Assurance Requirements and Description Document* (QARD), DOE/RW-0333P, Revision 20. No HLW glass testing scoping work will be performed without prior agreement by DOE.

(3) Required Research and Technology Testing:

(i) Characterization of Low-Activity Waste and High-Level Waste Feeds: The Contractor shall characterize Hanford tank waste for purposes of determining that feed meets feed specification requirements, supporting WTP environmental permitting activities, establishment of the WTP authorization basis, process verification testing, and product qualification testing. The Contractor shall request tank waste samples for this scope through ICD 23, *Waste Treatability Samples*, in order to perform the studies.

The analysis requirements for the as received and treated tank waste samples shall be defined by the Contractor in Contractor test plans. The Contractor shall provide test plans and interim reports to DOE at appropriate intermediate steps, and final reports in accordance with the requirements of Standard 2, *Research, Technology, and Modeling*. All analytic results shall be reported to DOE in accordance with *Standard Electronic Format Specification for Tank Waste Characterization Data Loader: Version 2.4* (HNF-3638, Revision 1), Lockheed Martin Corporation, Richland, Washington.

Characterization information for the samples shall include: viscosity, density, particle size distribution (if sufficient solids are present in samples), chemical composition, radiochemical composition, hazardous materials composition consistent with the analysis requirements of the Dangerous Waste Permit, authorization basis, and solids solubility versus concentration (if sufficient solids are present in samples).

(A) The Contractor shall compare actual tank waste analytical data to waste stream-modeling results to validate modeling results. If errors in modeling are observed the models shall be adjusted appropriately.

(B) The Contractor shall use tank waste samples to analyze, test, and assess the capability of the proposed waste treatment processes to meet the requirements for producing an IHLW form that can meet HWMA and RCRA de-listing technical requirements in accordance with Specification 1, *Immobilized High-Level Waste*, and for producing a Land Disposal Restrictions (LDR)-compliant ILAW form

in accordance with Specification 2, *Immobilized Low-Activity Waste*.

(C) The Contractor shall determine if the sample materials meet Specification 7, *Low-Activity Waste Envelopes Definition*, limits for LAW samples and Specification 8, *High-Level Waste Envelope Definition*, limits for HLW samples. The entrained solids in the LAW feed samples shall be characterized (where solids of sufficient quantity are available in the treatability samples) in accordance with Specification 7.2.2.1.

(D) The Contractor shall implement and execute the Regulatory Data Quality Objectives (DQO) entitled *Regulatory Data Quality Objectives Supporting Tank Waste Remediation System Privatization Project*, K.D. Wiemers, et al., dated December 1998, Revision 0, No. PNNL-12040 (Table C.5-1.1, Deliverable 2.4).

During the Contract period, the Contractor shall propose to DOE methods to optimize the DQO, and develop the test specifications and plans consistent with the DOE-revised DQO. As available, data and data needs identified during the treatment facility permitting process, the Risk Assessment Work Plan, and LDR/Delisting efforts will be used as inputs to the optimization process.

(E) The DQO characterization scope for R&T testing shall include characterization of the first HLW feed and first LAW feed (AY-102 [solids and supernatant]) (unless agreed to otherwise with DOE through optimization of the DQO).

(ii) Waste Separations Processing Testing: The Contractor shall continue to test and validate the capability of LAW pretreatment processes for removal of entrained solids (where solids of sufficient quantity are available in the treatability samples), ^{137}Cs, ^{90}Sr, and TRU elements, to meet ILAW product requirements. Activities shall address ability to meet contract requirements, operating requirements, operating limits, plant throughput requirements, and information for regulatory permits and the authorization basis. Radioactive testing shall be used to validate simulants and the results from simulant testing. Process scale-up shall be demonstrated with tank waste or appropriate simulants, as described below.

(A) Ion exchange chemical and radiological durability and regeneration properties shall be demonstrated. Determination of gas generation from the columns shall be determined. Scale-up of resin manufacturing shall be demonstrated and batch-to-batch consistency requirements shall be determined and the impacts addressed.

(B) The ^{90}Sr and TRU removal precipitation reaction mechanism shall be characterized via testing.

(iii) Validation of Sludge-Washing Process: The Contractor shall conduct sludge treatment testing using radioactive samples provided by DOE, and nonradioactive testing to develop and demonstrate process flowsheets and equipment systems to perform sludge washing, caustic leaching and oxidative leaching to minimize the volume of HLW glass produced.

Development testing of the sludge treatment process steps shall include evaluation of process recycles and ultrafilter system cleaning.

The testing results shall be provided to DOE for review and comment. Proposed process steps shall be submitted to DOE for review and approval (Table C.5.1-1, Deliverable 2.10).

Upon completion of sludge treatment scale-up and confirmatory testing with the Pretreatment Engineering Platform, the test system shall be flushed and dried to facilitate storage and preservation for a period in excess of one year. This condition shall be dry for piping and components that were used in contact with process simulant.

(iv) Immobilized Low-Activity Waste Process Testing: The Contractor shall conduct testing to determine the appropriate operating conditions for the LAW melter. Information to be obtained shall include:

(A) Determination of maximum waste loading (including sulfate incorporation) and melter throughput rates for waste envelopes A, B, and C. The Contractor shall continue to investigate glass formulations optimized to incorporate sulfate. These glasses prepared from simulants shall be subjected to the Product Consistency Test and Vapor Hydration Test in accordance with ILAW Specification 2.2.2.17, *Waste Form Testing.* In addition, the process ability of the glass formulation shall be assessed.

(B) Determination of offgas compositions for regulatory purposes and effects on the mass material balance due to recycle streams and secondary waste streams.

(C) Confirmation of the design concept for selected offgas equipment.

(D) Determination of operating conditions or melter feed additive requirements to minimize foaming and process-upset conditions.

(E) Monitor testing to assist in estimating maximum offgas flow requirements in an upset condition.

(F) Determination that glasses produced from a continuously-fed melter meets product specifications and requirements.

(G) Ability to remotely fill and seal full scale packages to Contract requirements (Specification 2).

(v) Immobilized Low-Activity Waste Qualification Testing:

(A) The Contractor shall prepare laboratory scale samples of ILAW glasses from the waste samples provided by DOE. The waste samples shall have been pretreated in accordance with the Contractor's LAW feed pretreatment processes.

(B) The Contractor shall use glasses prepared from DOE-supplied samples and Contractor prepared simulants to demonstrate that Contract requirements can be met (Specification 2). The tests

shall be consistent with the DOE-concurred upon ILAW Waste Form Compliance Plan (Table C.5-1.1, Deliverable 6.3). Glass composition ranges that meet operating and contract requirements shall be identified with non-radioactive glass testing. A planned target composition shall be identified for each glass composition range.

(C) For target glass compositions, radioactive glasses prepared with pretreated tank waste shall be used to demonstrate the ILAW durability requirements of Specification 2.2.2.17, *Waste Form Testing*. For Specifications 2.2.2.17.1 and 2.2.2.17.3, non-radioactive glasses may be used provided that the results from 2.2.2.17.2 are consistent for the non-radioactive glass and the radioactive glass.

(D) The Contractor shall obtain sufficient information for determining that the products meet LDR requirements in accordance with Standard 6, *Product Qualification, Characterization, and Certification*, and as needed to implement the DOE-concurred upon *Final Approach for ILAW LDR Compliance*, and to support the Standard 7 Contractor-prepared petitions for Hanford tank waste treatment standards.

(E) The Contractor shall provide samples, testing data, and compositional analysis to DOE for performance assessment analysis. Samples will only be provided when requested in advance by DOE; archiving of these samples is not required. The Contractor shall actively participate in the performance assessment effort to arrive at suitable compositions for processing and disposal purposes.

(vi) Immobilized High-Level Waste Process Testing: The Contractor shall conduct testing to determine the appropriate operating conditions for the HLW melter. Information to be obtained shall include:

(A) Determination of maximum waste loading and melter throughput rates for waste Envelope D and the products resulting from pretreatment of the LAW feed.

(B) Determination of offgas compositions for regulatory purposes and effects on the mass material balance due to recycle streams.

(C) Confirmation of the appropriateness of selected offgas equipment.

(D) Determination of operating conditions or melter feed additive requirements to minimize foaming and process-upset conditions.

(E) Determination of maximum offgas flow requirements, in an upset condition.

(F) Determination that glasses produced from a continuously fed melter produce glass that meets product specifications.

(G) Ability to fill full-scale packages to Contract requirements (Specification 1).

(vii) Immobilized High-Level Waste Qualification Testing:

(A) The Contractor shall prepare laboratory scale samples of IHLW glasses from the waste samples provided by DOE. The waste samples shall incorporate pretreatment Envelope D products from the pretreatment of the LAW samples provided by DOE.

(B) The Contractor shall use glasses prepared from DOE supplied samples and Contractor prepared simulants to demonstrate that Contract requirements can be met (Specification 1). The tests shall be consistent with the DOE-concurred upon IHLW Waste Form Compliance Plan (Table C.5-1.1, Deliverable 6.2) and relevant documents. Glass composition ranges that meet operating and contract requirements shall be identified with non-radioactive glass testing. A planned target composition shall be identified for each glass composition range.

(C) For target glass compositions, radioactive glasses prepared with pretreated tank waste shall be used to demonstrate the IHLW durability requirements described in Specification 1.

(D) The Contractor shall provide IHLW glass properties data and information in a form that allows DOE to further develop glass properties models. These models will include: (1) liquidus temperature; (2) volume fraction of crystals below the liquidus temperature; (3) viscosity as a function of temperature; (4) Toxicity Characteristic Leach Procedure; and (5) Product Consistency Test.

(E) The Contractor shall obtain sufficient information for determining that the products meet LDR and can be delisted in accordance with Standard 6, *Product Qualification, Characterization, and Certification*, as needed to implement the DOE-concurred upon *Final Approach for IHLW Delisting*, and to support the Contractor-developed Standard 7 petitions for exemption or exclusion of IHLW from RCRA.

The Contractor shall prepare full-scale prototype IHLW canister waste forms composed of simulated IHLW glass within the 4.5-meter tall, austenitic stainless steel canister. After filling the canister with simulated IHLW glass and canister closure, the Contractor shall test the IHLW canister to demonstrate compliance with the *Waste Acceptance System Requirements Document* (WASRD), Specification 4.8.3, *Dimensional Envelope for HLW Canisters*, and 4.8.4, *Filled HLW Canister Weights*. Drop tests shall be conducted to demonstrate compliance with WASRD Specification 4.8.8, *HLW Canister Drop*. (M047)

(viii) Effects of Separable Organics: The Contractor shall evaluate the effects of trace quantities (~25 ppm) of separable organics (tributyl phosphate and normal paraffin hydrocarbon) in the tank waste liquid feed to the WTP and the fate of the separable organics within the system. Each potentially affected unit operation (including ion exchange elution and evaporation) shall be examined for process, safety, and permitting implications. Based upon the results of these tests, the Contractor shall propose a deminimus concentration level for separable organics that could be sent to the WTP without adversely affecting the WTP (Table C.5-1.1, Deliverable 2.11).

(ix) Oxidative Leaching: The Contractor shall conduct a literature review and prepare a technical report (Table C.5-1.1, Deliverable 2.8 Technical Report on Oxidative Leaching) that evaluates the treatment processes for the oxidative leaching of chemical components (principally chromium [Cr] and associated components; i.e., sulfate) that limit the loading of HLW solid oxides in the HLW glass waste form. The literature review shall summarize existing experimental results and data, and present conceptual and realistic process flowsheets including the identification of process equipment and operating conditions. Based upon the study results, the Contractor shall provide a recommendation on the preferred process to conduct required separations.

The Contractor shall conduct technology testing work using simulants and actual waste testing to provide design and process operational information on the process used to remove Cr from the HLW waste stream. The process should have the capability to remove Cr from the pretreated HLW stream such that this chemical component, or reagents added to remove this component does not limit the HLW waste loading in the glass waste form. The Contractor shall test a minimum of (2) radioactive tank waste samples. (SY-102 and a second sample that must be provided so that analysis with sample SY-102 can be run concurrently) The test shall be conducted to provide proof of process demonstration (part of Deliverables 2.2 and 2.3), identify operating limits for plant processes, and to determine any impacts to the facility throughput and/or availability. The Contractor shall make recommendations to ORP for the modification of Specification 12, *Procedure to Determine the HLW Feed Treatment Approac*h and Specification 1, *Immobilized High-Level Waste*, Table TS-1 limits for Cr_2O_3 and sulfate, based upon the results of this experimentation. (Table C.5-1.1 Deliverable 2.9, Test Report on Oxidative Leaching).

(x) Vessel Mixing: The Contractor shall plan and perform large scale testing of pulse jet mixed vessels for both non-Newtonian and Newtonian vessel designs. Scope to be addressed includes planning, preparation, and performance of testing, including completion of test reports that supports:

1) Substantiation of the committed design;
2) Engineering, procurement, and construction risk reduction;
3) Design confirmation including benchmarking or validating Computational Fluid Dynamic models and low order models; and
4) Waste Treatment and Immobilization Plant (WTP) commissioning risk reduction.

Key equipment such as test vessels used in this work shall be designed such that reuse in potential future post commissioning testing to support

continued WTP operations is not precluded.

Detailed objectives for testing shall include:

1. Confirmation of scaling parameters for both non-Newtonian and Newtonian vessels. If scaling is not confirmed, alternate methods, such as full scale testing shall be performed as needed. Simulants shall include non-Newtonian and Newtonian slurries as applicable;
2. Confirmation of mixing performance with complex simulants including Newtonian and non-Newtonian that challenge the range of expected tank waste physical properties;
3. Definition and demonstration of heel removal system capability;
4. Determination and demonstration of mixing system limiting conditions of design including safety limits and operating limits;
5. Confirmation of prototypic level and density instrument function;
6. Confirmation of integrated pulse jet fluidics, mixing, sampling, and transfer system operations; and
7. Demonstrating the PJM control strategy including logic and transition with prototypic equipment through the range of operating conditions.

Large scale test objectives shall be documented and substantiated in a formal Request for Technology Development (RTD). The RTD shall be provided to DOE for review and comment. The results of test work shall be subject to error analysis prior to use in the final design. Simulant design and analysis requirements shall be specified. Simulant preparation shall be governed by a procedure, and the simulant shall be verified and validated to meet requirements before testing is initiated. **(221) (300) –** ***This sub-paragraph (x) is superseded by paragraph (h) in Standard 3.***

(b) Process and Facility Modeling Requirements:

The Contractor shall develop and use analytical models to predict and evaluate plant performance using ORP provided tank waste characterization information, waste feed vectors, and WTP Research and Technology (R&T) data, to support WTP process and facility design, support pre-operational planning assessments, and support technical integration with Tank Farm Contractor waste feed staging and product and secondary waste acceptance activities. The Contractor shall, at a minimum, use the following models:

(1) Operations Research Assessment of the Waste Treatment and Immobilization Plant: The Contractor shall conduct Operations Research assessments for the Pretreatment Facility, HLW Vitrification Facility, LAW Vitrification Facility, and Analytical Laboratory to determine that the WTP design incorporates appropriate design and operational features to meet integrated facility availability requirements and reduce construction and/or operations costs. The assessment shall include Balance of Facilities (BOF) including the glass former facility and where separate evaluations show a BOF system's predicted availability could impact integrated plant availability. Integrated facility assessments shall be performed to evaluate compliance with Contract Section C.7 (b) integrated facility availability. The scope of the assessments to estimate WTP facility availability shall include:

(i) Sampling and analysis requirements including sample turnaround times;
(ii) Vessel capacities;
(iii) Times to conduct individual process steps in unit operations;

(iv) Time for mechanical handling steps;
(v) Equipment reliability and availability time estimates;
(vi) Failure rates of critical instrumentation and control systems;
(vii) Time to diagnose equipment failures and preparation for repair; and
(viii) Time estimates for maintenance and repair of facility and process systems.

The Contractor shall separately document the basis for equipment reliability including estimates of mean time before failure, mean time to repair, and probability distributions for these assumptions.

The Contractor shall use the Operations Research Model to estimate the waste treatment capacity of each of the WTP facilities and the integrated WTP facility. The confidence level for the Operations Research Model assessment waste treatment capacity results shall be presented. Key equipment components and equipment systems which influence treatment capacity shall be identified and ranked.

The Operations Research Assessment shall be used to provide a basis for establishing the spare parts inventory list (Standard 3(c)(6)).

Where reliability, availability, maintainability, and inspectability (RAMI) data is not currently available, the Contractor shall make reasonable assumptions based upon best available information. The proposed configuration of the Operational Research Model, and major assumptions (e.g., process flow configuration, process flowsheet, RAMI input data) shall be presented to U.S. Department of Energy (DOE) for review and approval prior to completion of the model runs used to demonstrate Section C.7 compliance with treatment capacity requirements.

The Operations Research Model results, assumptions, model input parameters, and definition of the model output results shall be clearly documented and provided to DOE for comment (Table C.5-1.1, Deliverable 2.5). The Operations Research Model and outputs shall be updated as necessary, to support major design change assessments and reflect the latest design and information from R&T that would impact availability.

Electronic copies of the Operations Research assessments shall be provided to DOE with each completed assessment.

(2) Waste Treatment and Immobilization Plant Tank Utilization Assessments:
The Contractor shall perform Tank Utilization Assessments under specific feed vector assumptions provided by DOE and will be based upon the compositional limits defined in Specification 7, *Low-Activity Waste Envelopes Definition* and Specification 8, *High-Level Waste Envelope Definition*, tank waste inventory estimates, and the results of testing with actual tank waste samples. The Contractor shall perform Tank Utilization Assessments to support assessments of design changes that would affect model outcomes. The models shall reflect the latest design and information from research and technology. DOE shall review and approve the specific assumptions when the Tank Utilization Assessment model is used to evaluate Contract Section C.7 (b) design capacity requirements. The primary software used to run the dynamic flowsheet shall be Gensym G2 or other software as agreed to by DOE. The Contractor shall assess utilization of process tank capacity and supporting equipment capability and operational characteristics, to ensure that the tanks are appropriately sized to support process operations, sampling and analysis turnaround times, process control requirements, and waste form qualification requirements. The model assessments shall include material balance summaries of major chemical and radiochemical components to support

demonstration of model assessment integrity. Results shall be provided to DOE for review and comment (Table C.5-1.1, Deliverable 2.6).

The flowsheet and material balances shall estimate the quantity of ILAW, IHLW, and relevant secondary streams on an annual basis.

The material balances will be based on three standards for chemical composition estimation. The Standards are:

(i) Best available information that is based upon the analysis of tank waste samples planned to be treated in the WTP;

(ii) Agreed upon waste input inventory; and

(iii) Specification 7, *Low-Activity Waste Envelopes Definition*, and Specification 8, *High-Level Waste Envelope Definition*, concentration maximums.

The Contractor should evaluate the process chemistry predictions based on the material balance results. Unresolved process chemistry predictions should be verified through additional literature reviews and process chemistry testing.

Electronic copies of the Tank Utilization Assessments shall be provided to DOE with each completed assessment.

(3) Evaluation of River Protection Project Mission Waste Feed Vector: The Contractor shall evaluate the waste feed vector, provided by the Tank Farm Contractor, through DOE, to identify the characteristics that may limit the WTP treatment rate prior to completing Tank Utilization Assessments used to evaluate WTP performance. Comments, if any, shall be provided to the Tank Farm Contractor on any characteristics (e.g., solids concentration, chemical composition and radiochemical composition) that can improve processability of the projected waste feed compositions. The waste feed vector shall be adjusted by the Tank Farm Contractor, prior to use by the Contractor, to evaluate WTP performance. Tank Farm Contractor adjustments to the waste feeds are constrained by data limitations, as well as waste storage and retrieval infrastructure.

Electronic copies of the Tank Utilization assessments shall be provided to DOE with each completed assessment.

(4) Deleted **(230)**

(5) Configuration Control: The Contractor will establish and maintain a configuration control system to manage the models and analyses. The models and analyses will be subject to the QA and configuration control requirements imposed upon the Design Process in Section C.4, *Environment, Safety, Quality, and Health*, and Standard 1, *Management Products and Controls*.

Standard 3: Design

This Standard describes the Contractor's responsibilities for conducting facility design functions, maintaining design documentation, and conducting design reviews. The intent is to ensure that the Contractor has the necessary systems, processes, information, and deliverables in place to allow DOE evaluation that the WTP Project is proceeding appropriately.

(a) Design Process:

The Contractor shall perform the following activities:

(1) Acquire and place under configuration control all records from previous contractors within one (1) month of Contract award. The Contractor shall transition the WTP Conceptual Design and supporting information developed through Contract award.

(2) Provide to DOE for information the Contractor‘s design process (Table C.5-1.1, Deliverable 3.1). The process shall meet all requirements; laws and regulations; ensure that design is performed in controlled, safe, and efficient manner; and implement best industry practices. As changes to the process are made, the changes shall be provided to DOE for information.

(b) Establish and Maintain Facility Design Requirements: The Contractor shall comply with the Contract design process and the following:

(1) Functional Specification: The Contractor shall prepare a Functional Specification that defines the technical operational requirements of the WTP based on the WTP Conceptual Design and supporting documentation (Table C.5-1.1, Deliverable 3.2). This document shall define the waste treatment requirements, environmental compliance requirements, and authorization basis requirements of the facility as currently known and understood. The Functional Specification shall describe the process/functional requirements of the WTP, including:

(i) WTP feed characteristics including quantities, treatment rates, and mechanical, physical, chemical, and radiological properties (by ranges, envelopes, tanks, or transfer batches);

(ii) ILAW and IHLW product characteristics such as quantities, mechanical, physical, chemical, and radiological properties (by ranges, envelopes, tanks, or transfer batches);

(iii) Services and utility requirements, operating materials and supplies, and other inputs;

(iv) Estimates of effluents, emissions, solid wastes, by-products, and other outputs; and

(v) WTP operations limits.

(2) Basis of Design: The Contractor shall prepare for DOE review and comment (Table C.5-1.1, Deliverable 3.3(a)), and as changes occur (M171) a Basis of Design Document that identifies directly or by reference design requirements and design codes and standards that will serve as a basis for the continued design of the WTP. The Basis of Design shall be based on the WTP Conceptual Design, (including the Basis of Design directly developed in that phase), and supporting documentation. The Basis of Design shall be generally organized by discipline and shall at a minimum identify:

(i) Environmental permitting requirements from State laws and regulations, the Dangerous Waste Permit Application (DWPA), Notice(s) of Construction (NOC), Prevention of Significant Deterioration (PSD), etc.;

(ii) Summary of the WTP site characteristics, including climatic, geotechnical, and natural phenomena data (with numerical values specifically preferred where practical; otherwise, referenced to identified source);

(iii) Design requirements for the WTP;

(iv) Allowable process and atmospheric temperatures, pressures, flow rates, for design conditions (with numerical values specifically preferred where practical; otherwise, reference to identified source); and

(v) Applicable codes and standards, regulations and guidelines.

(3) The Contractor shall prepare for DOE review a Design Criteria Database (DCD) (Table C.5-1.1, Deliverable 3.3(b)). The DCD shall be used to identify potential design inputs from the design criteria contained in the source documents. The DCD shall be based on the WTP Conceptual Design and supporting documentation and updated as source documents are revised. The DCD shall contain design criteria extracted verbatim from the following source documents (and others as appropriate):

(i) Initial Safety Analysis Report (Preliminary Safety Analysis Report [PSAR]/Final Safety Analysis Report [FSAR] when submitted/approved);

(ii) Integrated Safety Management Plan;

(iii) Radiation Protection Plan for Design and Construction;

(iv) Safety Requirements Document-Volume II;

(v) Deleted **(226)**;

(vi) RPP-WTP Contract;

(vii) Basis of Design;

(viii) Functional Specification;

(ix) Operations Requirements Document;

(x) Deleted **(226)**;

(xi) Partial Construction Authorization Requests(s) (when submitted/approved);

(xii) Construction Authorization Request(s) (when submitted/approved);

(xiii) Dangerous Waste Permit Application (when submitted/approved);

(xiv) Notices of Construction (when submitted/approved);

(xv) Prevention of Significant Deterioration to the Environment (when submitted/approved); and

(xvi) Interface Control Documents.

(4) Operations Requirements Document: The Contractor shall prepare an Operations Requirements Document for DOE review and approval (Table C.5-1.1, Deliverable 3.4) based on the WTP Conceptual Design and supporting documentation. The operations requirements document shall define requirements for WTP life-cycle operations, including commissioning. These requirements will influence WTP design features to ensure cost efficient operations and provide for accurate life-cycle cost estimates, planning, and informed decision-making. The Operations Requirements Document shall include at a minimum:

(i) The operations and maintenance philosophy and requirements for the WTP, including requirements for reliability, availability, maintainability, and inspectability;

(ii) Description of the operations and maintenance philosophy for each of the WTP facilities (Balance of Facilities, Pretreatment, HLW Vitrification, and LAW Vitrification);

(iii) Requirements for change rooms, first aid stations, decontamination facilities, lunch rooms, training facilities, control rooms, and operating galleries;

(iv) Requirements for facilities and computer based (simulator) training facilities;

(v) Equipment accessibility for maintenance and operations including both contact and remotely maintained systems, clearances and tolerances allowed in mechanical systems, and housekeeping features;

(vi) Instrument and control requirements for control room and local instruments;

(vii) General sampling and analyses requirements;

(viii) Ergonomics and human factors requirements for operations and maintenance;

(ix) Maintenance and spares philosophy and requirements (including items to be present at transition to the Operations Contractor);

(x) Environmental compliance requirements; and

(xi) Health, safety, and site emergency services requirements.

Upon approval of the Operations Requirement Document, DOE will control the bolded text in the Operations Requirement Document and will consider any proposed changes.

(5) The Contractor shall compare R&T test results with the associated design calculations and design basis when appropriate. Any significant differences shall be reconciled. Test results and any subsequent calculations relating to the design shall be referenced within the appropriate system descriptions and other design control documentation.

(c) Establish and Maintain Design Documentation: The Contractor is required to establish a design process including design documentation and media, that complies with the Design Criteria Documents identified in Standard 3, (b).

Process and equipment design changes with potential impact on plant capacity, operability, or throughput shall require a technical analysis using an Operations Research model and Tank Utilization model to assess impact. (See Standard 2, *Research, Technology, and Modeling*.) Proposed design changes that impact the capacity, operability, and throughput shall be presented to DOE for review.

DOE shall have access to all Contractor-developed design documents and information, including paper and electronic files. The information shall be in the form of controlled copies updated by the Contractor. Information shall include, but not be limited to, the information described below.

Information shall contain relevant references, such as, system descriptions, process data sheets, and equipment data sheets and shall address Pretreatment, LAW Immobilization, HLW Immobilization, Analytical Laboratory, and Balance of Facilities. Changes to the products shall be documented in accordance with approved engineering procedures. DOE shall be invited to attend meetings where design products are updated, revised, or changed and DOE will be provided with copies of design change documentation upon request.

(1) System Descriptions: The system descriptions shall include, by reference or incorporation, all design documents (process flow diagrams, piping and instrumentation diagrams, engineering calculations, process data sheets, R&T development work and test reports, mechanical handling diagrams, mechanical flow diagrams, design proposal drawings, etc.) associated with the applicable systems (241).

(2) Process Data Sheets (Equipment): Provide unrestricted access to a complete file that includes every piece of equipment as an electronic sortable file of all process data sheets with all available information including: the equipment identification number; equipment name and description; the piping and instrument diagrams where the equipment is shown; capacity and operation parameters; and materials of construction.

(3) Process Data Sheets (Instrument Database): Provide unrestricted access to a complete file that includes every instrument as an electronic sortable file of all instrumentation process data sheets, with all available information, including:

(i) The instrument identification number;

(ii) The instrument name and/or description;

(iii) The piping and instrument diagrams where the instrument is shown; and

(iv) The associated R&T test plan results and references to the applicable test plans tied to design decisions via the design requirements documents.

(4) Calculations for Equipment Sizing: The calculation and technical basis for the capacity of major vessels, equipment, and piping shall be provided. The basis shall include, as applicable, sample analysis turnaround times and address reliability, availability, maintainability, and inspectability (RAMI).

(5) General Arrangement Drawings: General arrangement drawings for the WTP (e.g., Balance of Facilities, Pretreatment, LAW Conditioning, Analytical Laboratory, HLW Vitrification, and LAW Vitrification). The general arrangement drawings shall identify plan and elevation views of the facilities in sufficient detail to understand facility layout and the preliminary layout of major equipment components.

(6) Establishment of Master Equipment List:

The Contractor shall develop a Master Equipment List and Spare Parts List to support continuous and safe operations of the WTP facilities. The Master Equipment List and Spare Parts List shall meet the following requirements:

(i) A Master Equipment List shall be developed in an electronically sortable format with sufficient information to provide traceability to the WTP design, sufficient information to procure qualified spare parts, and linkage to preventative and corrective maintenance records (Table C.5-1.1 Deliverable 3.5).

(ii) Spare Parts List shall be established to support WTP operations. The Spare Parts List shall be developed by:

(A) Assessment of the mean time before failure of equipment as identified by the Operational Research Assessments (Standard 2, Deliverable 2.5); and

(B) Assessment of the time required to procure and modify replacement equipment.

(C) Ensuring that the spare parts list supports WTP operations for one (1) year following completion of Hot Commissioning.

(iii) Protected storage locations shall be identified for storage of the spare parts. The Spare Parts List shall be turned over to the Operations Contractor at the time of Contract completion.

(iv) The Spare Parts List, and basis, shall be provided to DOE for review and comment (Table C.5-1.1, Deliverable 3.9).

(7) 3-Dimensional Design Model (3-D Model): The Contractor shall provide access to all files of the 3-Dimensional Design Model (3-D Model). Access is required to support DOE awareness of current and contemplated changes to the design layout and assess proposed changes to the WTP and associated processes.

(8) Process Flow Diagrams: The Contractor shall prepare process flow diagrams for the Pretreatment Plant, HLW Vitrification Plant, and LAW Vitrification Plant. The process flow diagrams shall identify all main process equipment including in-cell equipment and supporting equipment for cold chemical makeup. Identification shall include names, functions, capacities, identification numbers, and include material balance line identifiers in the process flow lines using the numbers traceable to the material balance deliverable. Supporting

documentation shall specify the capacity and duty of the equipment systems, the process scheme and sequence description, and operating conditions.

(9) Material Balance: See Standard 2, *Research, Technology, and Modeling*.

(10) Piping and Instrument Diagrams: The Contractor shall prepare the piping and instrument diagrams for the Pretreatment, HLW Vitrification, Analytical Laboratory, and LAW Vitrification and balance of all other facilities and systems in the WTP. The piping and instrument diagrams shall identify all process and support equipment, instrument requirements, pipe sizes, and line numbers. Simplified control system information shall be presented on piping and instrument diagrams.

(11) Instrument and Control Documents: The Contractor shall prepare the instrument and control documents for the Pretreatment, HLW Vitrification, Analytical Laboratory, and LAW Vitrification and balance of all other facilities and systems in the WTP. These design documents shall include control system specifications, data sheets, software design specifications, and instrument databases. This design shall include features to address process safety and process control for product quality.

(12) Electrical Diagrams: The Contractor shall prepare electrical one-line diagrams for all process and facility systems. Electrical loads and systems, as well as the basis to support specification of the electrical systems, shall be identified.

(13) Equipment Design/Equipment Arrangement Diagrams: The Contractor shall prepare the design of all process and mechanical handling equipment for the Pretreatment, HLW Vitrification, LAW Vitrification, Analytical Laboratory, and Balance of Facilities. Equipment design data sheets shall be completed for all process equipment components. Equipment general arrangement drawings shall specify plan and elevation views.

(14) Equipment Arrangement and Piping Diagrams: The Contractor shall perform all physical design in the 3D model for the Pretreatment, HLW Vitrification, Analytical Laboratory, and LAW Vitrification facilities.

(15) Facility Ventilation System Design: The Contractor shall prepare the ventilation flow diagrams and heating, ventilation, and air conditioning system design for the Pretreatment, HLW Vitrification, LAW Vitrification, Analytical Laboratory, and Balance of Facilities. The diagrams shall identify the individual systems, all equipment components, and flows in the facilities. Sample locations and methods shall be specified. Equipment to provide motive force and ventilation control shall be identified.

(16) Facility Civil, Structural, and Architectural Design: The Contractor shall prepare the civil, structural, and architectural designs of the Pretreatment, HLW Vitrification, LAW Vitrification, Analytical Laboratory, and Balance of Facilities. The building sizes, location and requirements of load-bearing, shielding and internal walls shall be identified. Major penetrations in walls and floors shall be identified. All crane structures, filter housings, and facility mechanical systems shall be identified. Seismic analysis for the facilities for Pretreatment, HLW Vitrification, LAW Vitrification, and support facilities shall be completed in accordance with DOE and Ecology requirements to support structural analysis, definition of the facility, the Limited Work Authorization Request, and Construction Authorization Request.

(17) Mechanical Flow/Handling Diagrams: The Contractor shall prepare mechanical flow diagrams and mechanical handling diagrams for the Pretreatment, HLW Vitrification, LAW Vitrification, Analytical Laboratory, and Balance of Facilities. The diagrams shall be prepared with sufficient detail to support the hazards analysis review and the operations research model. The diagrams shall identify mechanical equipment and each step and sequence of the operation. Mechanical flow diagrams (sequence of operations) maybe either maintained as a standalone document or appended to the Systems Descriptions (241).

(18) Analytical Laboratory Facility Design: The Contractor shall further develop and provide the sampling and analysis requirements to support process control, environmental compliance and waste form qualification for DOE approval (Table C.5-1.1, Deliverable 3.6). The information shall include sample locations, sample purpose, analysis requirements, and frequency and turnaround times. Results of the assessment of process tank capacities and process operations will be used to verify and establish the specification and design of the Analytical Laboratory to support the WTP.

Reserve capacity in the Analytical Laboratory, to the extent there is any, shall be utilized for “limited technology testing” or increase throughput (e.g., Pretreatment, LAW and HLW capacity changes). Limited technology testing includes investigation of anticipated WTP operational performance, evaluation of process upsets, process improvements, analytical methods optimization, and qualification of new instruments.

Limited technology testing capabilities shall include: compositional and physical property analysis of the waste feeds; and small scale testing of the cross-flow filtration, sludge washing and leaching, cesium (Cs) ion exchange, and LAW and HLW glass melting processes. Testing of the waste feeds shall be completed to confirm planned operational flowsheets for the tank wastes to be treated in the WTP. Testing may be done in alternative facilities with prior DOE approval.

The Contractor shall identify samples from WTP operations that will be analyzed at non-WTP analytical facilities. The definitions of the outsourced samples shall include sample type and analyses required. The identification of the outsourced samples is to be included in the Sampling and Analyses Plan used to support the requirements definition for the Analytical Laboratory.

The Analytical Laboratory Facility design shall incorporate features and capability necessary to ensure efficient WTP operations and meet all permitting, process control, authorization basis, and waste form qualification requirements. The design should be validated with information from tank utilization modeling of the process tankage, and operational research modeling of the treatment process, as appropriate.

(19) Site Layout Drawings: The Contractor shall complete all site layout drawings, which shall include the exterior arrangement of all facilities and structures on the site in relation to one another, and their exterior interface points with all piping and electrical systems. The drawings shall identify all above-grade and below-grade structures, piping, and electrical systems. The drawings will reflect requirements during the construction and operations activities. Site drawings and documents shall be updated and provided to DOE for review and approval (Table C.5-1.1, Deliverable 3.7).

(20) Other Applicable Design Products Including:

(i) Ventilation and instrumentation diagrams;

(ii) Instrument schedules;

(iii) Electrical single line diagrams;

(iv) Electrical load schedules;

(v) Deleted (241);

(vi) Deleted (241); and

(vii) Design proposal drawings (equipment procurement drawings).

(21) Oxidative Leaching: The Contractor shall complete the necessary design products, including process flowsheets, material balances, and equipment designs to implement the recommended process for the oxidative leaching of HLW sludge and entrained solids.

(d) Waste Treatment and Immobilization Plant Optimization Study: The Contractor shall prepare for DOE review and approval a proposed set of optimization studies that improve life-cycle performance, cost, and schedule of the WTP. This will include process design (such as improved radiochemical separations), facility design (such as improved space utilization), and technologies (such as second generation treatment and immobilization technologies that are ready for demonstration and application); these will affect the Contract requirements (Table C.5-1.1, Deliverable 3.8). Optimization studies that do not affect the Contract requirements are the Contractor's responsibility and are separate from this activity. The Contractor shall seek input from DOE and the Tank Farm Contractor in developing the list of proposed studies. DOE and the Contractor shall jointly agree upon which studies shall be performed. All optimization studies shall address the following:

(1) Description of the item, process, system, or facility to be optimized and the basis for such optimization;

(2) Description of the research and technology program elements that are required to validate the required performance prior to incorporating the change into the baseline;

(3) Description of the design changes that are required to incorporate the change into the baseline;

(4) Effects of the proposed optimization on the tank farm operator authorization basis and the authorization basis interfaces between the WTP and the Tank Farm Contractor;

(5) Effects on WTP cost, schedule, plant capacity, and waste loading;

(6) Near-term impacts for Tank Farm Contractor;

(7) Estimated life cycle cost impacts to ORP;

(8) An evaluation of potential impacts on long-term interfaces with the Tank Farm Contractor;

(9) Technical risks eliminated, changed, or amplified by the proposed change;

(10) Regulatory issues eliminated, changed, or amplified by the proposed change;

(11) Potential changes in secondary waste and on returnable material volume and type; and

(12) An evaluation of the potential changes in energy needs and other ORP supplies material quantity.

The Contractor shall involve all affected parties to ensure a balanced and complete picture. DOE will evaluate the studies and consider changes to the Contract requirements if they are found to be in the best interest of the Government.

(e) U.S. Department of Energy Participation in Design Process: DOE staff and other Hanford Site contractor staff identified by DOE shall be invited to participate in all Design Overview activities. Design overview activities include any meeting that discusses significant issues associated with the establishment, development, and/or progress of the technical requirements for the design.

Design reviews and multi-disciplined topical overviews will be conducted on an as-mutually agreed upon basis.

In order to improve communications, the Contractor shall provide dedicated office space in the Contractor's design facilities for DOE staff on the fourth (4th) floor of the Project Office, and other facilities as may be necessary.

(f) Support to DOE Design Oversight Process: The Contractor shall support DOE as owner/operator of the WTP, in their independent oversight of the WTP design. This support shall include:

(1) Acquisition of design media;

(2) Access to key personnel involved in the development of the design;

(3) Preparation of formal responses to questions raised in the design process;

(4) Timely review of the DOE design oversight report; and

(5) Formal and timely resolution of any Findings and Assessment Follow-up Items.

The scope of the DOE design oversights shall include all contract work.

(g) Resolution of Technical and Design Issues identified by the External Flowsheet Review Team (EFRT):

The Contractor shall manage resolution and closure of technical and design issues identified in the EFRT report, *Comprehensive Review of the Hanford Waste Treatment Plant Flowsheet and Throughput*, March 2006. The Contractor shall:

(1) Prepare Issue Response Plans (IRP) for the 28 technical and design issues identified in the EFRT Report. DOE approval on the IRPs shall be obtained.

(2) Advise DOE on progress on resolving the issue, including schedule and issues status meetings, at a frequency agreed to with DOE.

(3) Summarize progress for each issue in the Contractor's Monthly Status Report (Deliverable 1.7 in Table C.5-1.1). This shall include technical progress; identification of new issues; cost, and schedule performance; and identification of potential project impacts from issue resolution.

(4) Prepare input for Closure Packages for each EFRT Issue. The Closure Packages will be finalized by DOE and shall provide a complete reference list to the supporting

documentation. Final Closure Packages shall have both DOE and contractor approval.

(5) Design and construction changes identified by closure of the IRP issues shall be identified and documented using the WTP Trend process.

(6) All EFRT Issues shall be resolved through the submittal of Closure Packages as they are completed.

(h) Vessel Mixing: (300) (304) (334)

The Contractor shall plan to perform a Full Scale Vessel Testing (FSVT) program to support design verification of the Pulse Jet Mixed (PJM) vessels to perform their mixing functions, control the operation of the PJMs, and provide a basis to update the WTP safety basis. . Planning for the FSVT program shall include identification of the PJM vessels to be tested at full scale considering vessels currently installed and vessels to be installed. For vessels that have not yet been installed, the design is to be verified before installation. Computational fluid dynamics (CFD) tools may be used to verify certain vessel designs in such cases that are justified with adequate technical bases and concurred by DOE. The Contractor is required to demonstrate CFD meets the acceptability requirements for design verification prior to use.

(1) RLD-8 Testing:

The Contractor shall plan and conduct FSVT utilizing the RLD-8 test vessel. The test program shall include the following elements, as a minimum:

(i) Development of a strategy/design guide for the approach to verify vessel designs to support their mixing, transfer and sampling functions.

(ii) Develop test specification(s) to document the associated vessel operating/process conditions, mixing requirements and data needs to support verification of the vessel mixing functions. The defined process conditions will serve as the specification of the requirements for the development of chemical/physical test simulants to be used in FSVT. Qualified simulant recipes are to be used. The Contractor is to ensure that the use of the simulants provides for appropriate controls to protect personnel and manage any environmental hazards.

(iii) Ensure that appropriate environmental permits are prepared and approved.

(iv) As the WTP design authority, develop the proposed test program planning documents (e.g. test plans, data analysis plan) for FSVT. Test plans will include identification of test objectives for FSVT to support verification of design mixing, transfer and sampling functions.

(v) Prepare a charter for a Joint Test Group and lead the Joint Test Group.

(vi) Design, construct, and prepare the FSVT facility and support equipment to conduct vessel mixing tests and PJM control tests.

(vii) Perform FSVT using approved test plans and procedures.

(viii) Ensure the data collected during testing meets the quality requirements for use in vessel design verification as specified in the test plan.

(ix) Prepare design calculations and analyses based on engineering methods and test analyses/reports to verify the vessel designs for performing their mixing, transfer and sampling functions.

(x) Retain custodial responsibility for the platform equipment and instrumentation that are used in the test program to ensure they are not damaged as part of any activities associated with testing.

(xi) In addition to the FSVT program, the Contractor shall develop and implement an integrated test strategy and program to verify the vessel level PJM control system design(s). This test program will demonstrate adequate performance of the PJM control systems with prototypic equipment.

(2) Pretreatment Vessel Mixing Design Verification (334):

The Contractor shall demonstrate the adequacy of design of PT vessels using full scale vessel and proof-of-concept testing. CFD tools may be used to verify certain vessel designs in such cases that are justified with adequate technical basis and concurred by DOE.

The test program shall include the same elements identified under RLD-8 testing and:

(i) Develop test specification(s) for the PT vessels (including the standard high-solids vessel) to document the associated vessel operating/process conditions, mixing requirements, and data needs to support verification of the vessel mixing functions.

(ii) Modify and prepare the FSVT facility, support facilities, prototypic test vessel, and support equipment to conduct vessel mixing and design verification testing as required.

(i) DFLAW Design **(350)**:

The DFLAW Design effort represents the engineering scope necessary to modify the current WTP facility to allow for the operation of the LAW facility in a stand alone fashion with a direct feed capability as well as integrated facility operations.

(1) <u>Design of BOF Utility Modifications: (329)</u>

The current BOF Utility Facilities are designed for full WTP Operation; therefore modification of these facilities will be required to support reduced throughput during DFLAW operation. Design modifications shall include; updating of control system software, providing for mechanical and electrical isolation, updating of all engineering primary documents and/or calculations, new instrumentation, providing piping modifications for extended layup, piping modifications for secondary headers with additional pumps, and new major pieces of equipment such as air compressors. Safety evaluations, permitting, and hazard analyses to perform the modifications are included in the scope of work.

(2) <u>Design of BOF Effluent Management Facility: (330)</u>

Design an Effluent Management Facility to store effluents (48 hours of storage capacity)

that meet interface acceptance criteria for discharge to the Liquid Effluent Retention Facility and the Effluent Treatment Facility for subsequent treatment or discharge to the Tank Farm Double Shell Tank system. The facility will be designed to allow for the recycling/blending of this concentrated effluent back into the LAW waste stream and allow for the ability to truck this concentrated effluent, if deemed feasible at a later date. The facility will allow for flushing between the Tank Farm Operation Company and LAW with limited impact on waste loading and allow for return of off specification waste.

(3) Design of BOF Effluent Management Facility: (339)

The current BOF infrastructure is designed to support full WTP Operations; therefore modification to the yard to support DFLAW operation will be required. Modifications of the BOF yard include: operating island fence, modified roadways, final grade and storm water drainage, sanitary sewer system, utility isolation, operating contractor interface, underground utilities, effluent and waste transfer lines, LAW waste and effluent valve pit, and a sodium hydroxide offloading pad. These are permanent plant modifications that allow operation of the LAW facility in a standalone fashion with a direct feed capability as well as integrated facility operations **(350)**.

(4) DFLAW Engineering Support: **(350)**

The Contractor shall provide engineering support through completion of the activities defined in Section J, Attachment Q.

Standard 4: Construction, Procurement, and Acceptance Testing

The purpose of this Standard is to describe additional requirements for Construction, Procurement, and Acceptance Testing. In the context of this Standard, the terms "*acceptance testing*" and "*acceptance*" refer to the Contractor's testing and acceptance of systems, components, equipment, etc., as needed for mechanical completion of the WTP. The DOE and/or Owners Agent will be allowed to observe system turnover from Construction to Commissioning. Acceptance does not refer to DOE acceptance of the WTP from the Contractor; DOE acceptance of the WTP will not occur until "Completion of Hot Commissioning".

(a) Construction, Procurement, and Acceptance Testing Plan: The Contractor shall prepare and submit a Construction, Procurement, and Acceptance Testing Plan for DOE approval (Table C.5-1.1, Deliverable 4.1) and update the Plan as required after initial submission. The Plan shall include:

(1) Description of procurement, construction bid, and work packages;

(2) Construction management and force account construction;

(3) Construction site management;

(4) Acceptance testing; and

(5) Descriptive linkage to the Project Execution Plan (PEP) described in Standard 1 and the Environment, Safety, Quality, and Health program described in Standard 7.

(b) Procurement:

(1) The Contractor shall procure all required material and equipment; prepare bid packages and solicitations; evaluate, award, and manage subcontracts; accept subcontractor materials and equipment; and verify subcontractor acceptance

tests.

(2) The Contractor shall submit a Purchasing System for DOE approval in accordance with Section I Clause, *Subcontracts* (Table C.5-1.1, Deliverable 4.2, Purchasing System).

(c) Construction Bid and Work Packages: The Contractor shall prepare bid and work packages; solicit, evaluate, award, and manage subcontracts; accept subcontractor construction; and verify subcontractor acceptance tests (Table C.5-1.1, Deliverable 4.3).

(d) Construction Management and Force Account Construction: The Contractor shall manage or perform all: supervision; required construction; furnish labor, equipment, and materials, management, and supervise construction and acceptance testing; and provide required systems and support for environmental protection, safety, quality, labor relations, and security.

(e) Construction Site Management: The Contractor shall manage the construction site and provide all required construction support services, construction site security, industrial hygiene, and temporary and permanent construction facilities.

(f) Construction and Acceptance Testing:

(1) The Contractor shall maintain an adequate construction inspection system and acceptance testing system and perform such inspections and testing, as well as ensure that the work performed under the Contract conforms to Contract requirements. The Contractor shall maintain complete inspection and testing records and make them available to DOE. The DOE and/or Owner's Agent shall be allowed to observe acceptance testing and system turnover. The Contractor shall develop and submit an integrated Construction and Acceptance Testing Program to DOE for approval (Table C.5-1.1, Deliverable 4.4) that includes the following elements:

(i) Checking and approval of all vendors' shop drawings to assure conformity with the approved design and working drawings and specifications;

(ii) Acceptance test plans and procedures for on-site Contractor/ subcontractor inspection of construction workmanship, compliance with design drawings and specifications, management of the design construction changes, and criteria for acceptance of fabricated and constructed items;

(iii) Identification and description of Contractor and vendor components to be tested and accepted including the identification of component, systems, and integrated facility testing;

(iv) Inspection of construction to assure adherence to approved working drawings and specifications;

(v) Identification of Contractor-proposed and DOE-specified construction witness or hold points;

(vi) Methods to complete field and laboratory tests to verify construction workmanship, materials and equipment, and approved working drawings and specifications;

(vii) Approaches and methods to troubleshoot and correct material acceptance and construction deficiencies;

(viii) Preparation of partial, interim, and final estimates, as well as reports of quantities and values of construction work performed, for payment or other purposes; and

(ix) Approach to transition from acceptance to facility cold commissioning and hot commissioning.

(2) The Contractor shall prepare, as part of the monthly report defined in Standard 1, *Management Products and Controls* (Table C.5-1.1, Deliverable 1.7), a monthly Construction Inspection and Acceptance Status Report that will document the progress of construction and facility acceptance and include the following information:

(i) Status on the deliverables of materials and fabricated items;

(ii) Estimates and reports on the quantities, value, and type of construction work completed for payment or other purposes; and

(iii) Status on the performance of the acceptance program and level of rework/non-conforming items received/constructed and identification of corrective actions.

(3) During the construction and acceptance phase, the Contractor shall remain current on the process and facility as-built program. The status on the as-built program is to be reported in accordance with the process defined in the Construction, Procurement, and Acceptance Testing Plan (Table C.5-1.1, Deliverable 4.1).

(4) The Contractor shall provide all necessary labor, equipment, materials, test equipment, any spare parts sufficient to maintain all structures, systems, and components (SSC) to meet the objectives of the testing program.

(5) The Contractor shall prepare for DOE review and comment an As-Built Program Description (Table C.5-1.1, Deliverable 4.7). The As-Built Program Description and associated procedures shall identify:

- Description of the as-built process, including the role of DOE;
- Drawing series to be as-built;
- Document control process for maintaining as-built; and
- Procedures for modification of the as-built.

(g) Certification for Start of Construction: The Contractor shall certify to DOE that construction has been initiated. "*Start of Construction*" is defined as the first pour of structural concrete for one (1) of the three (3) WTP facilities, Pretreatment, LAW Vitrification, or HLW Vitrification.

(h) U.S. Department of Energy Participation in Construction Review: The DOE staff, Tank Farm Contractor, and other Hanford Site contractor staff identified by DOE shall be invited to participate in all overview activities (Table C.5-1.1, Deliverable 4.5 Construction Overview Meetings). Construction overview activities include any meeting that discusses significant issues associated with the establishment, development, and/or progress of the WTP construction.

(i) Certification of Facility Acceptance Completion: The Contractor shall certify to DOE that facility acceptance has been completed. "*Completion of Facility Acceptance*" is defined when all components and systems associated with the Pretreatment, LAW Vitrification, and HLW Vitrification, have been installed and functionally tested, and the facility design as-built has been submitted in accordance with the Construction, Procurement, and Acceptance Testing Plan (Table C.5-1.1, Deliverable 4.1).

(j) Construction Emergency Response Plan: The Contractor shall develop and adhere to a Construction Emergency Response Plan that is compliant with the applicable requirements of Hanford Emergency Management Plan, DOE/RL-94-02, and the emergency and fire prevention requirements of 29 CFR 1910 and 29 CFR 1926. (Table C.5-1.1, Deliverable 4.6) (215) (256).

(k) Procurement of BOF Utility Modifications and LAW Valve Materials: The current BOF Utility Facilities are designed for full WTP Operation, therefore modification of these facilities will be required to support reduced throughput during DFLAW operation. Procurements based upon design modifications shall include; mechanical isolations, piping modifications for extended layup, piping modifications for secondary headers with additional pumps, and new major pieces of equipment such as air compressors. The LAW Valves provide isolation features that allow routing alignment for receiving waste and for transferring effluents in the DFLAW piping configuration or the PT facility configuration.

(l) BOF Isolation Construction: The current BOF Utility Facilities are designed for full WTP Operation, therefore modification of these facilities will be required to support reduced throughput during DFLAW operation. Construction activities shall include; excavations and backfill, mechanical and electrical isolations, piping installations for extended layup, piping installations for secondary headers with additional pumps installed, pneumatic and hydrostatic testing, and new major pieces of equipment such as air compressor installation. (348)

(m) Procurement of Effluent Management Facility (EMF) Equipment and Effluent Transfer Lines: The EMF contains equipment and instrumentation that have long lead times to procure. To achieve the scheduling milestones, procurements associated with completion of the EMC equipment and instrumentation are imperative and included in this work scope. New effluent and waster transfer lines are required to support DFLAW. The coaxial piping and associated support material have long lead times to procure and are included as part of this work scope. (354)

(n) EMF Limited Construction: Construction activities shall include executing earthwork in the parking lot north of the Lab to support the future EMF and out-buildings. EMF construction activities include civil earth work, concrete, utility and commodity installation, and required indirect scope to execute direct construction activities. (354)

Standard 5: Commissioning

The purpose of this Standard is to describe the requirements and deliverables for the Startup testing and Commissioning of the WTP.

Startup testing begins with a planned turnover of systems from construction, including component and system level tests that will be performed in a planned sequence at each facility, and precedes Cold commissioning of the facility.

The Commissioning process begins with testing during Cold Commissioning making production runs

using agreed upon simulant waste, then Hot Commissioning using actual tank waste, and continues through to turnover to the future Operations Contractor. Commissioning is supported by testing, operations, maintenance, procedure development, and training required to support the scope contained in Standard 5. The Contractor may choose to commission the facilities in a sequential order or a parallel order.

(a) Objectives: The Contractor shall:

(1) Demonstrate that the waste treatment capacity performance of the WTP facilities meets the facility minimum capacity criteria specified in Tables C.6-5.1 and C.6-5.2;

(2) Provide a Commissioning Plan that documents how objectives of Commissioning will be met;

(3) Demonstrate that the waste form products and secondary wastes produced in commissioning testing comply with DOE-approved compliance plans;

(4) Demonstrate facility remotability in areas designed for remote operations;

(5) Ensure WTP facilities, programs, and personnel are prepared for, and successfully complete an Operational Readiness Reviews **(M196)** in accordance with DOE Order 425.1D, CRD, *Verification of Readiness to Start Up or Restart Nuclear Facilities* (A190), prior to start of Hot Commissioning;

(6) Complete Critical Decision (CD) 4 in accordance with DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, CRD. Prerequisites for CD-4 will be completed prior to Hot Commissioning. Post CD-4 activities shall be completed prior to completion of Project Closeout (271); and

(7) Transition WTP facilities, programs, and operations personnel to the Operations Contractor.

(b) Simulant Testing: Simulant shall be used to demonstrate the normal flow of WTP feed material, individual facility production capability, and the ability to predict product quality, and produce acceptable ILAW and IHLW products.

A simulant(s) shall be defined to support cold commissioning performance testing. The waste feed simulant(s) shall be mutually agreed to by both DOE and the Contractor to represent typical feeds to the WTP. For Pre-treatment, this (**350**) simulant may be comprised of a baseline composition that with spiking will demonstrate water washing, caustic, and oxidative leaching to solubilize aluminum (Al) and chromium (Cr). The simulant compositions will be specified in a Cold Commissioning Simulant Definition deliverable (Table C.5-1.1, Deliverable 5.18) due to DOE, 24 months prior to the start of Cold Commissioning.

The Pretreatment Facility simulant properties for demonstrating capacity shall:

- Support caustic and oxidative leaching;
- Be based on the average chemical composition, solids loading, operating conditions and leaching performance based on the design basis G2 Model Run (24590-WTP-MRR-PET-08-002, Revision 2, *WTP Contract Run – (G2) Dynamic Model Run Results Report, August 25, 2008*);
- Have average physical properties including particle size, particle density and rheological properties;

- Contain the major chemical constituents required to cost effectively demonstrate treatment; and
- Support LAW and HLW Vitrification facility melter operations.

(c) Commissioning Plan: The Contractor shall prepare a Commissioning Plan for DOE review and approval (Table C.5-1.1, Deliverable 5.1), a minimum of twelve (12) months prior to the introduction of waste feed simulant to the WTP facilities (i.e., start of cold commissioning). The Plan shall:

(1) Meet the Commissioning objectives stated in Standard 5, (a);

(2) Define the sequence for commissioning of the WTP facilities;

(3) Describe the process for ensuring readiness to start cold commissioning;

(4) Define the WTP test control program;

(5) Define the Cold Commissioning and Hot Commissioning phase organizations; and

(6) Identify planned actions to ensure readiness, prior to Hot Commissioning of the associated facility, for Operational Readiness Reviews (ORRs) **(M196)** per DOE Order 425.1D, CRD*, Verification of Readiness to Start Up or Restart Nuclear Facilities* **(A190)** (e.g., facility testing, programmatic controls, qualification of personnel, and regulatory permits). Planning should be based on multiple ORRs for the WTP Project, with a single ORR for each applicable facility (LAW/Lab, PT, and HLW). **(M196) (257)**.

The Commissioning Plan shall be updated as required and provided to DOE for approval.

(d) Joint Test Group (JTG): The Contractor 's JTG will be responsible for:

(1) Verifying the correct functioning of applicable systems to engineering approved test acceptance criteria;

(2) Testing process and facility systems to test and evaluate the design basis operating envelope;

(3) Demonstrating emergency procedures for recovery from simulated off-normal events using drills, tabletop exercises or the simulator;

(4) Validating operating procedures and instructions during the commissioning test program;

(5) Completing corrective actions derived from the commissioning test program; and

(6) Confirming successful conduct and performance of Technical Safety Requirements (TSR) surveillance.

The DOE, DOE's Owner's Agent, and Operations Contractor will participate in the JTG as observers.

The JTG will approve the test procedures and results for Safety Class (SC), Safety Significant (SS), Environmental Performance, and DOE/RW-0333P QARD system acceptance testing during Commissioning, as well as Contract technical performance test results as defined in Standard 5, (e) for *Cold Commissioning* and Standard 5, (g) for *Hot Commissioning*.

(e) Cold Commissioning: During the Cold Commissioning test period, the Contractor shall conduct testing operations to verify that the WTP will perform in accordance with design specifications using DOE-approved non-radioactive simulated waste feeds that demonstrate the ability of the facility to treat tank waste. Prior to Cold Commissioning, the Contractor shall have in-place required permits, licenses, necessary safety programs (including initial authorization basis), and interfaces per Section C.9, *Interface Control Documents*, to support Cold Commissioning.

(1) The Contractor shall carry out the Cold Commissioning performance tests of the Pretreatment, LAW Vitrification, and HLW Vitrification facilities to:

(i) Verify through the Waste Form Qualification Tests (e)(3)(i) that the WTP can produce qualified waste products (Specification 1, *Immobilized High Level Waste* and Specification 2, *Immobilized Low-Activity Waste*) and secondary wastes based upon DOE-approved waste compliance plans (Deliverable 6.1. 6.2 and 6.3, Table C.5-1.1).

(ii) Demonstrate through the Cold Commissioning Capacity Tests (e)(3)(ii) the WTP capacity for process systems as defined in Table C.6-5.1.

(iii) Perform the Integrated Operations as described further in (e)(3)(iii).

(iv) Demonstrate through the Remotability Test (e)(3)(iv) the remotability of components installed in areas designed for remote operations.

(v) Demonstrate through the Environmental Performance test (e)(3)(v) that the WTP is operating in accordance with applicable permit requirements.

The testing, combined with other operational readiness activities, shall be planned and conceived to provide the basis necessary to support the Certification for Readiness for Hot Commissioning Start (Table C.5-1.0, Deliverable 5.10).

The Contractor shall provide a strategy to achieve the Cold Commissioning performance test objectives specified in the WTP Commissioning Plan. Representative temporary analytical facilities may be used to perform elements of these demonstrations. Resultant products from Cold Commissioning (Table C.5-1.1, Deliverable 5.6) shall be transferred to DOE in accordance with the *Interface Control Documents*. During the tests, the Contractor shall provide documentation of the waste form products for DOE acceptance in accordance with Specification 13, *Commissioning Waste Product Inspection and Acceptance.*

(2) Request for Approval to Initiate Cold Commissioning: Cold Commissioning begins with introduction of simulants into the process facility, vessels as defined in the PEMP. The Contractor shall request approval from DOE to initiate Cold Commissioning following:

- The Contractor's completion of a management assessment to evaluate the readiness of facilities and personnel to initiate cold commissioning based upon the Minimum Core Requirements identified in DOE Order 425.1D, CRD, *Verification of Readiness to Start Up or Restart Nuclear Facilities* (A190). The results of the management assessment shall be provided to DOE.

- Identification of the status of the authorization basis implementation, permits and safety program implementation, and any remaining construction scope that requires completion before simulant introduction.

The Contractor shall not proceed with introduction of simulants without DOE approval. The Contractor shall notify DOE that Cold Commissioning has commenced.

(3) Testing:

(i) Waste Form Qualification Tests (Table C.5-1.1; Deliverable 5.3): The Contractor shall complete WTP waste form qualification testing during cold commissioning to demonstrate the production of acceptable non-radioactive products (ILAW and IHLW) and secondary wastes in accordance with the Secondary Wastes Compliance Plan (Table C.5-1.1, Deliverable 6.1), ILAW Product Compliance Plan (Table C.5-1.1, Deliverable 6.3), and IHLW Waste Form Compliance Plan (Table C.5-1.1, Deliverable 6.2). Applicable process unit operations, sampling and analysis, process control systems, and operating procedures shall be utilized in these qualification tests in a manner that represents planned operations with actual wastes. Test results will be evaluated and documented as part of the waste form qualification reports identified in Standard 6, *Product Qualification, Characterization, and Certification*.

(ii) Cold Commissioning Capacity Tests:

Cold commissioning testing shall be conducted to demonstrate the capacity of the WTP as noted in Table C.6-5.1. Waste form products and secondary wastes will be produced in accordance with the qualification strategies and requirements identified in the Secondary Wastes Compliance Plan (Table C.5-1.1, Deliverable 6.1), ILAW Product Compliance Plan (Table C.5-1.1, Deliverable 6.3), and IHLW Waste Form Compliance Plan (Table C.5-1.1, Deliverable 6.2), and meet the relevant specification and interface requirements. The results shall be provided to DOE for review and approval. (Table C.5-1.1, Deliverable 5.4).

The Cold Commissioning Capacity Tests shall test the individual facility operations in terms of function and capacity. Applicable facility system components, both process and mechanical, shall be tested.

The water washing, caustic, and oxidative leaching process steps shall be performed consistent with the process model used to develop Table C.6-5.1 and the process steps as defined in Standard 2, Deliverable 2.10. Leaching effectiveness is not a criterion for acceptability of Cold Commissioning Capacity Test results.

The minimum testing duration for the Cold Commissioning Capacity Testing is defined below:

- The HLW and LAW Vitrification facilities shall be operated for 20 days.
- The Pretreatment testing duration is based on four Ultrafiltration cycles (two in each Ultrafiltration train).
- An Ultrafiltration cycle is a series of process steps including receipt, treatment, and transfer.
- The Cold Commissioning Capacity Test is based on the measurement of waste treated between the following points:
    - For HLW Pretreatment (i.e., solids) between UFP-VSL-00001A/B and HLP-VSL-00027A/B or HLP-VSL-00028.
    - For LAW Pretreatment (i.e., sodium) between UFP-VSL-00001A/B and TCP-VSL-00001.
    - The measure of HLW Pretreatment production will be based on a mass balance between the feed (UFP-VSL-00001A/B) and product vessels (HLP-VSL-00027A/B or HLP-VSL-00028) and adjusted for any changes to vessel heels. An insoluble component may be used to determine the quantity of treated solids.
    - The measure of LAW Pretreatment production will be based on a mass balance between the feed (UFP-VSL-00001A/B) and the product vessel (TCP-VSL-00001) and adjusted for any changes to vessel heels. This determination shall be based on waste Na as defined in Table C.7-1.1.

The Contractor shall have the right to extend the testing period for any facility beyond the testing duration indicated above, and in such an event the Contractor may choose any consecutive window within that period to report against.

Table C.6-5.1. Cold Commissioning Capacity Testing Criteria

Facility	Minimum Capacity	Treatment Capacity	Design Capacity
LAW Pretreatment	2244 MT Na per year	2620 MT Na per year	3740 MT Na per year
HLW Pretreatment	735 MT as-delivered solids per year	860 MT as-delivered solids per year	1225 MT as-delivered solids per year
LAW Vitrification	18 MT Glass per day	21 **(350)** MT Glass per day	30 MT Glass per day
HLW Vitrification	3.6 MT Glass per day	4.2 MT Glass per day	6.0 MT Glass per day

Notes to Table C.6-5.1

1. Production rates in Table C.6-5.1 are based on the Facility Specification treatment capacity for treating all waste feed batches from the HNF-SD-WM-SP-012, Revision 6, Tank Farm Contractor Operation and Utilization Plan (TFCOUP Revision 6, feed vector.)

Characterization of the as-delivered DOE approved simulant (Deliverable 5.18, Table C.5-1.1) and an updated model reflecting changes to design, assumptions, and administrative controls affecting throughput shall be used to re-establish performance criteria in Table C.6-5.1. .For example, model assumptions may change following completion of Phase I Pretreatment Engineering Platform testing. Changes to the model reflecting design, assumptions, and administrative controls shall be approved by DOE.

2. The revised values for Table C.6-5.1 will be documented in Cold Commissioning Capacity Test Criteria (Deliverable 5.20, Table C-5.1-1) due prior to completion of Deliverable 5.8. The Contract will be revised to incorporate the new table.

3. Interface service delays in excess of that assumed in the process models used to create Table C.6-5.1 shall not be counted in the duration of the performance runs.

4. The contractor shall manage the excess treated LAW simulant from the Cold Commissioning tests.

(iii) Integrated Operations Demonstration: The Contractor may choose to perform Cold Commissioning Capacity Tests of each of the facilities in a sequential order or in parallel, but ultimately shall be required to perform 10-day integrated operations demonstration of all five (5) WTP facilities. If sufficient recycle streams are not available, appropriate simulated recycle streams will be used. Credit for the 10-day integrated operations may be taken during the Cold Commissioning Capacity Test or the 10-day integrated operations demonstration may be performed separately.

The recycle of process streams are to be simulated in the process flowsheet if the facilities are operated in a sequential operating mode and representative recycle solutions are not available. The WTP process is comprised of a number of unit batch operations which are performed concurrently and in series to produce a number of discrete IHLW canisters and ILAW containers. The unit batch operations are linked by lag storage vessels which serve to decouple the process and preclude process interruptions. At no time are all operations expected to be occurring simultaneously.

(iv) Remotability Test: The Contractor shall demonstrate by prototypic remotability testing, and the use of the planned operating and maintenance procedures, all normally required remote maintenance activities to support operation of the WTP during hot operations. This testing shall include verification of remote access and viewing to remotely maintain equipment including the ability to install, connect, disconnect, remove and reconnect remote replaceable components, calibration and replacement of instruments located in areas serviced by remote cranes and manipulators, and the use of remote and direct viewing technologies.

This testing may be demonstrated and documented prior to commencing Cold Commissioning and shall be completed before the end of Cold Commissioning. Any design changes required, based upon these test results, shall be corrected and the specific systems retested to verify acceptability prior to the completion of Cold Commissioning.

(v) Environmental Performance Test: The Contractor shall complete environmental testing as required under the Dangerous Waste Permit Application, Air Permitting Requirements, and applicable Federal, State, and local laws, regulations, and permits to demonstrate the operation of the WTP in accordance with applicable legal and permit requirements. The testing requirements shall be based upon the Environmental Performance Test Plan described in the WTP conceptual design and supporting information and as modified by the Dangerous Waste Permit Application permitting process.

The Contractor shall produce an environmental performance test report(s) after the completion of each environmental performance test trial (Table C.5-1.1, Deliverable 5.7). The report shall, at a minimum, provide the required information identified in the Risk Assessment Work Plan (Table C.5-1.1, Deliverable 7.6), including a description of the sampling and analysis activities conducted during the testing, definition of the simulants, and assess the performance of the LAW and HLW Melter Treatment Units. The report shall also provide recommended operating conditions for the WTP to assure compliance with required permits and statutes.

(4) Completing Cold Commissioning: Cold Commissioning is considered complete, for Operational Performance Fee determination purposes, at the point when the capacity tests for Cold Commissioning described in Standard 5, (e(3)(ii) are complete and the test results are approved by the JTG (except as otherwise provided in Standard 5(h)). The Contractor shall not proceed to Hot Commissioning until Table C.6-5.1 Minimum Treatment Capacity values have been achieved or otherwise accepted by DOE as completed in accordance with Standard 5(h).

(5) Cold Commissioning Results and Documentation: The Contractor shall provide results from Cold Commissioning testing to DOE for review and approval (Table C.5-1.1, Deliverable 5.8). The information shall be in the form of controlled documents (hardcopy or electronic) maintained and updated by the Contractor. Information shall include, but not be limited to:

(i) System startup plans and system verification reports;

(ii) Test Plans and Summary Test Reports for demonstrating and/or establishing permitting conditions; and

(iii) Test Plans and Summary Test Reports for process verification and product qualification.

(6) Certification of Completion of Cold Commissioning: The Contractor shall certify to DOE that Cold Commissioning is complete and that the Contractor met the requirements contained in Standard 5(d) (Table C.5-1.1, Deliverable 5.9) or as outlined in Standard 5(h).

(f) Readiness:

(i) Operational Readiness Support Plan **(257)**: Prior to Operational Readiness Reviews, the Contractor, jointly with the TOC, shall submit an Operational Readiness Support Plan (Joint WTP/TOC Contract Deliverable (Table C.5-1.1; Deliverable 5.22)). The plan will address facility operational readiness requirements for the Tank Farms and each of the five (5) WTP facilities (Pretreatment, HLW, LAW, LAB, BOF). Topical areas for review may include (but are not limited to):

- Management Self-Assessment process;
- Start-up notification report;
- Procedures;
- Training and testing activities; and
- Cold and hot commissioning

(ii) Operational Readiness Review(s) **(M196)**: The WTP Operational Readiness Review process shall be conducted in accordance with DOE Order 425.1D, CRD*, Verification of Readiness to Start Up or Restart Nuclear Facilities* **(A190)***,* prior to the start of Hot Commissioning. (257).

(g) Hot Commissioning:

The objective of the Hot Commissioning phase is to:

- Demonstrate the operability of the WTP during radioactive operations
- Achieve the capacity criteria specified in Table C.6-5.2.

The Hot Commissioning period begins upon receipt of permission to commence Hot Commissioning from the DOE Authorization Authority in accordance with DOE Order 425.1D, CRD, *Verification of Readiness to Start Up or Restart Nuclear Facilities* (A190). DOE/ORP approval is required for the introduction of radioactive waste into the WTP. The approval for Hot Commissioning will be granted by DOE/ORP following DOE Authorization Authority approval for Hot Commissioning startup.

Hot Commissioning includes testing the facility using radioactive materials transferred from the tank farms. The Pretreatment Facility shall be tested to demonstrate the flow of radioactive feed material through the facility to produce LAW and HLW feed, which may be placed into lag storage or fed forward to support coincident LAW and/or HLW Hot Commissioning. Each WTP processing facility may be tested individually to demonstrate that the facility performs in accordance with operational, safety, and Contract performance requirements.

(1) Certification of Readiness for Hot Commissioning Start: The Contractor shall certify to DOE that the facility is ready to receive waste feed (Table C.5-1.1, Deliverable 5.10) and all Contractor requirements in the Section C.9, *Interface Control Documents* are complete.

(2) Waste Transfer Notification: For Hot Commissioning, the Contractor shall provide a written notice to the DOE Contracting Officer, specifying the date the Contractor requests the start of a transfer of a batch of feed, herein referred to as the waste transfer date. The written notice shall be provided to the DOE Contracting Officer at least two (2) months prior to the requested waste transfer date.

(3) Certification of Hot Commissioning Start: The Contractor shall certify to DOE that the facility Hot Commissioning has started (Table C.5-1.1, Deliverable 5.11). Start of Hot Commissioning is defined as receiving actual tank farm waste feed into one of the WTP processing facilities.

(4) Hot Commissioning Capacity Tests (Table C.5-1.1; Deliverable 5.21): Hot commissioning testing shall be conducted to demonstrate **(350)** capacity of the WTP as identified in Table C.6-5.2.

(5) The plant capacity test results shall be demonstrated using the plant instrumentation, and sampling, analyses, and product control systems. The JTG approved results of the Hot Commissioning Capacity Tests shall be provided to DOE for review and approval (Table C.5-1.1, Deliverable 5.12).

The Hot Commissioning **(350)** tests shall test the individual facility operations in terms of function and capacity. Applicable facility system components, both process and mechanical, shall be tested.

The leaching process shall be performed as required per Specification 12 and consistent with the process model used to develop Table C.6-5.2. Leaching effectiveness is not a criterion for acceptability of Hot Commissioning Capacity Test results.

The minimum testing duration for the Hot Commissioning Capacity Testing is defined below:

- The HLW and LAW Vitrification facilities shall be operated for 20 days.
- The Pretreatment testing duration is based on four Ultrafiltration cycles (two in each Ultrafiltration train). An Ultrafiltration cycle is a series of process steps including receipt, treatment, and transfer.
- The Hot Commissioning Capacity Testing **(350)** is based on the measurement of waste treated between the following points:
    - For HLW Pretreatment (i.e., solids) between UFP-VSL-00001A/B and HLP-VSL-00027A/B or HLP-VSL-00028
    - For LAW Pretreatment (i.e., sodium) between UFP-VSL-00001A/B and TCP-VSL-00001.
    - The measure of HLW Pretreatment production will be based on a mass balance between the feed (UFP-VSL-00001A/B) and product vessels (HLP-VSL-00027A/B or HLP-VSL-00028) and adjusted for any changes to vessel heels. An insoluble component may be used to determine the quantity of treated solids.
    - The measure of LAW Pretreatment production will be based on a mass balance between the feed (UFP-VSL-00001A/B) and the product vessel (TCP-VSL-00001) and adjusted for any changes to vessel heels. This determination shall be based on waste Na as defined in Table C.7-1.1.

The Contractor shall have the right to extend the testing period for any facility beyond the testing duration indicated above, and in such event the Contractor

may choose any consecutive window within that period to report against.

Processing of Vitrification Facility recycles will be done in parallel with continued Pretreatment Facility feed preparation during Vitrification Facility performance runs for at least 10 days or until Pretreatment feed is no longer available, whichever is sooner.

Table C.6-5.2. Hot Commissioning Capacity Testing Criteria

Facility	Minimum Capacity	Treatment Capacity	Design Capacity
LAW Pretreatment	2244 MT Na per year	2620 MT Na per year	3740 MT Na per year
HLW Pretreatment	735 MT as-delivered solids per year	860 MT as-delivered solids per year	1225 MT as-delivered solids per year
LAW Vitrification	18 MT Glass per day	21 **(350)** MT Glass per day	30 MT Glass per day
HLW Vitrification	3.6 MT Glass per day	4.2 MT Glass per day	6.0 MT Glass per day

Notes to Table C.6-5.2:

1. Production rates in Table C.6-5.2 are based on the Facility Specification (Table C.7-1.1) capacity for treating all waste feed batches from the HNF-SD-WM-SP-012, Revision 6, Tank Farm Contractor Operation and Utilization Plan (TFCOUP Revision 6, feed vector.) Characterization of the actual delivery feed to WTP and an updated model reflecting changes to design, assumptions, and administrative controls affecting throughput will be used to re-establish performance criteria in Table C.6-5.2. For example, model assumptions may change following completion of Phase I Pretreatment Engineering Platform testing. Changes to the model reflecting design, assumptions, and administrative controls shall be approved by DOE. The revised values for Table C.6-5.2 will be documented in Hot Commissioning Capacity Test Criteria (Deliverable 5.21, Table C-5.1-1) due prior to completion of Deliverable 5.14. The Contract will be revised to incorporate the new table.

2. Waste feed delivery delays, and other interface service delays in excess of that assumed in the process models used to create Table C.6-5.2 shall not be counted in the duration of the capacity runs.

3. If Supplemental LAW Treatment lag storage facilities are not available to receive the excess treated LAW, the LAW Pretreatment rates will be adjusted to align with LAW Vitrification performance.

(i) <u>HLW Pretreatment</u>: The HLW Pretreatment line shall be operated in order to produce feed to HLW Vitrification that results in IHLW in compliance with Specification 1.

(ii) <u>LAW Pretreatment</u>: The LAW Pretreatment line shall be operated to produce feed to the LAW that results in ILAW in compliance with Specification 2.

(iii) <u>Low-Activity Waste Vitrification</u>: The LAW Vitrification Facility shall produce containers of ILAW. Each container shall be routed through the complete process and equipment system, including level measurement,

sampling as required, inert fill as required, lid closure, decontamination, and placement in position for shipment. In accordance with ICD-15. documentation requirements for the production of the ILAW containers are described in Specification 13, and shall be transmitted to DOE per deliverable, Resultant Products from Hot Commissioning (Table C.5.1-1, Deliverable 5.13).

(iv) High-Level Waste Vitrification: The HLW Vitrification Facility shall produce canisters of IHLW. Each canister shall be routed through the complete process and equipment system, including level measurement, sampling, lid closure, decontamination, and placement of the canister in HLW storage in accordance with ICD-14. Documentation requirements for the production of the IHLW canisters are described in Specification 13, and shall be transmitted to DOE per deliverable, Resultant Products from Hot Commissioning (Table C.5.1-1, Deliverable 5.13).

(6) Hot Commissioning Results and Documentation: The Contractor shall provide Hot Commissioning test results to DOE for review and approval (Table C.5-1.1, Deliverable 5.14). The information shall be in the form of controlled copies or electronic media as requested by DOE. The information shall include, but not be limited to:

(i) Test Plans and Test Reports for demonstrating and establishing permitting conditions (RCRA, authorization basis, air, performance test plan, etc.);

(ii) Test Plans and Test Reports for process verification and product qualification, including documentation and certification, that the IHLW and ILAW products meet requirements per Specification 1 and Specification 2, respectively.

(iii) Updated process model assessments (Standard 2, (b)) that are reconciled with Cold and Hot Commissioning test data to demonstrate that the WTP has the capability to process the waste feed compositional variations that will be provided by the Tank Farm;

(iv) Certify waste product (ILAW and IHLW) and secondary waste acceptability per Standard 6, *Product Qualification, Characterization and Certification* through implementation of the Waste Compliance Plans;

(v) Copies of required information sent to regulators (RCRA, air, authorization basis, etc.), and as required elsewhere in the Contract.

(7) Certification of Completion of Hot Commissioning: **(350)** The Contractor shall provide Certification of Completion of Hot Commissioning. The Contractor shall certify to DOE that the Hot Commissioning is complete and that the Contractor met the requirements contained in Standard 5(g) (Table C.5-1.1, Deliverable 5.15 or as outlined in Standard 5(h).

(h) Cold and Hot Commissioning Capacity Testing Deficiency Remedial Actions: The Contractor and DOE agree that the Contractor shall be allowed to exercise best efforts to achieve the waste treatment capacity testing levels prescribed in Tables C.6.5-1 and C.6.5-2 for each WTP facility. However, in the event that a significant deficiency is encountered during Commissioning that degrades the performance of any facility so significantly that the minimum capacity levels for cold or hot commissioning of that facility cannot be achieved, the Contractor shall notify DOE of the need to expend additional time and funds to correct the deficiency.

It is the Contractor's responsibility within the scope of Commissioning to provide a realistic estimate of the cost and schedule for any such requisite remedial response. If both parties agree that a deficiency exists and that remedial measures are necessary then:

(1) If the deficiency results from an inadequate and/or incomplete test procedure, the Contractor shall correct the test procedure and re-test within its scope of Commissioning;

(2) If the deficiency results from a design or construction nonconformance, the Contractor shall correct the nonconformity and re-test within its scope of Commissioning;

(3) If the cause of a deficiency cannot be determined, the Contractor shall propose a reasonable investigation program to determine the cause and following ORP approval of the investigation cost and schedule, shall implement the investigation program.

(4) If DOE does not wish to fund additional remedial expenses, the related testing is consequently accepted as completed at the Minimum level defined in Section B.11 Attachment B-2-D.

(i) Facility Transition Plan: The Contractor shall prepare for DOE review and approval a WTP Facility Transition Plan (Table C.5-1.1, Deliverable 5.19) that describes the strategy, schedule, and requirements for safe and efficient transition of the WTP facilities to the Operations Contractor. The Plan shall identify, at a minimum for each facility, the proposed schedule for facility turnover and provide a checklist of requirements to be completed to ensure that the facilities can be safely transitioned and operated by the Operations Contractor. The Transition Plan shall also identify provisions to retain appropriate qualified engineering, operations, and maintenance staff to support continued safe operations of the WTP facilities at designed treatment rate of the facilities.
The Contractor shall obtain input and concurrence on the Facility Transition Plan from the Operations Contractor, if available, before transmittal to DOE. The Facility Transition Plan is due to the DOE 12 months prior to the start of Hot Commissioning.

(j) Transition: The following items shall be provided to the Operations Contractor at facility transition. In addition, systems and other items necessary to facilitate safe and efficient operation of the WTP shall be provided during the transition period in accordance with the WTP Facility Transition Plan (Deliverable 5.19, Table C.5-1.1).

(i) Safety Management Programs (SMPs) to ensure safe accomplishment of work (A190).

(ii) Facility safety documentation (normally DSA (Documented Safety Analysis) and TSRs that describes the safety envelope of the facility (A190).

(iii) Program to confirm and periodically reconfirm the condition and operability of Vital Safety Systems (VSS). This includes examinations of records of tests and calibration of these systems (A190).

(iv) The facility systems and procedures, as affected by facility modifications, that are consistent with the description of the facility, procedures, and accident analysis, and assumptions included in the safety basis (A190).

(v) Adequate and accurate procedures and safety limits are in place for operating the process systems and utility systems. The procedures include necessary revisions for all modifications that have been made to the facility. Facility processes ensure that only the most current revision to each procedure is in use (A190).

(vi) A routine operations drill program and an emergency management drill and exercise program. Records for each program are adequate to demonstrate the effectiveness of completed drills and exercises as well as planning for future drills and exercises (A190).

(vii) The formality and discipline of operations is adequate to conduct work safely and programs are in place to maintain this formality and discipline. This item is satisfied by transition of Conduct of Operations program.

(viii) The selection, training, and qualification programs for operations and operations support personnel (M152) (A190).

The facility transition period shall be planned to complete transition of all facilities within ninety (90) days following DOE's acceptance of the Contractor's Certification of Completion of Hot Commissioning (Table C.5-1.1, Deliverable 5.15).

(k) Completion of Contract Workscope Requirements: The Contractor shall complete post-Critical Decision 4 activities, *Approve Start of Operations or Project Closeout*, in accordance with DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, CRD (271).

(l) Post-Commissioning Services:

Following hot commissioning, the Contractor shall conduct necessary activities to ensure that the facility is safe and ready for hot operations and facility turnover.

DOE may request the Contractor to provide additional waste treatment from the successfully commissioned facility or to maintain standby status for a period of time.

If standby status is requested, the Contractor shall maintain the necessary staff for full facility operations as determined by the Contractor.

If DOE requests standby status, or additional waste treatment, beyond that required for hot commissioning, such requests will be pursuant to the Section I, I.82, *Changes*.

(m) Project Closeout: Project Closeout is complete when:

(1) DOE approves the Contractors Certification of Completion of Hot Commissioning (Table C.5-1.1, Deliverable 5.15).

(2) DOE accepts all ILAW and IHLW waste products produced during Hot Commissioning in accordance with Specification 13, *Waste Product Inspection and Acceptance.*

(3) The Contractor responds to technical questions from the DOE or Operations Contractor, as instructed by DOE for a period not to exceed six (6) months following DOE's approval of the Certification of Completion of Hot Commissioning (Table C.5-1.1, Deliverable 5.15).

(4) The Contractor provides support to DOE in the conduct of internal and external technical reviews and presentations for a period not to exceed six (6) months following DOE's approval of the Certification of Completion of Hot Commissioning (Table C.5-1.1, Deliverable 5.15).

(5) The Contractor assures operations, maintenance, engineering, licensing, and purchasing activities developed under this contract are transitioned to the Operating Contractor as instructed by DOE.

(6) The Contractor transitions spare parts to the Operating Contractor, as instructed by DOE.

(7) The Contractor completes transition of the WTP facilities to the Operating Contractor (Table C.5-1.1; Deliverable 5.16) (M152) in accordance with the approved WTP Facility Transition Plan (Table C.5-1.1, Deliverable 5.19).

Standard 6: Product Qualification, Characterization, and Certification

The purpose of this Standard is to describe the requirements for documentation that is used to qualify the immobilized waste products (IHLW and ILAW) and secondary wastes (solid waste, non-radioactive non-dangerous liquid effluents, radioactive dangerous liquid effluents, and air emissions).

Product qualification, characterization, and certification activities and deliverables shall be integrated with all technical, regulatory, and operability aspects of the WTP.

(a) The Contractor shall:

(1) Identify, quantify, and describe each immobilized waste product and secondary waste to be produced or generated by the WTP.

(2) Conduct activities necessary to qualify each immobilized waste product and to provide confidence, prior to commissioning operations, that the products will conform to the specifications and requirements in this Contract.

(3) Conduct activities necessary during commissioning to characterize and provide a basis for certifying that the immobilized waste products, and secondary wastes conform to the specifications and requirements in this Contract.

(4) Issue a certification document for each filled and sealed canister that the canister meets product specifications and the basis for the certification.

(5) Perform all product qualification, characterization, and certification activities in accordance with the requirements of Section C.4.

(b) The Contractor shall update the IHLW Waste Form Compliance Plan (Table C.5-1.1, Deliverable 6.2), the ILAW Product Compliance Plan (Table C.5-1.1, Deliverable 6.3), and the Secondary Wastes Compliance Plan (Table C.5-1.1, Deliverable 6.1) describing the plan for qualification, characterization, and certification of each immobilized waste product and secondary wastes included under this Contract. These Plans shall provide the following information:

(1) Identification, quantification, and description of each immobilized waste product and secondary waste. The description shall include chemical and radiochemical composition, physical properties, and a comparison to Contract requirements.

(2) Planned compliance strategies, compliance activities, and documentation to qualify each immobilized waste product and secondary waste for each requirement.

(3) Planned methods and documentation to characterize and provide a basis for certifying that each immobilized waste product, and secondary waste meets Contract requirements.

(4) Planned methods and documentation to comply with dangerous and hazardous waste regulations as required under law and in the Contract.

(5) Identification and description of documentation to be provided with each product package submitted for acceptance, and secondary waste submitted for transfer that (a) describes the product, (b) documents characterization activities, and (c) provides a basis for certifying that the product or waste conforms to the Contract requirements.

(c) The Contractor shall complete the following activities and prepare the documentation identified below:

(1) Update the ILAW Product Compliance Plan (Table C.5-1.1, Deliverable 6.3) for DOE review and approval.

(2) Update the IHLW Waste Form Compliance Plan (Table C.5-1.1, Deliverable 6.2) for DOE review and approval that addresses the requirements of the WASRD and identified in Specification 1, *Immobilized High-Level Waste Product*, for DOE approval. The Contractor shall provide documentation and technical support to DOE during the approval process. (M047)

(3) Update the Secondary Wastes Compliance Plan (Table C.5-1.1, Deliverable 6.1) for DOE review and approval.

(4) Implement the DOE-concurred upon ILAW Product Compliance Plan (Table C.5-1.1, Deliverable 6.3) and IHLW Waste Form Compliance Plan (Table C.5-1.1, Deliverable 6.2), and the Secondary Wastes Compliance Plan (Table C.5-1.1, Deliverable 6.1), including all planned qualification, certification, and characterization activities.

(5) Prepare qualification documentation for DOE review and comment related to ILAW, and IHLW products. Qualification documentation (Table C.5-1.1, Deliverables 6.4, IHLW Product Qualification Report, and 6.6, ILAW Product Qualification Report) shall be submitted for DOE approval during the facility cold and hot commissioning activities. The qualification documentation shall address each requirement of each specification and shall compile the results of testing, analyses, demonstrations, and inspections to demonstrate that each product will comply with Section C.8, *Operational Specifications*, of the Contract.

(6) The IHLW Product Qualification Report shall be submitted for DOE approval during the facility cold and hot commissioning activities. The Contractor shall provide documentation and technical support to DOE during the approval process.

(7) In accordance with Standard 7, DOE will be responsible for submitting the Contractor developed petition for exempting or excluding the IHLW product from RCRA and HWMA regulation (Table C.5-1.1, Deliverable 7.9). The Contractor shall develop the petition and support DOE in the petitioning process. If the exemption or exclusion is obtained, the Contractor shall implement the necessary procedures to provide IHLW that is exempted or excluded from RCRA and HWMA.

(8) In accordance with Standard 7, DOE will be responsible for submitting the Contractor-developed petition for a new treatment standard, specific to Hanford tank waste. The Contractor shall support DOE during the petitioning process, in accordance with Standard 7 (Table C.5-1.1, Deliverable 7.10). If the petition is approved, the Contractor shall implement the necessary procedures to treat the waste in accordance with the new treatment standard.

(9) Prepare production documentation for ILAW (Table C.5-1.1, Deliverable 6.7) and IHLW (Table C.5-1.1, Deliverable 6.5) products, and secondary wastes (Table C.5-1.1, Deliverable 6.10). The production documentation shall verify that the analyses, demonstrations, inspections and testing to characterize each product package, canister, or liquid stream for transfer and provide a basis for certification that each product and secondary waste complies with Section C.8, *Operational Specifications*, and requirements of this Contract.

(10) Submit to DOE all required documentation that qualifies, characterizes, quantifies, and certifies each immobilized waste product, and secondary wastes conforms to Contract requirements.

Proposed ILAW glass composition ranges shall be provided to DOE for approval no less than two (2) years before production of glasses in that range. DOE approval (or non) will be provided within six (6) months of the proposal. The Contractor shall only produce glasses that have received DOE approval.

(d) Dangerous and Hazardous Waste Requirements for the Immobilized High-Level Waste Product (Specification 1):

(1) The Contractor shall plan and perform process and product development testing, sampling and analysis, reporting, and certification necessary to: (1) characterize and designate the IHLW product for dangerous waste characteristics, dangerous waste criteria and dangerous waste sources pursuant to WAC 173-303-070 and demonstrate that the IHLW product does not exhibit any dangerous waste characteristics, WAC 173-303-090, and does not meet any dangerous waste criteria, WAC 173-303-100; (2) support the petition for exemption or exclusion of the IHLW product from RCRA and HWMA and the implementing regulations; and (3) comply with required applicable laws or regulations. The sampling, preparation, and testing methods shall conform to the requirements in WAC 173-303-110.

(2) The Contractor shall plan, develop, obtain, report, and certify the information required: (1) to demonstrate that the IHLW product does not exhibit any dangerous waste characteristics, WAC 173-303-090, and does not meet any dangerous waste criteria, WAC 173-303-100; (2) to demonstrate that the treated waste in the IHLW product is not prohibited from land disposal pursuant to WAC 173-303-140 and 40CFR268, “Land Disposal Restrictions”; (3) to petition EPA and Ecology for an exemption from RCRA and HWMA, and the implementing regulations; (4) to show that the IHLW meets the TSCA radioactive waste exemption criteria in 40CFR761.50 (b)(7)(ii); and (5) to comply with applicable laws, regulations, permits, licenses, other regulatory authorizations and approvals, and this Contract.

(e) Dangerous and Hazardous Waste Requirements for the Immobilized Low-Activity Waste Product (Specification 2):

The Contractor shall plan and perform process and product development testing, sampling, analysis, reporting, and certification necessary to:

(1) Characterize, support, and designate the ILAW product for dangerous waste characteristics, dangerous waste criteria, and dangerous waste sources pursuant to WAC 173-303-070 and demonstrate that the ILAW product does not exhibit any dangerous waste characteristics, WAC 173-303-090, and does not meet any dangerous waste criteria, WAC 173-303-100.

(2) The Contractor shall plan, develop, obtain, report, and certify the information required to:

(i) Demonstrate that the treated waste in the ILAW product is not prohibited from land disposal pursuant to WAC 173-303-140 and 40 CFR 268, “Land Disposal Restrictions”;

(ii) Demonstrate that the ILAW product does not exhibit any dangerous waste characteristics, WAC 173-303-090, and does not meet any dangerous waste criteria, WAC 173-303-100;

(iii) Show that the ILAW meets the TSCA radioactive waste exemption criteria in 40 CFR 761; and

(iv) Comply with applicable laws, regulations, permits, licenses, other regulatory authorizations and approvals, and this Contract.

(3) Support the petition for a new treatment standard for Hanford tank waste as described in Standard 7.

(4) Comply with required applicable laws or regulations.

(5) The sampling preparation and testing methods shall conform to requirements in WAC 173-303-110.

(f) The Contractor shall be responsible for characterizing the HLW and LAW Feed. The characterization may be based upon the available historical data and will use analysis of DOE-provided splits of representative samples of the waste feed to support compliance with regulatory, authorization basis, and technical requirements for the WTP and as otherwise required by this Contract. The Contractor shall perform analyses of the waste feed based on the analyses and requirements in the applicable DQO.

(g) The Contractor shall qualify and characterize the immobilized waste products, and secondary wastes using analysis, testing, inspection, and demonstration as defined for each specification or requirement shown in Table S6-2, *Qualification and Characterization*.

Table S6-2. Qualification and Characterization

Requirement	Qualification	Product Characterization
Chemical and Radiochemical Composition	A, D, I, T	A, D, I, T
Dangerous and Hazardous Wastes	A, D, I, T	A, D, I, T
Waste Loading	A, D, T	A, D, T
Waste Form Leaching/Durability	A, T	A, T
Waste Form Stability	A, D, T	D
Free Liquids, Explosivity, Pyrophoricity, Organic Materials, and Gases	A, D, I	A, D, I
Heat Generation and Surface Temperature	A	A
Dose Rate and Criticality	A	A, I
Package and Canister Dimensions	D, I	D, I
Weight and Mass	A, D, I	D, I
Void Space and Fill Height	D	D, I
Package and Canister Materials	D, I	D, I
Package and Canister Mechanical Strength	A, D, T	D
Labeling	D, I	I
Package and Canister Handling Features	D, I	D, I
Package and Canister Closure and Sealing	D, I	D, I
Surface Contamination	D	D, I

Legend
A = Analysis
D = Demonstration
I = Inspection
T = Testing

Definition of Terms: The following terms and definitions shall apply to this Standard.

Analysis (A) — As used in the specifications, an analysis is a set of engineering or scientific calculations that demonstrate that a product meets or exceeds a specification requirement. These calculations are typically based upon available data and assumptions regarding process operating conditions or materials. Analysis is required to identify conditions or assumptions, which might limit validity, and to identify specific documentation or measurements made during production to ensure validity (waste loading, container material, process additives, process measurements, etc.). Analyses shall be conducted and documented

in sufficient detail in such a way that a knowledgeable technical person can review and concur in their accuracy and validity. Evidence of peer review for accuracy for each analysis shall be provided. An analysis will be considered to demonstrate compliance with specification requirements when: (a) approved by DOE; and (b) when the conditions for validity or assumptions are verified by independent means (e.g., process control records, raw material certifications).

Demonstration (D) — A demonstration is the proof-of-principle of a specimen, article, or process test used to verify conformance to the conditions of an analysis or product specification. Demonstrations are conducted where analysis is insufficient to provide proof-of-product acceptability or where analysis indicates the need for verification of assumptions (e.g., waste loading, explosivity, scale-up, process control). Demonstration reports shall identify: (1) the demonstration being conducted; (2) the limits of the demonstration's validity; and (3) those inspections or tests that will be conducted during operations to confirm that the demonstration results are still applicable to the product being produced. Proposed demonstrations will be submitted as part of the Compliance Plans. A demonstration will constitute verification of compliance with a specification requirement when: (1) it has been approved by DOE; and (2) when the conditions for validity or assumptions have been verified by independent means (e.g., process control records, raw material certifications) during operation.

Inspection (I) — Inspection is a non-destructive examination or measurement of a product characteristic that confirms compliance with product specifications. Inspections are conducted when product characteristics can be easily determined by direct measurement (e.g., weight, dimensions, labeling, external temperature, etc.) or where the results of the calculations leave some doubt as to satisfaction of the product requirements.

Test (T) — A test is the evaluation of a product characteristic in which representative samples are destructively examined or measured to confirm compliance with product specifications. Tests are typically conducted where product characteristics cannot be readily determined by inspections, or where an inspection by itself, does not provide adequate confirmation of compliance (e.g., chemical composition, radionuclide release rate). Upon request by DOE, the Contractor shall split and provide DOE samples obtained from or representative of the delivered products. The Contractor is responsible for defining what constitutes a statistically representative sample (e.g., based on the extent of process control achieved for that product).

Qualification — Qualification is composed of activities conducted by the Contractor to provide confidence, prior to full-scale production operations, that the planned immobilized waste products and secondary wastes will conform to the specifications in the Contract.

Characterization — Characterization is composed of activities conducted by the Contractor to provide confidence that the actual immobilized waste products and secondary wastes produced during production operations conform to the specifications and requirements in the Contract.

Certification — Certification is the endorsement or guarantee by the Contractor that an immobilized waste product or secondary waste conforms to the Contract requirements and specifications.

Validation — Validation is composed of activities conducted by the Contractor with actual wastes or with full-scale process equipment to confirm that the results of the analyses, demonstrations, inspections, and test(s) conducted by the Contractor to qualify a product or process are representative of the product and process characteristics.

Verification — Verification is composed of activities conducted by DOE to confirm that each immobilized waste product or secondary waste conforms to the Contract requirements and specifications.

Standard 7: Environment, Safety, Quality, and Health

The purpose of this Standard is to: (1) define Contractor responsibilities for conventional non-radiological worker safety and health; radiological, nuclear, and process safety; environmental protection; quality assurance; and (2) identify specific deliverables the Contractor shall submit to DOE.

Where this Contract or references contained in this Contract, makes reference to the "DOE Regulatory Unit," in place of "DOE Regulatory Unit," read "DOE" (as the regulator of radiological, nuclear, and process safety).

(a) The primary objectives of ESQ&H are to:

(1) Demonstrate compliance with established requirements;

(2) Apply best commercial practices to provide conventional non-radiological worker safety and health protection; radiological, nuclear, and process safety, and environmental protection; and

(3) Implement a cost-effective program that integrates environmental protection, safety, quality, and health in all Contractor activities.

Environmental protection, safety, quality, and health program activities and deliverables shall be integrated with all technical and regulatory aspects of the WTP Project.

(b) The Contractor shall integrate safety and environmental awareness into all activities, including those of subcontractors at all levels. Work shall be accomplished in a manner that achieves high levels of quality; protects the environment, as well as the safety and health of workers and the public; and complies with all requirements. The Contractor shall identify hazards; manage risks; identify and implement good management practices; and make continued improvements in environment, safety, quality, and health performance.

(c) The Contractor is responsible for providing safe and healthful working conditions for employees and all other persons under the Contractor's control who work in the general vicinity of the Contractor site, including subcontractors. The Contractor shall develop and implement integrated programs for conventional non-radiological worker safety and health; radiological, nuclear, and process safety; and environmental protection. The Contractor shall implement its program, and submit the deliverables described in paragraphs (d) and (e) of this Standard.

(d) The Contractor shall develop and implement an integrated standards-based safety management program to ensure that radiological, nuclear, and process safety requirements are defined, implemented, and maintained. The Contractor shall conduct work in accordance with the Contractor developed and DOE approved Safety Requirements Document (SRD). The SRD is the set of ESQ&H tailored requirements as referenced in Section I Clause, *Laws, Regulations, and DOE Directives*.

(e) The specific deliverables and program requirements are divided into four categories: (1) non-radiological worker safety and health protection; (2) radiological, nuclear, and process safety; (3) quality assurance; and (4) environmental protection. The deliverables shall reflect the current degree of design and project maturity. The following information is provided to support development of deliverables required in each area of the ESQ&H program:

(1) Non-radiological Worker Safety and Health (Table C.5-1.1, Deliverable 7.0):

(i) The Contractor shall develop and implement an integrated standards-based safety management program. The Contractor's safety management program shall reflect proven principles of safety management and work planning that promotes accident prevention, employee involvement, and sound hazard analysis and control.

(ii) The Contractor's non-radiological worker safety and health program shall conform to 10 CFR 851, *Worker Safety and Health Program*, at the effective implementation date of May 15, 2007. (M114) (215)

(iii) DOE is responsible for the conduct of worker safety and health inspections and granting variances. (M114)

(iv) Proposed changes that impact cost and/or schedule will be analyzed under RL/REG-98-14, *Regulatory Unit Position on New Safety Information and Back-fits,* and if implemented, will be dispositioned in accordance with Section I Clause entitled, *Changes.*

(v) Deleted (215)

(2) Deleted (M166)

Table S7-1. Environment, Safety, Quality, and Health Deliverables

Regulatory Action	Deliverable	References	During Construction	Start of Hot Commissioning
Standards Approval	Safety Requirements Document,	ORP letter 01-OSR-0311, dated September 17, 2001	Revision	Revision
	Quality Assurance Program	10CFR830.120, NQA-1 2000	Revision	Revision
Authorization for Hot Commissioning	Emergency Response Plan	DOE/RL-94-02	Draft	Final
	Maintenance Implementation Plan	WAC246-247	Draft	Final
	Occurrence Reporting Plan	SCRD O 232.2 Occurrence Reporting and Processing of Operations Information (332)	Draft	Final
	Environmental Protection Program	29CFR1910, 40CFR68	Draft	Final
	Radiation Protection Program	10 CFR 835	Revision	Final

(Entire Table revised M166)

(3) Quality Assurance (Table C.5-1.1, Deliverable 7.2):

The Contractor shall develop a QA Program, documented in a QA program manual(s), and supported by documentation that describes overall implementation of QA requirements. Supporting documentation shall include procedures, instructions, plans, and manuals used to implement the Contractors QA program within the Contractors scope of work. Specific requirements for process development, waste form qualification and testing are described in Standards 2 and 6. The Contractor's QA program manual(s) shall be submitted to DOE for review and approval (Table C.5-1.1, Deliverable 7.2). The Contractor shall utilize a technically defensible graded approach to develop the QA program based upon the requirements of: (M066)

(i) QA for radiological, nuclear, and process safety shall be conducted in accordance with 10 CFR 830.120, Subpart A and DOE O 414.1C. (M066)

(ii) QA for process development, waste form qualification and testing shall be conducted as described in Standards 2 and 6. QA program requirements for all HLW and ILAW work shall be covered by the approved QA program. The QA program manual(s) shall address the following requirements: (M066):

(A) The Contractor shall implement the Office of Civilian Radioactive Waste Management's, *Quality Assurance Requirements and Description Document* (QARD), DOE/RW-0333P, Revision 20, for elements of the Contractor's scope that may affect the Immobilized High-Activity Waste (IHLW) product quality, including but not limited to, waste form development, qualification, characterization, production process control, and certification of the IHLW products.

(B) The Contractor shall implement the *National Consensus Standard* ASME NQA-1-2000, Part I and Part II, Subpart 2.7 for elements of the Contractor's scope that may affect product quality of the Immobilized Low-Activity Waste (ILAW) product, entrained solids, and sludge washing, including, but not limited to, waste form development, qualification, characterization, production process control, certification of ILAW product, entrained solids, and sludge washing. Furthermore, all research and technology activities (other than IHLW – see (A)) shall be conducted in accordance with NQA-1. (M066)

(iii) QA for permitting activities shall be conducted in accordance with all applicable laws and regulations, including RCRA, TSCA (if later directed by DOE), and WAC 173-303 QA requirements.

(iv) QA for facilities, projects, and secondary wastes not subject to the above requirements shall be done in accordance with DOE Order 414.1C. The Contractor shall maintain its QA program in accordance with DOE Order 414.1C. The Contractor has the option to not incorporate the elements of ANSI/ASQ Q 9001-2000, *Quality Management System,* requirements (for non-nuclear activities), which is referenced in the Contractor Requirements Document of DOE Order 414.1C. (M066) (A143) (M152)

(v) The Contractor may be required to use additional consensus standards in order to describe and implement a fully functional, systematic QA program for nuclear facility construction or for nuclear safety-related work. The RPP adopted the NQA-1-2000 as the primary QA reference document and the Contractor shall utilize this Standard to help achieve the quality objectives of this Contract, as necessary. (M066)

(vi) DOE or its designee(s) shall have access to and the right to conduct assessments, audits, and/or surveillance of the Contractor (and its subcontractors/suppliers, at any level) activities to ensure compliance with the appropriate requirements and the Contractor's QA program, at DOE discretion.

(4) Environmental Protection (Table C.5-1.1, Deliverable 7.3):

(i) The Contractor shall develop and implement an integrated environmental protection program. The Contractor shall design, construct, manage, and commission the WTP to assure compliance with environmental requirements, permits, licenses, and other regulatory approvals and agreements.

(ii) The Contractor shall develop and implement an integrated program to provide environmental protection and compliance. The Contractor shall integrate all permitting and compliance actions with the future WTP operator.

(iii) The Contractor shall identify all necessary permits, licenses, and other regulatory approvals and authorizations for the design, construction, commissioning, and operation of the WTP, unless otherwise identified in this Contract. The Contractor shall develop the necessary permit applications, license applications, requests for other regulatory authorizations, and supporting materials and documentation in accordance with Clause H.26, *Environmental Permits*. The Contractor shall provide all technical and regulatory information, documentation, and support to ensure that permits, licenses, and other regulatory authorizations and approvals are obtained in a timely manner to support the design, construction, commissioning, and operation of the WTP and other Hanford Site facilities that support the WTP.

(iv) The Contractor shall implement a program to track and address environmental compliance issues, and to implement and comply with all requirements (including, but not limited to, permitting, environmental reports, enforcement actions, consent decrees, *Hanford Federal Facility Agreement and Consent Order* milestones/reports/management commitments, NEPA, pollution prevention, and waste minimization).

(v) The Contractor shall work with the appropriate Hanford Site contractor in providing legally and regulatory required air and liquid effluent and near-facility environmental monitoring. The Contractor shall collect, compile, and/or integrate air and liquid effluent monitoring data from operations and activities under their control. The Contractor shall compare the monitoring data with regulatory and/or permit standards applicable to their activities and/or operations and provide the data and analyses to the appropriate Hanford Site contractor for use in preparing the mandatory State and Federal environmental reports for the Hanford Site in a timely manner. In addition, the Contractor shall provide appropriate

environmental data for the WTP to support Hanford Site assessments and preparation of the Hanford Site Environmental Report.

(vi) The Contractor shall prepare and submit to the Contracting Officer for review and action the following environmental protection deliverables. The deliverables shall be consistent with the design and schedule for construction and commissioning the WTP. Identification of the following deliverables does not modify or affect the Contractor's responsibilities for environmental permitting, compliance, and protection identified in the Contract or as required under applicable law or regulation. The Contractor shall have the responsibility to identify and develop any necessary modifications to existing permit applications, license applications, requests for regulatory authorizations/approvals, and supporting materials to support the design, construction, commissioning, and operation of the WTP.

(A) Environmental Plan (Table C.5-1.1, Deliverable 7.3): The Contractor shall develop a detailed plan that identifies the Contractor's structured approach for environmental protection, compliance, and permitting, including: (1) planned environmental permitting and compliance activities for design, construction, and commissioning the WTP; (2) detailed permitting and compliance schedule integrated and linked to the technical baseline; and (3) environmental monitoring and reporting requirements. The Contractor shall review permit applications, license applications, and other requests for regulatory authorizations/ approvals, and supporting materials that are in draft form and/or were submitted to regulatory agencies and identify any modifications necessary to support the design, construction, commissioning, and operation of the WTP in the Environmental Plan.

The Environmental Plan (Table C.5-1.1, Deliverable 7.3) shall be submitted for DOE review and approval, and include identification of where and when DOE or other site contractor action is anticipated or required. The Plan shall be submitted within three (3) months after contract award. The Plan shall be updated as significant changes to the permitting schedules warrant.

(B) Dangerous Waste Permit Application (Table C.5-1.1, Deliverable 7.5): Prepared as a chapter to the *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage and Disposal of Dangerous Waste at the Hanford Facility* (Permit No. WA 7890008967).

Dangerous Waste Codes are identified in the *Double-Shell Tank System Unit Permit Application* (DOE/RL-88-21, October 1, 1996). The Contractor facilities shall be permitted to assure that the facility may manage and treat all waste codes applicable to the Hanford Double-Shell Tank system.

The Contractor shall develop and implement a plan for DOE review and approval for revising the Dangerous Waste Permit Application and obtaining the final status permit modification. The plan shall be developed in cooperation with DOE and the regulatory agencies. The Contractor shall revise the Dangerous Waste Permit Application (Table C.5-1.1, Deliverable 7.5), support

the dangerous waste permitting process, and work with the regulatory agencies and DOE to obtain final status under the Dangerous Waste Regulations to support WTP construction and commissioning activities. Construction of the treatment facility may commence prior to a final status permit being issued provided the regulatory agencies agree.

(C) Risk Assessment Work Plan (Table C.5-1.1, Deliverable 7.6): The Contractor shall implement the Risk Assessment Work Plan as agreed to with DOE and the regulatory agencies, and conduct environmental performance tests during commissioning to validate the risk assessment and demonstrate WTP performance. The Risk Assessment Work Plan shall be the documented outcome of the Contractor's negotiated agreement with regulators to demonstrate that WTP will meet required environmental performance standards for a thermal treatment facility. The Risk Assessment Work Plan (Table C.5-1.1, Deliverable 7.6) may be a supplement to the Dangerous Waste Permit Application.

(D) Notice(s) of Construction (Table C.5-1.1, Deliverable 7.7): The Contractor shall prepare Notice(s) of Construction (NOC) for both radioactive and non-radioactive air emissions related to Contractor activities in accordance with applicable regulations. NOCs (Table C.5-1.1, Deliverable 7.7) shall be submitted for DOE approval no less than 150 days prior to scheduled submission to the regulators. The Contractor shall also provide draft permit modification language for the air-operating permit to the appropriate site contractor based on regulator approvals of NOC and consistent with the project schedule, Environmental Plan, and provisions of this Contract.

(E) Prevention of Significant Deterioration Permit Application (Table C.5-1.1, Deliverable 7.8): The Contractor shall prepare a Prevention of Significant Deterioration (PSD) Permit Application for air emissions related to Contractor activities in accordance with applicable regulations. The Permit Application (Table C.5-1.1, Deliverable 7.8) shall be submitted for DOE review, comment, and approval no less than 150 days prior to scheduled submission to the regulators. The Contractor shall also be responsible for providing draft permit modification language to the appropriate site contractor for the air-operating permit consistent with the project schedule and provisions of this Contract.

(F) Petitions for Exemption or Exclusion for Immobilized High-Level Waste (Table C.5-1.1, Deliverable 7.9): The Contractor shall develop a set of documents for DOE use in petitioning Ecology and EPA to exempt or exclude the IHLW from regulation under HWMA and RCRA and their implementing regulations, respectively. The petitions and supporting technical and regulatory materials shall be developed in accordance with applicable law, regulation, and permit. The Contractor shall include DOE-provided information in the petitions, and shall be responsible for establishing a schedule with DOE for when such information is needed. The Contractor shall collect and analyze characterization data and demonstration-scale treated waste product data to support the petition and compliance demonstration. The Contractor shall support DOE in

the petitioning process and interactions with the regulators. The petition (Table C.5-1.1, Deliverable 7.9) shall be submitted to DOE for review and approval.

(G) Petition for a New Treatment Standard for Hanford Tank Waste (Table C.5-1.1, Deliverable 7.10): The Contractor shall develop a petition for submittal to the regulatory agencies that proposes vitrification as the specified treatment technology for Hanford tank waste. The Contractor shall collect and analyze characterization data and demonstration-scale treated waste product data to support the petition and compliance demonstration. The Contractor shall support DOE in the petitioning process and interactions with the regulators. The Contractor shall obtain, report, and certify required information to DOE to demonstrate that the ILAW product is acceptable for land disposal. The petition (Table C.5-1.1, Deliverable 7.10) shall be submitted to DOE for review and approval.

Standard 8: Safeguards and Security

The purpose of this Standard is to describe the Safeguards and Security (SAS) requirements relevant to the WTP facility and operations.

(a) The Contractor shall develop and implement an SAS Program to ensure the protection of DOE-owned material, property, and information. The Contractor shall maintain and update all relevant aspects of the SAS Program that was previously concurred upon by DOE or part of the WTP Conceptual Design and supporting documentation.

(b) The SAS Program shall ensure the protection of DOE-owned material, property, and information.

(1) The scope of DOE SAS requirements includes:

(i) Physical protection;

(ii) Material control and accountability if found applicable throughout the period of the Contract;

(iii) Protection of DOE information and the Hanford Site access requirements; and

(iv) Government property protection.

(2) The Contractor's program shall comply with the applicable regulations, DOE Orders, and DOE-provided top-level SAS requirements stipulated in the DOE approved *Hanford Tank Waste Treatment and Immobilization Plant Safeguards and Security Plan*, 24590-WTP-PL-SS-02-001. The Contractor shall design the facility in a manner to provide adequate response time for the Hanford Patrol.

(3) The SAS deliverables shall be updated per Table S8-1 and as required to reflect known changes.

(c) The Contractor shall comply with the "Richland Regional Office Site Counterintelligence Support Plan Hanford Site - Bechtel National, Inc." (SCSP), and subsequent ORP approved revisions of the SCSP. The SCSP incorporates requirements listed in DOE Order 475.1 *Counterintelligence Program*, and its CRD O 475.1. (M071)

Table S8-1. Safeguards and Security Deliverables (Table C.5.1-1, Deliverable 8.0)

Deliverable Description	Reference	Contract Award	Start of Construction	Start of Cold Commissioning	During Hot Commissioning
Safeguards and Security Program Plan consisting of:					
MC&A Plan	Standard 8 and 24590-WTP-PL-SS-02-001	Not Required[1]	NA	NA	NA
Security Plan	Standard 8 and 24590-WTP-PL-SS-02-001	Existing DOE approved preliminary draft	See Note 2	Annual Revision	Annual Revision
Vulnerability/Risk Assessment Data	Standard 8 and 24590-WTP-PL-SS-02-001	NA	Ongoing, See Note 3	Ongoing	Ongoing
Internal Assessment Reports	Standard 8 and 24590-WTP-PL-SS-02-001	NA	NA	Final	Annual
External Assessment Reports	Standard 8 and 24590-WTP-PL-SS-02-001	Submission of Corrective Action Plan within 30 days of receipt of external review report.			

1. Based upon material attractiveness, it was confirmed that a separate MC&A plan is not required. MC&A requirements (if any) shall be tracked in the Security Plan.
2. Submit final Security Plan for DOE approval within 45 days of receipt of DOE comments to the preliminary draft plan.
3. Provide vulnerability/risk assessment data for the HLW, LAW, Pretreatment, Analytical Laboratory, and Balance of Facilities at the 60 percent and 90 percent design stages.

Standard 9: Nuclear Safety (Table C.5-1.1, Deliverable 9.1) **(257) (293)**

1. The Contractor shall develop and implement an integrated standards-based safety management program to ensure that radiological, nuclear, and process safety requirements are defined, implemented, and maintained. Radiological, nuclear, and process safety requirements shall be adapted to the specific hazards associated with the Contractor's WTP activities.

2. The Contractor's safety basis documents and maintenance process shall be developed and implemented to comply with the specific nuclear safety requirements established in 10 CFR 830, Subpart B, *Safety Basis Requirements,* and DOE-STD-3009, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses.

3. The Contractor shall prepare and submit to DOE for review and approval the nuclear safety-related deliverables required by 10 CFR 830, Subpart B, as well as the following per BNI procedures:

   a. Criticality Safety Evaluation Report;

   b. Safety Evaluation(s) (SE) that support Justifications for Continued Design, Procurement, and Installation (JCDPI); **(293)**

   c. Authorization Basis Amendment Requests (ABAR)

4. The Contractor shall submit the Documented Safety Analysis (DSA) for each facility no less than six (6) months prior to the need for ORP approval, and associated hazards analysis documents for information, to support Commissioning activities for those facilities.

5. The Contractor shall establish and implement a program to maintain the facility-specific Preliminary Documented Safety Analyses (PDSA) and Hazards Analysis Reports (HAR) current. The program shall establish a process to screen and evaluate proposed changes to the design of WTP facilities based on the potential to impact the hazards and accident analyses as defined in the facility-specific PDSAs. The procedure that implements this program shall be approved by DOE.

   All other changes (i.e., those within the analyzed safety basis document) will be incorporated into the PDSA via a direct page change within 60 days of contractor approved design changes or DOE-issued Safety Evaluation Reports (SER) unless an alternative duration is specified by DOE.

   Changes that are determined to be "unreviewed" in accordance with the DOE approved program procedure described in Section 5 of this Standard, shall be submitted to DOE for review and approval prior to implementation.

6. DOE may attend WTP hazards analysis, accident analysis, and control selection meetings as observers. DOE may observe WTP design reviews (and question the presenters) as ex-officio members. These observations provide DOE with continuing information concerning the safety aspects of the evolving design and do not constitute ORP approval of the matters discussed.

7. The Contractor shall provide quarterly, a listing of screenings and evaluations prepared in accordance with Standard 9, Item 5, above, that were determined to be within the analyzed safety basis and therefore already approved by DOE.

8. The Contractor shall ensure a mechanism exists to allow efficient and timely DOE review of engineering documents reviewed by the Contractor for safety basis impacts.

9. The Contractor shall identify and maintain the list of documents that constitute the authorization basis for each WTP nuclear facility. This list will be used by qualified screeners and evaluators to determine if a proposed design change is within the analyzed safety basis document(s). This list shall be provided to DOE annually, and upon DOE approval of any DSA, as part of the annual update submittal thereafter in conformance with 10 CFR § 830.202, Safety basis.

10. The Contractor shall maintain the Safety Requirements Document (SRD) consistent with the design of WTP facilities. Changes to the SRD will be processed consistent with Standard 9, Item 5, above. Changes that do not impact the safety basis documents will be implemented into the design criteria basis.

[NOTE: PREVIOUS TABLE S9-1 IS DELETED IN ITS ENTIRETY]

C.7 FACILITY SPECIFICATION

The Facility Specification provides minimum functional requirements for the process and facility design and the waste treatment capacity requirements. Additional requirements are contained in Section C.6, *Standards*. DOE will consider changes to the Facility Specifications that improve life-cycle performance, cost, and schedule.

(a) Functional Design Requirements: The WTP is comprised of five major facilities, Pretreatment (PT), LAW immobilization, HLW immobilization, Analytical Laboratory, and Balance of Plant Facilities (BOF). The WTP shall be designed to:

(1) Have a forty (40)-year operating life for the operating facilities (PT, HLW, LAW), Analytical Laboratory, and BOF exclusive of ancillary facilities (i.e., warehouses, construction support facilities, and administrative offices).

(2) Separately receive and store LAW feed (defined in Specification 7, *Low-Activity Waste Envelopes Definition*) and HLW feed (defined in Specification 8, *High-Level Wastes Envelope Definition*) in appropriately designed vessels. The DOE will provide waste transfer lines to an interface point described in ICD 19. The DOE will also provide adequate pumping motive force to transfer the waste to the WTP Receipt Vessels.

(3) For CLIN 2.1, LAW Vitrification shall be designed to receive treated LAW feed (Specification 7, Envelope E) from a Low Activity Waste Pretreatment System (LAWPS) provided by DOE. The DOE will provide waste transfer lines to an interface point described in ICD 30. The DOE will also provide adequate pumping motive force to transfer the waste to the WTP Receipt Vessels. **(350)**

(4) Treat and immobilize the LAW feed (Specification 7, Envelope A, B, C and E) **(350)** and provide the final waste products described in Specification 2, *Immobilized Low-Activity Waste Product*, for return to DOE.

(5) Implement the sludge treatment process steps as proposed by the Contractor, and approved by DOE in accordance with Standard 2, (a), (3), (iii), for solids washing, caustic leaching, and oxidative leaching; immobilize the HLW feed and radionuclides separated from LAW feed, and provide the final waste products described in Specification 1, *Immobilized High Level Waste Product*, for return to DOE.

(6) Disposition all secondary wastes in accordance with ICD requirements; secondary wastes are identified in Section C.9, *Interface Control Documents* and Standard 6, *Product Qualification, Characterization and Certification*.

(7) The Pretreatment Facility shall have the capability to return to the Hanford Double-Shell Tank Farm process streams in accordance with Specification 9, *Liquids or Slurries*, transferred to DOE tanks by pipeline.

(8) Provide for safeguards and security of DOE owned materials, property, and information in accordance with Standard 8, *Safeguards and Security*.

(9) Include a Radiochemical Analytical Laboratory to support the operations of the facilities, including: process control, waste form qualification testing, environmental analyses, and limited technology testing. The capacity of the Analytical Laboratory shall be sufficiently sized and scoped to support the waste treatment capacity of the facilities. The technical basis to support the definition of the Analytical

Laboratory facility shall be defined in the Analytical Laboratory Design Requirements (Table C.5-1.1, Deliverable 3.6).

(10) Have the ability to receive and process slightly contaminated sodium hydroxide (NaOH) with trace quantities of radionuclides (Na-22, Cs-137, H-3) for use as a process chemical. This sodium (Na) will be converted to sodium hydroxide (NaOH) prior to use at the WTP. The quantity and radionuclide content of the Na is provided in ICD 29, *Waste Na*.

(11) Capability to obtain samples of ILAW and IHLW glass to support process and product control needs for WTP.

(12) Include process and facility design features to safely and efficiently facilitate deactivation, decontamination, decommissioning, and RCRA closure of the facilities.

(13) Comply with applicable Federal, State, and local requirements, including environmental permits and other regulatory approvals and authorizations. The WTP shall be designed and operated to ensure that exposure to the maximally exposed off-site individual (non-acute) is ALARA but not more than 1.5 mrem per year and hazardous organic emissions are ALARA but not more than 0.375 tons per year from components regulated under 40 CFR 265, Subpart AA.

(14) Include office space at the WTP Site sufficient for the exclusive use of eight full-time DOE personnel and temporary space for ten transient DOE personnel.

(15) Identify fifteen (15) acres on the WTP site, north of the Pretreatment Facility, to allow for the expansion of the WTP LAW vitrification capacity, by the addition of a Supplemental LAW Treatment Facility. Interface details and project impacts (including scope adjustments) will be established if a decision is made to use this space.

(16) Include process and facility design features that will efficiently minimize the use of services and utilities, as well as the generation of secondary wastes and waste products consistent with the constraints specified in the Contract. Achievement of this requirement is demonstrated through research and technology, design reviews, and DOE's design oversight:

(i) Use of services and utilities including: ICD 1, *Raw Water*; ICD 2, *Potable Water*; ICD 11, *Electricity*;

(ii) Generation of secondary wastes, including: *Radioactive Solid Wastes*, *Dangerous Wastes, Non-Radioactive, Non-Dangerous Liquid Effluents*; *Radioactive, Dangerous Liquid Effluents*; and

(iii) Primary product volumes through improved waste loading greater than the Contract minimums: Specification 1, *Immobilized High-Level Waste Product*, and Specification 2, *Immobilized Low-Activity Waste Product*.

(17) Include the capability to manage tank waste streams to prevent or minimize undesirable precipitation. This capability shall include mitigation of precipitation following ultrafiltration using techniques including maintaining the post-filtration process stream above the filtration temperature. Approaches should minimize the need for sodium addition to provide life-cycle mission benefit.

(b) Waste Treatment Capacity Requirements: Waste treatment capacity requirements are specified below:

(1) The required WTP facility design capacity for each of the WTP facilities is defined in Table C.7-1.1. Supplemental LAW immobilization will be provided by a separate contract to support WTP treatment.

The waste treatment capacity for each major facility is defined as a product of the facility design capacity (facility nameplate design capacity) multiplied by the integrated facility availability factor.

Table C.7-1.1. WTP Facility Design Capacity

Facility	Design Capacity	Treatment Capacity
LAW Pretreatment (1)	3740 MT Na per year	2620 MT Na per year
HLW Pretreatment (2)	1225 MT as-delivered solids per year	860 MT as-delivered solids per year
LAW Vitrification	30 MT Glass per day	21 MT Glass per day
HLW Vitrification	7.5 MT Glass per day	5.25 MT Glass per day
Analytical Laboratory	Support all WTP Facilities at Design Capacity	Support all WTP Facilities at Treatment Capacity
Balance of Facilities	Support all WTP Facilities at Design Capacity	Support all WTP Facilities at Treatment Capacity

Notes:
1. The LAW waste treatment capacity is based on waste sodium (Na). Waste Na is defined as Na from the following sources: Na from the LAW Feed Envelopes in accordance with Specification 7, *Low Activity Waste Envelopes Definition* and soluble Na from the HLW Envelope in accordance with Specification 8, *High Level Waste Envelope Definition*. In addition, the chemical Na added to wash and leach the solids defined in the sludge treatment flowsheet, approved by DOE (Table C.5-1.1, Deliverable 2.1) and any Na required to maintain chemical stability of the Ultrafiltration system permeate is included in the definition of waste Na.
2. As delivered solids represents the mass of the solid cations and anions delivered in the waste feed batches provided by the TFCOUP Revision 6.0 Feed Vector.
3. Confirmation that the WTP design will achieve the listed design capacities is contained in document 24590-WTP-MRR-PET-08-002, Revision 2, WTP Contract Run - (G2) Dynamic Model Run Results Report, August 25, 2008.

The Contractor shall evaluate the design capacity of the WTP Pretreatment, LAW Vitrification, and HLW Vitrification facilities using the Standard 2, (b), (2), *WTP Tank Utilization Assessment Model*. The design capacity is determined by the estimated average processing rate when treating all waste as defined by TFCOUP, Revision 6.0.

ILAW loading shall be based on Specification 2.2.2.2, *Waste Loading,* and the IHLW waste loading shall be based on Specification 1, Table TS-1, *Minimum Component Limits in High-Level Waste Glass*. For purposes of predicting Pretreatment throughput rates and total treatment times at those rates, modeling assumptions shall be used such that the Pretreatment throughput is not limited by the vitrification facilities.

The Contractor is to estimate the integrated facility availability factor from the Operations Research Assessment as defined in Standard 2 (b) (1) *Operational Research Assessment.* The determination of integrated facility availability for the purpose of WTP facility design compliance shall be based on estimates of the total time to treat all tank wastes, with no reliability/availability/ maintainability/inspectability (RAMI) failures applied, divided by the total time to treat all tank wastes, with all RAMI failures applied. The minimum integrated facility availability and the individual facility availabilities shall be equal to or greater than 70 percent.

The integrated facility availability assessment shall be based on modeling for the expected duration of the treatment mission.

ORP approval shall be obtained on all assumptions used for waste treatment capacity determinations using the WTP Tank Utilization Assessment and Operations Research Assessment models. As example, model assumptions may change following completion of Phase I Pretreatment Engineering Platform testing. These assumptions shall be documented in the WTP Basis of Design (Deliverable 3.3(a), Table C.5-1.1)

(2) The LAW Vitrification Facility shall be designed to support a facility design capacity of 30 MTG/day.

- The LAW Vitrification Facility shall be capable of vitrifying treated LAW Envelopes A, B, C and E **(350)** in compliance with the waste loading specifications identified in Specification 2.2.2.2., *Waste Loading*.

(3) The HLW Vitrification Facility shall be designed with two HLW melter systems to support a combined design capacity of 6 MTG/day with the original melters and up to 7.5 MTG/day with replacement melters.

(4) The Pretreatment Facility shall have the capability to receive and store 1.5 Mgal of LAW feed. The design shall include the capability to receive without interruption 1.125 Mgal of LAW feed while processing from the remaining capacity of 0.375 Mgal of LAW feed. The tanks shall be connected to allow blending.

(5) The Pretreatment Facility shall have the feed-forward capability for a nominal 240,000 gallons of feed lag storage for HLW vitrification facility operations, based upon the facility design capacity, while being capable of receiving without interruption no less than 145,000 **(M183)** gallons of HLW feed per batch. HLW feed batch receipt facilities shall be designed to allow receipt without interruption to waste feed processing.

(6) The Pretreatment Facility shall have the capability to prepare at least 81,000 gallons of transferable and blended HLW feed within a single vessel for transfer to the HLW Vitrification Facility.

(7) The Pretreatment Facility shall have the established capability to conduct sludge washing, caustic leaching, and oxidative leaching on HLW sludge and entrained

solids. The Pretreatment Facility shall include the following capabilities to permit operational flexibility for sludge washing, caustic leaching, and oxidative leaching flowsheet and treatment capacity:

(i) Provide two ultrafiltration trains to support solid-liquid separation, sludge washing, caustic leaching, and oxidative leaching. The ultrafilter surface area for each train shall be approximately 1,500 square feet, unless the Contractor demonstrates that greater average filter flux rates can be achieved with an alternative design.

(ii) Provide the capability to mix chemical reagents used in the leaching processes, in line with ultrafiltration vessel recirculation pumps, to shorten mixing times.

(iii) Perform caustic leaching between 80 and 90°C to enhance leaching kinetics.

(iv) Include the capability to remove heels from the ultrafiltration feed vessels to move treated solids forward in the process and minimize recycle.

(v) Operate filtration at 45°C or higher to increase filter flux rates and potentially reduce caustic required in leaching.

(vi) Add caustic to ultrafilter permeate vessels to minimize the potential for post-filtration precipitation of aluminum species and reduce the volume of permeate that must pass through the ultrafilters.

(vii) Increase the capacity of the cesium ion exchange system to a nominal 30 gallon/minute flowrate. This shall accommodate the increased waste volume resulting from caustic increases required to effectively conduct sludge washing, caustic leaching, and oxidative leaching on HLW sludge and entrained solids.

(viii) Provide the capability to perform caustic leaching in the ultrafiltration feed preparation vessel in addition to the ultrafiltration feed vessel.

(c) Waste Treatment and Immobilization Plant Expandability Requirements: The Contractor shall design the WTP to ensure that the plant is designed and built with features to provide increased waste treatment capacities (items (3) and (10) below), or which allow for expansion to support increased treatment capabilities (items (1), (2), and (4) through (9) below), as follows:

(1) The LAW Facility design shall not preclude the installation of a third melter, melter power and control systems, melter feed, offgas treatment, container handling, HVAC, and other systems and components not initially installed. The capacity to expand the waste treatment shall be consistent with an increase in the design capacity of 30 MTG/day to 45 MTG/day.

(2) Pretreatment can connect to a potential new facility designed to receive and treat the Hanford cesium (Cs) and strontium (Sr) capsules prior to incorporation into the HLW feed for immobilization in the HLW Vitrification Facility. The scope shall be limited to the installation of process piping between an appropriately identified HLW feed process vessel and a location adjacent to the Pretreatment Facility where connections to a potential new facility could be easily accomplished.

(3) Analytical Laboratory capabilities shall be included in the initial design to support an increase in LAW waste treatment capacity described in (b)(1) above.

(4) HLW Immobilization can connect to a potential new facility for the interim storage of IHLW canisters. Space on the facility site plan shall be provided to accommodate this additional storage capacity.

(5) Provide four piping stub-outs from the Pretreatment Facility (225) Tunnel to route HLW slurry feed to and from a potential future HLW slurry feed concentration facility.

(6) Tank Farm feed delivery routing capability, within the Pretreatment Facility, to connect a potential new facility ahead of the feed receipt tanks, and the ability to feed the potential new facility from the feed receipt tanks (225), shall be provided. This routing capability shall include the installation of piping that will allow for tie-in at a later date.

(7) Routing capability, from the Pretreatment Facility to transfer treated and concentrated LAW feed to a potential new facility shall be provided. This routing capability shall include the installation of piping exterior to the pretreatment building that will allow for tie-in at a later date.

(8) Provide the capability to install future alternative solids filtering technologies in Pretreatment Facility hot cell areas used for the ultrafiltration system (Pretreatment Areas 34 and 35). This capability shall be accomplished by the addition of spare wall penetrations and associated piping or conduit runs into accessible areas to the extent practical.

(9) The glass former feed capability shall be designed to support LAW Vitrification operations at a design capacity of 30 MTG/day, and HLW Vitrification at a design capacity of 7.5 MTG/day. The glass former facility shall be capable of being expanded to support operation at 45 MTG/day.

(10) Provide HLW facility systems and permits to support the future operation of the HLW Facility at a design capacity of 7.5 MTG/day including melter power supplies, pour cave cooling, and support for additional melter bubblers as necessary. The dangerous waste permit shall be modified to support the operation of the HLW Vitrification facility at 7.5 MTG/day. Melter demonstration trials may be limited to the design capacity of the HLW melter system available at the time of these trials. The expanded HLW vitrification capacity will be achieved by a second generation HLW melter.

(d) Waste Treatment and Immobilization Plant Unit Operation: The WTP treatment process shall include Pretreatment Unit Operations, HLW Vitrification Unit Operations, and LAW Vitrification Unit Operations.

(1) Pretreatment Unit Operations: Pretreatment shall include the following major process functions:

(i) Ultra-Filtration: This operation separates solids from supernatant. Separation is required to allow subsequent treatment of the waste fractions as IHLW and ILAW respectively.

(ii) Sr/TRU Removal: This operation removes ^{90}Sr and TRU elements to allow for production of an ILAW waste product that meets Specification 2.2.2.8, *Radionuclide Concentration Limitations*. The technology for the removal of ^{90}Sr is an isotopic dilution process that uses non-radioactive Sr as the reagent. The removal of TRU is accomplished using sodium permanganate

for de-complexation and adsorption of the TRU elements.

(iii) Cs Removal: This operation removes ^{137}Cs from the filtered supernatant to allow for production of an ILAW waste product that meets the Specification 2.2.2.8, *Radionuclide Concentration Limitations*. In addition, ^{137}Cs will be further removed, to achieve a 0.3 Ci/m^3 in the ILAW product, to facilitate the maintenance concept established for the ILAW melter system. The Cs removal process shall use an elutable ion exchange resin. Resin selection shall consider technical acceptability and life cycle costs. Ion-exchange resins shall be qualified for WTP operations and may include SuperLig® SL-644 resin, spherical resorcinol formaldehyde, or other qualified resins.

(iv) Technetium (Tc) Removal: This operation removes ^{99}Tc (in the sodium [Na] pertechnetate form) from the filtered supernatant to allow for production of an ILAW waste product that meets the Specification 2.2.2.8, *Radionuclide Concentration Limitations*. The Contractor shall not design or procure equipment relating to the Technetium Ion Exchange System. However, the Contractor shall provide space within the Pretreatment Facility for such equipment should it become necessary to provide technetium removal capability in the future. Contractor shall place floor embedments and wall penetrations within the facility to ensure that the option to install the Technetium Ion Exchange System equipment is maintained. Should Tc removal be required in the future, the Tc removal process shall use the elutable SuperLig ® SL-639 resin (registered trademark of IBC Advanced Technologies, Inc.) or DOE-approved equivalent. The Contractor shall not conduct additional research on alternative resins for use in this process.

(v) Waste Concentration: This operation concentrates the main process stream (Envelope A, B, and C supernatants and envelope D solids as required) and dilute internal facility recycles recovered from the wash and leach steps that are part of the HLW sludge treatment. Radionuclides recovered from the supernatant fraction in the cesium ion exchange process are concentrated for reagent recovery and to minimize the liquid volume of feed to HLW.

(vi) Liquid Effluent Treatment: This operation collects the WTP effluent and provides for the discharge to the Hanford Site 200 East Area Effluent Treatment Facility (ETF) or allows for the re-use of liquid effluent as process water with the WTP. Treated effluent will be transferred to the Hanford Site ETF as required.

(vii) Washing, Caustic Leaching, and Oxidative Leaching of HLW Solids: The Pretreatment Facility shall have the capability to conduct washing, leaching and oxidative leaching of HLW solids. Washing, caustic leaching, and oxidative leaching shall be performed using the process steps proposed by the Contractor. The objective of the water washing process step is to remove soluble Na and sulfate so that the HLW glass waste oxide loading is not limited by Na and/or sulfate. Water washing is defined as the dilution of dissolved waste constituents either with process water or very diluted caustic solution. The objective of the caustic leaching process step is to remove aluminum from the feed to HLW Vitrification so that the HLW glass waste oxide loading is not limited by aluminum. The objective of the oxidative leaching process is to remove chromium from the feed to HLW Vitrification so that the HLW glass waste oxide loading is not limited by chromium. These objectives are not absolute requirements, but will be balanced as described in Specification 12 with other operational parameters. .For example, if the approved flowsheet or process steps (Standard 2(a)(3)(iii)) results in glass limited by aluminum (Al), chromium (Cr) sulfate, or sodium (Na) it is acceptable.

The proposed process steps for sludge treatment, developed using data from the testing described in Standard 2(a)(3)(iii), shall be submitted to DOE for review and approval (Table C.5.1-1 Deliverable 2.10).

The Contractor shall evaluate their proposed procedure for Specification 12, *Procedure to Determine Waste Feed Treatment Approach*, against the results obtained in sludge treatment testing. The procedure shall provide projections of IHLW and ILAW quantities produced consistent with the sludge treatment testing and proposed process steps. The Contractor shall recommend the specific test procedure (e.g., testing and modeling) for Specification 12, for DOE review and approval (Table C.5.1-1, Deliverable C.7-1).

(2) High-Level Waste Vitrification Unit Operations: HLW Vitrification shall include the following major process functions:

(i) High-Level Waste Feed Preparation: HLW melter feed will be prepared from treated HLW solids, concentrates from radionuclide recovery processes, and glass forming chemicals. The HLW feeds will be prepared, sampled, and qualified prior to the HLW Vitrification operation. The qualification strategy is to be developed and documented in the IHLW Waste Form Compliance Plan (Table C.5-1.1, Deliverable 6.2).

(ii) High-Level Waste Vitrification: HLW feed shall be converted to a borosilicate glass in a ceramic lined, joule heated melter. The glass product shall meet Specification 1, *Immobilized High-Level Waste Product*.

(iii) High-Level Waste Melter Offgas Treatment: Offgas treatment system shall be designed to meet environmental permitting requirements. The primary offgas treatment system consists of a submerged bed scrubber (SBS), a wet electrostatic precipitator (WESP), and high-efficiency particle absorber (HEPA) filters. Before exiting the facility, the offgas is treated by a secondary offgas treatment system consisting of activated carbon adsorbers, a sliver mordenite column, a thermal catalytic oxidizer (TCO), and a selective catalytic reducer (SCR).

(iv) High-Level Waste Canister Closure, Decontamination, and Inspection: The HLW canister is sealed via welding. The canister is decontaminated using a chemical etching process that uses [cerium] Ce (IV) as the chemical reagent. (M047)

(3) Low-Activity Waste Vitrification Unit Operations: LAW Vitrification shall include the following major process functions:

(i) Low-Activity Waste Feed Preparation: LAW melter feed will be prepared from the pretreated supernatant and glass forming chemicals. The qualification strategy shall be developed and documented in the ILAW Product Compliance Plan (Table C.5-1.1, Deliverable 6.3).

(ii) Low-Activity Waste Vitrification: LAW feed shall be converted to a glass that meets Specification 2, *Immobilized Low-Activity Waste Product.*, in a ceramic-lined, joule-heated melter.

(iii) CLIN 2.1 Direct Feed LAW Vitrification Unit Operations Design **(350)**: Modification to implement DFLAW shall provide the capability to operate LAW, BOF and the Analytical Laboratory [collectively the (LBL)] in integrated configuration both with feed from PT and in the DFLAW configuration. Operation in each configuration is not simultaneous.

Transfer line(s) for LAW feed from the Tank Farm (TF) and liquid effluent return shall be routed from the LAW Facility to the TF/WTP interface point as defined in Interface Control Document (ICD) 30 and 31, respectively. The WTP Project contractor shall perform required modification at the interface point.

(iv) Low-Activity Waste Melter Off-gas Treatment: The offgas treatment system shall be designed to meet environmental permitting requirements.

(v) Low-Activity Waste Container Closure, Decontamination, and Inspection: Container closure, decontamination, and inspection shall be conducted in accordance with Specification 2, *Immobilized Low-Activity Waste Product*. The ILAW Product container is sealed, decontaminated, and then the container is weighed and checked for dimensionality. The container is decontaminated using a solid carbon dioxide abrasion process. Temperature and gamma dose rate measurements will be taken on selected containers.

(e) Plant Operator Qualification and Training Facility Design (simulator): The Contractor shall develop a “limited” full scope simulator. The simulator may be located off site.
The simulator facility will include three (3) control room replications (main Pretreatment Facility control room, LAW Vitrification Facility control room, and HLW Vitrification Facility control room), along with the associated infrastructure and offices to support the simulator facility operations.

The “limited” full scope simulator is defined as a training environment that closely models the process and associated equipment located in the actual control rooms. This simulator will provide an environment for understanding the process and control strategies to optimize plant performance and to provide training for situations that would not normally be experienced during normal plant operations.

C.8 OPERATIONAL SPECIFICATIONS

This section provides the WTP Operational Specifications including LAW and HLW feed characteristics, intermediate waste product requirements, final waste product requirements, and waste product inspection and acceptance.

Specification 1:	Immobilized High-Level Waste Product
Specification 2:	Immobilized Low-Activity Waste Product
Specification 3:	Entrained Solids
Specification 4:	Reserved
Specification 5:	Reserved
Specification 6:	Reserved
Specification 7:	Low-Activity Waste Envelopes Definition
Specification 8:	High-Level Waste Envelope Definition
Specification 9:	Liquids or Slurries Transferred to DOE Tanks by Pipeline
Specification 10:	Reserved
Specification 11:	Reserved
Specification 12:	Procedure to Determine the Waste Feed Treatment Approach
Specification 13:	Waste Product Inspection and Acceptance

Specification 1: Immobilized High-Level Waste Product

1.1 Scope: This Specification defines requirements for the IHLW product, a waste product. The IHLW product is a vitrified borosilicate glass waste form for ultimate disposal in the proposed geologic repository.

1.2 Requirements:

1.2.1 References:

1.2.1.1 CRD. DOE/RW-0406. Revision 8. September 12, 2007. *Civilian Radioactive Waste Management Systems Requirements Document*, ICN 1. U.S. Department of Energy, Office of Civilian Radioactive Waste Management. Washington, D.C.

1.2.1.2 DOE Manual 435.1-1. July 9, 1999. *Radioactive Waste Management Manual.* U.S. Department of Energy, Washington, D.C.

1.2.1.3 WASRD. DOE/RW-0351. Revision 5. May 31, 2007. *Waste Acceptance System Requirements Document (WASRD)*. U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Washington, D.C. (M047) (M114)

1.2.1.4 WAPS. DOE/EM-0093. Revision 2. December 1996. *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms,* U.S. Department of Energy, Washington D.C. (M047) (M114)

1.2.1.5 IICD. DOE/RW-0511. Revision 4. March 7, 2008. Integrated Interface Control Document, Volume 1. *High-Level Radioactive Waste and U.S. Department of Energy and Naval Spent Nuclear Fuel to the Civilian Radioactive Waste Management System*. U.S. Department of Energy, Washington D.C.

1.2.1.6 MOA. Revision 2. February 2007. *Memorandum of Agreement for Acceptance of Spent Nuclear Fuel and High-Level Nuclear Waste (MOA) between Environmental Management (EM) U.S. Department of Energy (DOE), Washington, DC. and Office of Civilian Radioactive Waste Management (DOE-RW or OCRWM)*. U.S. Department of Energy, Washington, D.C. (M114)

1.2.1.7 QARD. DOE/RW-0333P. Revision 20. January 2008. *Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program (QARD*). U.S. Department of Energy, Office of Civilian Radioactive Waste Management, Washington, D.C.

1.2.1.8 40 CFR 268. "Land Disposal Restrictions." *Code of Federal Regulations*. U.S. Environmental Protection Agency, Washington, D.C.

1.2.1.9 WAC 173-303. "Dangerous Waste Regulations." *Washington Administrative Code*, as amended.

1.2.1.10 HWMA. *Hazardous Waste Management Act.*

1.2.1.11 RCRA. *Resource Conservation and Recovery Act*.

1.2.2 Product Requirements:

1.2.2.1 Immobilized High-Level Waste:

1.2.2.1.1 Product and Disposal Requirements: The IHLW product shall meet the requirements established in the *Waste Acceptance Product Specifications* (WAPS) and the supporting documents *Waste Acceptance Systems Requirements Document* (WASRD), and Integrated Interface Control Document (IICD). The WAPS, WASRD, and IICD identify the requirements of DOE-RW for acceptance of IHLW for disposal at a federal geologic repository. A *Memorandum of Agreement for Acceptance of Department of Energy Spent Nuclear Fuel and High-Level Nuclear Waste*, (MOA) sets forth, specifies, and lists the programmatic protocols, technical data, specifications and requirements for producing an acceptable IHLW waste form for disposal at a federal geologic repository. The *Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program* (QARD) establishes the minimum QA requirements for compliance with the US Department of Energy, Office of Civilian Radioactive Waste Management (DOE-RW, or OCRWM). These requirements must be met before the IHLW waste glass canisters will be accepted by the DOE Office of River Protection (ORP) for onsite interim storage and later formal acceptance by DOE-RW for final disposal.

1.2.2.1.2 Canister System: The reference canister system used to contain the IHLW product shall be a 4.5-meter long by 0.61-meter diameter canister system with a neck and flange design similar to that used at the West Valley Demonstration Project.

1. "Fill Height: Fill height shall be equivalent to at least 87 percent of the volume of the empty canister. The average fill height over all the canisters shall be at least 95 percent of the volume of the empty canister."
2. "Maximum Heat Generation Rate: The maximum heat generation rate for any single canister shall not exceed 1500 watts per canister when delivered to DOE."
3. "Surface Contamination Limitations: Removable contamination on the external surfaces of the package shall not exceed 3,670 Bq/m^2 for alpha and 36,700 Bq/m^2 for beta-gamma. (M047)

1.2.2.1.3 Condition at Delivery: At time of delivery to DOE, the HLW form shall stand upright without support on a flat horizontal surface and properly fit into a right-circular, cylindrical cavity (64-cm diameter and 4.51-m length).

1.2.2.1.4 Dangerous and Hazardous Waste Requirements: The WTP shall be designed, constructed, and operated so that the IHLW product does not designate as characteristic or criteria for dangerous waste or extremely hazardous waste pursuant to WAC 173-303-070, and is not restricted from land disposal pursuant to WAC 173-303-140 and 40 CFR 268, "Land Disposal Restrictions."

1.2.2.1.5 Product Loading: Loading of non-volatile components in Envelope D shall be achieved such that the concentration of at least one of the waste components or waste component combinations in Table TS-1.1, *Minimum Component Limits in High-Level Waste Glass*, exceeds its minimum weight percent in HLW glass as identified in Table TS-1.1 (e.g., for a high-iron waste, the waste product shall incorporate at least 12.5 weight percent [wt%] iron oxide from the waste into the glass). The product loading shall not cause the limits in any other requirement of this specification to be violated. Product waste loading shall be calculated on an average basis for each batch transfer of Waste Envelope D. The waste loading may be adjusted downward if necessary to comply with Universal Treatment Standards leaching requirements.

1.2.3 Handling Requirements:

1.2.3.1 Product Handling: The canister shall have a point of connection that allows vertical upward, vertical downward, and horizontal motion while attached to a hoist and grapple.

1.3 Quality Assurance: A QA Program for the IHLW form development, qualification, characterization, and certification is required and shall be consistent with DOE/RW-0333P. (M152)

1.4 Inspection and Acceptance: The DOE-approved IHLW Waste Form Compliance Plan (Table C.5-1.1, Deliverable 6.2), described in Standard 6, *Product Qualification, Characterization, and Certification*, defines the content and delivery of documentation required to demonstrate compliance with the requirements of this specification. Product inspection and acceptance shall be performed in accordance with Specification 13, *Waste Product Inspection and Acceptance*, and the required IHLW QA Program.

Table TS-1.1 Minimum Component Limits in High-Level Waste Glass

Component	Weight Percent in HLW Glass
Fe_2O_3	12.5
Al_2O_3	11.0
$Na_2O + K_2O$	15.0
ZrO_2	10.0
UO_2	8.0
ThO_2	4.0
CaO	7.0
MgO	5.0
BaO	4.0
CdO	3.0
NiO	3.0
PbO	1.0
TiO_2	1.0
Bi_2O_3	2.0
P_2O_5	3.0
F	1.7
$Al_2O_3 + ZrO_2$	14.0
$Al_2O_3 + ZrO_2 + Fe_2O_3$	21.0
MgO + CaO	8.0

Component	Weight Percent in HLW Glass
Cr_2O_3	0.5
SO_3	0.5
Ag_2O	0.25
Rh_2O_3 + Ru_2O_3 +PdO	0.25
Any single waste oxide (exclusive of Si) not specifically identified in Specification 8, TS-8.1 and 8.4	0.2
Total of all other waste oxides (exclusive of Si) not specifically identified in this table.	8.0

Specification 2: Immobilized Low-Activity Waste Product

2.1 Scope: This Specification defines the requirements for the ILAW product, a final waste product. The ILAW product is a glass waste form for disposal on the Hanford Site.

2.2 Requirements:

2.2.1 References:

2.2.1.1 10 CFR 61. "Licensing Requirements for Land Disposal of Radioactive Waste." *Code of Federal Regulations*. U.S. Nuclear Regulatory Commission, Washington, D.C.

2.2.1.2 40 CFR 268. "Land Disposal Restrictions." *Code of Federal Regulations*. U.S. Environmental Protection Agency, Washington, D.C.

2.2.1.3 49 CFR 172.101. "Table 2 - Radionuclides." *Code of Federal Regulations*. U.S. Department of Transportation, Washington, D.C.

2.2.1.4 49 CFR 173. "Shippers-General Requirements for Shipments and Packaging. Subpart I - Radioactive Materials." *Code of Federal Regulations*. U.S. Department of Transportation, Washington, D.C.

2.2.1.5 DELETED (310)

2.2.1.6 ANSI/ANS-16.1. April 14, 1986. *Measurement of the Leachability of Solidified Low-Level Radioactive Wastes by a Short Term Test Procedure.* American National Standards Institute/American Nuclear Society, La Grange Park, Illinois.

2.2.1.7 ANSI/ANS-55.1. July 28, 1992. *Solid Radioactive Waste Processing System for Light-Water-Cooled Reactor Plants; Appendix B - Testing for Free Liquids in Solidified Matrices*. American National Standards Institute/American Nuclear Society, La Grange Park, Illinois.

2.2.1.8 ASTM B553-79. May 25, 1979. *Standard Test Method for Thermocycling of Electroplated Plastics*. American Society for Testing and Materials, Easton, Maryland.

2.2.1.9 ASTM C39/C39M-01. July 2001. *Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens*. American Society for Testing and Materials, Easton, Maryland.

2.2.1.10 ASTM C1285-02. October 2002. *Standard Test Methods for Determining Chemical Durability of Nuclear Waste Glasses: The Product Consistency Test (PCT)*. American Society for Testing and Materials, Easton, Maryland.

2.2.1.11 ASTM G21-96. July 10, 1999. *Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi*. American Society for Testing and Materials, Easton, Maryland.

2.2.1.12 ASTM G22-76 (R1996). November 26, 1976. *Standard Practice for Determining Resistance of Plastics to Bacteria*. American Society for Testing and Materials, Easton, Maryland.

2.2.1.13 DOE Manual 435.1-1. July 9, 1999. *Radioactive Waste Management Manual*. U.S. Department of Energy, Washington, D.C.

2.2.1.14 NRC. January 1995. *Branch Technical Position on Concentration Averaging and Encapsulation*. Division of Waste Management, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C.

2.2.1.15 NRC. January 1991. *Technical Position on Waste Form*, Revision 1, Low-Level Waste. Division Management Branch, Office of Nuclear Material Safety and Safeguards, U. S. Nuclear Regulatory Commission, Washington, D.C.

2.2.1.16 NUREG/BR-0204. July 1998. *Instructions for Completing NRC's Uniform Low-Level Radioactive Waste Manifest*. U.S. Nuclear Regulatory Commission, Washington, D.C.

2.2.1.17 SW-846, *Test Methods for Evaluating Solid Waste*, *Physical/Chemical Methods*. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

2.2.1.18 WA 7890008967. Revision 2. August 1995 (as modified). *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage and Disposal of Dangerous Waste at the Hanford Facility*. Washington State Department of Ecology, Olympia, Washington.

2.2.1.19 WAC 173-303. "Dangerous Waste Regulations." *Washington Administrative Code*, as amended.

2.2.1.20 Vitreous State Laboratory, 1998. *Glass Formulation and Testing with TWRS LAW Simulants*. The Catholic University of America, Washington, D.C.

2.2.1.21 *Appendix I.7: ILAW Special Packaging Authorization of the Hanford Sitewide Transportation Safety Document, Revision 1-E, DOE/RL-2001-36, May 2011.* ***(293)***

2.2.2 Product Requirements:

2.2.2.1 Package Description: The ILAW product shall be in the form of a package. The constituent parts of each package are a sealed stainless-steel container enclosing a poured glass waste form and an optional filler material of sand or glass. If an optional filler is used, DOE approval on the filler composition is required.

2.2.2.2 Waste Loading: The loading of waste sodium from Envelope A in the ILAW glass shall be greater than 14 weight percent based on Na_2O. The loading of waste sodium from Envelope B in the ILAW glass shall be greater than 3.0 weight percent based on Na_2O. The loading of waste sodium from Envelope C in the ILAW glass shall be greater than 10 weight percent (wt%) based on Na_2O.

2.2.2.3 Size and Configuration: The package shall be a 304L stainless-steel right circular cylinder. The height of the package shall be 2.286 m (90"), and the diameter shall be 1.22 m (48"). At the time of acceptance, the ILAW package shall stand without support on a flat, horizontal surface.

2.2.2.4 Mass: The mass of each package shall not exceed 10,000 kilograms.

2.2.2.5 Void Space: The void space in the container shall not exceed 10 percent of the total internal volume at the time of filling, excluding void space internal to the

glass waste form (e.g., small bubbles in the glass). After cooling, if necessary, the container shall be filled with suitable inert dry filler such that the void space meets the requirements of Dangerous Waste Regulation WAC 173-303-665 (12); i.e., the container shall be at least ninety (90) percent full when placed in the landfill.

2.2.2.6 Chemical Composition Documentation: The chemical composition of the waste form, filler, and package shall be identified.

2.2.2.6.1 DELETED

2.2.2.6.2 Chemical Composition During Production: The production documentation (Table C.5-1.1, Deliverable 6.7) shall provide the chemical composition of each waste form, optional filler, and package. The reported composition shall include elements (excluding oxygen) present in concentrations greater than 0.5 percent by weight and elements and compounds required to meet regulatory or Contract requirements.

2.2.2.6.3 DELETED

2.2.2.7 Radiological Composition Documentation: The radionuclide composition of the waste form shall be documented. Radionuclides shall be identified that are significant as defined in NUREG/BR-0204 and 49 CFR 172.101 (Table 2). Technetium-99 (^{99}Tc) shall be considered to be significant at concentrations greater than 0.003 Ci/m^3 in the ILAW form. The inventories shall be indexed to December 31, 2002. The documentation shall be consistent with the radiological description format described in NUREG/BR-0204.

2.2.2.7.1 Radionuclide Composition Qualification: The ILAW Product Qualification Report (Table C.5-1.1, Deliverable 6.6) shall identify the estimated radionuclide concentration in the waste form.

2.2.2.7.2 Radionuclide Composition During Production: The ILAW production documentation (Table C.5-1.1, Deliverable 6.7) shall identify the radionuclide inventory in each ILAW package produced. The actual inventory indexed at the month of product transfer and the inventory indexed to December 31, 2002, shall be reported.

2.2.2.8 Radionuclide Concentration Limitations: The radionuclide concentration of the ILAW form shall not exceed Class C limits as defined in 10 CFR 61.55. In addition, the average glass concentrations of cesium-137 (^{137}Cs) and strontium-90 (^{90}Sr) shall be limited as follows: $^{137}Cs < 3$ Ci/m^3 and $^{90}Sr < 20$ Ci/m^3. The method used to perform concentration averaging should be identified in the ILAW Product Compliance Plan.

2.2.2.9 Surface Dose Rate Limitations: The dose rate at any point on the external surface of the package shall not exceed 500 mrem/hr.

2.2.2.10 Surface Contamination Limitations: Removable contamination on the external surfaces of the package shall be maintained as low as reasonably achievable (49 CFR 173.443) as defined by DOE/RL-2001-36 Appendix I.7. **(293)**

2.2.2.11 Labeling: Each package shall have an identification number on the shoulder and side of the package as described in the ILAW Product Compliance Plan (Table C.5-1.1, Deliverable 6.3). The lettering on the label shall be at least 5.0 cm high, and characters shall have a width of at least 3.5 cm. The label shall contain a unique identification (e.g., serial number), which shall be assigned to each package and the corresponding documentation. Labels and markings shall have a predicted service life of 50 years assuming that the packages are stored in a ventilated enclosure at ambient temperatures.

2.2.2.12 Closure and Sealing: The fully loaded package shall be closed and sealed. The closure system shall be sealed to prevent the dispersal of radioactive material during the most severe conditions encountered during normal use and handling. The closure system shall be designed to ensure that the seal remains intact for a storage period of 50 years in an ambient-temperature, ventilated enclosure.

2.2.2.13 External Temperature: The temperature of the accessible external surfaces of the package shall not exceed 465°F (alternating pour) or 550°F (single pour) when returned to DOE. This temperature constraint shall assume a shaded, still air environment at an ambient temperature of 38°C.

2.2.2.14 Free Liquids: The package shall contain no detectable free liquids as defined in ANSI/ANS-55.1 or SW-846 Method 9095.

2.2.2.15 Pyrophoricity or Explosivity: The package contents shall not be pyrophoric, readily capable of detonation, or readily capable of explosive decomposition or reaction (including reaction with water) at normal pressure and temperature. The waste form and any optional filler materials shall not be ignitable or reactive as defined in WAC 173-303-090(5) and WAC 173-303-090(7).

2.2.2.16 Explosive or Toxic Gases: The package shall not contain or be capable of generating quantities of explosive (e.g., hydrogen) or toxic gases, vapors, or fumes harmful to persons handling the waste.

2.2.2.17 Waste Form Testing:

2.2.2.17.1 DELETED

2.2.2.17.2 Product Consistency Test: The normalized mass loss of sodium, silicon, and boron shall be measured using a seven day product consistency test run at 90°C as defined in ASTM C1285-98. The test shall be conducted with a glass to water ratio of 1 gram of glass (-100 +200 mesh) per 10 milliliters of water. The normalized mass loss shall be less than 2.0 grams/m^2. Qualification testing shall include glass samples subjected to representative waste form cooling curves. The product consistency test shall be conducted on waste form samples that are statistically representative of the production glass.

2.2.2.17.3 Vapor Hydration Test: The glass corrosion rate shall be measured using at least a seven (7)-day vapor hydration test run at 200°C as defined in the DOE-concurred upon ILAW Product Compliance Plan. The measured glass alteration rate shall be less than 50 grams/(m^2 day). Qualification testing shall include glass samples subjected to representative waste form cooling curves. The vapor hydration test shall be conducted on waste form samples that are representative of the production glass.

2.2.2.18 Compressive Strength: The mean compressive strength of the waste form shall be determined by testing representative non-radioactive samples.
The compressive strength shall be at least 3.45E6 Pa when tested in accordance with ASTM C39/C39M-99 or an equivalent testing method.

2.2.2.19 DELETED

2.2.2.19.1 DELETED

2.2.2.19.2 DELETED

2.2.2.19.3 DELETED

2.2.2.19.4 DELETED

2.2.2.20 Dangerous Waste Limitations: The ILAW product shall be acceptable for land disposal under the State of Washington *Dangerous Waste Regulations*, WAC 173-303, and RCRA LDR in 40 CFR 268.

2.2.2.21 Compression Testing: Each fully loaded package shall be able to withstand a compression load of five (5) times the weight of the filled container. Compliance with this specification shall be established by using the compression (stacking) test described in 49 CFR 173.465(d) or evaluated against this test by any of the methods authorized by 49 CFR 173.461(a). The integrity of the package shall be demonstrated by showing that the seal remains intact in accordance with Specification 2.2.2.12, *Closure and Sealing*.

2.2.2.22 Container Material Degradation: The container and handling appurtenances shall be designed to allow safe lifting and movement (in accordance with Specification 2.2.3.1) after a storage period of fifty (50) years.

2.2.2.23 Manifesting: A shipping manifest shall be prepared for delivery with each shipment of ILAW product. Information on the manifest shall satisfy the requirements in DOE Manual 435.1-1, Chapter IV, Section I.(2), and NUREG/BR-0204. Any package containing dangerous waste must be labeled and manifested in accordance with WAC 173-303-370 and the *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Wastes* (Permit No. WA 7890008967).

2.2.3 Handling Requirements:

2.2.3.1 Package Handling: The package shall be compatible with crane lifting and movement. The package shall be equipped with lifting and other handling appurtenances designed to allow safe lifting, and movement, when fully loaded. The package shall maintain its integrity during handling, and transportation.

2.3 Quality Assurance: A QA Program (Table C.5-1.1, Deliverable 7.2) for ILAW Product development, qualification, characterization, and certification is required and shall be based upon NQA-1 (2000). The QA Plan shall address the QA/quality control requirements addressed in SW-846 and WAC 173-303-806. (M066)

2.4 Inspection and Acceptance: The DOE-approved ILAW Product Compliance Plan (Table C.5-1.1, Deliverable 6.3), described in Standard 6, *Product Qualification, Characterization, and Certification,* defines the content and delivery of documentation required to demonstrate compliance with the requirements of this specification. Product inspection and acceptance shall be performed in

accordance with Specification 13, *Waste Product Inspection and Acceptance*, and the required ILAW QA Program. In addition to Specification 13 requirements for ILAW, the Contractor shall conform to the Contractor Certification Program as described in DOE Manual 435.1-1, Chapter IV, Section J.(1).

Specification 3: Reserved

Specification 4: Reserved

Specification 5: Reserved

Specification 6: Reserved

Specification 7: Low-Activity Waste Envelopes Definition

7.1 Scope: This Specification establishes four **(350)** LAW feed envelopes, Waste Envelopes A, B, and C (feed from the tank farms per ICD 19) and waste envelope E (Direct Feed from LAWPS, per ICD 30) **(350)**. Each waste envelope provides the compositional limits for chemical and radioactive constituents in the waste feed to be provided to the WTP. The WTP shall be designed to treat the waste envelopes with the limits established in this specification. Waste composition information from TFCOUP Revision 6 is used to establish overall WTP design capacity as defined in Section C.7 and is not otherwise used for design.

7.2 Requirements:

7.2.1 References:

7.2.1.1 HNF-SD-WM-SAR-067, Revision 1-I. March 2000. *Tank Waste Remediation System Final Safety Analysis Report*. CH2M HILL Hanford Group, Inc., Richland, Washington.

7.2.1.2 HNF-SD-WM-TSR-006, Revision 1-HE. March 2000. *Tank Waste Remediation System Technical Safety Requirements*, CH2M HILL Hanford Group, Inc., Richland, Washington.

7.2.1.3 OSD-T-151-00007, Revision H-22. June 14, 2000. *Operating Specification for 241-AN, AP, AW, AY, AZ, and SY Tank Farms*. CH2M HILL Hanford Group, Inc., Richland, Washington.

7.2.1.4 DOE/RL-88-21, Revision 10. December 21, 1999. *Double Shell Tank Unit Permits Application*. U.S. Department of Energy, Richland Operations Office, Richland, Washington.

7.2.2 Envelope Requirements:

7.2.2.1 Composition: This specification lists the concentration limits for the LAW Envelopes A, B, C and E **(350)** feed to be transferred by DOE to the Contractor for LAW services in Tables TS-7.1, *Low-Activity Waste Chemical Composition, Soluble Fraction Only,* and TS-7.2, *Low-Activity Waste Radionuclide Content, Soluble Fraction Only*. The concentration limits apply to the soluble fraction only. The Na concentration limits for the LAW feeds are identified below.

Waste Feed	Na (mole per liter)
Envelope A, B, C, E **(350)**	4 – 10
AZ-101 Supernatant	2 – 5
HLW Slurry and other HLW Liquids (Defined in Specification 8, *High-Level Waste Envelope Definition*)	0.1 – 10*

*The feed delivery batch size shall be such that, after receipt in WTP and blending with pre-existing receipt tank contents, the sodium molarity will not exceed 7 **(M183)**.

The Contractor shall work with the TF Contractor to develop compositional and radionuclide limits for Envelope E (Table 5.1-1, Deliverable C.8-1). Preliminary information and requirements to consider include:

Envelope E concentration of radionuclides shall meet the criteria to

produce acceptable ILAW including ^{137}Cs less than or equal to 0.3 Ci per cubic meter of glass, an external dose rate of less than or equal to 500 mRem/hr. be non-transuranic, not exceed class C limits as defined in 10 CFR 61.55 and ^{90}Sr less than 20 Ci/m^3 . The E envelope activity limit for ^{137}Cs is 0.095 µCi/mL and the activity limit for gross alpha/beta is 1.6E-02 µCi/mL. **(350)**

The LAW feeds may contain up to 3.8 weight percent (wt%) solids and will be delivered to the WTP after there has been sufficient settling time to ensure solids that settle faster than 0.03 ft/min have settled below the transfer location within the tank farms feed tank **(M183)**. Solids are defined as the product of centrifuging the LAW feed, separating and drying the solids, and removing the dissolved solids contribution. The insoluble fraction characterization will include measurements of Al, Cr, Fe, Mn, Na, P, S, Si, U, TIC, TOC, ^{60}Co, ^{90}Sr, ^{99}Tc, ^{137}Cs, ^{154}Eu, $^{239/240}Pu$, ^{241}Am, and total alpha concentrations. Trace quantities of unspecified radionuclides, chemicals, and other impurities may be present in the waste feed.

All LAW feed (soluble and insoluble components) will meet the Tank Farm Operations specifications given in OSD-T-151-00007 (except for free hydroxide), the *Tank Waste Remediation System Final Safety Analysis Report*, and *Technical Safety Requirements*, as applicable.

The radiochemical inventory of the LAW feed at the time of delivery shall be compared to the specification limits to assess compliance. The specifications for ^{60}Co, and ^{154}Eu shall apply at the time of delivery for ILAW immobilization.

The LAW feed provided shall not contain a visible separate organic phase.

The LAW feed provided will generate gases, including hydrogen and ammonia, at a nearly constant rate and a nearly uniform composition. The Contractor is responsible for the management of changes in gas release rate and distribution resulting from their waste processing activities.

Dangerous waste codes are identified in the *Double-Shell Tank System Unit Permit Application* (DOE/RL-88-21, December 21, 1999). Multi-source leachate (F039) is included as a waste derived from non-specific source wastes F001 through F005.

7.2.2.2 Radioactive Material Concentration: The maximum ^{137}Cs concentration equivalent in the transferred Envelope A, Envelope B, and Envelope C wastes feeds shall not exceed 1.2 Ci/l. The maximum ^{137}Cs concentration equivalent in the liquid fraction of Tanks AZ-101 and AZ-102 feeds shall not exceed 3.0 Ci/l.

Table TS-7.1 Low-Activity Waste Chemical Composition, Soluble Fraction Only

Chemical Analyte	Maximum Ratio, analyte (mole) to sodium (mole)		
	Envelope A	Envelope B	Envelope C[3]
Al	2.5E-01	2.5E-01	2.5E-01
Ba	1.0E-04	1.0E-04	1.0E-04
Ca	4.0E-02	4.0E-02	4.0E-02

Table TS-7.1 Low-Activity Waste Chemical Composition, Soluble Fraction Only

Chemical Analyte	Maximum Ratio, analyte (mole) to sodium (mole)		
	Envelope A	Envelope B	Envelope C[3]
Cd	4.0E-03	4.0E-03	4.0E-03
Cl	3.7E-02	8.9E-02	3.7E-02
Cr	6.9E-03	2.0E-02	6.9E-03
F	9.1E-02	2.0E-01	9.1E-02
Fe	1.0E-02	1.0E-02	1.0E-02
Hg	1.4E-05	1.4E-05	1.4E-05
K	1.8E-01	1.8E-01	1.8E-01
La	8.3E-05	8.3E-05	8.3E-05
Ni	3.0E-03	3.0E-03	3.0E-03
NO_2	3.8E-01	3.8E-01	3.8E-01
NO_3	8.0E-01	8.0E-01	8.0E-01
Pb	6.8E-04	6.8E-04	6.8E-04
PO_4	3.8E-02	1.3E-01	3.8E-02
SO_4	1.0E-02	7.0E-02	2.0E-02
TIC[1]	3.0E-01	3.0E-01	3.0E-01
TOC[2]	5.0E-01	5.0E-01	5.0E-01
U	1.2E-03	1.2E-03	1.2E-03

Notes:

1. Mole of inorganic carbon atoms/mole sodium.
2. Mole of organic carbon atoms/mole sodium.
3. Envelope C LAW is limited to complexed tank wastes from Hanford tanks AN-102 and AN-107.

Table TS-7.2 Low-Activity Waste Radionuclide Content, Soluble Fraction Only
Maximum Ratio, radionuclide to sodium (mole)

Radionuclide	Envelope A		Envelope B		Envelope C	
	Bq	uCi	Bq	uCi	Bq	uCi
TRU	4.80E+05	1.30E+01	4.80E+05	1.30E+01	3.00E+06	8.11E+01
^{137}Cs	4.30E+09	1.16E+05	2.00E+10	5.41E+05	4.30E+09	1.16E+05
^{90}SR	4.40E+07	1.19E+03	4.40E+07	1.19E+03	8.00E+08	2.16E+04
^{99}Tc	7.10E+06	1.92E+02	7.10E+06	1.92E+02	7.10E+06	1.92E+02

^{60}Co	6.10E+04	1.65E+00	6.10E+04	1.65E+00	3.70E+05	1.00E+01
^{154}Eu	6.00E+05	1.62E+01	6.00E+05	1.62E+01	4.30E+06	1.16E+02

Notes:

1. The activity limit shall apply to the feed certification date.

2. TRU is defined as: Alpha-emitting radionuclides with an atomic number greater than 92 with half-life greater than 20 years.

   Some radionuclides, such as ^{90}Sr and ^{137}Cs, have daughters with relatively short half-lives. These daughters have not been listed in this table. However, they are present in concentrations associated with the normal decay chains of the radionuclides.

1Bq = 2.703 e-5 uCi

Specification 8: High-Level Waste Envelope Definition

8.1 Scope: This Specification establishes the HLW slurry composition and the unwashed solids composition (Envelope D). This waste envelope provides the compositional limits for chemical and radioactive constituents and physical properties in the waste feed to be provided to the WTP. The WTP shall be designed to treat the feed envelope with the limits established in this specification. Waste Composition information from TFCOUP Revision 6 is used to establish overall WTP design capacity as defined in Section C.7 and is not otherwise used for design.

8.2 Requirements:

8.2.1 References:

8.2.1.1 HNF-SD-WM-SAR-067, Revision 1-I. March 2000. *Tank Waste Remediation System Final Safety Analysis Report*. CH2M HILL Hanford Group, Inc., Richland, Washington.

8.2.1.2 HNF-SD-WM-TSR-006, Revision 1-HE. March 2000. *Tank Waste Remediation System Technical Safety Requirements*, CH2M HILL Hanford Group, Inc., Richland, Washington.

8.2.1.3 OSD-T-151-00007, Revision H-22. June 14, 2000. *Operating Specification for 241-AN, AP, AW, AY, AZ, and SY Tank Farms*. CH2M HILL Hanford Group, Inc., Richland, Washington.

8.2.1.4 DOE/RL-88-21, Revision 10. December 21, 1999. *Double Shell Tank Unit Permits Application*. U.S. Department of Energy, Richland Operations Office, Richland, Washington.

8.2.1.5 RPP-7475, Revision 0. December 7, 2000. *Criticality Safety Evaluation of Hanford Tank Farms Facility,* CH2M HILL Hanford Group, Inc., Richland, Washington.

8.2.1.6 CPS-T-149-00012, Revision A-3. March 14, 2002. *Criticality Prevention Specification - Tank Farms Operations*.

8.2.2 High-Level Waste Slurry Description and Envelope Requirements:

8.2.2.1 Composition: The HLW slurry will contain a mixture of liquids (Envelopes A, B, or C) and solids (Envelope D). The compositional range of the liquid fraction is defined in Specification 7, *Low-Activity Waste Envelopes Definition*. For liquid fractions with a sodium molarity of less than three (3), the liquid shall be treated as if 3 molar sodium were present for feed certification purposes. The *Radioactive Material Concentration* specification contained in Specification 7.2.2.2 does not apply to Envelope A, B, or C liquids. The composition range of the Envelope D unwashed solids is given in Tables TS-8.1, TS-8.2 and TS-8.3, and TS-8.4. The feed concentration will be between 10 and 200 grams of unwashed solids/liter, except for feeds from waste Tanks AZ-101 and AZ-102, where minimum-solids content does not apply. The feed delivery batch size will be such that, after receipt in WTP and blending with pre-existing receipt tank contents, the concentration will not exceed a linear range of 107 grams of unwashed solids/liter at 0.1 molar sodium up to 144 grams/liter at 7 molar sodium **(M183)**.

Compositions for Envelope D unwashed solids (Tables TS-8.1, TS-8.2 and TS-8.3, and TS-8.4) are defined in terms of elemental or anion concentrations

and radionuclide activities per 100 grams equivalent non-volatile waste oxides. The non-volatile waste oxides include sodium oxide and silicon oxide.

The HLW feed components identified in Tables TS-8.1, TS-8.2, and TS-8.3 are waste components important to establishing the waste oxide loading in the HLW glass. Only these components have concentration limits, which will be used to provide the basis for certification that the HLW feed is within specification limits.

The HLW feed components identified in Table TS-8.4 are also important to HLW glass production. The concentrations of these components in the waste are not expected to exceed the maximum values listed in Table TS-8.4. Information on these components will be provided to support product and process qualification but will not be used as a basis for determining if the feed meets specification requirements.

All HLW feed (soluble and insoluble components) will meet the Tank Farm Operations specifications given in OSD-T-151-00007 (except for free hydroxide), the *Tank Waste Remediation System Final Safety Analysis Report* (HNF-SD-WM-SAR-067), and *Technical Safety Requirements* (HNF-SD-WM-TSR-006, Revision 1-D) as applicable. The radiochemical inventory of the waste feed at the time of delivery shall be compared to the specification limits to assess compliance.

Trace quantities of unspecified radionuclides, chemicals, and other impurities may be present in the waste feed. Feed will be delivered by pipeline in batches. Limits apply to the total retrievable contents of waste from a feed tank. Some elements, components, and isotopes are determined by calculation and not analytic measurement.

The HLW feed provided will not contain a visible separate organic layer.

The HLW waste provided will generate gases due to radiolysis including hydrogen and ammonia at a nearly constant rate and nearly uniform composition. The Contractor is responsible for the management of changes in gas release rate and distribution resulting from their waste processing activities.

Applicable dangerous waste codes are identified in the *Double-Shell Tank System Unit Permit Application* (DOE/RL-88-21, December 21, 1999). Multi-source leachate (F039) is included as a waste derived from non-specific source wastes F001 through F005.

Table TS-8.1 High-Level Waste Feed Unwashed Solids Maximum Non-Volatile Component Composition (grams per 100 grams non-volatile waste oxides)

Non-Volatile Element	Maximum (grams / 100 grams waste oxides)	Non-Volatile Element	Maximum (grams / 100 grams waste oxides)
As	0.16	Pu	0.054
B	1.3	Rb	0.19
Be	0.065	Sb	0.84
Ce	0.81	Se	0.52
Co	0.45	Sr	0.52
Cs	0.58	Ta	0.03
Cu	0.48	Tc	0.26
Hg	0.1	Te	0.13
La	2.6	Tl	0.45
Li	0.14	V	0.032
Mn	6.5	W	0.24
Mo	0.65	Y	0.16
Nd	1.7	Zn	0.42
Pr	0.35		

Table TS-8.2 High-Level Waste Feed Unwashed Solids Maximum Volatile Component Composition (grams per 100 grams non-volatile waste oxides)

Volatile Components	Maximum (grams / 100 grams waste oxides)
Cl	0.33
CO_3^{-2}	30
NO_2	36 (total NO_2/NO_3) as NO_3
NO_3	
TOC	11
CN	1.6
NH_3	1.6

Table TS-8.3 High-Level Waste Feed Unwashed Solids Maximum Radionuclide Composition (Curies per 100 grams non-volatile waste oxides)

Isotope	Maximum (Ci / 100 grams waste oxides)	Isotope	Maximum (Ci / 100 grams waste oxides)	Isotope	Maximum (Ci / 100 grams waste oxides)
^{3}H	6.5E-05	^{129}I	2.9E-07	^{237}Np	7.4E-05
^{14}C	6.5E-06	^{137}Cs	1.5E00	^{238}Pu	3.5E-04
^{60}Co	1E-02	^{152}Eu	4.8E-04	^{239}Pu	3.1E-03
^{90}Sr	1E+01	^{154}Eu	5.2E-02	^{241}Pu	2.2E-02
^{99}Tc	1.5E-02			^{241}Am	9.0E-02
^{125}Sb	3.2E-02	^{233}U	4.5E-06 (all tanks except AY-101/C-104)(2.0E-04 for AY-101/C-104 only)	$^{243+244}Cm$	3.0E-03
^{126}Sn	1.5E-04	^{235}U	2.5E-07		

Table TS-8.4 Additional High-Level Waste Feed Unwashed Composition for Non-Volatile Components (grams per 100 grams non-volatile waste oxides)

Non-Volatile Element	Maximum (grams / 100 grams waste oxides)	Non-Volatile Element	Maximum (grams / 100 grams waste oxides)
Ag	0.55	Ni	2.4
Al	14	P	1.7
Ba	4.5	Pb	1.1
Bi	2.8	Pd	0.13
Ca	7.1	Rh	0.13
Cd	4.5	Ru	0.35
Cr	0.68	S	0.65
F	3.5	Si	19
Fe	29	Ti	1.3
K	1.3	U	14
Mg	2.1	Zr	15
Na	19		
Th	5.0		

Specification 9: Liquids or Slurries Transferred to DOE Tanks by Pipeline

9.1 Scope: This Specification defines the requirements for return of any feed material to the Hanford tanks, and the requirements for return of any LAW process stream recycle materials during direct feed LAW operations per CLIN 2.1. **(350)**

9.2 Requirements:

9.2.1 References:

9.2.1.1 Greenburg, A.E., L.S. Clesceri, and A.D. Eaton, eds. *Standard Methods for the Examination of Water and Wastewater*. 19th edition 1995, American Public Health Association, Washington, D.C.

9.2.2 Product Requirements:

9.2.2.1 Product Composition: The elemental composition of the product shall be provided: (1) for all elements (excluding oxygen) constituting more than 0.5 weight percent (wt%) of the product on a dry basis; (2) for all radionuclides present in concentrations greater than five percent of the total activity; and (3) for all elements and compounds required to meet regulatory or Contract requirements.

9.2.2.2 Composition Limits and Transport Properties: The composition and transport properties shall comply with all applicable Hanford Site tank farms waste acceptance criteria.

9.2.2.3 Criticality: The plutonium (Pu) concentration in the returned material shall meet all applicable Hanford Site tank farm criteria. The isotopic concentration of the fissile materials in the returned product shall be provided to DOE prior to transfer.

9.2.2.4 Storage: A visible separate organic phase shall not develop during prolonged storage of the product materials in the Double-Shell Tank System.

9.2.2.5 Heat Generation: The Contractor shall determine and report the heat generation rate for product in the Secondary Wastes Compliance Plan (Table C.5-1.1, Deliverable 6.1).

9.2.2.6 Physical Parameters: The Contractor shall determine and report the specific gravity, viscosity, solids content, particle size distribution and particle density, pH, and temperature of the product at the time of transfer to DOE. Procedure 2540F, *Settled Solids*, from *Standard Methods for the Examination of Water and Wastewater*, or an equivalent methodology shall be used to determine the volume of solids in the liquid or slurry.

9.2.2.7 Radioactive Material Concentration: The returned intermediate product shall not contain more than 6 curies per liter (Ci/l) equivalent of ^{137}Cs. The Contractor shall dilute the returned product, if necessary, to achieve this concentration limit.

9.2.2.8 Prevention of Exothermic Reaction: The returned intermediate product shall not have the potential for an exothermic reaction.

9.2.3 Handling Requirements: None

9.3 Inspection and Acceptance: The Secondary Wastes Compliance Plan, described in Standard 6, *Product Qualification, Characterization, and Certification,* defines the content and delivery documentation required to demonstrate compliance with the requirements of this specification. Product inspection and acceptance shall be performed in accordance with Specification 13, *Waste Product Inspection and Acceptance.*

Specification 10: Reserved

Specification 11: Reserved

Specification 12: Procedure to Determine the Waste Feed Treatment Approach (Table C.5-1, Deliverable C.7-1) (M152)

12.1 Scope: This Specification defines requirements to develop a procedure to determine the waste feed treatment approach for a batch of feed slurry. Waste feed treatment requirements to caustic leach, or oxidative leach shall be established based on results of this testing.

12.2 Requirements:

12.2.1 References: None.

12.2.2 Waste Treatment Flowsheet: The process flowsheet for waste feed caustic leaching, and oxidative leaching shall be approved by DOE as required by Standard 2 (a)(3)(iii). The Contractor shall implement the approved process flowsheet during facility operations.

12.2.3 Procedure:

12.2.3.1 Procedure Objective: During WTP operations, including hot commissioning, testing shall be performed to predict the quantity of IHLW and ILAW product produced in WTP as a result of (1) solids washing; (2) caustic leaching and washing; and (3) caustic leaching, washing, and oxidative leaching.

12.2.3.2 Procedure Definition: The Contractor shall establish a laboratory test procedure to prescribe waste treatment within the given design and operating capabilities of the WTP. The procedure shall take a representative sample of slurry, characterize the initial sample, characterize the sample after treatment, forecast the quantity of IHLW product and ILAW product produced as a result of the plant process, and prescribe the process conditions for optimizing facility performance during the treatment process. The prescribed process shall consider all reagents, process parameters, and recycle impacts associated with waste treatment. The Contractor shall define the process location from where the representative sample of slurry is taken. Definition of this point shall consider representativeness of the sample, heel blending, recycle, and requirements for process control. The procedure shall be submitted to DOE for review and approval.

12.2.4 Criteria: The Contractor shall propose specific criteria to determine the required waste treatment approach for DOE's approval. These criteria will be based on objectives to reduce the number of IHLW canisters, shorten WTP processing mission duration, and reduce WTP operations cost. Minimization of IHLW produced will have greater importance than minimization of ILAW produced.

12.3 Quality Assurance: A QA Program (Table C.5-1.1, Deliverable 7.2) for the work to be performed is required. The QA Program shall be based upon NQA-1. (M066)

Specification 13: Waste Product Inspection and Acceptance

13.1 Scope: This Specification defines the protocol for acceptance and transfer of waste products (ILAW product and IHLW product) to DOE and defines the contents of Deliverable 5.13 (Resultant Products from Hot Commissioning), per requirements in Standard 5.

13.2 ILAW Product and Production Acceptance Requirements:

13.2.1 Acceptance of ILAW Product for On-Site Disposal

Acceptance of ILAW product shall be based on certification by the Contractor that the ILAW product (i.e., containerized waste form) has been provided in compliance with the requirements of Standard 6, *Product Qualification, Characterization, and Certification*, and Specification 2, *Immobilized Low Activity Waste*. The certification and acceptance of ILAW product shall be done on a lot basis. The lot size shall be proposed by the Contractor, and agreed to by DOE. The lot size shall consider the compliance strategy for process/product control of the ILAW product to comply with applicable Specification 2 requirements, capacity for lag storage, and requirements for the interface with the on-site transportation and disposal operations.

Physical transfer of the ILAW product shall be conducted in accordance with ICD 15.

13.2.2 Compliance of ILAW Product with Hot Commissioning Capacity Testing Criteria

The Contractor shall submit the production records to comply with Deliverable 5.13 (Resultant Products for Hot Commissioning) to certify that the ILAW product complies with the requirements for the Hot Commissioning Capacity Testing identified in Standard 5 (*Hot Commissioning Capacity Tests*). The content of the ILAW production documentation shall include, but not be limited to, the following information:

- Number of ILAW glass-filled product containers produced (lot basis).
- Number of ILAW glass-filled product containers transferred to on-site disposal.
- Certification of compliance for each ILAW glass-filled product container (lot basis).
- Summaries of the following information for each ILAW product unit produced during commissioning (lot basis):
    - Sodium waste loading
    - Radionuclide content
    - Non-Radionuclide chemical composition
    - Glass weight and percent fill per container

In the event the ILAW glass-filled product is identified as not meeting all requirements of Specification 2, the ILAW product will be classified as non-conforming. The Contracting Officer shall be notified within twenty-four (24) hours after the Contractor has determined that a non-conforming product has been produced.

A corrective action plan shall be prepared that describes how to convert the non-conforming condition to a non-standard condition, with the latter condition enabling the product to be acceptable for on-site disposal.

The corrective action plan shall also describe how to prevent recurrence of the non-conforming condition.

DOE acknowledges that during the transition between Cold Commissioning and Hot Commissioning that a limited number of ILAW containers will be produced that do not meet the waste loading requirements as identified in Specification 2.2.2.2. DOE will accept these containers and provide credit for these containers in the Hot Commissioning Capacity Test. The Contractor shall describe the approach to minimize the number of containers that do not meet waste loading requirements in the commissioning plan.

Non-conforming ILAW product other than as noted above will not be credited for determination of the WTP plant production capability, per the Hot Commissioning Capacity Testing.

13.2.3 DOE Acceptance of Production Documentation

The DOE Contracting Officer will be responsible for reviewing the submitted production documentation for compliance with Specification 2, and notifying the Contractor, within thirty (30) days, as to whether compliance was achieved.

13.3 IHLW Product and Production Acceptance Requirements:

13.3.1 Acceptance of IHLW Product for On-Site Interim Storage

Acceptance of IHLW product for on-site interim storage shall be based on certification by the Contractor that the subject IHLW product (i.e., containerized waste form) has been provided in compliance with the requirements of Standard 6, *Product Qualification, Characterization, and Certification*, and Specification 1, Immobilized *High Level Waste*. The certification and acceptance of IHLW product shall be done on a lot basis. The lot size shall be proposed by the Contractor and agreed to by DOE. The lot size shall consider the compliance strategy for process/product control of the IHLW product to comply with applicable Specification 1 requirements, capacity for lag storage, and requirements for the interface with the on-site transportation and on-site interim storage operations.

Physical transfer of the IHLW product shall be conducted in accordance with ICD 14.

13.3.2 Compliance of IHLW Product with Hot Commissioning Capacity Testing Requirements

The Contractor shall submit the production records to comply with Deliverable 5.13 (Resultant Products for Hot Commissioning) to certify that the IHLW product complies with the requirements for the Hot Commissioning Capacity Testing, identified in Standard 5(*Hot Commissioning Capacity Tests*). The content of the IHLW production documentation shall be consistent with the IHLW Waste Form Compliance Plan (Deliverable 6.2, Table C.5-1.1) and include, but not be limited to the following information:

- Number of IHLW glass-filled product canisters produced (lot basis).
- Number of IHLW glass-filled product containers transferred to on-site disposal.
- Certification of compliance for each IHLW glass-filled product container (lot basis).
- Summaries of the following information for each IHLW product unit produced during commissioning (lot basis):
    - Waste loading
    - Radionuclide content
    - Non-Radionuclide chemical composition

- Glass weight and percent fill per container

In the event the IHLW glass-filled product is identified as not meeting all requirements of Specification 1, the IHLW product will be classified as non-conforming. The Contracting Officer shall be notified within twenty-four (24) hours after the Contractor has determined that a non-conforming product has been produced.

The non-conforming IHLW product shall be clearly identified. A corrective action plan shall be prepared that describes how to convert the non-conforming condition to a non-standard condition, with the latter condition enabling the product to be acceptable for on-site interim storage.

The corrective action plan shall also describe how to prevent recurrence of the non-conforming condition.

DOE acknowledges that during the transition between Cold Commissioning and Hot Commissioning that a limited number of IHLW product canisters will be produced that do not meet the waste loading limits as identified in Specification 1. DOE will accept these canisters and provide credit for these canisters in the Hot Commissioning Capacity Test. The Contractor shall describe the approach to minimize the number of canisters that do not meet waste loading requirements in the commissioning plan.

Non-conforming IHLW product other than noted above will not be credited for determination of the WTP plant production capability, per the Hot Commissioning performance testing.

13.3.3 DOE Acceptance of Production Documentation

The DOE Contracting Officer will be responsible for reviewing the submitted production documentation for compliance with Specification 1, and notifying the Contractor, within thirty (30) days, as to whether compliance was achieved.

C.9 INTERFACE CONTROL DOCUMENTS

This Section provides the requirements for ICDs that describe the physical and administrative interfaces among DOE, ORP, the Tank Farm Contractor, and other Hanford Site contractors.

The RPP involves two or more contractors, under contract to ORP that carry out the functions necessary to achieve the RPP mission. The WTP facilities are located on the Hanford Site and will rely upon other organizations to provide support services. In order to assure that the efforts and facilities are coordinated, a formal system of interface management was developed by RPP. The objective of the interface management system is to assure documentation and management of shared responsibilities for: (1) transfer of energy, data, or materials; and (2) development, operation, and maintenance of physically compatible facilities and subsystems.

The approach to managing the interfaces is based upon development of ICDs that identify the requirements, roles, and responsibilities for all parties to the interface.

(a) (1) An initial set of ICDs was prepared as part of the WTP Conceptual Design:

ICD 1: Raw Water
ICD 2: Potable Water
ICD 3: Radioactive Solid Wastes
ICD 4: Reserved
ICD 5: Non-Radioactive, Non-Dangerous Liquid Effluents
ICD 6: Radioactive, Dangerous Liquid Effluents
ICD 7: Reserved
ICD 8: Reserved
ICD 9: Land for Siting
ICD 10: Reserved
ICD 11: Electricity
ICD 12: Roads
ICD 13: Reserved
ICD 14: Immobilized High-Level Waste
ICD 15: Immobilized Low-Activity Waste
ICD 16 Reserved
ICD 17: Reserved
ICD 18: Reserved
ICD 19: Waste Feed
ICD 20: Reserved
ICD 21: Reserved
ICD 22: Reserved
ICD 23: Waste Treatability Samples
ICD 24: Reserved
ICD 25: Inactive
ICD 26: Reserved
ICD 27: Inactive

(2) Post-award ICDs:

ICD 28: Pit 30 Aggregate Supply for Construction
ICD-29 Waste Na
ICD 30: Direct LAW Feed
ICD 31: DFLAW Effluent Returns to Double-Shell Tanks (**350**)

(b) The Contractor shall update the ICDs as required throughout the period of Contract performance. ICDs shall reflect all interfaces and services needed in the construction and performance testing phases, and projected interface and services needed for the future commissioning and operating phases. The ICDs shall be managed in accordance with the Interface Management Plan (Table C.5-1.1, Deliverable 1.4).

(c) The Contractor shall ensure that the ICDs include, at a minimum, details on the following areas consistent with the maturity of the project:

(1) Physical Interfaces:

(i) Location and description of each hand-off point;

(ii) Interface block diagrams and schematics that clearly define organizational responsibilities for each interface (e.g., ownership, construction, and maintenance);

(iii) Type, quantity, and composition of material;

(iv) Packaging requirements;

(v) Design drawings (as appropriate); and

(vi) Operations and maintenance requirements.

(2) Administrative Interfaces:

(i) Procedures that define the administrative transfer of interface items (e.g., who, what, when, where, and how).

(ii) Linkage to the integrated RPP and individual Contractor project baseline. These schedules and logic must contain detail that demonstrates that the key ICD events or milestones are achievable.

(iii) Documentation necessary for official hand-off of interface items.

(iv) Authorization basis and permitting integration.

(3) Acceptance Criteria shall be developed for every hand-off item.

(d) Changes to ICDs will be made in accordance with Standard 1, *Management Products and Controls*.