U.S. Department of Energy
P.O. Box 450, MSIN H6-60
Richland, Washington, 99352

JAN 30 2012

12-WTP-0045

The Honorable Peter S. Winokur
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, DC 20004-2901

TRANSMITTAL OF DEFENSE NUCLEAR FACILITIES SAFETY BOARD (DNFSB) RECOMMENDATION 2010-2 IMPLEMENTATION PLAN (IP) DELIVERABLE 5.7.3.1

Dear Mr. Chairman:

This letter provides you the deliverable responsive to Commitment 5.7.3.1 of the U. S. Department of Energy (DOE) plan to address Waste Treatment and Immobilization Plant (WTP) Vessel Mixing Issues; IP for DNFSB Recommendation 2010-2.

The attached report outlines the "plan and schedule to systematically evaluate the hazards of known technical issues, M3 vessel assessment summary reports, LOAM benchmark data, and LSIT results."

A list of known technical issues was developed by evaluating issues and concerns documented in an established WTP system (e.g., Project Issues Evaluation Reporting [PIER], Action Tracking System [ATS]) or formally identified by an external source (e.g., DOE, independent review group). The list is dynamic and will be subject to further changes due to the normal evolution of the WTP project. This list will be updated as needed to reflect addition and resolution of technical issues. DOE will provide the DNFSB a status of changes in the list in its quarterly 2010-02 IP briefing and will update this response annually, as well as provide updates related to the project schedule and achievement of milestones that are noted in the plan, supportive of completing the work associated with the DNFSB's concern.

If you have any questions, please contact me at (509) 376-6727 or you may contact Ben Harp, WTP Start-up and Commissioning Integration Manager at (509) 376-1462.

Sincerely,

Dale E. Knutson

Dale E. Knutson, Federal Project Director
Waste Treatment and Immobilization Plant

WTP:WRW

Attachment

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Document title: **Plan and Schedule to Systematically Evaluate the Hazards of Known Technical Issues, M3 Vessel Assessment Summary Reports, LOAM Benchmark Data and LSIT - Response to DNFSB Recommendation 2010-02 Implementation Plan Commitment 5.7.3.1**

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History Sheet

Rev	Reason for revision	Revised by
0	Initial Issue	

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Acronyms

ABAR	authorization basis amendment request
ATS	Action Tracking System
BNI	Bechtel National, Inc.
CFD	computational fluid dynamics
CIARS	Critical Items Action Reporting System
CPR	Construction Project Review
CRESP	Consortium for Risk Evaluation with Stakeholder Participation
CSER	criticality safety evaluation report
CSSG	Criticality Safety Support Group
DBA	design basis accident
DOE	US Department of Energy
DNFSB	Defense Nuclear Facilities Safety Board
DSA	documented safety analysis
DQO	data quality objective
EFRT	External Flowsheet Review Team
E&NS	Environmental and Nuclear Safety
EMAB	Environmental Management Advisory Board
FRP	waste feed receipt process system
HAR	hazards analysis report
HLW	high-level waste
ICD	interface control document
IP	implementation plan
IPT	Integrated Project Team
JCDPI	justification for continued design, procurement, and installation
LOAM	low order accumulation model
LSIT	Large Scale Integrated Testing
MSOW	management suspension of work
NETL	National Energy Technology Laboratory
ORP	Office of River Protection
PDSA	preliminary documented safety analysis
PEP	project execution plan
PIER	Project Issues Evaluation Reporting
PJM	pulse jet mixer
PNNL	Pacific Northwest National Laboratory
PSAR	Preliminary Safety Analysis Report

PTF	Pretreatment Facility
PVP	pretreatment vessel vent process system
PVV	process vessel vent exhaust system
SRNL	Savannah River National Laboratory
SSC	structures, systems and components
SSR	Safety System Reconciliation
TIEF	Technical Issue Evaluation Form
TOC	Tank Operations Contractor
TSR	technical safety requirement
UFP	ultrafiltration process system
USQ	unreviewed safety question
VCT	Vessel Completion Team
WAC	waste acceptance criteria
WTP	Hanford Waste Treatment and Immobilization Plant

1 Introduction

The Hanford Waste Treatment and Immobilization Plant (WTP) is being constructed to immobilize waste, which is currently stored in underground tanks that resulted from over 40 years of reactor operations and plutonium production for national defense.

The Defense Nuclear Facilities Safety Board (DNFSB) expressed concerns related to WTP's mixing and transfer systems in Recommendation 2010-02, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant* that was issued to the Secretary of Energy on November 10, 2011 (Reference 5.1). The recommendation addressed the need for the US Department of Energy (DOE) to ensure that WTP, in conjunction with the Hanford tank farm waste feed delivery system, will operate safely and effectively during the operating life to eliminate the risks posed by the high-level waste (HLW) in the Hanford tank farm facility. The safety issues relevant to the DNFSB's concerns about the pulse jet mixing and transfer systems are identified in Recommendation 2010-02 as:

1. Accumulation of fissile material at the bottom of vessels leading to potential criticality;
2. Generation and accumulation of hydrogen resulting from the accumulation of solids; and
3. The possibility that accumulating solids will interfere with the vessel-level detection system leading to loss of pulse jet mixer (PJM) control and overblows (discharge of air from the PJM).

The DOE issued an implementation plan (IP) for DNFSB Recommendation 2010-02 on November 10, 2011 (Reference 5.1) that identified commitments for each of the seven sub-recommendations. The DOE commitments for Sub-Recommendation 7, *Technical and Safety-Related Risks*, provide the key activities to integrate nuclear safety into the design. The overall approach ensures that the results of the hazard and accident analyses are used to select controls, and identify the safety functions and functional requirements that need to be incorporated into the design.

The plan and schedule in this document provide the key activities to systematically identify and evaluate hazards of known technical issues. For the purpose of this document, a known technical issue is defined as an issue or concern documented in an established WTP system that could impact mixing, transport, or sampling. In addition, the Pretreatment Facility (PTF) comprehensive hazards and accident analysis will be updated based on knowledge gained in the Large Scale Integrated Testing (LSIT) as that program is completed. The testing will provide the technical basis for limiting conditions for operation by establishing the performance capabilities of those safety systems for normal, abnormal, and accident conditions.

Table 1 reiterates the commitments in Sub-Recommendation 7.

Table 1 Sub-Recommendation 7 Commitments

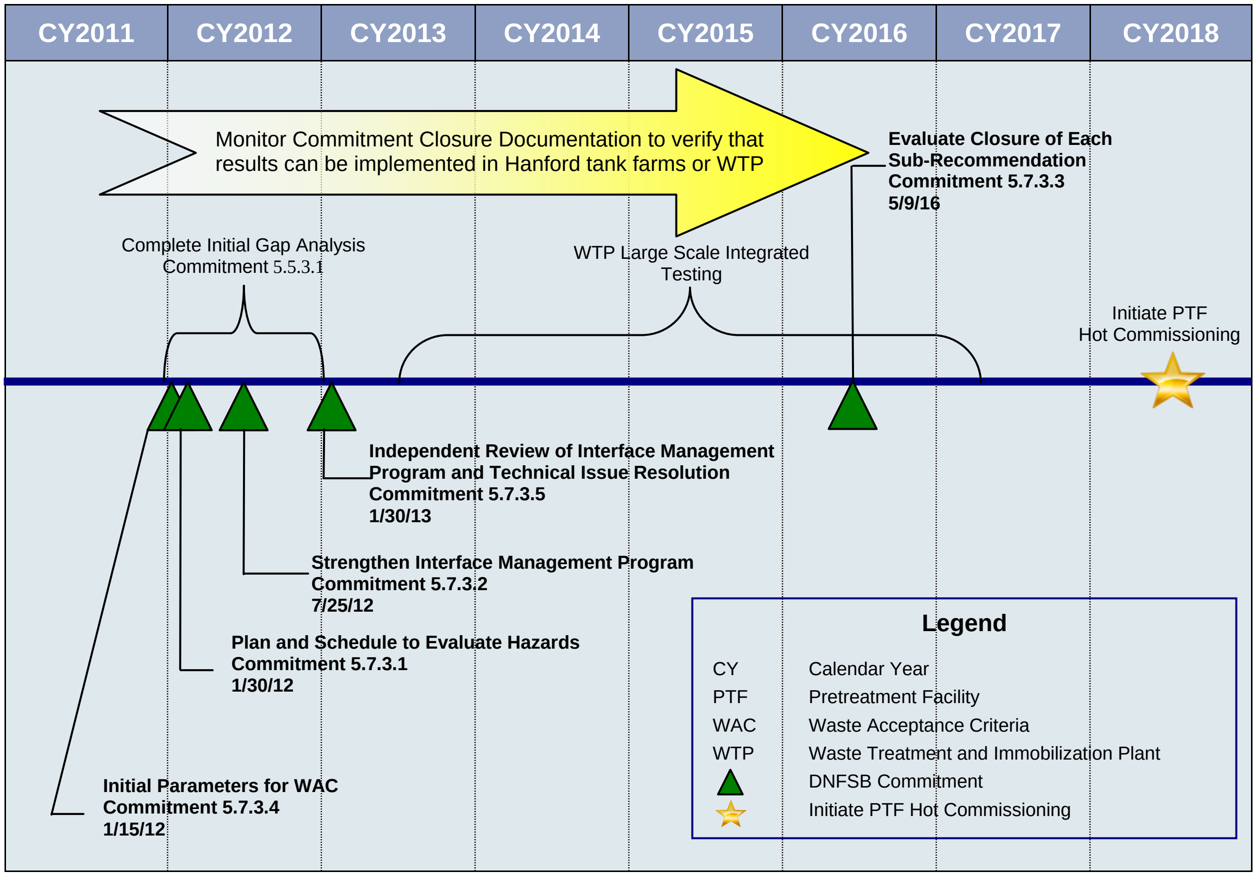
Commitment No.	Due Date	POC	Commitment Description
5.7.3.1	01/30/2012	BNI	Establish a plan and schedule to systematically evaluate the hazards of known technical issues, M3 vessel assessment summary reports, LOAM benchmark data, and LSIT results.
5.7.3.2	07/25/2012	DOE	Strengthen our Interface Management Program to improve the integrated management of the technical and safety risks in WTP and the Hanford tank farms.
5.7.3.3	05/09/2016	DOE	Evaluate the closure document for each sub-recommendation to verify the results can be implemented in the Hanford tank farms or the WTP.
5.7.3.4	01/15/2012	BNI	Identify key inputs, assumptions, safety margin uncertainties, and nuclear safety parameters required to be included in the waste acceptance criteria.
5.7.3.5	01/30/2013	DOE-HQ	Conduct an independent review of the Interface Management Programs strengthened under Commitment 5.7.3.2 to evaluate the effectiveness of the program and implementing procedures and verify and technical safety-related issues are being identified, evaluated, and tracked to closure.

BNI Bechtel National, Inc.
HQ Headquarters
LOAM low order accumulation model

Sub-Recommendation 7 is a cross-cutting set of commitments that will integrate the infrastructure between DOE contractors and ensure that the hazards of Hanford HLW are consistently understood and analyzed. Establishing a consistent technical basis for the analysis and control of hazardous material stored in the Hanford tank farms and processing at WTP facilities will deliver a nuclear safety control strategy to govern the retrieval, transport, process, storage, and disposal of the HLW.

The execution schedule including DNFSB Sub-Recommendation 7 and primary interfacing commitments are illustrated in Figure 1. In summary, DOE will strengthen the interface management program between the Hanford tank farm facility and the WTP. The updated program will provide an integrated system for evaluating, tracking, and closing safety-related risks. The program will also provide systematic evaluation of potential issues to determine the impact to the design of one or more facilities and ensure nuclear safety is adequately implemented in design solutions.

Figure 1 Technical and Safety-Related Risks Overview Schedule



2 Commitment 5.7.3.1

Sub-Recommendation 7, Commitment 5.7.3.1 states:

> *Establish the plan and schedule to systematically evaluate the hazards of known technical issues, M3 vessel assessment summary reports, LOAM benchmark data, and LSIT results*.

The deliverable must consist of:

> *An approved plan that establishes the key activities and schedule to systematically evaluate the hazards and resolve known technical issues and evaluate the results of testing to provide the technical basis to integrate nuclear safety into the Pretreatment Facility design and develop a documented safety analysis that supports commissioning and operations. The plan shall be iterative and develop and validate requirements. The plan shall maintain alignment between design and the safety basis.*

The implementation plan for DNFSB Recommendation 2010-02 (Reference 5.1) provides additional discussion on this commitment as follows:

> *Resolution of this sub-recommendation will strengthen DOE's processes needed to manage emerging issues and consistently provide solutions that integrate nuclear safety and design. The systematic evaluation of hazards will support updates to WTP accident analysis and control decision that integrates nuclear safety and design for PTF.*

3 Response to Commitment 5.7.3.1

Commitment 5.7.3.1 requires a plan and schedule to systematically evaluate the hazards and resolve known technical issues. The list of known technical issues was developed by evaluating issues and concerns documented in an established WTP system (e.g., Project Issues Evaluation Reporting [PIER], Action Tracking System [ATS]) or identified by an external source (e.g., DOE, independent review group). Additional descriptions are provided below to clarify use of the term known technical issue in this document.

A known technical issue is defined as an issue or concern documented in an established WTP system that could impact mixing, transport, or sampling. Technical issues may impact design, nuclear safety, and/or operability. A design issue is anything that affects the fit, form, or function of structures, systems, and components (SSC) and potentially interferes with the ability to perform the intended design function. A nuclear safety issue is anything that has the potential to impact the established safety basis (e.g., hazards analyses, accident analyses) or the development of the functional requirements of safety controls. An operational issue includes anything that impacts the ability to implement safety controls.

Resolution signifies the closure of a known technical issue with adequate integration of nuclear safety into the design (as needed) and a control strategy that can be implemented in the facility.

Technical issues include the following types of concerns:

- Uncertainties in the adequacy of current design performance;
- Key assumptions that may have been in error or remain unverified;
- Unevaluated conditions that have not been considered in the design or hazards analyses;
- External and internal reviews and assessments;
- Inaccuracies, inconsistencies or ambiguities in the safety basis; and/or
- Inadequate performance testing or analyses.

The list of known technical issues compiled for this commitment in Appendix A represents a “snapshot” in time. Section 3.1 describes the process used to develop the initial list of known technical issues.

The list is dynamic and will be subject to further changes due to the normal evolution of the WTP project. This list will be updated as needed to reflect addition and resolution of technical issues. DOE will provide the DNFSB a status of changes in the list in its quarterly 2010-02 IP briefing and will update this response annually.

Examples of activities that could impact the list of known technical issues are itemized below:

- Internal and external reviews and assessments;
- Emerging technical issues;
- Design evolution;
- Safety analysis evolution (e.g., hazards analyses, accident analyses);
- Control decision evolution; and
- Additional testing or modeling needs being identified

3.1 Development of Initial Known Technical Issues List

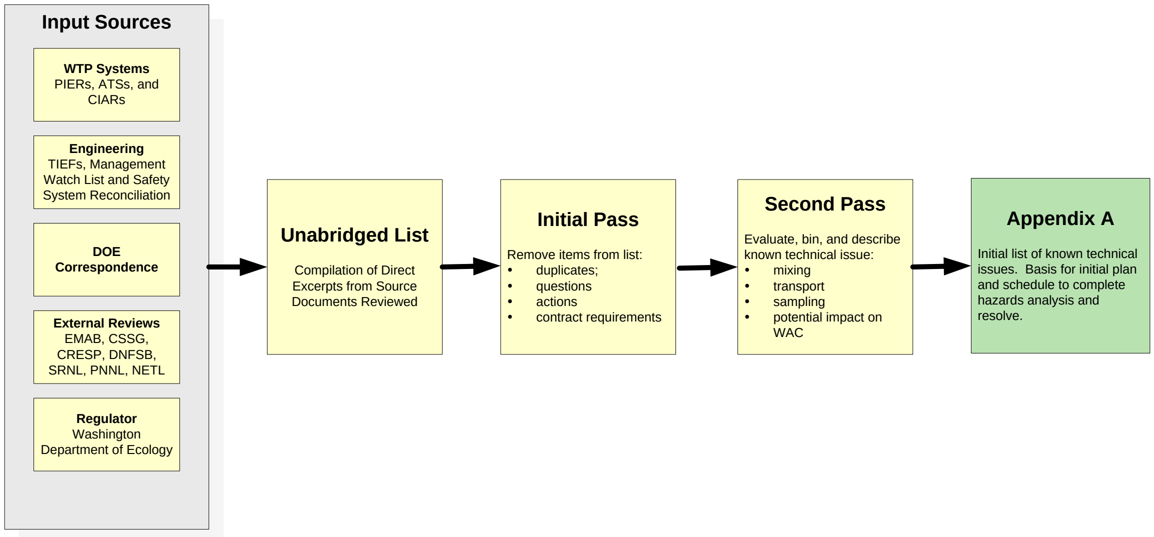
The initial list of known technical issues related to mixing, transport or sampling was developed by evaluating the key information systems itemized below:

- Project Issues Evaluation Reporting System (PIER) (Reference 5.48);
- Action Tracking System (ATS) (Reference 5.49);

- Critical Items Action Reporting System (CIARS);
- External and Oversight Reviews (including Criticality Safety Steering Group, Environmental Management Advisory Board, Technical Steering Group);
- Engineering's Technical Issues, Management Watch List, and Safety System Reconciliation (SSR) actions;
- Consortium for Risk Evaluation with Stakeholder Participation (CRESP) Letter Report 7;
- National Energy Technology Laboratory (NETL) feedback;
- Pacific Northwest National Laboratory (PNNL) feedback;
- Savannah River National Laboratory (SRNL) feedback;
- Vessel Completion Team feedback;
- Washington State Department of Ecology; and
- Open DOE-WTP Safety Evaluation Report Conditions of Approval.

Figure 2 illustrates the process used to develop the list of known technical issues. Each source was systematically evaluated by an interdisciplinary group to understand the potential issue as well as the potential impact to nuclear safety basis, design, or operations. After the unabridged list was developed, the group consolidated duplications, and removed items that tracked or recommended actions but did not reflect an open technical issue. The ultimate objective was to provide the initial list of technical issues that could impact the design (e.g., new controls required), safety basis (e.g., existing analysis inadequate, incomplete, or not integrated into the design) and/or operations (e.g., facilitate development of the operational controls to be implemented in the plant operating procedures). Resolution of the technical issues on the list will be iterative until the safety basis and the design converge.

Figure 2 Development of Known Technical Issues



CSSG	Criticality Safety Support Group
EMAB	Environmental Management Advisory Board
TIEF	Technical Issue Evaluation Form

The group used the following criteria during the evaluation to determine if an item needed to be included in the list:

- ***Mixing*** – the item potentially impacts the ability of the mixing system to adequately mix the range of HLW to be processed in the PTF
- ***Transport*** – the item potentially impacts the ability to mobilize and retrieve solids from a vessel and/or transport through the PTF process
- ***Sampling*** – the item potentially impacts the ability to collect, analyze or use a sample for both process and nuclear safety and

The initial list was also evaluated to determine if the item could potentially impact acceptance criteria for waste transferred from the Hanford tank farms to PTF as input into the DOE response for IP Commitment 5.7.3.4. Items that also could result in inadequate or incomplete nuclear safety control strategies were included in the Appendix A list.

Appendix A presents the list of known technical issues. The list contains the following columns:

Source Document - Document from which the issue originated.

Excerpt from Source Document - Direct excerpt from the source.

Issue Description - Provides additional information to describe the technical issue related to the verbatim excerpt.

Impacted System / Function - Each item in the list was evaluated to determine if there was a potential to impact mixing (M), transport (T), sampling (S), and/or the waste acceptance criteria (WAC). Columns were provided to present the results of that evaluation. An "x" was used in the appropriate column to document the results.

Hazard - Each item in the list was evaluated to determine the primary hazard(s) associated with the known technical issue. Columns were provided to present the results of that evaluation. An "x" was used in the appropriate column to document the results. The column labeled "H" indicates that there is a potential for hydrogen to accumulate to above lower flammability levels, "C" indicates that there is a potential for solids to accumulate and result in an inadvertent criticality, and "CF" indicates that there is a potential to lose confinement of HLW in a vessel (e.g., from overblows, erosion, corrosion).

WTP has established an integrated project team to coordinate LSIT and closure of issues related to the vessels. This team is called the Vessel Completion Team (VCT) and consists of representatives from interfacing organizations. The VCT is developing a detailed working list comprised of the known technical issues in Appendix A of this document, questions, and open actions associated with vessels. Appendix A is organized according to the following categories used in the VCT list of known technical issues in the working list, which will be mapped to LSIT objectives and closure criteria (as appropriate):

- PJM control strategy
- Sampling system capability
- Transfer/Pump out capability
- Heel management
- Integrated operations
- Performance testing and scaling
- Design margin
- PJM restart after an abnormal or accident condition
- Validation of computational fluid dynamics
- High temperature operations
- Criticality
- Erosion/corrosion

The VCT working list has not yet been fully evaluated to determine the potential impacts to nuclear safety or existing safety basis documents. Due to the range of uncertainties on system performance, additional testing information is required to address each category and to provide input to the safety basis process.

3.2 Plan to Complete Hazards Analysis of Known Technical Issues

Three initial activities were identified to support the plan, schedule, and resolution of known technical issues.

- Updating the WTP procedures to provide the framework for integration of nuclear safety into the design;
- Identifying the LSIT test plan and objectives needed to document the system evaluation and performance in the safety basis document for SSCs providing mixing, transport, and sampling functions; and
- Identifying and documenting waste feed characterization for design and safety basis purposes.

The updated WTP procedures will establish the integrated process for WTP organizations to integrate nuclear safety into the design and eventual WTP facilities operations. The procedures will establish clear roles, responsibilities, authorities and accountabilities for each WTP organization along with the integrated process steps for Engineering, Environmental and Nuclear Safety (E&NS), Operations and other key interfacing organizations.

DOE-WTP has recently issued a modification to the BNI contract related to safety basis requirements. Section 3.2.2 provides an overview of the change in the regulatory construct for WTP facilities.

The LSIT plan is addressed in Sub-Recommendation 1, *Large Scale Test Plan.* Requests for technology development will be prepared for each series of related tests amplifying the testing needs documented in 24590-WTP-RPT-ENG-10-001, *Integrated Pulse Jet Mixed Vessel Design and Control Strategy* (Reference 5.12) (Commitment 5.1.3.10) and in test plans and specifications (Commitments 5.1.3.6 and 5.1.3.12).

Successful integration of nuclear safety into design requires a common understanding of the physical parameters of the high level waste (e.g., particle size, particle size distribution, density, hardness, molarity) to be processed in the WTP. In addition, the use and application of those parameters in safety basis and design basis activities must be aligned. WTP will develop a databook that presents physical parameters of the waste feed along with the basis for evaluating those parameters to finalize the design and safety basis documents.

The balance of this section provides the first iteration of the plan and schedule required to evaluate the hazards of known technical issues.

3.2.1 Integration of Nuclear Safety into Design

Integration of nuclear safety into design is iterative as the design progresses. Each proposed design change requires an evaluation of the proposed change to determine the impact to the hazards analysis, accident analyses, safety function and functional requirements, and control decision. WTP is developing and implementing improvements to both the authorization basis and design verification programs that will facilitate adequate alignment of nuclear safety and design. In addition to program improvements, WTP has evaluated the identified inadequacies and either confirmed that the ongoing design work could continue or suspended activities until the misalignment is corrected. However, inadequacies have been identified as described below and those Appendix A entries grouped under “Integration of Nuclear Safety into Design.”

DOE-WTP notified WTP of concerns related to the lack of progress in delivering an integrated plan that maintains the nuclear safety licensing activities of the WTP in accordance with 10 CFR 830 (CCN 239884 [Reference 5.46]). In addition, DOE-WTP issued the following finding regarding the nuclear safety and design verification programs in a surveillance report on the process vessel vent exhaust system (PVV) header piping installation in Planning Area 7 (CCN 237683 [Reference 5.24]): *BNI’s Authorization Basis program and Design Verification programs are not adequate to ensure Authorization Basis requirements are adequately aligned (in a timely manner before material installations), with applicable facility design after the design has been issued for procurement / issued for construction. The cause of the finding is that current informal processes used to document Project impacts and decisions related to safety basis changes that affect existing design / installation are no longer adequate given the advanced state of Engineering, Procurement, and Construction and the potential for installations to become irreversible, or only reversible at unacceptable project expense*.

WTP is finalizing a causal analysis of key misalignment issues identified in Appendix A. This causal analysis will identify the root and contributing causes for the misalignment and judgment of needs to prevent future occurrences. The final causal analysis will supplement this document and be incorporated into the planned safety basis and design verification program improvements.

The safety basis and design verification program improvements are discussed in Sections 3.2.1.1 and 3.2.1.2, respectively. The process to evaluate potential misalignments are discussed in Section 3.2.1.3.

3.2.1.1 Nuclear Safety Program Changes

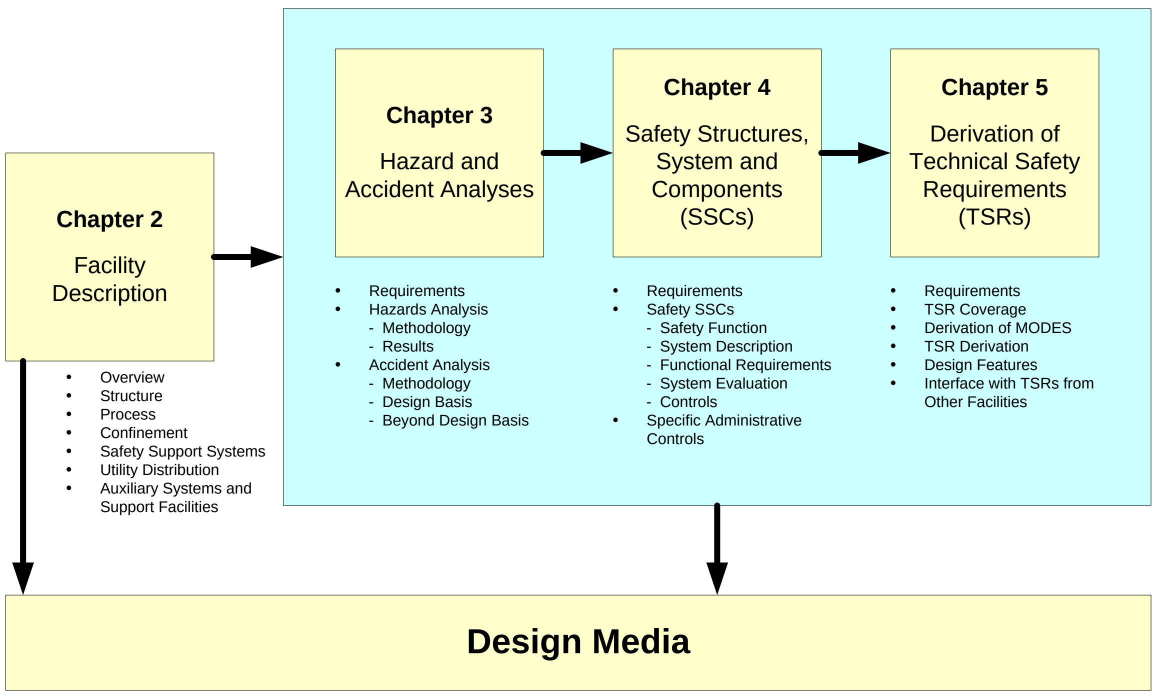
The WTP procedures governing the development and maintenance of safety basis documents are being modified to implement DOE-WTP contract direction. The updated procedures will be integrated with existing WTP engineering procedures for design.

Integrating nuclear safety requirements into the design and safety envelope for a facility is an iterative process. As the design progresses and technical issues emerge, the potential impact of the design change or emerging issues will be evaluated against the DOE-WTP approved safety basis document(s) to determine if additional safety analysis (i.e., hazards analysis, accident analysis, control decision) are needed. If an emerging technical issue originates as the safety analyses evolve, the issue will be evaluated to determine the impact to the existing and ongoing design. The resolution of the issue must include input from engineering, nuclear safety and operations. DOE will monitor issue resolution to understand and integrate resolutions with the Hanford tank farms (as needed).

The updated process will strengthen the flow down of requirements and guidance in DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses* (Reference 5.47). Changes to the safety analysis procedures will ensure systematic evaluation of hazards and clear traceability from hazardous conditions to the selected control. This increased rigor will facilitate readiness activities, commissioning, and ultimate operations of the WTP facilities.

Figure 3 provides an overview of the core chapters of the safety basis documents and the flow/integration of design and nuclear safety.

Figure 3 Integration of Nuclear Safety Into the Design



The integration of nuclear safety into the design will be improved by specific process steps for interfacing organizations to document safety functions and functional requirements in the safety basis documents and implement in the design. In some cases, ongoing hazards and accident analysis may identify new/revised safety functions or functional requirements. To ensure that those requirements are communicated to engineering and operations, the updated procedures will provide the mechanism to incorporate updated nuclear safety requirements into the design in advance of a safety basis document change.

Figure 4 illustrates the integration of nuclear safety requirements into the design in the new regulatory construct. The enhanced programs are focused on completing design and establishing the foundation for readiness and commissioning activities.

Specific functions that will be included in the updated programs include:

Nuclear Safety Technical Review - The updated independent review process will provide a means for the E&NS organization to provide comments and input to facilitate completion of the design, and/or support startup and commissioning. This process is a ‘constructive input’ review that is conducted early in the design and commissioning processes, work scheduling/planning, and procedure preparation processes.

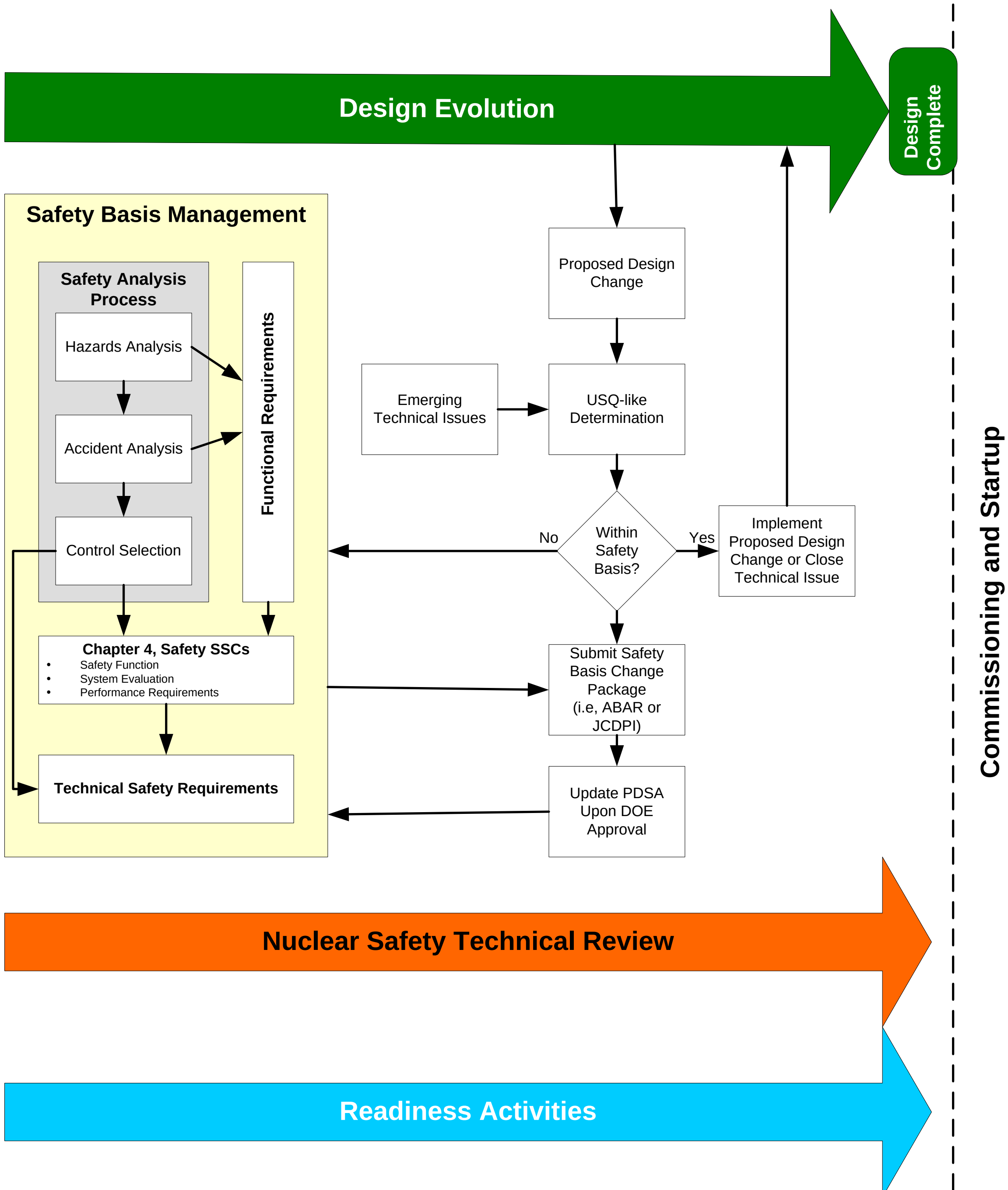
USQ Process - The USQ process is required by 10 CFR 830. The process will be tailored appropriately for use as the primary method for maintaining configuration control of the preliminary documented safety analyses (PDSA) (in advance of documented safety analysis [DSA] development using a “USQ-like” process).

Hazards Analysis, Accident Analysis, and Control Selection - These three functions form the core of the safety basis development process.

JCDPI Authorization - The JCDPI process will be used to obtain DOE approval to proceed with baseline activities (i.e., design, construction, procurement, and/or installation) in advance of a formal change to the safety basis. The process will address the potential nuclear safety risk.

Safety Basis Management - This function covers requirements and processes for safety basis document development and documentation (e.g., format and content). It will also describe the control of changes to the safety basis - whether DOE approval is required or not and the requirements for maintaining the safety basis.

Figure 4 Revised Regulatory Construct



JCDPI	justification for continued design, procurement, and installation
USQ	unreviewed safety question
ABAR	authorization basis amendment request

3.2.1.2 Design Program Changes

Engineering is also making changes to existing procedures to improve the design verification process. The procedures under development will verify that safety is effectively integrated into design as described in CCN 237683, S-11-WED-RPPWTP-042, *Review of Pretreatment Facility Vessel Vent Process System Header Pipe Installation in Planning Area 7* (Reference 5.24).

The WTP response to the DOE-WTP surveillance report discussed in Section 3.2.1 includes corrective actions related to the design verification program.

1. Revise the process used to validate requirements prior to their approval in the design criteria document. The resulting process will require conducting an analysis to understand the impacts of change and identifying affected design documents prior to approving criteria changes.
2. Revise project procedures to describe a revised Project process for responding to misalignment with safety basis requirements that could potentially affect the design of procured or installed SSCs.
3. Revise authorization basis maintenance procedure and interfacing Engineering procedures to re-focus the JCDPI process on commercial risk and distinguish from nuclear safety risk.

3.2.1.3 Initial Extent of Condition Review

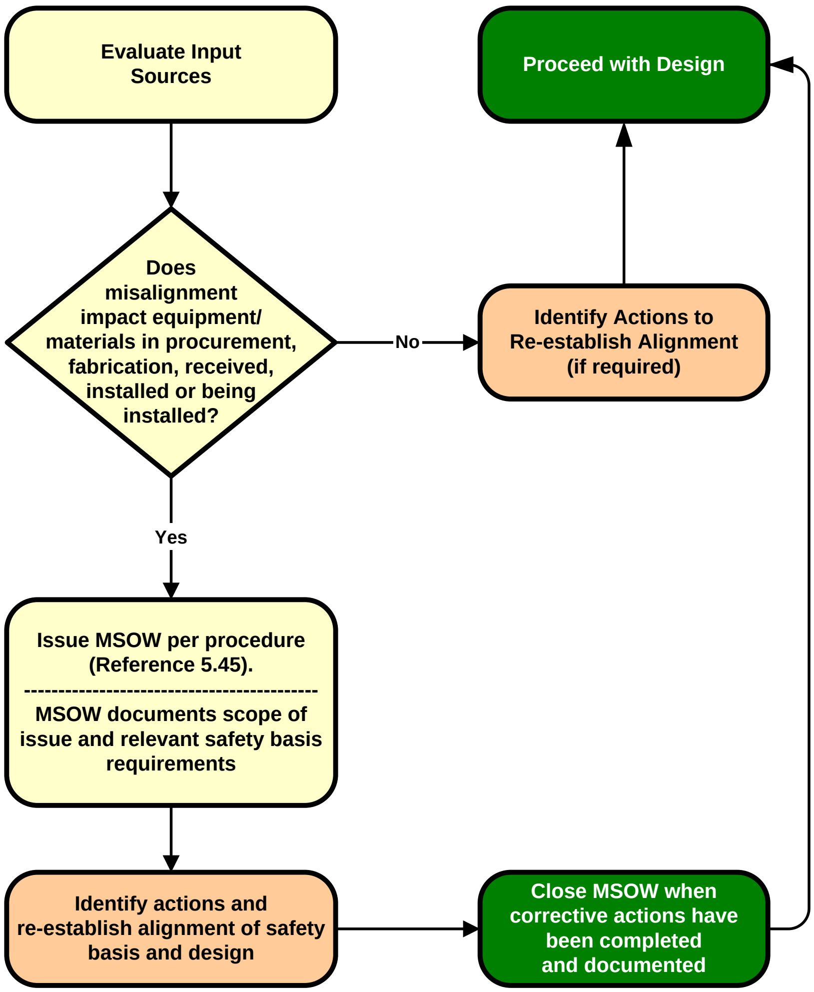
WTP reviewed the sequence of events related to the pretreatment vessel vent process system (PVP)/PVV design to understand the safety-related risks associated with the misalignment between the design and the safety basis documents. This review identified the need for process enhancements to clearly define requirements for addressing ongoing procurements/ installation when disconnects are identified between issued design and safety basis requirements (e.g., when PDSA changes are made), and a lengthy period of time is required to bring the design into alignment with the safety basis requirements.

An initial extent of condition review was completed by a joint team of WTP/DOE staff of each item on the SSR list, which identified potential issues where the technical basis and the safety basis were not aligned. The SSR list was developed in response to a recommendation in Construction Project Review (CPR) - 4. Highlights of the extent of condition are as follows:

- Each of the items on the SSR list was evaluated. Several items were removed from the list because they did not represent a misalignment between the safety basis and design (CCN 226536 [Reference 5.50]).
- For each item determined to represent a misalignment, WTP used the Management Suspension of Work (MSOW) process to suspend work (if needed) and document the project response.

The MSOW process will be used when misalignments between nuclear safety and design are found (Figure 5). The process (defined in 24590-WTP-GPP-MGT-008, *Work Pause / Management suspension of Work / Stop Work* [Reference 5.44]), is being revised to refine the roles and responsibilities for nuclear safety to ensure the disposition, resolution and closure of MSOW items adequately integrate nuclear safety.

Figure 5 Process to Evaluate Potential Misalignments Between Technical Basis and Safety Basis



3.2.2 Hazards Analysis of Known Technical Issues

3.2.2.1 Overview of Hazards Analysis and Safety Basis Maintenance Processes

The PTF safety basis documents (i.e., PDSA and criticality safety evaluation report [CSER]) have not been maintained current in all areas. In addition, several known technical issues directly impact the ability of specifically credited controls to perform their intended safety function. The current WTP baseline includes three main iterations to address the technical issues known in late 2010. These focused activities will reconstitute the hazards analysis, accident analysis and control decisions. Figure 6 provides an overview of the current schedule and approach for upgrading PTF safety basis documents.

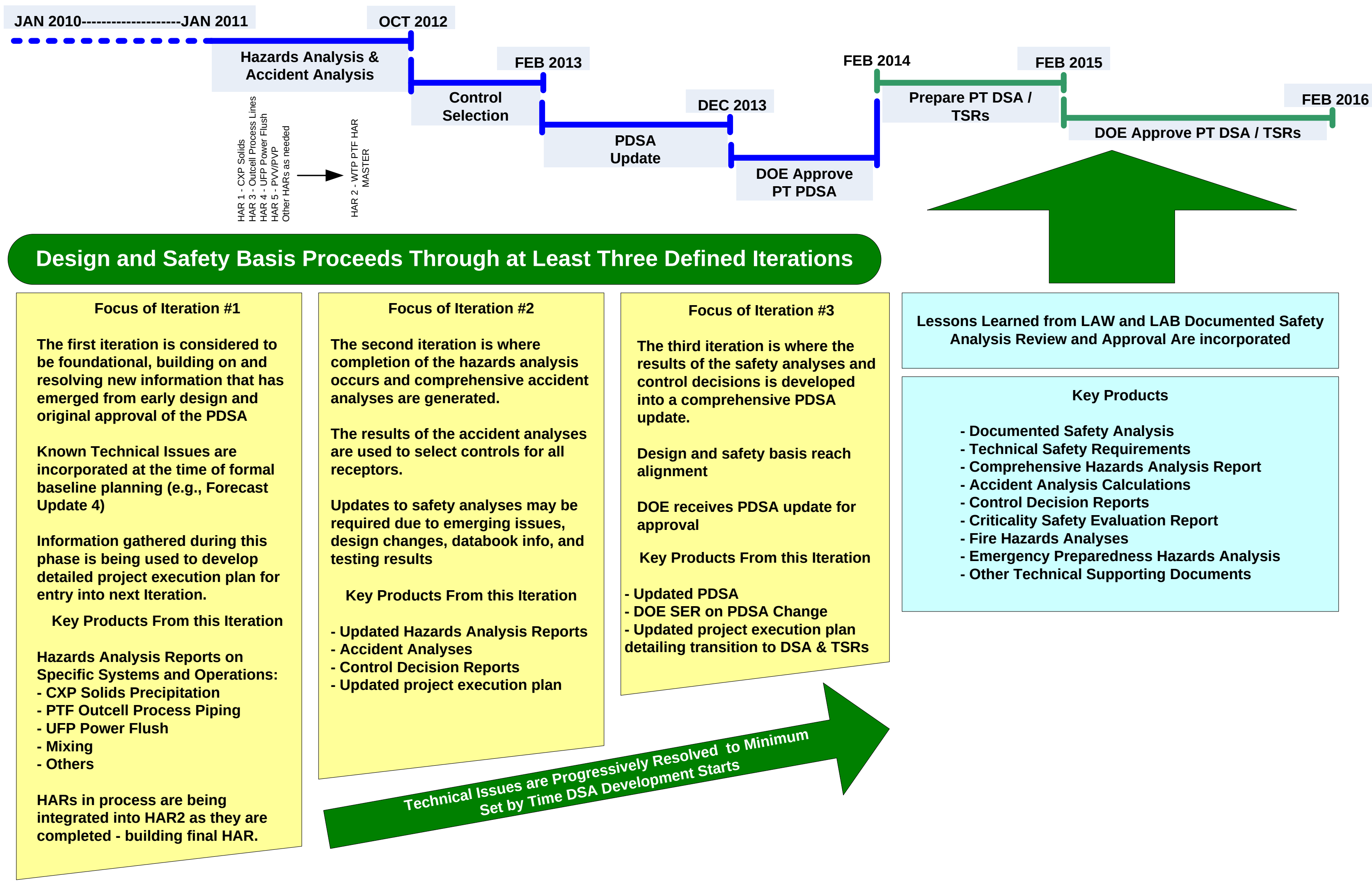
The plan to complete hazards analyses to resolve known technical issues will be completed in three main iterations.

The first iteration will focus on reconstituting the PTF hazards analysis based on the technical issues known as of late 2010. This iteration will provide the foundation resolving technical issues and input for updates to accident analysis, control strategies, and the PDSA. Results of this iteration that are refinements of existing safety analysis will be incorporated into the PDSA in a comprehensive update that will be initiated at the conclusion of the second iteration. If this iteration identifies new or modified hazardous conditions that are not adequately addressed in the design, the accident analysis will be updated (as needed) and controls decisions will provided to engineering to minimize the impact to ongoing engineering and construction activities.

The second iteration will focus on reconstituting the design basis accidents based on the comprehensive hazards analysis report and design evolution. The updated accident analysis ensures that the spectrum of hazards have been addressed and subsequent controls are adequate to safely operate the facility. Results of this iteration that are refinements of existing accident analyses will be incorporated into the PDSA in a comprehensive update and corresponding design basis accident calculations. If this iteration identifies new or modified safety functions or functional requirements that are not adequately addressed in the design, the updated safety requirements will provided to engineering to minimize the impact to ongoing engineering and construction activities.

The third iteration will focus on a comprehensive update to the PDSA that incorporates the results of the first two iterations and interim safety basis changes (e.g., JCDPIs, ABARs, SEs) that were prepared to process changes to the design and/or control strategies.

Figure 6 Schedule and Approach for Upgrading Pretreatment Facility Safety Basis Documents



A comprehensive hazard analysis of PTF is needed to augment the focused hazards assessments. This effort will involve a systematic evaluation of all hazards, area by area, considering systems, processes, source terms (radiological and chemical), and interfaces and interactions. The interim focused and comprehensive PTF safety analysis (i.e., hazards and accident analyses) will also address the known technical issues itemized in Appendix A (as needed). These updated safety analyses will be used to confirm or develop existing safety functions and functional requirements. If any discrepancies are identified they will be added to the list of known technical issues for evaluation, tracking and closure.

Tables 2 and 3 itemize the interim and planned hazards analyses to evaluate several of the known technical issues consistent with the DRAFT PEP. The PEP for PTF includes the balance of the safety basis activities required to reconstitute the safety basis.

Table 2 Series I PTF Hazards Analysis

System	Document Title	Status and Document Number
Ultrafiltration Process System (UFP)	*Hazards Analysis Report for WTP Pretreatment Facility, Appendix A - Ultrafiltration Process*	In Review 24590-PTF-HAR-ENS-11-0002 Rev. 2 DRAFT (Reference 5.2)
Ultrafiltration Process Power Flush System (UFP)	*Hazards Analysis Report for the PTF Revisions to Functional Classification for the Hot Cell Portions of the UFP Power Flush System*	Complete 24590-PTF-HAR-ENS-11-0004 Rev. 0 dated 9/17/11 (Reference 5.65)
Out Cell Process Piping	*Hazards Analysis Report for the PTF Out-Cell Process Piping, C3/C5 Enclosures, and Removal of TCP-BULGE-00004*	Complete 24590-PTF-HAR-ENS-11-0003 Rev. 0 dated 7/1/11 (Reference 5.66)
Process Vessel Mixing using PJMs for hydrogen control	*Hazards Analysis Report for WTP Pretreatment Facility, Appendix B - Mixing for Gas Release*	In Review 24590-PTF-HAR-ENS-11-0002 Rev. 2 DRAFT (Reference 5.2)
Waste Feed Receipt Process System (FRP)	*Hazards Analysis Report for WTP Pretreatment Facility, Appendix D - Feed Receipt Process (FRP)*	Complete 24590-PTF-HAR-ENS-11-0002 Rev. 2 DRAFT (Reference 5.2)
Cesium Ion Exchange Process System (CXP)	*Hazards Analysis Report for Cesium Ion Exchange Process System Design Change*	Complete 24590-PTF-HAR-ENS-0001 Rev. 0 dated 5/31/11 (Reference 5.67)
Cesium Nitric Acid Recovery Process System (CNP)	Will become an appendix to Hazards Analysis Report for WTP Pretreatment Facility	In Process

Table 2 Series I PTF Hazards Analysis

System	Document Title	Status and Document Number
High Level Waste (HLW) Lag Storage and Feed Blending Process System (HLP)	*Hazards Analysis Report for WTP Pretreatment Facility, Appendix C - HLW Lag Storage and Feed Blending Process System (HLP)*	In Review 24590-PTF-HAR-ENS-0002 Rev. 2 DRAFT (Reference 5.2)
Waste Feed Evaporation Process System (FEP)	Will become an appendix to Hazards Analysis Report for WTP Pretreatment Facility	Planned in CY12
Pretreatment Vessel Vent Process System (PVP) and Process Vessel Vent Exhaust System (PVV).		
Plant Wash and Disposal System (PWD)		

Table 3 Series II and Series III PTF Hazards Analysis

Hazards Analysis Series	System
Series II - Low Hazard Process Systems or Support Systems	Autosampling System (ASX)
	Main Control Room (MCR) and the C1 ventilation system (C1V)
	C5 Ventilation System (C5V)
	Demineralized Water (DIW)
	High Pressure Steam system (HPS) and the Low Pressure Steam System (LPS) including the secondary steam loop
	Instrument Service Air System (ISA) and Plant Service Air System (PSA)
	Pulse Jet Ventilation System (PJV)
	Spent Resin Collection and Dewatering Process System (RDP)
	Treated LAW Concentrate Storage System (TCP)
	Treated LAW Evaporation Process System (TLP)
Series III - Facility Wide or Multi System Hazards	Area based - front door to back door
	Miscellaneous facility wide low hazard systems (e.g., utilities)
	Issues waiting resolution of a predecessor
	Issues missed in Series I HAZOP scope

E&NS is finalizing a project execution plan (PEP) that will detail the safety basis activities and schedule to support development of a final DSA in 24590-PTF-PL-ENS-11-003, *Project Execution Plan to Rebaseline the Pretreatment Facility Preliminary Documented Safety Analysis (PDSA)* (DRAFT).

As WTP implements the current baseline and resolves known technical issues, changes to key safety basis documents presented below will be made to document the iterations between the design and safety basis.

1. Hazards Analysis Report: The focused and comprehensive PTF hazards analyses will be successively compiled into one composite PTF hazards analysis report (HAR).

2. Accident Analysis Calculations: The focused and comprehensive hazards analysis process will generate a list of bounding, representative, and unique design basis accidents (DBA) that will require formal quantification of consequences.

3. Control Selection Report: A integrated control selection team will be used to ensure the selected controls are bounding and representative for the analyzed hazards and capable to perform their intended safety function. The teams conclusions will be formally documented in a Control Selection Report.

4. Criticality Safety Evaluation Report: The CSER will be updated to address new information including PuO_2 particle size distribution and sampling requirements (Commitment 5.1.3.4). The CSER update is covered by pending actions described in 2010-02 IP Commitments 5.1.3.4 and 5.4.3.3.

5. PDSA Updates: The PDSA will be updated periodically in accordance with the revised WTP safety basis processes maintenance procedures.

6. Documented Safety Analysis: The PDSA will provide the foundation for developing a DSA that supports commissioning.

3.2.2.2 Potential Inadequacies in Existing Safety Basis Documents

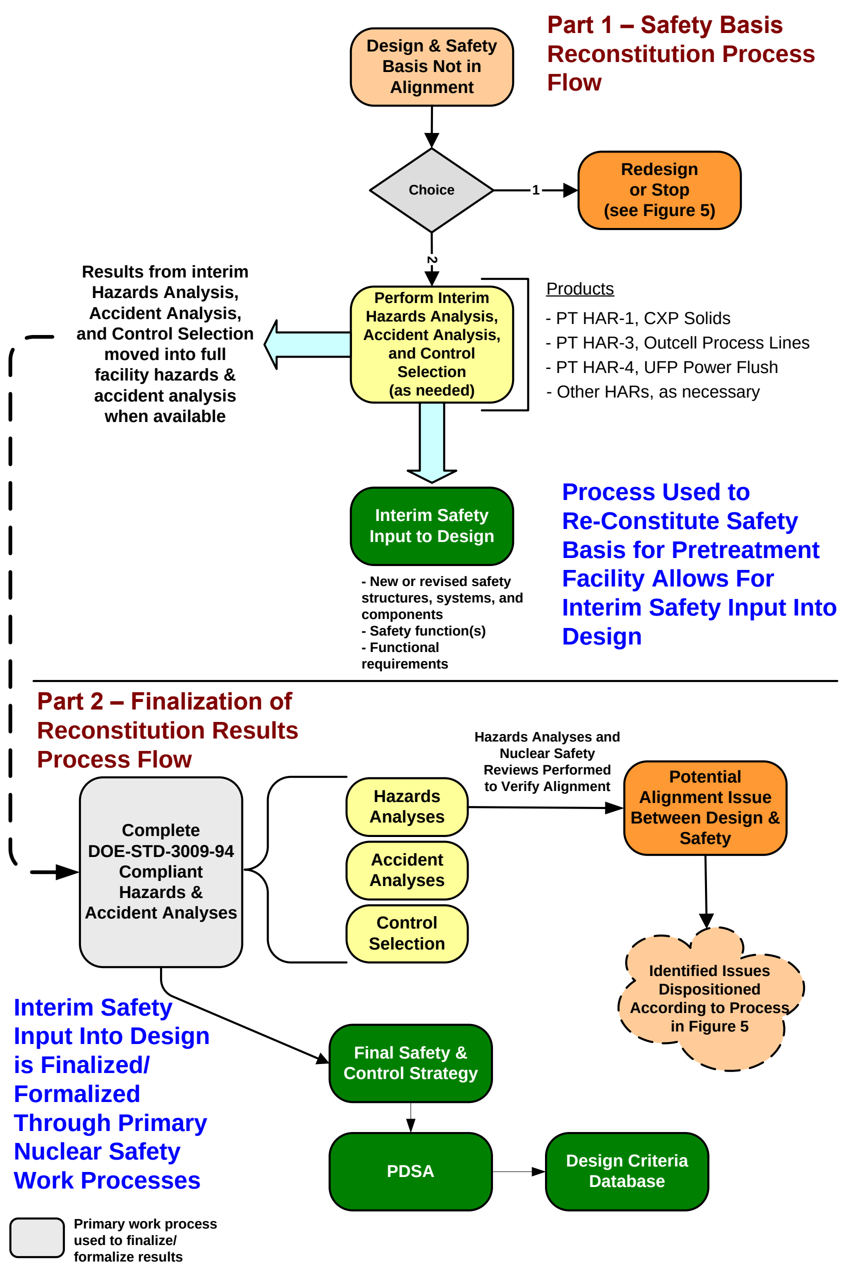
WTP identified several SSCs that were not aligned with the safety basis. Each of those items were evaluated as described in Section 3.2.1.3. In addition, the DOE Construction Project Review identified technical issues on the inadequacy and flow down of safety functions and functional requirements. The construction project review contained recommendations for WTP to:

- Complete an extent of condition review to determine safety bases that are not supported by a technical basis; and
- Establish a plan to ensure credited safety functions / functional requirements are preserved as design inputs.

WTP will conduct an extent of conditions review to assess the existing state of PTF functional requirements considering the current design phase. This will involve both a system by system evaluation to determine if there are deficiencies in current functional requirement development, along with a comparison of the functional requirements against the design criteria. This process is expected to identify new technical issues and areas where focused hazards analysis are needed as an interim measure before a comprehensive PTF hazards analysis can be completed. If large discrepancies are found, MSOWs may be generated.

In addition to the iterative nature of updating the safety basis, resolution of technical issues is also iterative. Figure 7 illustrates key process steps and decision points that will be used during the iterations to provide disciplined resolution and disposition.

Figure 7 Work Process Flowchart



3.2.3 Hazards Analysis of New Testing Information

Actions to evaluate transfer, mixing and sampling system performance are covered under 2010-02 IP Commitments: 5.1.3.1 (LSIT); 5.1.3.2 (Simulants used in testing); 5.1.3.3 (computational fluid dynamics [CFD]); 5.1.3.4 (WTP sampling); and 5.1.3.6 (heel management). Calculations and other types of testing may be necessary to evaluate and resolve other technical issues as they arise (such as erosion or corrosion).

3.2.3.1 Vessel Testing Data

This section describes actions to evaluate M3, LOAM benchmark testing, and LSIT results as required by 2010-02 IP Commitment 5.7.3.1. Commitment 5.7.3.1 cites three key sources of vessel testing data to be evaluated to update hazard / accident analyses. This will support subsequent actions to identify inputs and assumptions required to be protected with TSRs, and to establish control strategies for safe operation of the PTF. The M3 testing and resulting vessel assessment reports are complete; LOAM benchmark testing was conducted before the startup of LSIT to support resolution of residual risks upon “closure” of the M3 issue; and preparations for LSIT are currently underway.

In June 2011, the DNFSB raised concerns regarding use of the LOAM model in the PJM designs (Reference 5.14). WTP responded to the DNFSB concern in September 2011 affirming that LOAM will not be used for design work.

A limited scope HAR has been completed which documents the results of the hazards analysis of the vessel assessment reports prepared for M3 closure (Reference 5.2). The hazards analysis focused on mixing for gas release. The results of the LOAM benchmark testing were not included in that hazards analysis report. The M3 vessel assessment reports will be superseded by LSIT test reports and validated CFD modeling results. The final results, providing the basis for mixing performance, will be used to update the PTF hazards analysis.

Consistent with the safety basis program changes described in Section 3.2.1.1, Nuclear Safety is integrated into the planning for LSIT, analyses, modeling, and evaluation of vessels based on results, as follows:

1. Evaluation of inputs and assumptions used in the models that predict mixing performance (e.g., the computational fluid dynamics code).
2. Identification of the nuclear safety requirements to be addressed by LSIT, modeling, or other analyses needed to support development of a DSA.
3. Evaluation of vessel hazards (i.e., conduct hazards analysis, accident analysis, and select controls) based on LSIT modeling results and assumptions, as needed. The results of the hazards and accident analysis will be used to update the control strategies and functional requirements.

4. Updating / developing the pertinent HARs.
5. Updating the PDSA and TSRs based on the best available mixing performance data, and comprehensive hazards and accident analysis results.

4 Summary Plan and Schedule

Commitment 5.7.3.1 requires an approved plan that establishes the key activities and schedule to systematically evaluate the hazards and resolve known technical issues and evaluate the results of testing to provide the technical basis to integrate nuclear safety into the PTF design and develop a documented safety analysis that supports commissioning and operations.

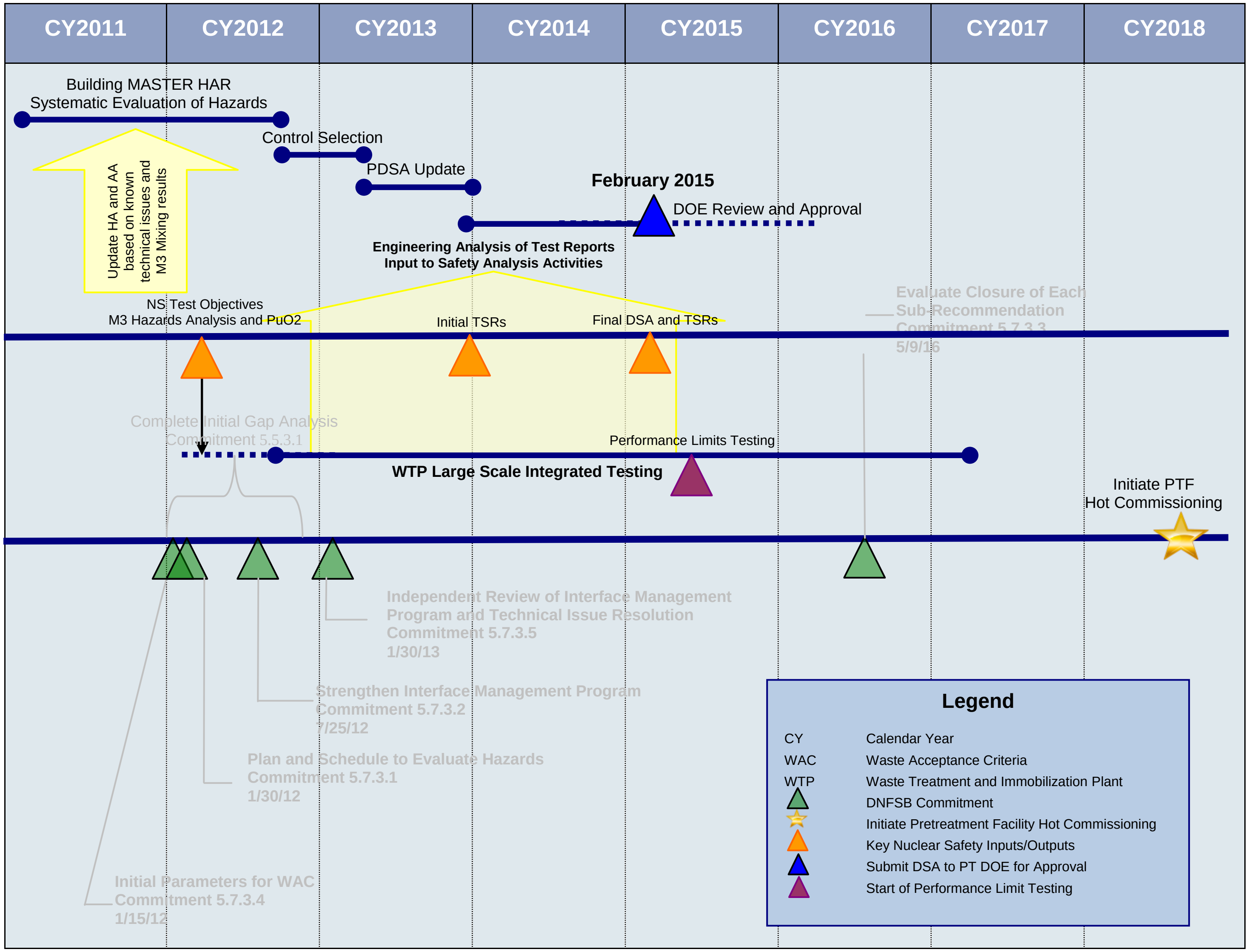
Table 4 provides the plan and schedule for the activities discussed in this report.

Table 4 Plan and Schedule

Plan Actions	Target Schedule
Update E&NS procedures to implement DOE-WTP contract direction for nuclear safety deliverables.	June 2012
Update Engineering procedures to implement DOE-WTP contract direction for nuclear safety deliverables.	June 2012
Issue project execution plan for the PTF safety basis development program.	June 2012
Develop a data book for waste feed characteristics. The data book will identify the physical parameters of the waste feed characteristics and provide the technical basis for the use of those parameters safety basis and design basis calculations.	March 2013
Complete an extent of condition review to determine safety bases that are not supported by a technical basis (CPR5-14).	June 2012
Establish a plan to ensure credited safety functions / functional requirements are preserved as design inputs (CPR5-15).	September 2012
Complete hazards and accident analysis iterations, which are focused on reconstituting the hazards analysis to reflect changes to the process flowsheet, results of mixing tests, and resolution of design issues.	June 2013
Complete comprehensive update to PDSA.	June 2014
Prepare DSA (final iteration).	December 2016

An overview of the integrated plan and schedule is provided in Figure 8. E&NS has prepared two risks to document and resolve baseline planning issues. Risk ENS-006 addresses the funding and schedule risks related to development of the DSAs to support commissioning. Risk ENS-008 addresses the funding and resource risks related to supporting commissioning activities.

Figure 8 Overview of Testing and Safety Basis Timelines



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Appendix A

Known Technical Issues

Known Technical Issues

Item	Source Document #	Excerpt from Source Document	Issue Description	Impacted System / Function				Hazard		
				M	T	S	W	H	C	CF
PJM Control/Bubbler Accuracy										
1	CCN 243898, Attachment A, Source: R&T Issues (WS8) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Need to review the PJM air use plan to ensure all tanks are mixed adequately and consistently.	The PJM control strategy has not been finalized. The limit on the number of PJMs and spargers that can operate simultaneously has not been established.	X				X	X	
2	24590-WTP-3YD-50-00003, Appendix A (Reference 5.3)	Unresolved Issue 20 Review R&T results from EFRT and AFA testing, update sequencing of PJM and spargers sequential operations (Appendix B), to establish design details and operating sequences for PJMs and spargers during proposed post-DBE modes of operation. Validate and document this post-DBE design for Newtonian and non-Newtonian vessels through a series of structured multidiscipline ISM meetings, verifying I&C design supports sequential mixing operations sequences so established. Update this SD accordingly.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. The current design, technical baseline, and the authorization basis are not consistently aligned. The process may identify new technical issues.	X	X	X		X	X	
3	CCN 243898, Attachment A, Source: R&T (WS8) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Lack of adequate samples, inadequate level detection, and bubbler ops problems means a time based system may be implemented.	The control scheme for PJMs has not been finalized.	X		X		X	X	
4	24590-WTP-PIER-11-0588-C (Reference 5.51) 24590-WTP-PIER-11-0645-D (Reference 5.52) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	PJM/Sparger impact on Bubbler Accuracy	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated.	X				X	X	
5	24590-WTP-ATS-QAIS-07-1249 (Reference 5.5) 24590-WTP-3YD-50-00003 (Reference 5.3)	The following list of unresolved issues was extracted from Appendix A of SD for PJM Mixing, 24590-WTP-3YD-50-00003, Rev B (number corresponds to SD Unresolved Items list): 3) Determine how aspiration will be detected. What is the control strategy for aspiration? 23) Determine and implement ITS flush system for bubbler and sparge tubes that may become plugged.	3) Effects of aspiration have not been evaluated. Aspiration could result in contamination in air line piping and potential adverse impacts on mixing efficacy. 23) There is a potential for bubbler and sparge tubes to become plugged. Sparger plugging directly reduces mixing. Bubbler plugging could impact PJM control.	X						

C = Criticality
CF = Confinement
H = Hydrogen
M = Mixing
S = Sampling
T = Transport
W = Waste Acceptance Criteria

Known Technical Issues

Item	Source Document #	Excerpt from Source Document	Issue Description	Impacted System / Function				Hazard		
				M	T	S	W	H	C	CF
6	CIARS 10-097, Action 4 (Reference 5.31) CCN 243898, Attachment A, Source: DOE-HQ-DNFSB to TSG (WT10) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Action 63: As the PJM control design is completed the specific change in suction and drive time for each vessel as a result of level and density will need to be determined to evaluate accuracy needed in these measurements to minimize overblows.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated.	X						X
7	CCN 220452 (Reference 5.19)	The normal PJM air supply and venting control strategy is not complete to support the identification of PJM operating parameters for pulse length, duty cycle, pulse volume fraction, and air pressures. The impact of off-normal conditions, such as blockage of level detection probes on effective and safe operation of the PJMs has not been completely evaluated.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated.	X				X	X	X
8	CCN 243898, Attachment A, Source: R&T Issues (Reference 5.33)	Improved level control especially at low Tank Levels.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. Level measurements for PJM control may be inadequate at low tank levels.	X				X	X	X
9	RPP-44491 (Reference 5.43)	RE: RPP-44491, Revision 0 - Table A-1 Evaluation Results Summary Matrix Bubbler issues include solids entrainment.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. Level measurements for PJM control may be inadequate at low tank levels.							
10	CCN 221575 (Reference 5.21) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	The PJM mixed vessels have steady state solids concentrations that have been shown to be stratified throughout the vessel height. This outcome is directly related to the solids particle size distribution (PSD), particle density, and fluid properties in the specific vessel; that is vessels with larger, heavier particles in fluids of lesser density and viscosity have a larger degree of solids stratification. As a general rule, the TSG has considered 20 micron particles to generally move with the fluid phase and therefore blend as miscible fluids would blend. Larger, denser particles stratify, typically toward the vessel bottom.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. Bubbler level detection feeds PJM control based on the differential pressure between bubblers at two different elevations in a vessel. This methodology is predicated on density being consistent throughout the waste volume. Previous testing demonstrated that vessel contents will become stratified and the impacts of stratification on bubbler accuracy, and hence PJM control, has not been determined.	X		X		X	X	
11	CCN 243898, Attachment A, Source: DOE-HQ-DNFSB to TSG (WT10) (Reference 5.33)	During normal operations, it is possible that a thin layer of sediment could be present due to rapid settling of the particles during the PJM refill cycle. The depth of this potential layer will be evaluated and included in the design of bubbler heights.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. Current controls may not adequately cover post DBE operating conditions for PJMs. Excessive sediment depth could accumulate while PJMs are idle after a DBE, and interfere with subsequent PJM control.	X						X

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Known Technical Issues

Item	Source Document #	Excerpt from Source Document	Issue Description	Impacted System / Function				Hazard		
				M	T	S	W	H	C	CF
Sampling										
12	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	The transfer/sampling system used at MCE's test facility is not geometrically scaled and functionally prototypic. The technical basis (or even the sampling bias) for using the system to collect data (that prove that solids do not accumulate during vessel pump-outs) has not been developed.	Prototypic operation of transfer / sampling system during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated.		X	X		X	X	
Transfer/Pump Out										
13	CCN 243898, Attachment A, Source: PNNL Tech (WS9) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Technical Issues Related to Suction Lines (M1) High concentrations of solids in the suction lines cause much higher line losses (several times those provided in WTP-RPT-189) than are incorporated in the current design guide. This problem has increased as the need to fully mix the high concentration waste receipt vessels has been removed and much higher suction pipe input concentrations are now expected. The long suction pipe lengths make this problem critical. § The slow suction line velocities (resulting from the high line pressure loss) are expected to cause inline deposition of high concentration materials. § The design of positive displacement or Moyno® progressing cavity pumps on long suction lines with high line loses must evaluate the pressure at key points in the suction pipe. With the receipt vessels being at atmospheric pressure (~30 inches Hg), a pressure drop in the suction pipe to 2 inches Hg (or lower including vacuum) will allow the slurry to boil at plant temperatures (~80 degrees F). The creation of vapor in the suction lines has long been identified in slurry handbooks as the point where positive displacement pumps may not prime. If vacuum conditions are developed anywhere along the pipe, piping must be designed to handle the vacuum. § Air entrainment at the pump inlet was observed at the PEP ultrafiltration loop at levels that limited pump performance (WTP-RPT-197 Pretreatment Engineering Platform Phase 1 Final Test Report). The entrained air degraded the ability of the pumps to meet the flow requirements.	There is a potential for line plugging in transfer lines.		X			X	X	X

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14	CCN 243898, Attachment A, Source: R&T (WS8) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Prevention of Suction Line Air Entrainment especially the UFP line	The impacts from the potential for air entrainment in suction lines to cause pumps to be less efficient (thus reducing transfer rates) has not been evaluated.		X			X	X	
Heel Management										
15	RPP-44491 (Reference 5.43)	RE: RPP-44491, Revision 0 - Table A-1 Evaluation Results Summary Matrix PTF Flushing and Cleaning Strategies Issue: - Additional equipment and instrumentation may b required to ensure adequate mixing in WTP vessels using PJMs; additional simulants may be needed, specific mixing tests may be defined (especially if neither prototypic nor full-scale testing is performed before commissioning), operations may be refined to accommodate mixing results, and contingency plans may be developed for internal changes to vessels. -PJMs potentially do not meet Technology Readiness Level 6. - The operating contractor should plan to limit FRP-2 feed saturation temperature to near or below FRP-2 temperature. - The operating contractor should add FRP-2 heel rinse to prevent cumulative buildup.	The PJM design and operation scheme has not been completed.		X			X	X	
16	CCN 21895, CIARS 10-095, Action 4 from CRESP (Reference 5.18) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Action 18: Functional performance specifications need to be developed for inspecting and accessing vessel bottoms.	Vessel bottoms may not be adequately inspected.	X				X	X	
17	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	What volume of heel is acceptable during an outage (i.e., no mixing)	The acceptable residual heel mass has not been determined.	X				X	X	

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Integrated Operations										
18	24590-WTP-3YD-50-00003, Appendix A (Reference 5.3)	Unresolved Issues 31 & 34 EFRT M6: Process-operating limits have not been completely defined. Project Response Plan for Implementation of EFRT Recommendations - M6: Process Operating Limits Not Completely Defined & P4: Gelation / Precipitation. EFRT M6: Methods shall be implemented to maintain waste characteristics within the design basis of mixing and purging system (this may include caustic addition). Conditions within the vessel may change the waste properties e.g., sparging may change the pH of the waste. A change in the pH of the waste can also affect the fluid characteristics.	Process operating limits for mixing have not been identified or documented. Methods have not been implemented to maintain waste characteristics within the design basis of mixing and purging systems (e.g., sparging may change waste pH).	X	X			X	X	X
19	PIER-MGT-11-0759-C (Reference 5.36)	Potential of long lengths of horizontal PJM/RFD air line piping to be filled with the contents of the parent vessel due to the suction mode of PJM/RFD operation	There is a potential for air line piping to become filled with the contents of parent vessel during PJM suction mode. This could lead to blocked lines that hinder air supply and degrade the safety mixing function.	X						X
20	CCN 243898, Attachment A, Source: DOE-HQ-DNFSB to TSG (WT10) (Reference 5 33) CIARS 10-095, Action 7 (Reference 5.45)	Full scale testing of PJMs, PJM controls, prototypic bubblers and fast settling solids are needed to assure the details of the design will support mixing. ...there are other issues that will be included in the planned full scale test, such as acceptable fluid velocities from pump suction piping and increased power of PJMs effect on bubbler performance. ... the additional planned testing will be used to locate bubblers in as advantageous a position as possible to minimize process effects.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated.	X						X
21	CCN 243898, Attachment A, Source: R&T Issues (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Evaluate the adequacy of the PJV system to handle PJM exhaust. Need review of the complete air system.	The PJM control strategy has not been finalized. There is a potential for the PJV system to become overwhelmed from PJM exhaust.	X						X

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22	CCN 243898, Attachment B (Reference 5.33)	44 - Waste creep Pulse Jet Ventilation (PJV) Supply air has the potential for internal contamination between pulse jet pairs and control racks. This is being tracked as an open item #78 on the DWP Integration Meeting Action Item Log BNI provided a test report based on testing at SRS, and a white paper identifying necessary changes in PJM operation and design changes to allow cleanout via a hose connection at the air racks.	The current design may not be ALARA in that facility workers may be exposed to unplanned radiation levels due to contaminated PJM air intake lines. Washdown capability has been added to address this concern, but determination of frequency has not been established based on operational testing to inform decisions.	X						X
Performance/Scaling										
23	CIARS 10-094, Action 2 (Reference 5.27)	Action 90: Determine if the existing data set related to PJM behavior is sufficient. If not identify additional actions. There are technical uncertainties related to PJM behavior with settling slurries. There is a scarcity of data for PJM performance on settled or cohesive layers, and it's unclear if the existing correlations developed for vessels without layers can be applied to settling waste. While previous studies on PJM mixing of uniform non-Newtonian materials quantified many aspects of PJM performance, data to quantify the roles of important operational parameters (jet velocity, pulse size, and duty cycle) and geometry (number of PJM tubes, nozzle size, bottom shape) are absent.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. There is a scarcity of data for PJM performance on settled or cohesive layers. The existing correlations developed for vessels with homogenous waste may not be applicable to settling waste. The current design may not adequately prevents solids from accumulating under all operating conditions.	X				X	X	X
24	CIARS 10-094, Action 3 (Reference 5.28)	Action 91: Determine if the existing data set related to settling dynamics and strength of settled layers is sufficient. If not identify additional actions. The most significant uncertainty is that the existing models and data on settling dynamics and the strength of settled layers have not included experimental testing to confirm the scaling behavior or to determine the increasing strength with depth into a settled layer.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. The existing models and data on settling dynamics and the strength of settled layers have not included experimental testing to confirm the scaling behavior or to determine the increasing strength with depth into a settled layer.	X				X	X	
25	CCN 243898, Attachment A, Source: R&T Issues (WS8) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33) CIARS 10-094, Action 1 (Reference 5.26)	Demonstrate adequate mixing and bottom clearing with settling solids in a non-Newtonian slurry. Especially needed under 6- 10 Pa.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. Vessel mixing may not adequately clear settling solids in a non-Newtonian slurry with low shear strength, which could result in excessive solids accumulations.	X				X	X	

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26	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	There is some risk that application of scaling relationships derived from 4 PJM tests may not apply precisely to other PJM configurations. Additional testing would be required to further reduce the potential risk associated with this issue.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. There is a potential that PJMs as designed may not perform as anticipated.	X				X	X	
Design Margin Identification										
27	CCN 220452 (Reference 5.19)	Vessel off-normal operating conditions may result in the formation of solids (by agglomeration or precipitation) that have a settling velocity greater than 0.03 ft/min.	Whether the potential for off normal operating conditions to enhance agglomeration and precipitation processes in FRP-02 has not been evaluated.	X				X	X	
28	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	HPAV internal to vessel head/charge vessels/PJM/bubbler/piping	The stress on vessel head, charger head, PJMs, bubblers, nozzle loads, and associated piping due to hydrogen events has not been determined.	X				X		X
29	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	What is the upper shear strength of solids left settled for 24 hrs.	System performance limits have not been determined.	X				X	X	
30	CCN 21895, CIARS 10-095, Action 6 from CRESP (Reference 5.18) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33) 24590-WTP-PIER-MGT-10-0463-C (Reference 5.53)	Action 20: Assessments of potential particle segregation during sedimentation should consider estimates based on considerations beyond the equivalent volume sphere. Usually vessels with significant sources of steam are designed for full vacuum. On review of an EDR on the UFP-VSL-00001A/B it was noted that the external design pressure was changed to only 2 psig even as steam sparging was being added to the vessel. The steam line from the rack has a 1-inch vacuum breaker (in series with a spring check valve and manual isolation valve) combined with an 1.5-inch air bleed (with an RO, spring check, and manual isolation valves, in series) from PSA. An automatic valve coordinates the PSA inbleed with steam valve closure. The RO is sized to limit inbleed to ~70 scfm (PTF-M6C-UFP-00023). These provisions are intended to maintain pressure in the header/sparger but are not effective/intended for protecting the vessel from vacuum.	Prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated. The performance of solids may not be adequately predicted by simulants. System performance limits have not been determined.	X				X	X	

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31	CCN 243898, Attachment A, Source: R&T (WS8) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Define and demonstrate PT rheology control scheme to keep yield strength within limits especially if it needs to be controlled within specific limits to prevent settling. Need to account for dilutions, flushes, etc. Evaluate additives and margins.	System performance limits have not been determined.							
32	CCN 243898, Attachment A, Source: DOE-HQ-DNFSB to TSG (WT10) (Reference 5 33) CIARS 10-097, Action 2 (Reference 5.30) CCN 243898, Attachment A, Source: EMAB Sept 2010 (WS14) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	The timing for operation of the PJMs post-design basis event in these vessels (HLP-22, UFP-1, FEP-17) will be evaluated to determine a maximum sediment depth, which will then be incorporated in the evaluation of the control of the PJMs post design basis events.	The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated.	X				X	X	X
33	24590-WTP-ATS-QAIS-10-0937 (Reference 5.8)	The following list was extracted from Appendix A of Rev. B of the referenced SD for PJM mixing (24590-WTP-3YD-50-00003, Rev. B, "*System Description for Pulse Jet Mixer and Sparger Mixing Subsystems*"). The numbers correspond to the Unresolved Items list. 21) Engineering to confirm basic recovery scenarios for PJMs and spargers after they have been idle for extended periods. Also, necessary R&T testing, if required, must be defined. 36) Demonstrate the waste can be mixed & remain Newtonian. The PJMs maintain the rheological properties of the waste after the initial mixing of the waste material with dilution water.	21) The control scheme for PJMs has not been finalized. Therefore, prototypic operation of PJM recovery has not been fully demonstrated. 36) There is incomplete understanding of effects of mixing on rheology (shear thickening). Therefore, the control strategy has not been finalized. If this phenomenon could happen, Newtonian fluids might become non-Newtonian in a vessel not designed to mix non-Newtonian slurries.	X				X	X	
34	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	What is the bounding weight percent at the pump suction.	System performance limits have not been determined.		X			X	X	
CFD V&V and Comparison										
35	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Is Newtonian fluid representative of a sheared non-Newtonian fluid.	The assumption that is planned to be used to evaluate non-Newtonian vessels using Newtonian calculational tools has not been validated.	X				X	X	

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High Temperature Operation										
36	24590-WTP-MG5-PIER-11-0588-C (Reference 5.51) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	The adjustment in suction time due to temperatures above the assumed temperature for a vessel specific FLUMP curve	The control scheme for PJMs has not been finalized. The effects of temperature on PJM controls have not been determined.	X				X	X	
Criticality										
37	CCN 204621, COA #4 (Reference 5.54)	The Contractor will clearly identify all CSL compliant and confirmatory sampling points in diagrams and descriptions in the WTP CSER, including Section 8.0: Criticality Safety Limits and Controls. It is not clear in the CSER where there are sampling points other than the waste feed receipt vessels. Table 4-6 only provides a summary of vessels where criticality sampling may be drawn. Along with identifying all sampling points, the CSER should also identify the need for clarity and robustness in the sampling program, as recommended by review documented in CCN 211306 and CCN 193437, DOE Criticality Safety Support Group - Review of the Waste Treatment and Immobilization Plant (WTP) Preliminary Criticality Safety Evaluation Report (CSER).	The criticality sampling program has not been sufficiently defined.			X			X	
38	CCN 204621, COA #5 (Reference 5.54)	A lack of justification for CSL 8.3 for estimation of the maximum Pu concentration using WTPCLs and an assessment of worst-case or contingent conditions in the CSER, indicates that Pu concentration is so far below the calculated Pu concentration SSL indicates that no credible events could possibly exceed subcritical limits. The margin between CSL 8.3 and its SSL is by a factor of nearly 500. DOE does not believe that CSL 8.3 is warranted as a TSR level control required for criticality safety in WTP. The Contractor is requested to eliminate CSL 8.3 as a TSR level control or provide appropriate justification to ORP for its retention.	The criticality sampling program has not been sufficiently defined.			X			X	

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39	CCN 204621, COA #6 (Reference 5.54)	The Contractor should re-evaluate the need for CSL 8.4 as a TSR level control. DOE does not find an adequate justification for using CSL 8.4 for controlling criticality with a TSR control. Estimation of maximum Pu concentration using WTPCLs of high Pu waste feed batches indicates that Pu concentration is far below the concentration SSL. Processes that may dissolve Pu in the liquid portion of the waste (e.g., wash/leach) will result in Pu/metal loadings far below CSL 8.4. Additionally, acid additions that are discussed in the contingency conditions (CSER, Section 7) indicate that no credible events would exceed subcritical limits.	The criticality sampling program has not been sufficiently defined.							
40	24590-WTP-RPT-ENS-10-002 (Reference 5.55)	The CSER identifies four CSLs, each requiring sampling to verify waste parameters are adequate to ensure criticality remains incredible. The current CSLs require sampling of waste in either the feed receipt vessels or, in some cases, in subsequent vessels in the PT process. The stated uncertainty value of 5% for how representative the sample is of tank contents may not be achievable with the current sampling and vessel mixing design.	Assumptions underpinning the current criticality safety strategy, as documented in the CSER may not be achievable with the current sampling and vessel mixing design.	X	X	X			X	
41	CCN 204621, COA #7 (Reference 5.54)	The Contractor will evaluate and include uncertainty in the BBI estimates to assess the likelihood of violating CSLs instead of simply providing point estimates for waste feed batches (vectors) as shown in CSER Figures 4-1 through 4-4.	The criticality safety controls have not been finalized.							
42	24590-WTP-CSER-ENS-08-0001 (Reference 5.32)	Appendix A logs action items that remain open upon development of the 24590-WTP-CSER-ENS-08-0001, Rev 0. These action items are documented in the action tracking system (ATS) per the CSER. Examples that pertain to PTF mixing, transport or sampling: A.1.2: Representativeness of sampling; A.1.3: Potential for Offspec Feed; A.1.6: Effects of gravity segregation; A.1.8: Confidence level of sampling methods.	Criticality safety controls have not been finalized.							

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Erosion/Corrosion										
43	CCN-243898, Attachment E (Reference 5.33)	The project team has not shown that the design wear allowances for vessels, piping, and PJM nozzles are adequate to ensure that components located in the black cells will reliably function for the 40-year design life of the facility.	If erosion corrosion allowances are not adequate, the confinement function of SSC may not be met over the design life of the plant.	X	X	X				X
44	24590-WTP-PIER-MGT-11-1072-B (Reference 5.56)	Finding S-11-WED-RPPWTP-026-F02; Priority Level 1: A total of (10) WTP process vessels were found to have anticipated, maximum operating temperatures in excess of the corrosion related limiting temperature identified in corrosion literature for the selected materials of construction.	If erosion corrosion allowances are not adequate, the confinement function of SSC may not be met over the design life of the plant.	X	X	X				X
45	24590-WTP-PIER-MGT-11-1071-B (Reference 5.57)	Finding: S-11-WED-RPPWTP-026-F01; Priority Level 2: Materials corrosion performance margins to provide performance flexibility and to account for uncertainties in pitting, crevice corrosion, and stress corrosion cracking behavior in WTP-specific process environments were not developed and documented during the evaluation and selection of materials (i.e., in the Corrosion Evaluations) for twenty WTP process vessels	If erosion corrosion allowances are not adequate, the confinement function of SSC may not be met over the design life of the plant.	X	X	X				X
46	24590-WTP-PIER-MGT-11-1073-C (Reference 5.58)	Observation S-11-WED-RPPWTP-026-O01: It was observed that there was no mention in the Preparation of Corrosion Evaluations design guide of the need to satisfy the Design Process procedure requirements to add materials corrosion performance margins to input information to account for the uncertainties and maturity of that information and to provide flexibility in implementing design details.	If erosion corrosion allowances are not adequate, the confinement function of SSC may not be met over the design life of the plant.	X	X	X				X

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Integration Of Nuclear Safety Into Design										
47	CCN 237683 (Reference 5.24) PIER-MGT-11-0979-B (Reference 5.37)	BNI's Authorization Basis program and Design Verification programs are not adequate to ensure Authorization Basis requirements are adequately aligned (in a timely manner before material installations), with applicable facility design after the design has been issued for procurement/issued for construction (IFP/IFC). When changes are made to the safety basis, those changes are not flowed down into the design instantaneously. Therefore, there will be a lag time between the revised safety basis and the necessary design changes. The cause of the finding is that current informal processes used to document Project impacts and decisions related to safety basis changes that affect existing design/installation are no longer adequate given the advanced state of Engineering, Procurement, and Construction and the potential for installations to become irreversible, or only reversible at unacceptable project expense.	BNI's Authorization Basis program and Design Verification programs are not adequate to ensure Authorization Basis requirements are adequately aligned (in a timely manner before material installations), with applicable facility design after the design has been issued for procurement/issued for construction.	X	X	X	X	X	X	X
48	CCN 237683 (Reference 5.24) PIER-MGT-11-0980-D (Reference 5.38)	Observation S-11-WED-RPPWTP-042-O01: Where safety basis requirements change after the associated design [Issued for Procurement/Issued for Construction] (IFP/IFC), especially when broad changes such as is the case for the PVP system are pending (but before they happen), a robust discussion between BNI Environmental and Nuclear Safety and the responsible [Integrated Project Team] (IPC) would reduce risk to the project and ensure requirements changes were fully evaluated up front.	WTP processes are inadequate to ensure timely integration of nuclear safety in the design during initial design phases.	X	X	X	X	X	X	X
49	CCN 237683 (Reference 5.24) PIER-MGT-11-0981-D (Reference 5.39)	Observation S-11-WED-RPPWTP-042-O02: Where authorization basis requirements change after the associated design is IFP/IFC, and impacts are identified to issued design elements, in order to prevent irreversible insulations as required by the WTP QAM, there should be a process for clearly tracking and identifying affected elements.	WTP processes are inadequate to ensure timely integration of nuclear safety in the design during initial design phases.							

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50	CCN 237683 (Reference 5.24) PIER-MGT-11-0982-D (Reference 5.40)	Observation S-11-WED-RPPWTP-042-O03: Hazards Analysis Meeting, aka HAZOP, to determine if controls proposed by Engineering in CCN: 234424 are feasible, could reduce the significant risk associated with future installation of PTF piping modules.	Hazards associated with proposed PVP/PVV design changes have not been analyzed using a HAZOPs.		X					X
51	24590-WTP-ATS-QAIS-07-1251 (Reference 5.6)	The following list was extracted from Appendix A of the referenced SD for PJM mixing, 24590-WTP-3YD-50-00003, Rev B (number corresponds to SD Unresolved Items list): 10) Acceptability and impacts associated with incorporation of Non-Q PJM flush system into design. 33) EFRT M6 & M13: Describe PJM operating modes at elevated temperature including set point. Resolve issues of boiling in suction mode at 85C and potentially 100C. How does it affect adequate mixing requirements (flashing)?	10) The safety and functional requirements of PJM flush systems have not been established. 33) The impacts of potential boiling within the PJM has not been evaluated.	X				X	X	X
52	24590-WTP-PIER-MGT-11-0660-C (Reference 5.35)	Contrary to SC 4.1-4, the PT C5V HEPA filters may not appropriately protect against all accident conditions related to the PVP/PVV system	Smoke generated from CXP resin fires may plug the PVV or C5V HEPA filters. This could result in filter loading and subsequent release of radioactive materials to the environment.	X						X
53	24590-WTP-ATS-QAIS-08-1771 (Reference 5.59)	BNI will perform a test of intermittently operated PJMs in Newtonian vessels with high solids content to confirm that the required mixing time to release hydrogen is one hour or less by June 30, 2007. In the event that the required mixing time is greater than 1 hour, notify ORP in a revised ABAR of the impact of the increase.	The control strategy for the prevention of hydrogen accumulation has not been finalized.							

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Known Technical Issues

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				M	T	S	W	H	C	CF
54	24590-WTP-PIER-MGT-10-0364-B (Reference 5.60)	Calculations do not demonstrate assurance of active purging of tanks at required flow rates post DBE (assuming loss of less than SC-I piping in vessels and PVP/PVV systems). 24590-PTF-M6C-PVP-00017, Rev A, HADCRT Analysis of PTF PVP System at Various Operating Scenarios does not account for loss of piping downstream of the scrubber entrance. Several piping connections to equipment (caustic scrubber, HEMEs) are SC-III and considered not to survive a DBE. The assessment team reviewed the P&IDs and found nineteen SC-III connections (line numbers listed in the Piping CRAD). Were these connections to fail post-DBE, preferential flow into the system downstream of the header would be approximately 3600 scfm, which is essentially the system rated flow, at a system vacuum of -60 inches w.g. This PIER is associated with Management Suspension of Work (MSOW) 24590-WTP-MSOW-MGT-11-0003.	The design and safety basis are not consistently aligned.							

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55	24590-WTP-ATS-QAIS-08-1871 (Reference 5.7)	The current requirement for fire protection of SC & SS systems it that they maintain the capability of performing their safety function following a credible fire event. This fire event has recently (CCN 166111) been defined through the ISM process as a 2 hour, 1800 F fire. Mechanical Systems evaluation of such a fire event indicates that pipe failure is a concern if the pipe is not protected in some fashion. The concern is potential failure of air lines and instruments related to the SC PJMs, spargers, and vessel level detectors required for vessel mixing and HPAV controls, and the air lines providing vessel head space purge. In PT, there are maybe 5 to 7 room areas, each containing several racks of concern. All SC racks are redundant with the redundant unit(s) being located in separate fire zones. However, the failure of any given air line could fail the system due to excessive air losses through ruptured air piping. This represents a common cause failure of the entire ITS air system. One action was assigned to Mech Systems (CCN 184021). Target completion date 3-15-13.	Fires have not been systematically analyzed. Therefore, the fire control strategy has not been established. The ITS air supply system design is potentially susceptible to a common cause failure.	X				X	X	X
56	24590-WTP-3YD-50-00003, Rev B, Appendix A (Reference 5.3)	Unresolved Issue 4 Reconcile the PSARs and Safety Envelope Documents for the Pretreatment and HLW Vitrification facilities with the details that have been derived from this document.	The current design, technical baseline, and the authorization basis are not consistently aligned. The process may identify new technical issues.	X	X	X		X	X	
57	24590-WTP-RPT-OP-11-007 (Reference 5.13)	Although the WAC parameter list has been developed and vetted through the process presented in the initial WAC DQO, finalization of the documented safety analyses, additional DQOs, and final design activities may result in the identification of additional parameters associated with waste transfer or processability.	The establishment of nuclear safety waste acceptance limits have not been completed	X	X	X	X			

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58	24590-WTP-PIER-MGT-12-0021-D (Reference 5.41)	Appendix A of 24590-WTP-RPT-ENG-08-021-06, EFRT Issue M3 PJM Vessel Mixing Assessment, Volume 6 - FRP-VSL-00002A/B/C/D, Revision 1, states that the FRP-02 vessels are evaluated based on a maximum entrained solids content of 3.8 wt%. Other documentation such as 24590-WTP-RPT-MGT-11-014, Initial Data Quality Objectives for WTP Feed Acceptance Criteria, Revision 0, 24590-WTP-PL-PR-04-0001, Integrated Sampling and Analysis Requirements Document (ISARD), Revision 2, 24590-WTP-ICD-MG-01-015, ICD 19 - Interface Control Document for Waste Feed, Revision 5, and Specification 7, Low-Activity Waste Envelopes Definition, of the WTP Contract all specify the 3.8 wt% value. The Pretreatment Facility PDSA states that the waste feed receipt vessels (FRP-VSL-00002A/B/C/D) are prohibited from receiving waste containing solids greater than or equal to 5 weight percent. This requirement is specified as an Administrative Control in Section 5.5.22.1, Administrative Controls - Source Inventory Receipt Acceptance Program. While a waste acceptance criteria of <3.8 wt% complies with the established control in the PDSA, the values should be consistent with each other.	Technical basis and safety basis documentation are not consistently aligned.	X			X	X		
59	24590-WTP-RPT-ENG-08-021-06 (Reference 5.10)	Table A-1, FRP-02 Design Basis Properties indicates that the allowable slurry density is 1.1 g/mL or 1.6 g/mL. This range is not reflected in ICD-19 nor the PDSA. The allowable slurry density must be identified.	An evaluation of inputs, assumptions, and limits that require TSR protection has not been complete (this is not an ICD-19 issue).				X	X	X	

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				M	**T**	**S**	**W**	**H**	**C**	**CF**
60	WTP-24590-PIER-MGT-12-0030-D (Reference 5.42)	The waste acceptance criteria in ICD-19 (24590-WTP-ICD-MG-01-019, Rev 5) Table 8, General Feed Parameters, specifies that the arithmetic average particle hardness of the waste feed must be less than or equal to 4.4 Mohs. The Pretreatment PDSA (24590-WTP-PSAR-ESH-01-002-02, Rev 4w) includes a waste acceptance criteria in Section 5.5.22.1, Administrative Controls - Source Inventory Receipt Acceptance Program, that requires tank farm samples to meet specific particle hardness requirements. The ability to measure particle hardness is in question and although particle hardness is identified in ICD-19 as a waste acceptance criteria, ICD-19 Open Item 15 states that particle hardness and arithmetic average particle size are values not expected to be measured directly, are under investigation, and will likely be replaced. Establishing particle hardness as a waste acceptance criteria may represent a credited control that cannot be implemented.	Technical basis and safety basis documentation are not consistently aligned.				X			X
61	24590-WTP-RPT-ENG-08-021-06 (Reference 5.10)	Table A-1, FRP-02 Design Basis Properties indicates that the maximum temperature for waste is 59 °F to 120 °F. This represents a range and not a maximum allowable temperature. The 120 °F is identified in ICD-19 and the PDSA. The determination as to whether a minimum temperature of 59 °F is important must be made.	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.				X	X	X	
62	24590-WTP-RPT-ENG-08-021-08 (Reference 5.11)	Appendix A, Criterion 1, states that gravity refill for the PJM is necessary for temperatures above 139.4 degrees F. This limitation is not described in the PDSA.	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.	X				X	X	
63	24590-WTP-RPT-ENG-08-021-08 (Reference 5.11)	Appendix A, Criterion 2, states that the slurry viscosity must be less than or equal to 50 cP and the slurry density must be less than or equal to 1.7 g/mL. These updated values have not been reflected in ICD-19 nor the PDSA. The changes result in increased capability and the existing values are conservative. The determination as to whether the increased capability should be reflected in the waste acceptance criteria must be made.	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed (this is not an ICD-19 issue).				X	X	X	

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64	CCN 214125 (Reference 5.16) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Describe how WTP will protect the controls that limits non-Newtonian waste to a viscosity of 30 cP and a shear strength of 30 Pa. (M3 tracking #526) Tracking Number WTP-10-019-02.	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.	X	X			X	X	
65	CCN 214123 (Reference 5.15)	Provide additional detail on how assumptions for testing (e.g.,. 200 Pa shear strength) will be captured and carried forth in the Documented Safety Analysis. (M3 tracking #523) Tracking Number WTP-10-017-17	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.	X				X	X	
66	24590-WTP-RPT-ENG-08-021-06 (Reference 5.10)	Table A-1, FRP-02 Design Basis Properties indicates that the allowable viscosity range is 1.1 cP to 26 cP. This value is not reflected in ICD-19 nor the PDSA. The allowable viscosity must be identified.	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed has not been completed.				X	X	X	
67	24590-WTP-RPT-ENG-08-021-08 (Reference 5.11)	Appendix A, Table 5, proposes the following design basis property for HLP-VSL-00022: Solids concentration of 10 grams unwashed solids/liter to a maximum of 107 g/L at 0.1 M Na to 144 g/L at 7M Na	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.				X	X	X	
68	24590-WTP-RPT-ENG-08-021-08 (Reference 5.11)	Appendix A, Table 5, proposes the following design basis property for HLP-VSL-00022: Sodium content of 0.1 to 7M	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.				X	X	X	
69	24590-WTP-RPT-ENG-08-021-08 (Reference 5.11)	Appendix A, Table 5, proposes the following design basis property for HLP-VSL-00022: Solids density of 2.9 g/mL	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.				X	X	X	
70	24590-WTP-RPT-ENG-08-021-08 (Reference 5.11)	Appendix A, Table 5, proposes the following design basis property for HLP-VSL-00022: Particle size of 0.7 to 700 microns	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.				X	X	X	
71	24590-WTP-RPT-ENG-08-021-08 (Reference 5.11)	Appendix A, Table 5, proposes the following design basis property for HLP-VSL-00022: Viscosity of 1 to 50 cP	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.				X	X	X	
72	24590-WTP-RPT-ENG-08-021-08 (Reference 5.11)	Appendix A, Table 5, proposes the following design basis property for HLP-VSL-00022: Slurry density of 1.0 to 1.7 g/mL	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.				X	X	X	
73	24590-WTP-RPT-ENG-08-021-08 (Reference 5.11)	Section 4 states the minimum temperatures is 59 degrees F.	An evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.				X	X	X	

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74	CCN 236930 (Reference 5.23)	• Government furnished design and technology (e.g., pulse jet mixer); • There have been directed changes and conditions of approval that have not been consistently aligned with the hazards and/or accident analyses; • Evolving requirements (e.g., Regulatory Construct) over the project life cycle were not consistently flowed to implementing procedures and/or the design; • Hazards analyses techniques were focused on individual processes versus the integrated facility process; • Accident analyses have not evolved in parallel with the hazards analyses; • Some control strategies are selected based on postulated radiological consequences in scoping calculations versus deriving the controls from the hazards and accident analyses; • The facility(ies) selected a more conservative control based on the unavailability of safety analysis or technical details related to the design; • Closure of assumptions requiring verification have impacted the design and/or safety basis; • Flow-down of safety function and functional requirements from the safety basis documents to the design criteria database has been incomplete; and • Some selected control strategies are not implementable in the design and/or implementing procedures and other control were selected and/or negotiated versus derived from hazards / accident analyses.	Technical basis and safety basis documentation are not consistently aligned.	X	X	X	X	X	X	X
75	24590-WTP-PIER-MGT-09-1288-C (Reference 5.34)	For vessels with temps above 139F with safety mixing or HPAV safety controls, does the vessel require safety temperature measurement feeding the PJM control to prevent boiling in the PJM during suction phase (PIER 09-1288-C, safety control of PJM at Hi Temps)	The impacts of potential boiling within the PJM has not been evaluated.	X				X	X	X

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76	CIARS 10-089 (PT IPT Issue), Action 3 (Reference 5.25)	Action 587: Update the integrated technical baseline to: 1) support design confirmation of the PJM vessel designs for mixing; and 2) assess WTP design capacity performance. The WIPSD, ISAR, and Contract Run (G2) Model Run results should be updated to account for stratified solids in the vessel to determine if the WTP contract waste treatment capacity requirements are met. This should include stream properties. Unit dose factors must be consistent with the SB and represent current design. The fluid properties must include: solid concentration, rheological properties, particle sizes/distributions and densities, and chemical species.	An evaluation of inputs and assumptions that require TSR protection has not been completed.	X	X	X		X	X	
77	24590-WTP-PIER-11-0588-C (Reference 5.51) 24590-WTP-PIER-11-0645-D (Reference 5.52) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Evaluate PJM creep as a result of phase II testing to establish frequency for PJM flushes (washdown line usage)	The current design may not be ALARA in that facility workers may be exposed to unplanned radiation levels due to contaminated PJM air intake lines. Washdown capability has been added to address this concern, but determination of frequency has not been established based on operational testing to inform decisions.	X						
78	RPP-44491 (Reference 5.44)	RE: RPP-44491, Revision 0 - Table A-1 Evaluation Results Summary Matrix PVP header will be vulnerable to pressurization. Foam carried with air could deposit solids throughout overflow piping. Measure overflow piping aerosol or foam levels in commissioning and add water wash capability to branches if concentrations warrant. Add PIs to PT vessels and verify adequate vacuum during commissioning. Increase PVP suction Fan capacity if needed.	The interrelationships between PJM operations and PVV/PVP operations may not been fully evaluated.							

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79	RPP-44491 (Reference 5.43) 24590-WTP-PIER-MGT-09-1779-C (Reference 5.61) 24590-WTP-PIER-MGT-11-0863-C (Reference 5.62) 24590-WTP-PIER-MGT-11-0761-B (Reference 5.63)	RE: RPP-44491, Revision 0 - Table A-1 Evaluation Results Summary Matrix Flushing plans don't prevent precipitation and plugging in piping or vessels due to diffusion in cooling - not in G2 modeling. Flushing plans don't prevent precipitates from accumulating in RFD transfer piping. Add time and temperature dependant dilution and flushes to procedures and modeling., especially FRP-2 vessels and suction lines. The hazards analysis to support the PT PDSA includes an implicit requirement for the Jet Pump Pairs to meet the barometric head isolation requirement, but that requirement was not flowed into the PDSA. The hazards analysis is documented and controlled in the SIPD database.	The functional requirements for the flushing system have not been adequately established or verified. Technical basis and safety basis documentation are not consistently aligned. Technical basis and safety basis documentation are not consistently aligned. The safety basis documents for WTP facilities do not adequately establish the functional requirements for safety SSCs.	X	X	X	X	X	X	

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79 (cont)		The document 24590-PTF-JCDPI-ENS-11-0002 incorrectly assigned a safety class hydrogen mitigation function to the Pretreatment Facility vessel vent system air filtration components, and in particular to the HEME. This was apparently due to errors made while incorporating changes to the PDSA directed by CCN 112120, which is the Safety Evaluation Report for the ABAR, 24590-WTP-SE-ENS-04-0156. The ABAR requested that the SSC's needed to provide a reliable vent path to exhaust hydrogen purge air from the process vessels be changed from the air filtration pathway to the passive vessel air inbleeds. The request was approved by ORP via CCN 112120, which directed that text in the PDSA assigning that function to the air filtration components be removed from the PDSA and that function be explicitly assigned to the passive inbleeds. This new function was added to the PDSA in Section 4.3.12.3 (sixth bullet), and to Table 4A-1 (page 4A-3 top row). However, the corresponding function assigned to the air filtration SSC's was not deleted. When Table 4A was copied into the PDSA addendum, this error was carried over, with the result that the JCDPI inadvertently credited the HEME with a safety class hydrogen mitigation function. In order for the HEME to be able to perform this safety function, additional safety class interlocks are also required by the JCDPI to prevent the HEME (and downstream HEPA's) from being overloaded by aerosols generated by sparger or PJM overblows. The end result of the changes requested by the JCDPI is to produce a less safe design, by substituting active safety features for the original, passive, controls. The safety basis documents for WTP facilities do not adequately establish the functional requirements for safety SSCs. Chapter 4 of the PDSAs might not consistently identify or define functional requirements necessary for engineering to properly capture the requirements via the DCD and flow down into implementing documents.								

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Waste Characteristics Uncertainty										
80	CCN 243898 Attachment A, Source: PNNL Tech (WS9) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	The simulants used in the testing are not sufficiently bounding of the tank waste properties that are currently documented for the Hanford Waste Tanks (WTP-RPT-153 Estimate of Hanford Waste Insoluble Solid Particle Size and Density Distribution, WTP-RPT-154 Estimate of Hanford Waste Rheology and Settling Behavior, and WTP-RPT-177 An Approach to Understanding Cohesive Slurry Settling, Mobilization, and Hydrogen Gas Retention in Pulsed Jet Mixed Vessels). § The Plutonium oxide simulant particle use in phase 2 testing for HLP-22 and FEP-17 was sized to be 10 micron (using a 12 micron sieve cut) where in actual waste images, 4 of the 18 Pu particle photos (WTP-RPT-153) displayed particles that were over 10 microns (with one being a 23 micron sphere). § The design basis event (DEB) simulant formulation required a layer of solids at a concentration of ≈ 67% solids concentration to achieve the "reasonable minimum upper bound" of 200 Pa shear strength within 24 hours. This simulant did not exhibit cohesive properties which is different from many of the actual waste sludge materials which do exhibit cohesive behavior. The non-cohesive simulant means the post-DBE simulant is expected to behave differently in mixing and mobilization tests than highly cohesive simulant (WTP/RPP-MOA-PNNL-00494 Recipes for Simulant Strengths).	There is limited waste characterization data, and system performance limits have not been determined.	X				X	X	

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81	24590-WTP-ATS-MGT-11-0559 (Reference 5.4)	TOC baseline sampling plans and capabilities are not currently compatible with WTP sample and analysis requirements. This ICD Issue will be jointly tracked and resolved by WTP and TOC. In order to close this ICD Issue, WTP must complete development of the Pre-Qualification Data Quality Objectives and TOC must modify the TOC baseline to include the installation of certification flow loops, including the operations costs for collection and analysis of the required samples. Both parties (WTP and TOC) will be responsible for a coordinated effort to verify that all requirements of the WTP sample and analysis requirements found in the documents listed below are compatible with the modified TOC baseline. The closure documentation for the tasks described above (WTP's and TOC's) must be submitted to DOE-ORP for approval, and DOE-ORP must grant approval, prior to closure of the overall ICD Issue.	Hanford tank farm baseline sampling plans and capabilities may not be currently compatible with WTP sample and analysis requirements.			X		X	X	
82	CCN 243898, Attachment A, Source: PNNL Tech (WS9) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	The second category is Technical Uncertainties for Waste Characterization. § The most significant uncertainty is that the existing models and data on settling dynamics and the strength of settled layers have not included experimental testing to confirm the scaling behavior or to determine the increasing strength with depth into a settled layer. It is expected that a sound understanding of settling dynamics will be needed to design, or to determine the operating limits of, a mixing system capable of managing the strength and thickness of settled layers.	System performance limits have not been determined.	X				X	X	
83	CCN 215316 (Reference 5.17) 24590-WTP-CSER-ENS-08-0001, Open Item A.1.2 (Reference 5.32)	The Pulse Jet Mixer testing also raised issues on the mixing tank sampling uncertainty assumptions in the WTP preliminary CSER. Further data is needed to determine a reasonable sampling uncertainty.	The projected uncertainty for sampling results specified in the CSER are not achievable with current or projected sampling capabilities. The CSER did not adequately establish or define sampling uncertainty. There is limited waste characterization data. New technical data indicates the waste may contain large fissile particles (e.g., PuO_2) not associated with poisons that were previously not accounted for in criticality control strategy development. This may impact the validity of existing criticality safety controls. In addition, the current CSER does not provide explicit data on sampling methods / locations and analytical methodologies.	X					X	

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84	CCN 215316 (Reference 5.17) 24590-WTP-CSER-ENS-08-0001, Open Item A.1.6 (Reference 5.32)	Transmittal Letter - Item 2, The WTP preliminary Criticality Safety Evaluation Report assumes sampling of input batches would have an uncertainty of five percent. This is no longer a reasonable assumption. Further data is needed to determine the sampling uncertainty.	The projected uncertainty for sampling results specified in the CSER may not be achievable with current or projected sampling capabilities. This involves a lack of clarity of which parameters this uncertainty applied to in the CSER.			X			X	
85	CCN 215316 (Reference 5.17) 24590-WTP-CSER-ENS-08-0001, Open Item A.1.6 (Reference 5.32)	Section 3.4 - 1. The fundamental issue of the possible separation of nuclear poisons from fissile material, raised by results of testing scale models of the WTP Pulse Jet Mixer, needs a resolution. The issue of heel removal from the mixing tank also needs resolution.	There is a potential for mixing to separate poisons from fissile materials. This increases the risk of a criticality because poisons may be separated from fissile material. Heel removal processes may selectively remove poisons without fissile materials resulting in a potential increased criticality risk due to fissile material accumulation in a more favorable geometry.	X					X	
86	CCN 215316 (Reference 5.17)	Transmittal Letter - Item 1, Mixing tank operation may break up the agglomerated solids and solids with weak chemical bonds, and has the potential to separate the lighter material from the heavier particles. Also, the current design does not assure heel removal from the mixing tank. The observed piles in the M-3 test of heavier particles would be a criticality risk if they are predominately plutonium. Further M-3 testing is needed to see if these issues can be resolved by design changes.	There is a potential for mixing to separate poisons from fissile materials. This increases the risk of a criticality because poisons may be separated from fissile material.	X				X	X	
87	CCN 225248 (Reference 5.22)	WTP-10-017-18 18) Provide an assessment on the limiting size of other fissile material such as U-233. (M3 Item #524 tracked in ATS-10-0811)	There is limited waste characterization data; and an evaluation of inputs, assumptions, and limits that require TSR protection has not been completed. The assumed size of non plutonium fissile materials (e.g. U-233) particles in incoming feed may not be conservative.	X	X	X			X	
88	CCN 243898, Attachment A, Source: R&T (WS8) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	While Pu with adsorbers may not be an issue, if the PuO_2 crit limit of 200 grs/vessel is to be protected, will all incoming samples have to be analyzed for this? How? Where?	There is limited waste characterization data, and an evaluation of inputs, assumptions, and limits that require TSR protection has not been completed. New technical data indicates the waste may contain large fissile particles (e.g., PuO2) not associated with poisons that were previously not accounted for in criticality control strategy development. This may impact the validity of existing criticality safety controls. In addition, the current CSER does not provide explicit data on sampling methods / locations and analytical methodologies.			X			X	
89	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	The bounding PuO_2 particle (or other large uranium or transuranic particle) is defined and represented in the simulant.	There is limited waste characterization data; and an evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.	X	X	X			X	
90	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Clearly define what is the basis of the particle sizing used in all phases of design so that it can clearly be evaluated should future work change the particle size.	There is limited waste characterization data; and an evaluation of inputs, assumptions, and limits that require TSR protection has not been completed.	X	X	X			X	

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91	CCN 243898, Attachment A, Source: PNNL Tech (WS9) (Reference B.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	The mixing systems in the non-Newtonian vessels were developed with some design margin but testing was directed at what was thought at the time to be the most challenging mixing requirement: that is the mixing of non-Newtonian slurries with rheological properties at the expected upper bound. Recently some concern has been raised by others that the vessels may at times contain slurries that exhibit Newtonian rheology. Limited data was obtained in the non-Newtonian test program with glass beads in water to assess the solids suspension capabilities of the mixing systems in the non-Newtonian vessels. It is unclear at this time if this data set is sufficient to form a design basis for the non-Newtonian vessels.	There is limited waste characterization data. Prototypic operation of PJMs during normal operations, maintenance, and credible off normal conditions have not been fully demonstrated.	X				X	X	

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Known Technical Issues

Item	Source Document #	Excerpt from Source Document	Issue Description	Impacted System / Function				Hazard		
				M	**T**	**S**	**W**	**H**	**C**	**CF**
92	24590-WTP-PIER-MGT-11-1292 (Reference 5.9)	Document 24590-WTP-ICD-MG-01-019, ICD 19 - Interface Control Document for Waste Feed, Revision 5, describes the required physical and administrative interactions to allow for the transfer of Hanford tank waste by the Tank Operating Contractor (TOC) to the Waste Treatment and Immobilization Plant (WTP). Included in ICD 19 is the acceptance criteria for waste feed. Table 6, LAW Transfer Properties, and Table 7, HLW Transfer Properties, both indicate that the Slurry pH must be greater than or equal to 12. Document 24590-WTP-RPT-MGT-11-014, Initial Data Quality Objectives for WTP Feed Acceptance Criteria (DQO), Revision 0, Table 4-1, Data Inputs with Action Limits, identifies Action Limit Values for LAW and HLW Feed for pH values greater than 7. The comments section of the table states "Part of WTP permit requirements [C-2a(1),C-2a(2), and Table 3A-3], to ensure compatibility with WTP construction material and treatment processes". Document 24590-WTP-PL-PR-04-0001, Integrated Sampling and Analysis Requirements Document (ISARD), Revision 2 also indicates that the pH must be greater than 7. It appears that the Action Limits specified in the DQO are based on permitting requirements. The pH value of greater than 7 is non-conservative with respect to the waste acceptance criteria identified in ICD 19. The appropriate pH value must be determined and the documents must be revised to use a consistent value.	The ICD and WTP DQO have inconsistent specifications related to acceptable waste pH. This increases the risk of waste being transferred with characteristics outside of the design basis.				X	X	X	
93	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Is the design basis slurry an accurate representation of actual tank waste with a strong technical basis	There is limited waste characterization data. Waste may exceed design basis slurry characteristics for the normal transfer, sampling and mixing systems. Thus, various aspects of the design and controls may not perform adequately for all the slurries that will be processed.	X	X	X		X	X	
94	CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	The review team had insufficient time to validate that when the pulse from the PJMs stops and the turbulent jet model is not applicable, the slurry yield stress is re-established and the particles will remain suspended until the next discharge cycle for all Hanford sludge types, e.g., REDOX, cladding, etc. The Project should ensure that the recommended static yield stress can be achieved for other sludge types during the pre-qualification runs.	There is insufficient knowledge of waste characteristics. The control scheme for PJMs has not been finalized.	X				X	X	

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95	CCN 218915, CIARS 10-095, Action 2 from CRESP (Reference 5.18) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Action 16: The cumulative design margin as a result of design assumptions should be quantitatively assessed against the individual batches of the planned feed vector (e.g., with respect to zone of influence, mixing energy/power, actual and anticipated settling velocities).	There is limited waste characterization data. There may not be adequate design margin because methods have not been developed for analyzing PJM performance for each feed batch that will be received. The existing design may not adequately prevent solids from accumulating under all operating conditions.	X				X	X	
96	CCN 243898, Attachment A, Source: R&T Issues (WS8) (Reference 5.33) CCN 243898, Attachment C, VCT Spreadsheet (Reference 5.33)	Sampling streams with solids and settling solids is difficult especially with non homogeneously mixed vessels. Need to determine accuracy and bias of samplers with several feeds. Reduces startup risk.	The CSER analysis assumes homogeneous samples which has been shown by testing to be unachievable.			X			X	
97	CCN 243898, Attachment A, Source: R&T Issues (WS8) (Reference 5.33)	Impact of GFC in Recycles - effect rheology and precipitation?	Assumptions regarding waste characteristics may be inaccurate impacting mixing performance.	X	X	X		X		
98	CIARS 10-097, Action 1 (Reference 5.29)	Action 57: Develop a new or revised design that is able to provide a statistically valid, representative sample of the solids fraction. Ensure homogeneity and representativeness of samples. Ensure sample is representative and effective in identifying large particles of concern. Determine sampling and analysis requirements; Revise CSER to account for sampling at tank farm waste staging tanks instead of WTP receipt tanks if this sampling strategy were adopted.	What constitutes a representative sample and when they are required has not been defined. There is a potential for waste stratification to preclude collection of representative samples.			X		X	X	
99	CCN 243898, Attachment D (Reference 5.33)	The vessel testing activities will include determining the acceptability of vessel sampling in conditions where sampling may be challenged by mixing performance, i.e., solids-containing vessels. There may be cases where the sample system operation during normal vessel operations does not retrieve some large dense particles for analysis.	What constitutes a representative sample and when they are required has not been defined. There is a potential for waste stratification to preclude collection of representative samples.			X		X	X	

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