MAY 24 1999
Sta. 15 22

ENGINEERING DATA TRANSMITTAL

1. EDT 624019

2. To: (Receiving Organization) SST Engineering	3. From: (Originating Organization) TWRS Equipment Engineering	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: 101-SY RAPID Response	6. Design Authority/Design Agent/Cog. Engr.: W. J. Powell	7. Purchase Order No.: N/A
8. Originator Remarks: This document is the design review report for the 101-SY RAPID mitigation. It is being routed for review and approval.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 241-SY
		12. Major Assm. Dwg. No.: N/A
11. Receiver Remarks:	11A. Design Baseline Document? (X) Yes ( ) No	13. Permit/Permit Application No.: N/A
		14. Required Response Date: 5/20/99

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	HNF-4519		0	Design review report for the SY-101 RAPID mitigation system	ESQ	~~4~~ 1	1	1

16. KEY

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

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
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Design Review Report For the SY-101 Rapid Mitigation System

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U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 624019   UC: 2000
Org Code: 74700   Charge Code: 108968
B&R Code: EW3130000   Total Pages: 240

Key Words: Tank 241-SY-101, Mitigation, Pump, Transfer, Design Review RAPID Mitigation System

Abstract: This report documents the system design review completed for the SY-101 RAPID Mitigation System. The report documents acceptability of the system design for design implementation, identifies the documents that were reviewed, the members of the review team, the scope of review, and identifies remaining open items.

Christine Willingham   5-24-99
Release Approval   Date

MAY 24 1999
DATE: HANFORD
STA: 15 RELEASE
ID: 22
Release Stamp

Approved For Public Release

HNF-4519

DESIGN REVIEW REPORT FOR THE SY-101 RAPID MITIGATION SYSTEM

Richard L. Schlosser

May 21, 1999

1.0 SCOPE 1

1.1 OVERVIEW 1

Table 1.1. SY-101 System Design Review Sequence 3

1.2 RAPID SYSTEM DESIGN 4

1.3 DOCUMENTS 4

1.3.1 Support Documents Reviewed 4

1.3.2 Drawings Reviewed 5

1.3.3 Reference Documents 5

1.4 REVIEW OBJECTIVES 6

2.0 SUMMARY 6

2.1 ALTERNATIVES 7

3.0 DOCUMENTATION 8

3.1 DESIGN REVIEW CHECKLIST 8

3.2 DESIGN REVIEW COMMITTEE 8

3.3 OUTSTANDING ACTION ITEMS 10
3.3.1 Design Requirements, HNF-3885 11
3.3.2 Conceptual Design Review (30%) 11
3.3.3 Prefabricated Pump Pit, HNF-4169 12
3.3.4 Transfer Pump Piping, HNF-4170 12
3.3.5 Mobile Water Support Skid, HNF-4043 12
3.3.6 Overground Transfer Line (OGT) 13
3.3.7 Anti-Siphoning Slurry Distributor Assembly, HNF-4216 13
3.3.8 Structural Design Criteria, HNF-4252 13
3.3.9 Electrical Installation, ECN 647721 13
3.3.10 Mobile Water Support Skid, ECN 653826 to HNF-4043 13
3.3.11 System Design Review and Hose in Hose Option, HNF-4407 13

Appendix A, Design Review Checklist System Design Review

Appendix B, Functional Requirements and Technical Criteria Design Review Meeting Minutes

Appendix C, 30% Conceptual Design Review Meeting Minutes and Review Comment Records

Appendix D, Design Review Meeting Minutes Specification HNF-4169, "Prefabricated Pump Pit"

Appendix E, Design Review Meeting Minutes Specification HNF-4170, "Transfer Pump Piping"

Appendix F, *Design Review Meeting Minutes Specification HNF-4043, "Mobile Water Support Skid"*

Appendix G, Design Review Meeting Minutes 30% Conceptual Design Review Temporary Overground Transfer Line

Appendix H, *Design Review Meeting Minutes Specification Anti-Syphoning Skurry Distributor Assembly*

Appendix I, Design Review Meeting Minutes HNF-4252, "Structural Design Criteria"

Appendix J, Design Review Meeting Minutes ECN 647721, "Electrical Installation"

Appendix K, Design Review Meeting Minutes ECN 652826, Revision to "Specification for Mobile Water Support Skid"

Appendix L, System Design Review Agenda, Meeting Minutes

Appendix M, *Draft Control Decision Record*

Appendix N, Draft HNF-4264, "Process Control Plan"

HNF-4519
DESIGN REVIEW REPORT FOR THE SY-101 RAPID MITIGATION SYSTEM

1.0 SCOPE

1.1 OVERVIEW

This report documents design reviews conducted of the SY-101 Respond And Pump In Days (RAPID) Mitigation System. As part of the SY-101 Surface-Level-Rise Remediation Project, the SY-101 RAPID Mitigation System will reduce the potential unacceptable consequences of crust growth in Tank 241-SY-101 (SY-101). Projections of the crust growth rate indicate that the waste level in the tank may reach the juncture of the primary and secondary confinement structures of the tank late in 1999. Because of this time constraint, many design activities are being conducted in parallel and design reviews were conducted for system adequacy as well as design implementation throughout the process.

Design implementation, as used in this design review report, is the final component selection (e.g., which circuit breaker, valve, or thermocouple) that meets the approved design requirements, system design, and design and procurement specifications. Design implementation includes the necessary analysis, testing, verification, and qualification to demonstrate compliance with the system design and design requirements. Design implementation is outside the scope of this design review. The design activities performed prior to detailed design implementation (i.e., system mission requirements, functional design requirements, technical criteria, system conceptual design, and where design and build contracts were placed, the procurement specification) have been reviewed and are within the scope of this design review report. Detailed design implementation will be controlled, reviewed, and where appropriate, approved in accordance with Tank Waste Remediation System (TWRS) engineering procedures. Review of detailed design implementation will continue until all components necessary to perform the transfer function are installed and tested.

Likewise, radiological design reviews are integrated into this process, thus providing assurance that the design incorporates features to minimize personnel exposure. Aspects of this review will also continue during operation of the completed system to ensure that subsequent transfers and back dilution of the waste in SY-101 are conducted safely.

The review process was initiated with a review of design criteria based on verbal descriptions of the system mission, a review of the initial design concepts (and subsequent changes), reviews of each procurement specification requiring supplied design, and the completed integrated system design. Each review relied on the completion of earlier reviews and the design criteria established. The reviews focused on ensuring that the system design meets requirements of the TWRS Authorization Basis

(Basis for Interim Operation and Technical Safety Requirements), applicable safety, health, and environmental requirements, appropriate codes and standards, and DOE Orders. Those documents and drawings depicting or specifying system design, especially for safety-related design features were reviewed. The reviews did not specifically address all equipment; i.e., individual procurement of components was only addressed where the procurement involved engineered equipment. Changes to reviewed documents were processed without additional review if the changes were found to be bounded by the completed review. However, changes to reviewed documents were addressed if they were found to be outside the scope of the previous review. The individual reviews encompassed by this design review are summarized in Table 1.1.

Each individual review was documented by Meeting Minutes or Review Comment Records (RCRs). Employing a graded approach, Meeting Minutes provided a record of comments generated for relatively small-scope review sessions, while RCRs were developed for the extensive reviews conducted of the conceptual design and the integrated system design. In addition to comments developed during presentation of design media at meetings, the review team members also provided comments based on their specific disciplinary responsibility for inclusion in the RCRs. During reviews of procurement specifications, numerous reviewer comments were evaluated, responded to, and incorporated during the review meeting. Those comments were not specifically documented.

Table 1.1. SY-101 System Design Review Sequence.

Review	Date(s)	Record	Comments Identified/Open
HNF-3885, Rev. 0 (Design Criteria) Appendix B	February 4, 1999	Meeting Minutes	67/0
30% Design Review (Conceptual Design) Appendix C	February 16-17, 1999	Meeting Minutes & RCRs	157/4
HNF-4169, Rev. 0 (PPP Enclosure) Appendix D	March 9, 1999	Meeting Minutes	20/1
HNF-4170, Rev. 0 (Transfer Pump Piping) Appendix E	March 9, 1999	Meeting Minutes	8/0
HNF-4043, Rev 0 (Water Skid Specification) Appendix F	March 10, 1999	Meeting Minutes	8/0
33% Design Review (Overground Transfer Option) Appendix G	March 11, 1999	Meeting Minutes	21/1
HNF-4216 (Slurry Distributor) Appendix H	March 25, 1999	Meeting Minutes	18/0
HNF-4252 (Structural Design Criteria) Appendix I	March 26, 1999	Meeting Minutes	3/0
ECN 647721 (electrical installation) Appendix J	April 9, 1999	Meeting Minutes	34/0
ECN 653826 (modification of Water Skid Specification) Appendix K	April 13, 1999	Meeting Minutes	10/0
SY-101 RAPID Mitigation System - System Design, and HNF-4407 (Hose in Hose Option) Appendix L	April 29-May 10, 1999	Meeting Minutes and RCRs	46/18

1.2 RAPID SYSTEM DESIGN

The SY-101 RAPID Mitigation System consists of a transfer pump located in Tank 241-SY-101; a transfer line from the transfer pump to Tank 241-SY-102, and a discharge connection to disperse transferred waste into Tank 241-SY-102. In order to meet process limitations and flushing of transfer components, a water supply system is included to provide dilution and flush water to the transfer pump and lines. Requisite supporting structures, instrumentation, controls, and interconnections to utilities and other support systems are also included in the system design.

Portions of the system have more than one design. The multiple designs provide appropriate assurance that the risk of system completion can be reduced. As the design progressed, design options were eliminated based on technical, cost, and schedule impacts. Likewise as the design matured, new alternative designs were developed. At this time, the transfer line has two designs (secondary containment by either piping or flexible hose), and the power supply interface has criteria to implement changes should load analysis results indicate the need for additional power.

1.3 DOCUMENTS

1.3.1 Support Documents Reviewed

- HNF-3885, "Functional Requirements and Technical Criteria for the 241-SY-101 RAPID Mitigation System"
- HNF-4043, "Specification for SY101 RAPID Mitigation Mobile Water Support Skid" and revision by ECN 653826
- HNF-4169, "Specification for SY-101 RAPID Mitigation Prefabricated Pump Pit"
- HNF-4170, "Specification for SY-101 RAPID Mitigation Transfer Pump Piping"
- HNF-4216, "Specification for SY-101 RAPID Mitigation System Anti-Siphoning Slurry Distributor Assembly"
- HNF-4252, "Structural Design Criteria for the SY-101 RAPID Mitigation System"
- HNF-4407, "Specification for SY-101 RAPID Mitigation System Hose and Hose Assembly"

1.3.2 Drawings Reviewed

H-14-103558, Sheet 1 of 2, Rev. 0
H-14-103559, Sheet 1 of 2, Rev. 0
H-14-103565, Sheet 2 of 2, Rev. 0
H-14-103570, Sheet 1 of 2, Rev. 0
H-14-103591, Sheet 1, Rev. 0
H-14-103610, Sheet 1, Rev. 0
H-14-103640, Sheet 1 of 2, Rev. 0
H-14-103641, Sheet 1 of 3, Rev. 0
H-14-103641, Sheet 3 of 3, Rev. 0
H-14-103643, Sheet 1 of 3, Rev. 0
H-14-103643, Sheet 3 of 3, Rev. 0
H-14-103649, Sheet 1 of 6, Rev. 0
H-14-103649, Sheet 3 of 6, Rev. 0
H-14-103649, Sheet 5 of 6, Rev. 0
H-14-103651, Sheet 1 of 1, Rev. 0
H-14-103652, Sheet 2 of 2, Rev. 0
H-14-103653, Sheet 2 of 5, Rev. 0
H-14-103653, Sheet 4 of 5, Rev. 0
H-14-103654, Sheet 1 of 4, Rev. 0
H-14-103654, Sheet 3 of 4, Rev. 0
H-14-103655, Sheet 1 of 2, Rev. 0
H-14-103656, Sheet 1 of 1, Rev. 0
H-14-103558, Sheet 2 of 2, Rev. 0
H-14-103565, Sheet 1 of 2, Rev. 0
H-14-103566, Sheet 1, Rev. 0
H-14-103590, Sheet 1, Rev. 0
H-14-103607, Sheet 1 of 1, Rev. 0
H-14-103616, Sheet 1, Rev. 0
H-14-103640, Sheet 2 of 2, Rev. 0
H-14-103641, Sheet 2 of 3, Rev. 0
H-14-103642, Sheet 1 of 1, Rev. 0
H-14-103643, Sheet 2 of 3, Rev. 0
H-14-103647, Sheet 1 of 1, Rev. 0
H-14-103649, Sheet 2 of 6, Rev. 0
H-14-103649, Sheet 4 of 6, Rev. 0
H-14-103649, Sheet 6 of 6, Rev. 0
H-14-103652, Sheet 1 of 2, Rev. 0
H-14-103653, Sheet 1 of 5, Rev. 0
H-14-103653, Sheet 3 of 5, Rev. 0
H-14-103653, Sheet 5 of 5, Rev. 0
H-14-103654, Sheet 2 of 4, Rev. 0
H-14-103654, Sheet 4 of 4, Rev. 0
H-14-103655, Sheet 2 of 2, Rev. 0

1.3.3 Reference Documents

Benegas, T. R., *Engineering Task Plan for Waste Transfer from Tank 241-SY-101 to 241-SY-102*, HNF-4044, dated April 27, 1999.

Estey, S. D., Draft *Process Control Plan for Tank 241-SY-101 Surface Level Rise Remediation*, HNF-4264, dated March 29, 1999. (Appendix N)

Kripps, L. J., *Draft Control Decision Record – Tank 241-SY-101 Waste Transfer*, dated May 1999. (Appendix M)

Noorani, Y. G., *Tank Waste Remediation System Basis for Interim Operation*, Revision 1-C, dated March 4, 1999.

Noorani, Y. G., *Tank Waste Remediation System Technical Safety Requirements*, Revision 0-R, dated March 10, 1999.

1.4 REVIEW OBJECTIVES

The objective of the system design review for the SY-101 RAPID Mitigation System was to provide a technical assessment of the acceptability of the system design. Since the design progressed at an accelerated rate, the system review provided a determination of the overall system satisfaction of process, nuclear safety, industrial safety, acceptance testing, availability, operability, and maintainability, and radiological control aspects of the design. Where the design was sufficiently mature, the detailed implementation of design requirements was addressed.

In some cases, detailed component level design to implement the system design basis has been finalized, while in others only the overall system design has been finalized. For the case where only the system design is complete, the system design review objective was to ensure that appropriate criteria and requirements are established to ensure that any alternative satisfies the basic system needs.

If multiple designs were fully developed, each option was reviewed. The objective in these cases was to ensure that management decisions based on schedule and cost may be treated independently of the technical concept selected since each alternative meets its design requirements.

Review comments for which dispositions have not been accepted were placed in to one of three categories: (1) requires closure for system design, (2) requires closure in implementing the design or prior to system operation, or (3) recommendations for risk reduction to be implemented if cost and schedule allow.

2.0 SUMMARY

Based on the system design reviews performed, the SY-101 Surface-Level-Rise Remediation Project waste transfer system was found to meet the applicable requirements related to system design. Some engineering calculations are still being completed and need to be documented; however, because of SY-101 Surface-Level-Rise Project time constraints, a number of activities are being completed in parallel. Material procurements, fabrication and field construction are underway proceeding at some risk.

Two designs were reviewed for the transfer line -- a hose in an encasement pipe and a hose in an encasement hose. Both designs were found acceptable. The existing available facility electrical power was found deficient. The planned design solutions; 1) upgrade the existing power distribution system and/or 2) provide temporary additional portable power, are acceptable.

As each item on the Design Review Checklist and the remaining open items from individual reviews were evaluated, the item was checked against these categories. None of the Design Review Checklist items or remaining open action items from individual reviews requires disposition prior to accepting the system design. The Design Review Committee concludes that applicable criteria are in place, and the system is ready for design implementation.

2.1 ALTERNATIVES

During the conduct of the system design review, numerous solutions to identified problems were considered. This section summarizes various major alternatives. In addition, the alternatives that were incorporated into the design, based in part on review comments and associated discussions, are indicated.

Review of HNF-3885 resulted in the addition of critical assumptions, a requirement to complete design requirement matrices, and significant rewording of the document to establish the functions and requirements at a level that did not assume particular design alternatives.

The 30% design review resulted in several significant comments associated with the conceptual design selection of an underground transfer line configuration. The comments and discussion addressed the ability to construct the line in the time constraints of the SY-101 Surface-Level-Rise Project. The comments raised about an underground transfer line were a major factor in selecting the overground transfer line.

Development of assumptions and analyses to meet comments about the electrical design resulted in a specific load redistribution and criteria to ensure alternative power sources are available to meet system needs. A number of specific implementation details were discussed and various options considered, with alternatives selected based on collective programmatic, technical, legal, and radiological inputs.

Multiple design alternatives were also discussed to address the requirement to minimize dome loading while providing adequate shielding, particularly in the area of the Prefabricated Pump Pit (PPP). The use of very conservative radiological source terms for development of the shielding design and determining administrative controls were extensively discussed, resulting in the application of more realistic source terms and application of related engineered features and administrative radiological controls to ensure worker protection.

The review of the design and fabrication specification for the PPP (HNF-4169) addressed specific design alternatives to limit riser loading by changes to the interface with the tank riser. In addition to limiting the riser loading, the alternative selected does not involve Washington Administrative Code periodic surveillance requirements. Numerous issues associated with design details and related alternative design solutions were discussed, which resulted in a design better suited for decontamination. As part of this review, provisions were incorporated for using temporary shielding to allow lighter weight construction of the PPP while limiting the permanently installed weight of the equipment. Based on discussions of various potential accidents and related design concepts that would require assignment of functional attributes to the PPP enclosure, the enclosure was required to meet Safety Class requirements, conforming to requirements developed later in the hazard and accident analysis process.

The review of the design and fabrication specification for the transfer pump piping (HNF-4170) addressed alternatives to improve constructability of the piping, minimize potential leakage sources, and ensure proper fit-up of the piping to the pump, the PPP enclosure, the transfer line, and the water supply systems.

The review of the design and fabrication specification for the water skid (HNF-4043) provided discussion of appropriateness of various approaches to satisfy required control, monitoring, and isolation requirements.

Conceptual design for the selected overground transfer option was reviewed at the "33%" design review. Alternatives discussed at this review focused on significant radiological control concerns associated with routing a major source of radiation in a relatively unshielded location. These discussions resulted in selection of an administratively controlled high radiation area that would minimize impacts on other operations and maintenance activities in adjacent areas. In addition, significant discussion of the proposed flanged connection design resulted in application of a PUREX connector at the SY-102 discharge to allow dismantling without the requirement to cut the discharge flange, minimizing potential exposure and special cutting and line closure requirements during line removal after use. Maximum radius changes for the encasement piping were incorporated after discussion of alternatives available to ease both installation and removal of the temporary transfer line. The drop leg attachment enclosure at SY-102 was extensively discussed to provide multiple design options for improved accessibility, leakage monitoring, and confinement testing.

3.0 DOCUMENTATION

3.1 DESIGN REVIEW CHECKLIST

As part of the design review, a design review checklist was prepared to document the overall assessment of system satisfaction of requirements. This checklist addresses major design considerations rather than specific requirements. Open items from the checklist are summarized in Section 3.3.11 of this report. The checklist is included as Appendix A of this report.

3.2 DESIGN REVIEW COMMITTEE

The Design Review Committee was selected to provide an independent assessment and review of various aspects of the design for the SY-101 RAPID Mitigation System. Members selected are listed below (note – all members selected by the Chairperson were assigned by agreement with their respective managers):

- Chairperson: Richard L. Schlosser – Mr. Schlosser was selected by the TWRS Chief Engineer, with concurrence of the Project Manager for the SY-101 Surface-Level-Rise Remediation Project. In addition to satisfying responsibilities of the chairperson, Mr. Schlosser provided specific technical expertise for mechanical engineering and nuclear engineering aspects of the design. He is also a qualified Radiological Control Design Reviewer.

- Alternate Co-Chairperson: Shafik H. Rifaey was selected by the Chairperson to serve as Co-Chairperson. Mr. Rifaey's selection was accepted by both the TWRS Chief Engineer and the Project Manager for the SY-101 Surface-Level-Rise Remediation Project. Mr. Rifaey also provided specific technical expertise for both mechanical engineering and nuclear engineering. He is also a qualified Radiological Control Design Reviewer.

- Alternate Co-Chairperson: Timothy C. Oten was selected by the Chairperson to serve with Mr. Rifaey as Co-Chairperson. Mr. Oten also provided specific technical expertise for both mechanical engineering and instrumentation and controls engineering. He is also a qualified Radiological Control Design Reviewer.

- Secretary: Chris E. Jensen was selected to provide secretarial services and mechanical engineering expertise.

- Secretary: Shakir U. Zaman was selected to provide secretarial services and mechanical engineering expertise.

- Mazen G. Al-Wazani was selected to provide electrical engineering and electrical code expertise. He is also a qualified Radiological Control Design Reviewer.

- John W. Bloom was selected to provide nuclear safety and licensing expertise. He is a qualified Radiological Control Design Reviewer.

- As the Cognizant Engineer for the SY Tank Farm, Mark H. Brown was selected, to be a design review team member.

- Robert J. Giordano was assigned by the TWRS Radiological Control Manager to provide radiological control expertise.

- John D. Guberski was selected to provide environmental compliance expertise.

- John W. Hobbs was assigned by the TWRS Radiological Control Manager to provide radiological control expertise.

- Rick A. Huckfeldt was selected to provide fire protection and industrial safety expertise.

- Laroy S. Krogsrud was selected as the Cognizant Safety Engineer for the SY Tank Farm.

- Douglas C. Larsen was selected to provide operations expertise. He is a qualified Radiological Control Design Reviewer.

- Michael L. McElroy was assigned as the Cognizant Quality Assurance Engineer.

- Louis E. Pokos was selected to provide maintenance engineering expertise. He is a qualified Radiological Control Design Reviewer.

- Daniel A. Reynolds was selected to provide process engineering expertise. He is a qualified Radiological Control Design Reviewer.

- Charles C. Scaief, III was selected to provide instrumentation and control engineering and electrical engineering expertise. He is a qualified Radiological Control Design Reviewer.

- Craig P. Shaw was selected to provide pump design engineering expertise. He is a qualified Radiological Control Design Reviewer.

- Hassan H. Ziada was selected to provide structural engineering, stress analysis, and mechanical and structural code compliance expertise.

In addition to the core reviewers identified above, the SY-101 RAPID Mitigation System Cognizant Engineer (Michael F. Erhart), Design Authority (William J. Powell), and Cognizant Engineering Manager (Ronald W. Reed) actively participated in the review and their comments were treated as comments provided by the review team. Messrs. Powell and Reed are also Qualified Radiological Control Design Reviewers.

Since many of the review team activities were conducted at meetings with a large cross-section of project design team members, the inputs of project team members were beneficial in clearly stating the comments. Special acknowledgement for assistance is given to J. R. Biggs for his extensive input to both constructability and operability issues and their resolution, and to Richard M. Pierson for his significant input to and resolution of radiological control and shielding issues.

3.3 OUTSTANDING ACTION ITEMS

This Section summarizes outstanding action items resulting from the system design review. The summary is organized into groupings associated with the particular portion of the review that identified the action.

3.3.1 Design Requirements, HNF-3885

Sixty-seven action items were identified in meeting minutes for review of HNF-3885. The action items were incorporated into a listing of all comments received from both internal reviews and the Design Review Committee. The Design Review Committee members reviewed the full disposition document and concurred that all Action Items were provided with acceptable dispositions. No open action items remain.

3.3.2 Conceptual Design Review (30%)

One hundred fifty seven action items were identified in Review Comment Records, including forty-five action items identified in meeting minutes for review sessions conducted February 16-17, 1999. Remaining open action items are summarized below:

- **RCR 45:** "Replacement of the pump is a critical should seismic or other conditions warrant. The design needs to include provisions (including removal hardware) for pump replacement. Also, procedures and training need to be developed to enable timely pump replacement."

  The design impacts have been addressed. Training and Procedure development remain open. The open action item is in the second category, i.e., "requires closure in implementing the design or prior to operation." (see Section 1.4). The system design is acceptable. Resolution is required prior to system operation.

- **RCR 84:** "Why is the drop leg at 160 inches? Justify and document the length?"

  The design was set to prevent disturbance of the sludge layer in Tank 241-SY-102 and provide adequate mixing of the transferred waste to ensure waste compatibility (control phosphate settling). The minimum waste level in Tank 241-SY-102 must be sufficiently above the drop leg discharge to mitigate ammonia release and remains an open item. The open action item is in the second category (see Section 1.4). The system design is acceptable. This minimum submergence needs to be ensured by Operations prior to system operation. The open action item for RCR 38 in section 3.3.11 also addresses this item from another perspective.

- **RCR 93:** "Design limits and bases including temperature limits (upper and lower), flow ranges, critical velocities, and dilution rates for the dilution and flush water need to be provided."

  The design has been established based on the developed functions and requirements provided by HNF-3885 and input taken from the draft of HNF-4264. Design limits and bases need to be conformed to the approved HNF-4264 after its release. The open item is in the second category (see Section 1.4). The system design is acceptable. The design limits and capabilities of the structures, systems and components of the SY-101 RAPID Mitigation System need to be confirmed as part of design implementation.

- **RCR 98:** "Instrumentation needs to reflect the logic of operations developed in the Process Control Plan as well as critical characteristics and interactions of the system and its components."

  As is the case for RCR 93 above, the instrumentation design was established based on the developed functions and requirements provided by HNF-3885 with input taken from the draft of HNF-4264. Instrumentation application needs to conform to the approved HNF-4264 after its release. The open item is in the second category (see Section 1.4). The system design is acceptable. The suitability of the instrumentation for the SY-101 RAPID Mitigation System needs to be confirmed with both the Process Control Plan and the completed safety analysis as part of design implementation.

3.3.3 Prefabricated Pump Pit, HNF-4169

Twenty action items were identified in meeting minutes on March 9, 1999. The remaining open action item is summarized below:

- **Action Item 99-007-018:** The committee recommended that a painting specification be provided to ensure proper coating materials are applied. The project agreed to provide this specification after HNF-4169 is issued.

  The painting specification is required to ensure that carbon steel components are protected from the environment. The open action item is in the second category (see Section 1.4). The system design is acceptable. Resolution is required as part of design implementation.

3.3.4 Transfer Pump Piping, HNF-4170

Eight action items were identified in meeting minutes on March 9, 1999. No open action items remain.

3.3.5 Mobile Water Support Skid, HNF-4043

Eight action items were identified in meeting minutes on March 10, 1999. No open action items remain.

3.3.6 Overground Transfer Line (OGT)

Twenty-one action items were identified in meeting minutes on March 11, 1999. The remaining open action item is summarized below:

- **Action Item 99-009-014:** A concern was raised as to the meaning of the OGT being "temporary". The project agreed to establish some end of activity to begin D&D activities.

  The Application of a "temporary" designation is necessary to ensure that use of various system components such as power and instrument cables, are confirmed to be acceptable. The end of activity for the overground transfer line needs to be defined. The open action item is in the second category (see Section 1.4). The system design is acceptable. Resolution is required as part of design implementation.

3.3.7 Anti-Siphoning Slurry Distributor Assembly, HNF-4216

Eighteen action items were identified in meeting minutes on March 25, 1999. No open action items remain.

3.3.8 Structural Design Criteria, HNF-4252

Three action items were identified in meeting minutes on March 26, 1999. No open action items remain.

3.3.9 Electrical Installation, ECN 647721

Thirty-four action items were identified in meeting minutes on April 9, 1999. No open action items remain.

3.3.10 Mobile Water Support Skid, ECN 653826 to HNF-4043

Ten action items were identified in meeting minutes on April 13, 1999. No open action items remain.

3.3.11 System Design Review and Hose in Hose Option, HNF-4407

Forty-six action items were identified by RCRs generated during review of the system design of the SY-101 RAPID Mitigation System and review of the Hose in Hose Option Specification, HNF-4407. The remaining open action items are summarized below:

- **RCR 3:** "How is ASME B31.1 applied? What testing is applied to ensure the hose does not leak in actual application? How do you show equivalency to ASME Section III requirements? We also need an analysis for evaluating the tensile strength. It was suggested that a group evaluate all aspects of HAHA *[hose and hose assembly]* design."

  DOE Order 6430.1A requires that Safety Class designs comply with ASME III or other comparable safety related codes and standards appropriate for the system being designed. The standards for synthetic rubber hose only address inspection and testing of hoses; they do not address analysis of the hose design. The hose will be qualified for service based on an engineering evaluation to document compliance with the requirements comparable to ASME III and testing of the hose to demonstrate it's suitability for service. The open action item is in the second category (see Section 1.4). The system design is acceptable. The engineering evaluation and suitability testing must be completed as part of design implementation.

- **RCR 4:** "Provide heat transfer analysis for heat trace and airflow effects on the primary and secondary hose."

  The hose in hose assembly is heat traced and insulated to prevent the waste from cooling as it is transferred. A heat transfer analysis is being performed to determine the appropriate set point for the heat trace temperature controller and to confirm that the operating temperature of the hose material is not exceeded. The open action item is in the second category (see Section 1.4). The system design is acceptable. The analysis must be documented as part of design implementation.

- **RCR 6:** "Mark Brown will set up a meeting to resolve concerns and issues regarding draining and supporting the transfer line *[hose in hose option]*."

  A meeting was held on May 13, 1999. Discussion at the meeting indicated a number of unresolved issues related to drainage and support of the hose in hose transfer line should this option be selected. Design alternatives vary from allowing the line to follow the existing contour of the soil to providing a supporting berm for continuous slope from SY-101 to SY-102. Allowing the line to follow the surface contour will result in a dead-leg that is approximately one foot below the discharge at SY-102 and two feet below the attachment at the PPP at SY-101. Although flushing will provide some removal of radioactive material, administrative control of transfer line removal will be required to ensure proper drainage of the hose after completion of the transfer. The open action item is in the second category (see Section 1.4). The system design is acceptable. Transfer line routing and drainage provisions must be completed and documented as part of design implementation.

- **RCR 7:** "A requirement to engineering evaluation for the hose assembly stress evaluation will be added to the SDC *[Structural Design Criteria]* in HNF-4252."

  The hose in hose assembly design needs to be structurally analyzed to appropriate criteria for the application. The proposed design analysis will address fluid flow reaction forces for steady-state and transient conditions. Support structures and restraints for reaction loads and applicable natural phenomena loads will also be included in the analysis. The open action item is in the second category (see Section 1.4). The system design is acceptable. Applicable acceptance criteria must be included in the criteria of HNF-4252 and a requisite analysis completed and documented as part of design implementation.

- **RCR 10:** "Add local alarms for the leak detectors on the P&ID."

  The specific action requested by this comment has been addressed; however, potential impacts to other documentation have not been finalized. The open action item is in the second category (see Section 1.4). The system design is acceptable. All design impacts must be resolved as part of design implementation.

- **RCR 11:** "MEL *[Master Equipment List]* shall include instrument set points and accuracy and should reference any calculations. This shall be referenced as a note on the drawing."

  A definitive response has not been provided for this comment. The concern reflected by the comment is that instrument set points and accuracy are design requirements that must be documented in appropriate locations to maintain configuration management of the information. The open action item is in the second category (see Section 1.4). The system design is acceptable. Applicable configuration control needs to be established for these design details and instrument set point and accuracy requirements documented as part of design implementation.

- **RCR 13:** "HNF–3885 needs to be revised. This shall also include the limits of the VFD *[variable frequency drive]*."

  HNF-3885 provides functions and requirements for the SY-101 RAPID Mitigation System. The document needs to provide all functions and requirements imposed on the design. Also, the document was prepared before related safety and process control analyses were finalized. Criteria for the system must be revised to be consistent with safety analysis, process control, and other applicable requirements developed after the document was issued. Specific conditions assumed in the initial issue of the functions and requirements need to conform to an analysis completed afterward. Spare VFD units have been procured as like-for-like replacements, not requiring imposition of specific component requirements. The open action item is in the second category (see Section 1.4). The system design is acceptable. For system acceptance, the finalized functions and requirements must documented as part of design implementation.

- **RCR 21:** "H-14-103641: Comments by Mazen *[M. G. Al-Wazani]* need to be resolved before May 28, 1999."

  Specific design media corrections are required. Specific corrections identified have been incorporated and drawing release is in process. The open action item is in the second category (see Section 1.4). The system design is acceptable. For system acceptance, the design must be documented on appropriate design media as part of design implementation. The HOLD Point has been removed.

- **RCR 25:** "Electrical power load analysis shall be completed to show adequacy of power to meet system demand. The load analysis shall be prepared as a revision to the facility loading analysis. Both the 252-S facility load analysis and the revision ECN shall be completed and issued by May 28th."

  The adequacy of the power supply is critical to system design. Directed changes were incorporated into HNF-3885 to ensure that power sources are appropriately evaluated for adequacy and appropriate design features are incorporated. The open action item is in the second category (see Section 1.4). The system design is acceptable. For system acceptance, the design must be within the capabilities of the electrical power supply system provided as part of design implementation. With revision of the criteria to establish appropriate requirements for electric power supply, the HOLD and completion date identified with this item have been removed.

- **RCR 26:** "An evaluation shall be performed whether lightning protection is warranted for the new 101-SY to 102-SY transfer line and its associated components."

  Lightning protection needs to be consistent with the conditions analyzed in the facility Authorization Basis. The open action item is in the second category (see Section 1.4). The system design is acceptable. For system acceptance, the SY-101 RAPID Mitigation System design must be shown to comply with requirements of the Authorization Basis as part of design implementation.

- **RCR 27:** "A red line mark up of electrical *[and instrumentation]* drawings has been provided to Jerry Wilk. These comments need to be resolved."

  Comments included on electrical drawings depict changes necessary to adequately describe the facility on design media. As a normal part of the design process, incorporation of comment resolutions on the drawings is being completed. The open action item is in the second category (see Section 1.4). The system design is acceptable. For system acceptance, the drawings must document the system configuration as part of design implementation.

- **RCR 36:** "*[On drawing H-14-]* 103616, to allow the waste flowmeter to operate full, there is space in the spool piece following it to put in an offset — to allow a high point in the system. This change is simple, inexpensive and fast; it would do a lot of good for process control. It is recommended for good engineering and process control improvement, if we do not have time, this goes away. If the next comment (37) is implemented this goes away."

Based on extensive discussion, changes to the installation would have an unacceptable impact on the implementation schedule. Flowmeter accuracy will be evaluated during system operation; however, it has been assessed to be acceptable to allow an initial setting of dilution flow. The open action item is in the third category; i.e., recommended for risk reduction if cost and schedule allow (see Section 1.4). The system design is acceptable. Since the operational requirement has been satisfied by the current design, improvement of the design is desirable for risk reduction.

- **RCR 37:** "*[On drawing H-14-]* 103616, to allow the waste flowmeter to operate full we could put in a valve between valves V-354, -355 and pressure switch PS-370. This would allow an operational high point purge and allow us to recycle diluted waste to SY-101. This could be a possible solution to some of the problem of crust level rise and is recommended – if time allows."

  Based on extensive discussion, changes to the installation would have an unacceptable impact on the implementation schedule. Flowmeter accuracy will be evaluated during system operation; however, it has been assessed to be of acceptable accuracy to allow an initial setting of dilution flow. The open action item is in the third category (see Section 1.4). The system design is acceptable. Since the operational requirement has been satisfied by current design, improvement of the design is desirable for risk reduction.

- **RCR 38:** "*[On drawing H-14-]* 103590, the dropleg is shown at 160 inches above the tank bottom. The lower administrative level for the tank level is 130 inches. Modify the dropleg to add 30 inches to extend it to 130 inches from the tank bottom. This will allow the dropleg to be covered whenever the next cross-site transfer is done. This will allow us the flexibility in this and other transfers."

  This condition is related to the conceptual design review comment, RCR 84, described in Section 3.3.2 above. A longer drop leg would provide more flexible operation of the system; however, the design would require evaluation for impact on various parameters governed by the process controls developed. This open action item is in the third category (see Section 1.4). The system design is acceptable. Disposition to provide a drop leg of greater length would provide risk reduction, cost and schedule permitting. The open action item for RCR 84 in Section 3.3.2 also addresses this item from another perspective.

- **RCR 39:** "*[On drawing H-14-]* 103607, the identifiers C, D, and J do not appear to be accurate. The C identifier, primary transfer line, should be 370 psi working pressure, and 60 psi working pressure for the encasement. Both at 155° F, per

HNF-4407. What does SST mean? Is this appropriate in identifier C? Identifier J does not exist with hose in hose line design. Revise."

Values developed for HNF-4407 will be included, as applicable, and Item J has been deleted, consistent with the disposition of RCR 31 from this review. The open action item is in the second category (see Section 1.4). The system design is acceptable. For system acceptance, the drawings must document the system configuration as part of design implementation.

- **RCR 43:** "Same comment *[as RCR comment 42]* for pump outlet line flush, and pump internal flush. The pump internal flush, how did we get 10 gpm? Is it a limit? Best estimate? Sounds low for pump internals."

  The disposition provided delineates the basis for selection of the value and describes anticipated system performance. The open action item is in the second category (see Section 1.4). The system design is acceptable. For system acceptance, the basis for the flow value, limit, and related information must confirmed to be acceptable as part of design implementation.

- **RCR 45:** *"[On drawing H-14-]* 103656, P&ID, we need something to slow down the flow of water, from the 75 gal. Tank, during emergency conditions (loss of power at the water skid). This will allow the operator time to monitor the flush water to the pump and to the transfer line. The option recommended is an orifice at the outlet of the75 gal. Tank that could fit between two flanges. The rate needs to be reduced to about 45 gal/min. This will allow half of the volume to be flushed to the pump (47 sec.) and half to the line. HOLD Point."

  Initial requirements imposed included the requirement to provide transfer line flushing in the event of a loss of the water supply for flow dilution. The system provides termination of the transfer and immediate flush of the transfer line as originally required. This open action item is in the second category (see Section 1.4). The system design is acceptable. Adequacy of protection provided for the transfer pump under upset indications must be resolved as part of design implementation. The HOLD Point is removed.

- **RCR 46:** "The process flow meter must have a totalizer on it. H-14-103652 shows FIT-367 to be a "LCD INDICATOR/TOTALIZER." This is what is necessary for process control. H-14-103656 does not show the totalizer function for FE-367. HOLD Point."

  See related discussions for the open action items, RCR 36 and RCR 37, in this section above. Based on extensive discussion, changes to the installation are easily incorporated into the design. This design change may provide useful data for confirmation of the material balance required and may prove valuable if acceptable accuracy can be verified during initial operation of the system. Flow totalizer accuracy will be evaluated during system operation. The open action item is in the third category (see Section 1.4). The system design is acceptable. Since the operational requirement for flow balance setting and performance of required mass balances have been satisfied by current design, this improvement of the design is not required, but rather, desirable for risk reduction. The design team has agreed to add the totalizer function. The HOLD Point is removed.

In addition to the remaining open items from the system design review, several open items were identified from the Design Review Checklist. These open items are summarized below:

- Calculation completion - There are several engineering calculations that need to be completed and documented. The analyses are continuing; however, because of the time constraints required to complete the first waste transfer, construction is already underway and proceeding at risk. This item is in the second category (see Section 1.4). The system design is acceptable. Design calculations must be completed and issued as part of design implementation.

- The structural design criteria assumption that "vortex shedding loads created by jet flow past the transfer pump will not develop" requires verification. Similar analyses have been performed for other equipment demonstrating component load applicability. This item is in the second category (see Section 1.4). The system design is acceptable. The assumption must be verified as part of design implementation.

- Assumptions, requirements, and criteria included in the Functional Requirements and Technical Criteria that were based on preliminary safety analysis and process control information must be verified with final information. This item is in the second category (see Section 1.4). The system design is acceptable. Requirements and criteria must conform to the design basis as part of design implementation.

- Design based on current draft information, e.g., safety analysis results (as described in Control Decision Records) and process controls (as described in the Process Control Plan), must be verified with final information. This item is in the second category (see Section 1.4). The system design is acceptable. Design must conform to the design basis as part of design implementation.

- Additional testing requirements for the transfer line encasement must be finalized for the encasement hose option. This item is in the second category (see Section 1.4). The system design is acceptable. Appropriate quality requirements for the encasement hose must be documented as part of design implementation.

- A compliance matrix to identify requirements, the design attributes that satisfy the requirements, and the Structures, Systems, and Components (SSCs) that implement the requirements must be completed. This item is in the second category (see Section 1.4). The system design is acceptable. Ensured compliance with requirements is necessary as part of design implementation.

- The implementation of electrical power supply requirements based on a load analysis must be completed. This item is in the second category (see Section 1.4). The system design is acceptable. The electrical power system interfaces and design must be completed as part of design implementation.

- Routing of the hose-in-hose transfer line including hydraulic gradient must be finalized. In particular, the gradient of the hose to be self draining to SY-102 or with a dead leg between the PPP and SY-102 must be finalized by considering a combination of radiological controls, shielding, access restrictions, line protection, and worker protection concerns. The resolution must address installation and removal as well as operation of the system. This item is in the second category (see Section 1.4). The system design is acceptable. The hose-in-hose option routing and gradient must be completed as part of design implementation if this option is selected. See also RCR 6 above.

- Critical Characteristics for each safety-related component must be defined. This item is in the second category (see Section 1.4). The system design is acceptable. Critical characteristics must be determined to ensure that appropriate equipment qualification requirements are established as part of design implementation.

APPENDIX A

DESIGN REVIEW CHECKLIST
SYSTEM DESIGN REVIEW

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
		DESIGN BASIS	
1	Have assumptions necessary to perform the design task been adequately described and are they reasonable?	Yes	Assumptions have been delineated in HNF-3885, Section 1.2.1 and Control Decision Records.
2	Have assumptions been identified for verification during design execution or when the design has been completed?	Yes	Assumptions associated with waste volume and waste compatibility require completion of a waste compatibility assessment prior to transfer, which is required for any transfer. Assumptions identified related to safety classification in HNF-3885, Revision 0 require verification based on the hazard and accident analysis performed. This has been imposed as a requirement during the design review process and must be completed as part of design implementation. The assumption in HNF-4252 that "vortex shedding loads created by jet flow past the transfer pump *[from mixer pump operation in tank SY-101]* will not develop" requires verification. This assumption must be verified as part of design implementation. Design based on the draft Process Control Plan (HNF-4264) must be verified as part of the design implementation. Although not specifically stated as an assumption in the documentation reviewed, all design has been based on a draft of the Process Control Plan and close coordination of the design with ongoing development of the Process Control Plan. As part of design implementation, design must be verified against the issued HNF-4264.
3	Has testing been defined to complete verification after design completion?	Yes	The hose supplier will perform pressure testing and vacuum testing of the hose prior to shipment. The pressure test will be performed at 150% of the rated pressure, in accordance with ASME B31.3. Due to the unique application, additional testing will be defined and performed after receipt as part of design implementation.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
3	(continued)		All other testing appropriate for design verification has been identified and specified for various portions of the design. The system design precludes full testing of the completed system with simulated or actual materials, geometry, and environmental conditions.
4	Have adequate acceptance criteria been specified and are the verification methods stated appropriately?	Yes	Equipment acceptance criteria have been established and imposed on the suppliers to ensure that equipment provided has satisfactorily met specified requirements. Component and equipment acceptance criteria have also been established to verify subassemblies completed on site to verify performance. Run-in testing of the transfer pump has been specified and performed to verify suitability of the pump for the application. To the extent practical, verification by specific testing has been specified.
5	Have the appropriate Quality Assurance requirements been specified?	Yes	Specific quality assurance requirements have been imposed in design/construct specifications and procurement documentation. See HNF-4043, HNF-4169, HNF-4170, HNF-4216, and HNF-4407 for application of both standard, and where appropriate for the design application, augmented Quality Assurance requirements for testing, inspections, and documentation have been applied. Engineered equipment has been provided by vendors qualified to NQA-1.
6	Were sources of information identified?	Yes	Sources have been delineated for design, environmental, and process information utilized in developing design. Interfaces with existing facilities have been attributed to applicable facility documentation (in addition, the design provided updating of interface documents to ensure configuration management).

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
7	Does the design meet the established requirements and/or design criteria?	Yes	The system has been designed to the requirements of HNF-3885. In addition, the design activity requires development of compliance matrices to document satisfaction of regulatory, environmental, and process control requirements. Equipment relied on for safety is identified in a Safety Equipment List being developed in concert with completion of the hazard and accident analysis performed for the system.
8	Does the design meet established requirements for associated system physical and functional interfaces?	Yes	Physical and functional interface requirements are specified in HNF-3885. Where interfaces have been found incompatible with available physical and functional interfaces, the design requirements have been revised to reflect as-found interface conditions. The electrical power interface with the 252-S substation was found to be inadequately specified in HNF-3885. HNF-3885 has been revised to correct this deficiency.
9	Have the interface requirements with existing facility documentation been clearly presented?	Yes	As stated in Item 6 above, interface requirements with the existing facility have been clearly defined, including update of existing facility documentation and field verification of interface conditions.
10	Are there any open interface problems?	Yes	The system interface with existing facility electrical power has been identified as a problem. The requirements of HNF-3885 are being changed to provide specific requirements for augmentation of power from the 252-S substation.
11	Have engineering standards and criteria been specified properly in the design?	Yes	Engineering standards and criteria have been specified properly. HNF-3885 requires application of appropriate standards and criteria.
12	Has appropriate consideration been given to use of standardized parts, materials and processes?	Yes	The design incorporates application of TWRS standardized designs, such as application of PUREX connectors, leak detector circuit design, and valve operator connections.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
13	Does the design represent the simplest design consistent with functional requirements and expected service conditions?	Yes	The design has been simplified to the extent practical for operation and maintenance of the system. Based on incorporation of design features to simplify installation, inspection, and removal, the system has been designed to specifically meet the expected service conditions, with full design consideration of decontamination and radiological control needs, especially for removable temporary portions of the system.
14	Are the applicable codes, standards, and requirements, including revisions, properly identified and are their design requirements provided for?	Yes	Specific codes, standards, and requirements have been delineated in HNF-3885, in addition to application of codes and standards compatible with interfacing systems. Supplemental requirements have been specified, where appropriate, to ensure satisfaction of potentially inconsistent or more stringent requirements.
15	Does the design minimize life-cycle cost to the extent practicable?	Yes	The design has provided simplified design for components that are anticipated to need periodic replacement, such as the transfer line design.
16	Have available data on similar designs been considered?	Yes	The design has relied on similar applications for transfer systems. The transfer pump was selected based on availability to support the urgent need to provide the installed system. Although the pump is not a comparable design to other transfer pumps, the pump was specifically developed for operation in the intended service.
17	Does the design meet functional requirements to: a Ensure stresses are within design limits?	Yes	Design for stress has been controlled by HNF-4252, developed specifically for system structural analysis. In addition, pressure boundary components have been designed to meet allowable loading conditions. Calculations will be documented in HNF-4358.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
17	b Meet defined steady-state, transient, and faulted conditions?	Yes	Specific design features have been incorporated to serve all normal operating conditions. Transient operation is accommodated by inclusion of design features to provide flushing and break siphon on transfer pump shutdown. To address potential faulted conditions, such as loss of power, instruments have been provided with fail-safe design or are powered from the same source as the equipment requiring shutdown to restore safe conditions. To minimize potential for line plugging and personnel exposure, the design has been provided with a pressurized flush water reservoir.
18	Will the design meet the following environmental conditions?		
	a Temperature (steady-state and transient)	Yes	Equipment has been specified and designed to meet process control temperature requirements, including transient conditions.
	b Flow (steady-state and transient) including induced Vibration	Yes	All system components have been designed to accommodate design flow conditions. The primary transfer line is a flexible hose. For the application, specific analysis is being performed to ensure that the hose is appropriately restrained. Starting transients are controlled by use of a variable frequency drive to control the transfer pump. As stated in Item 2, the assumption in HNF-4252 that vortex shedding loads created by jet flow past the transfer pump *[from mixer pump operation in tank SY-101]* will not develop requires verification.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
18	c Pressure (steady-state and transient)	Yes	Pressure containing components have been designed to accommodate the design pressure conditions for their application. Pressure retaining components are pressure tested at 150% of design pressure to ensure acceptability. Overpressure protection is provided for system components that could be exposed to higher pressure due to the pumps provided as part of the Mobile Water Support Skid.
	d Seismic/natural phenomena (as required by safety analysis)	Yes	All components required for safety are being evaluated for loading due to applicable seismic and other natural phenomena.
	e Nuclear radiation	Yes	All components have been selected to meet anticipated radiation exposure.
	f For Safety Class items, impact of non-qualified equipment that will be near-by (3 over 1 problem)	Yes	Safety related portions of the system have been evaluated considering the impact of non-safety SSCs due to loading combinations including the response to natural phenomena events. For example, the PPP enclosure and the 241-SY-101 riser below the PPP are being analyzed considering the weight and response of the suspended transfer pump prior t installation.
	g Ambient environmental conditions	Yes	The design SSCs are either protected by enclosures or designed to perform in the ambient conditions applicable, as delineated in HNF-3885 and other applicable documents. Outdoor electrical equipment is installed in weatherproof enclosures. Likewise submerged portions of the transfer pump motor are designed to provide isolation from immersion.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
18	g (continued)		Components located in areas subject to potential exposure to elevated levels of flammable gases have been designed to applicable requirements of the Authorization Basis and the specific requirements imposed for tank SY-101 as a formally classified NFPA Class I, Division 2, Group B hazardous location.
19	Have allowable leakages been specified?	Yes	Primary boundary leakage is limited as required by the Authorization Basis. This limitation is specified as a requirement to limit the total quantity of material released to less than analyzed for the Authorization Basis. Leakage is detectable within twenty-four hours as required by the Washington Administrative Code.
20	Does the design meet all established safety requirements?	Yes	The design has incorporated safety features necessary to meet industrial safety requirements. SSCs in exposed locations have been designed and constructed to meet OSHA requirements for their application. The design has incorporated safety features as Safety Class or Safety Significant to prevent or mitigate potential accident conditions developed in the Authorization Basis and system specific hazard and accident analysis developed.
21	Has an acceptable level of radiation exposure been defined?	Yes	Based on multiple design constraints, the design has been developed to make provisions for addition of temporary shielding to minimize personnel exposure. However the design constraints led to establishment of a high radiation work area encompassing to the system components during transfer system operations. All other operations are performed utilizing monitoring and control stations located to allow operation of the system without entry into the high radiation area.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
21	(continued)		The only entry into the high radiation area will be for two to four minutes post transfer to initiate flush to further reduce the source term. Dilution flow will be maximized two to four minutes prior to planned pump shutdown.
22	Have calculations been performed to define expected radiation exposure and establish acceptable shielding design?	Yes	Calculations have been performed to determine radiation exposure and determine shielding requirements. Based on the analysis, appropriate exposure minimization utilizing both design and administrative controls has been developed.
23	Have nuclear criticality safety considerations been incorporated?	Yes	The waste compatibility assessment will address criticality. In addition, nuclear criticality safety is addressed by existing administrative controls. The tanks contain wastes with a significant quantity of transuranic material. Concentrations of transuranic elements in the tanks are low and the tanks remain highly subcritical. Transfer of wastes from one tank to another does not segregate the fissile and fissionable material from neutron absorbing material. Therefore, the waste material remains highly subcritical.
24	Has the design been analyzed to appropriate requirements of HNF-PRO-097 and is the analysis appropriately documented?	Yes	HNF-PRO-097 requirements are being satisfied by application of conditions as delineated in the TWRS Authorization Basis. Applicable load combinations and performance categories for natural phenomena loads have been determined for the equipment making up the RAPID Mitigation System in HNF-4252.
25	Will separate Acceptance Test Specification(s)/ Procedure(s) be required? - If yes, identify responsible organization(s) for preparation and issue (TBD if unknown)	Yes	SY-101 RAPID Mitigation System Acceptance Tests will be performed as delineated in the Engineering Task Plan, HNF-4044

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
26	Have calculations been developed to provide proper component specifications and/or requirements?	Yes	Calculations necessary to specify components are being prepared for the system. Structural loads and load combinations are being calculated to ensure that components of appropriate design are specified. For components procured as part of a design and fabrication specification, applicable loads and load combinations have been provided in the specification, or the specification has imposed submittal requirements for the supplier to provide the design information for analysis by the design team. Analysis is scheduled for completion; however, procurement is proceeding at risk.
27	Have safety systems, structures, and components been identified?	Yes	Through the hazard and accident analysis process, controls have been developed and allocated to the systems, structures, and components (SSCs) of the system. Specific safety functions are allocated to the safety SSCs and are being documented in the Safety Equipment List. As in item 2 above, the safety SSCs must be verified to the completed safety analysis prepared as part of design implementation.
28	Have all credible non-standard conditions been properly considered?	Yes	Hazards have been evaluated and credible events analyzed to meet nuclear safety requirements. In addition, radiological and process concerns associated with operational upsets have led to a redundant design with transfer line flushing from an accumulator tank. This provides flushing of the line in the event of a loss of power to reduce radiation sources and prevent waste crystallization in the line. The anti-siphoning slurry distributor at SY-102 ensures that waste transfer is terminated under any pump shutdown condition.
29	Are existing Authorization Basis analyses implemented in the design?	Yes	Existing Authorization Basis analyses have been applied to the design.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
30	Has the need for safety analysis of this design been determined?	Yes	Safety analysis including hazard identification, accident analysis, and control development have been identified and results have been incorporated in the design. As stated in Items 2 and 27 above, the safety SSCs must be verified against the completed safety analysis prepared as part of design implementation.
31	Are existing Authorization Basis controls implemented in the design?	Yes	Existing Authorization Basis controls have been applied to the design. In addition, specific controls for flammable gas hazards have been implemented as if they were Authorization Basis controls.
32	Do the requirements incorporate appropriate environmental compliance controls?	Yes	An environmental compliance matrix has been prepared to document compliance with environmental design requirements. This compliance matrix must be completed as part of design implementation.
33	Does the design comply with applicable environmental design requirements (i.e. WAC 173-303, etc.)?	Yes	An environmental compliance matrix has been prepared to document compliance with environmental design requirements. This compliance matrix must be completed as part of design implementation.
34	Will new or modified environmental permits be required?	No	The current environmental permit governs operation of the SY-101 RAPID Mitigation System.
35	Has availability of power to meet requirements for the systems, structures, and components been verified?	Yes	Electric load analysis of the 252-S substation identified the requirement to supplement the existing power supply for operation of the system. As a result of this determination, the electrical requirements of HNF-3885 were revised to provide specific criteria for application of supplemental power supplies. Final allocation of electrical loads to the 252-S substation and any supplemental power supply source(s) must be completed to the requirements of HNF-3885 as part of design implementation.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
36	Have requirements for receiving and storing the equipment item(s) been defined?	Yes	Receiving requirements are applied for all equipment. Uniquely purchased components are specified to require vendor submittal of storage requirements. In addition, all equipment is received and inspected in accordance with a Quality Inspection Plan.
37	Has a compliance matrix been prepared to ensure that applicable codes, standards, and Authorization Basis, Environmental, DOE Order, and system functional requirements are properly identified and controlled?	Yes	Compliance matrices have been developed to document compliance with requirements. The compliance matrices must be completed as part of detailed design.
38	Have the interface requirements with existing facility equipment and systems been clearly presented?	Yes	Design drawings have identified interfaces with existing facility equipment and systems. To facilitate clarity of presentation, the designers have incorporated all completed changes to the drawings prior to providing the appropriate interfaces.
COMPONENT SELECTION			
39	Can the equipment be readily assembled/disassembled as designed?	Yes	All designs have been prepared for ease of assembly. Consideration has been given to identifying critical dimensions and to ensuring that mating surfaces have appropriate fabrication tolerances to facilitate assembly.
40	Have applicable modifications to commercial grade items and any associated verification operations or tests been appropriately documented?	N/A	
41	Have qualified and certified parts been specified?	Yes	Based on specific design applications and the applicable codes and standards, requisite qualification criteria for parts have been determined and imposed on suppliers.
42	Is the design producible by conventional means?	Yes	The design was predicated on application of standard commercial parts and items to minimize the potential schedule impacts of special order parts and equipment.
43	Do manufacturing, processing, and fabrication procedures minimize stress corrosion and fatigue?	Yes	The system design documents reviewed provide requirements to address stress corrosion, particularly for fabrication of stainless steel parts.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
44	Do the part and assembly clearances and tolerances take into account the effects of age, wear, thermal movement, and applied loads?	Yes	Thermal movement is the only applicable condition for the system design. Flexible connections accommodate the thermal movement.
45	Are mechanical tolerances within the limits of normal shop practice?	Yes	All tolerances were compared to applicable standards and guidance. With the exception of critical dimensions, tolerances, and surface finishes, standard shop tolerances have been applied. Where dimensions, surface finish, and/or tolerances were identified as critical, the critical parameter was set to meet requirements and evaluated for machining capability.
46	Are assembly clearances adequate to prevent unacceptable damage to adjacent components?	Yes	The design applied maximum clearances to protect components from damage. Components in the Prefabricated Pump Pit are fairly close to each other, but are fabricated as an assembly, minimizing the chance of component damage.
47	For large and heavy components designed with built-in rigging to minimize personnel exposure during installation, maintenance, and decontamination?	Yes	All large and heavy components have been designed with appropriate lifting points to allow rigging and hoisting using standard rigging practices.
48	Are operations, surveillance, and maintenance access provisions designed to minimize personnel exposure?	Yes	Operations and surveillance activities specifically addressed exposure minimization. Once the valve lineup is set, the system can be operated from remote locations. The design has also been assessed for impacts on other operations and surveillance activities to ensure that those activities can be performed outside the high radiation area. Design features for system flushing and decontamination are provided to minimize personnel exposure during maintenance activities.
49	Have adequate equipment laydown areas been provided?	Yes	Field verification was performed to verify adequacy of laydown areas for staging, installation, and removal of equipment.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
50	Are components designed to facilitate flushing and decontamination?	Yes	System components have been designed to facilitate flushing and decontamination. Materials and fabrication weld finishes were specified to simplify decontamination. Decontamination spray nozzles are provided to remove contamination of exterior surfaces exposed to tank waste. All waste transfer piping and components are designed with flushing provisions, including the transfer pump internals.
51	Has permanent shielding been incorporated to minimize personnel exposure?	Yes	Permanent shielding has been provided at the tank risers and via the steel walls of the PPP. Temporary shielding is also utilized. Item 52.
52	If permanent shielding is not provided, have design provisions been included to facilitate placement of temporary shielding?	Yes	The design incorporates attachment points for multiple layers of temporary shielding. Structural analysis of the components includes the weight of temporary shielding.
53	Has remote operation been incorporated to minimize personnel exposure?	Yes	As stated in Item 48 above, remote operation has been included in system design for all activities. Valving of the PPP is remote using reach rods. Dilution throttling is at water skid valve stand. Decontamination and decommissioning will not be remote.
54	Have appropriate design requirements been implemented for contamination control?		
	a Butt-welded pipe fittings	Yes	
	b Low point drains for piping and enclosures	Yes	Low point drainage has been provided. Detail design for the hose in hose option has not been finalized and may result in an undrained low point, however, flushing and line removal options have been identified.
	c Piping routed to minimize dead legs and low points	Yes	The hose in hose option may have a dead leg as described in b above.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
54	d Curbed radioactive floor drains	No	The Prefabricated Pump Pit has been designed with a slope to ensure that leakage will be routed to the drain. The SY-102 drop leg enclosure is provided with a curbed sector to ensure that leaks can be detected prior to the leakage draining into the tank.
	e No cross-connection of radioactive and non-radioactive drains?	N/A	
	f Isolation of non-radioactive fluid systems from radioactive fluid systems to prevent cross-contamination	Yes	Check valves and interlocked pressure switches are provided to isolate the water skid from potential radioactive waste leakage. In addition, the water skid normally provides an air gap isolation from the service water system to preclude service water contamination should the check valves and pressure switches fail to perform their function.
55	Are tolerances, fabrication techniques, processes, etc., consistent with standard practices and the proposed application?	Yes	Critical dimensional tolerances and material finishes have been included in specification of the Prefabricated Pump Pit and other SSCs. These dimensions and tolerances have been verified to be within standard machining capabilities. For critical finishes on the welded fabrication, machining has been specified after fabrication.
56	Can the design and its parts be easily inspected for conformance to engineering specifications?	Yes	
57	Have welding, bolting, joining methods been adequately specified?	Yes	Welding has been specified to appropriate codes and standards. In addition, heat input and tool and material controls have been specified for fabrication of stainless steel components.
58	Have NDE methods been applied correctly?	Yes	Nondestructive examination has been specified to the applicable codes and standards. For critical applications, supplemental NDE has been specified.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
59	If the design includes safety SSCs, have the critical characteristics been identified?	Yes	Critical characteristics have been identified and are being applied to dedication of safety SSCs. Identification of critical characteristics must be completed and verified to be consistent with the finalized safety analysis as part of design implementation.
60	If locking provisions or locking devices have been included: a Are they accessible? b If inaccessible after assembly, have they been sufficiently evaluated and tested to ensure their adequacy?	 N/A N/A	
61	If the design includes safety SSCs, has a Safety Equipment List (or input to the facility Safety Equipment List) been prepared?	Yes	A system Safety Equipment List has been prepared. The Safety Equipment List must be completed, verified to be consistent with the completed safety analysis, and issued as part of design implementation.
MATERIAL SELECTION			
62	Have non-corrosive materials been used where required?	Yes	The primary material of construction used is stainless steel, not susceptible to corrosion from the waste material to be handled. Carbon steel components have been used for structural components and enclosures that will be exposed to an outdoor environment. In these applications, suitable protective coatings are specified. Protective coating specification for carbon steel portions of the Prefabricated Pump Pit must be completed and coating performed as part of design implementation.
63	Can the assemblies be stored for extended periods of time without degrading effects?	Yes	
64	Does the design avoid any materials unproven for use in the anticipated environment?	Yes	All materials have been selected based on their known properties when exposed to the anticipated environment.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
65	Are coatings (or finishes) compatible with the expected environment and application?	Yes	See Item 62 above.
66	Are surface finish requirements the least stringent possible?	Yes	See Item 55 above. In addition to specifying sequence of machining, the least stringent finish requirement necessary is selected for each machined surface. Fabrication workmanship has been limited to finish requirements for decontamination and personnel safety Protective finishes (coatings) are limited to those material surfaces requiring protection. Stainless Steel components suitable for their environment have no specified coating requirements.
67	Are the specified materials compatible with each other and the environmental conditions to which the material will be exposed?	Yes	Selection conditions are as described in Items 48, 50, 54, 62, and 64 above.
68	Are the specified construction materials resistant to the following as applicable:		EPDM rubber specified for hose in hose has had extensive use in similar environments at Hanford.
	a Moisture?	Yes	
	b Oxygen/Oxidizers?	Yes	
	c Acids?	N/A	
	d Salts?	Yes	
	e Radiation?	Yes	
OPERATIONS & MAINTENANCE			
69	Has the design appropriately considered maintenance, operation and reliability, including maintenance procedures and techniques, unique maintenance requirements and frequencies?	Yes	Operational and safety reliability has been considered throughout the design. Specific maintenance reliability consideration has not been a significant input due to the short operational cycle for the system. The design provisions include a full set of spare equipment, with spare subassemblies such as the transfer pump piping provided to minimize maintenance activities required should replacement be required.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
70	Does the design use engineered safety and operational protections to avoid an excessive risk-taking dependence on administrative infallibility?	Yes	Due to the critical need to complete design, construction, and testing within a limited time period, every design aspect was reviewed to establish the minimum overall risk. This review developed design approaches to maximize use of engineered features, while limiting administrative controls to those that are routine within TWRS.
71	Have human factors engineering and operability been considered?	Yes	Specific consideration of human factors has been included throughout the design. This has resulted in design such as selection of specific audible and visual alarms, orientation of outdoor instrument readouts relative to the sun, and design to ensure that shutdown controls will operate under all selection modes at all control locations.
72	Is an Operation and Maintenance Manual required? If so, have requirements been clearly identified?	No	A specific Operation and Maintenance Manual is not necessary for the system. Vendor provided manuals are required for all components or subassemblies that require operational setting or calibration. For subsystems such as the Mobile Water Support Skid, applicable instructions are provided to meet a specification requirement.
73	Are current operating documents (procedures, specifications, etc.) applicable to the design?	Yes	Specific operating procedures and specifications are required for the design. The operational control of the pump variable frequency drive is unique to this transfer system. Requirements for dilution are consistent with low flow saltwell pumping, however, dilution has not been routinely required for double-shell tank transfers in the recent past.
74	Has adequate accessibility been provided for in-service inspection?	N/A	In-service inspection is not required for the application.
75	Have personnel radiation protection requirements been considered and identified?	Yes	The design incorporates a four meter corridor established as a high radiation area during operation of the system. The design locates system controls and monitoring outside the corridor.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
76	Have necessary features been provided to maintain personnel radiation exposure as low as reasonably achievable?	Yes`	Operational monitoring and control is performed remotely to ensure doses are kept ALARA. As stated in Item 48 above, the design does result exposure of the operators for a short duration while the flush flow is established.
77	Can the hardware be adequately decontaminated and disposed of after use if it is radiologically or chemically contaminated?	Yes	See Item 50 above.
78	Have locking provisions or locking devices been required where critical to operation or maintenance?	N/A	
RADIOLOGICAL & TOXICOLOGICAL CONSIDERATIONS			
79	Equipment design and administrative controls ensure that doses are ALARA		
	a How does the design incorporate physical design features as the primary method to maintain exposures ALARA?	Yes	The design incorporates remote operation and monitoring to maintain exposures ALARA. Due to the overground routing of the transfer line, exposure reduction relies on a combined application of shielding and administrative control.
	b Where administrative controls are relied on to maintain exposures ALARA, how were design features demonstrated to be impractical?	Yes	Weight restrictions to control tank dome loading precluded application of additional shielding for the above grade portions of the system. Excavation and burial of the system was not technically feasible.
	c How are the administrative controls that are used demonstrated to be practical?	Yes	The controls applied for the high radiation area (access control and posting) are a practical solution, allowing installation of a temporary fence boundary and temporary shielding with controlled access points. Specific review of the routing ensured that establishment of the high radiation area would not have significant impact on other operation and surveillance requirements.
	d How are ALARA decision-making methods applied to justify the design and administrative controls and assure that occupational exposure is maintained ALARA?	Yes	Each portion of the design has been designed for simplicity. At each stage of the process, the assigned radiological control and shielding design engineers evaluated options to provide both appropriate design measures and administrative controls.

APPENDIX A
DESIGN REVIEW CHECKLIST

System Design Review

SY-101 RAPID MITIGATION SYSTEM			Applicable	Design Review Remarks
Item		Review Consideration	(yes/no/NA)	And Pending Actions
79	e	For continuously occupied areas, how does the design meet the objectives of maintaining exposure ALARA and < 0.5 mrem/hr dose rate?	Yes	All activities performed in the DACS trailer and at the MCC are performed outside the SY Tank Farm. All activities performed at the 302C water system are performed outside the SY Tank Farm. For these portions of the system, isolation from radiation sources is achieved by water isolation as described in Item 54f above.
	f	For areas not continuously occupied, how does the design meet the objectives of maintaining exposure ALARA and < 20% of applicable standards of 10CFR835.202?	Yes	Control and monitoring functions are limited to areas remote from potential radiation sources during system operation. Those activities performed in the high radiation area are reduced to simplified operations of short duration.
	g	How does the design meet the objective to avoid releases of airborne radioactivity to the workplace atmosphere under normal conditions?	Yes	All system boundaries are established with both a primary and a secondary confinement. Airborne releases are controlled by the existing ventilation system.
	h	How do the design controls meet the objective to avoid inhalation of radioactive material in any situation?	Yes	The system maintains full isolation from the radioactive material. Specific construction steps that will require breaching the containments of SY-101 and SY-102 that will be performed under work controls specifically developed for work at open risers.
	i	How does the design and material selection include features that facilitate maintenance, decontamination, and decommissioning?	Yes	The primary features of the system minimize components requiring maintenance access in potentially contaminated or high radiation areas. The system has specifically designed features to flush system components and decontaminate externally contaminated surfaces except the encasement for the hose in hose option. The primary material of construction selected is stainless steel to simplify decontamination except the transfer line.

APPENDIX A
DESIGN REVIEW CHECKLIST

System Design Review

SY-101 RAPID MITIGATION SYSTEM		Applicable	Design Review Remarks
Item	Review Consideration	(yes/no/NA)	And Pending Actions
79	j Does the design incorporate plans for monitoring during routine operations to demonstrate exposure levels are ALARA?	Yes	Portions of the design that may provide high exposure are located such that field survey is easily performed. Those work stations that will be manned during system operation are either in an uncontrolled area, or are located such that shielding can be provided should the measured radiation levels be excessive.
80	Have design features incorporated consideration of:		
	a Adequacy of space for anticipated operations, maintenance, and decommissioning?	Yes	In all portions of the system, access has been considered. The most restrictive maintenance location is for components located in the Prefabricated Pump Pit. For this location, complete spare subassemblies have been provided to simplify the maintenance. Removal of the temporary transfer line after completion of the transfer is a process evolution that still requires further development, particularly for the hose in hose option. This must be completed during design implementation.
	b Location of radiation areas, traffic patterns, location of survey equipment, change areas, and personnel decontamination?	Yes	Specific location of controlled access points for the high radiation area corridor is designed to provide adequate control. Traffic patterns for routine tank farm activities have been evaluated as part of development of the routing and high radiation area corridor. Change areas, staging and decontamination controls can be applied at existing facilities.
	c Is the design capable of maintaining entry control for each radiological area commensurate with the existing or potential hazards within the area(s) as described in 10CFR835.501?	Yes	The design will specifically incorporates appropriate features and controls.
	d Does the design entrance of each access point to high and very high radiation have control features required by 10CFR835.502?	Yes	The design entrance(s) for the established high radiation area will be through locked access only.
	e Are equipment and controls located for accessibility and to minimize exposure to personnel under all conditions?	Yes	All operational controls are located remotely from the high radiation areas. If the operation requires termination, this can be performed from any of three manned locations, two of which are located outside the radiation area.

APPENDIX A
DESIGN REVIEW CHECKLIST
System Design Review

SY-101 RAPID MITIGATION SYSTEM			Applicable	Design Review Remarks
Item		Review Consideration	(yes/no/NA)	And Pending Actions
80	f	Are entry control points adequately sized to allow personnel and equipment access?	Yes	The entry control point(s) for the high radiation area is in an outdoor area with ample access. The entry control point for the SY tank farm provides facilities for full crew changes and appropriate monitoring and decontamination.
	g	Are exits from radiological areas adequate for personnel and equipment monitoring and decontamination?	Yes	The exits for personnel and equipment are adequate for construction, operation, and removal activities. This has been demonstrated within the last ten years by comparable system installation work performed at Tank SY-101.
	h	Has maximum distance been provided between the serviceable components and manned control locations and the substantial radiation sources?	Yes	The serviceable components and manned locations have been remotely located. Serviceable components within the Prefabricated Pump Pit have been designed as a replaceable assembly to minimize personnel exposure if service is required.

APPENDIX B

FUNCTIONAL REQUIREMENTS AND TECHNICAL CRITERIA DESIGN REVIEW MEETING MINUTES

MEETING MINUTES

SUBJECT: Design Review Group (DRG) 99-004, Design Requirements Document for the SY-101 Rapid Mitigation System

TO:			BUILDING
T. R. Benegas	G1-54	(Project)	2750E
M. H. Brown	T4-07	(DRG)	
D. L. Dyekman	S7-03	(DRG)	
C. E. Hanson	G1-54	(Project)	
A. J. Kostelnik	S7-12	(Project)	
L. S. Krogsrud	T4-07	(DRG)	
S. N. Maruvada	A3-02	(FDH)	
M. L. McElroy	G1-54	(DRG)	
R. W. Reed	T4-07	(DRG)	
G. W. Ryan	R1-44	(DRG)	
C. C. Scaief	R1-56	(DRG)	
C. P. Shaw	R3-74	(DRG)	
S. W. Shaw	G1-54	(Project)	
H. H. Ziada	R1-56	(DRG)	

FROM:	CHAIRMAN
Chris E. Jensen	Richard L. Schlosser

DEPARTMENT-OPERATION-COMPONENT	AREA	SHIFT	DATE OF MEETING	NUMBER ATTENDING
TWRS Engineering	200E	Day	February 4, 1999	16

The review of the subject design requirements was introduced by the chairman. The comments for this meeting will be documented via the meeting minutes.

The chairman emphasized that compliance with the procedural requirements for engineering documents will be adhered to for this review.

The review committee agreed that all documents that are to be generated should be captured in the Engineering Task Plan (ETP). The project people at the meeting agreed to include the documents to be generated as part of the ETP (Action Item 99-004-001).

The chairman recommended that the project advise Maintenance and Surveillance Engineering, to ensure that maintenance and calibration procedures are developed in a timely manner. The project agreed to do so (Action Item 99-004-002).

Action Item 99-004-003 (Benegas): Page 1, item 1.1, first paragraph, delete "...temporary above ground...". This is not a design requirement.

Action Item 99-004-004 (Benegas): Page 1, item 1.1, Mr. C. P. Shaw raised the issue of waste compatibility in the transfer of waste from SY-101 to SY-102. The project did not recall any studies that address the issue. The project agreed to identify this as an assumption that the waste is compatible or verify that it is compatible.

Action Item 99-004-005 (Benegas): Page 2, item 2.1, The chairman pointed out that there are several government documents missing in the list. The title of this item is to be changed to "Major" Government Documents, and Washington Administrative Code 173.303, 10CFR830.120, and DOE Order 6430.1A are required to be added to the list.

Action Item 99-004-006 (Benegas): Page 2, item 2.2, Mr. Jensen commented that the reference to ASME B31.3 was not the current edition. The current edition will be identified. Dr. Ziada and Mr. Jensen also pointed out that the requirements in HNF-PRO-097 requires that safety class process equipment shall be designed to ASME Boiler and Pressure Vessel Code (B&PVC) Section III. Dr. Ziada pointed out that the ANSI B30 standard for lifting equipment needs to be identified. Mr. Brown also pointed out that ACI requirements need to be identified as well. The DRG agreed that to limit the number of non-government documents in the list the following statement needs to be added to item 2.2: "These are the Codes and Standards identified at this time. Others may be identified as the design progresses." Mr. Benegas agreed to the actions above.

Action Item 99-004-007 (Benegas): Dr. Ziada discussed requirements for the piping codes. He explained that the requirements of HNF-PRO-097 may be able to be waived, if DOE is willing to agree. This could allow the use of ASME B31.3 with addition quality requirements. The chairman agreed that this could save significant time on the schedule, due to the significant requirements imposed by ASME B&PVC Section III.

Action Item 99-004-008 (Benegas): Page 3, item 3.0, Mr. Brown recommended that the "Flush and Dilution System" be added to the bulleted list in this section. The project agreed.

Action Item 99-004-009 (Benegas): Page 3, item 3.0, Dr. Ziada recommended that the project component interfaces be systematically identified. This should be accomplished by adding a section in this section specifically identifying component interfaces using component identification. The project agreed to add an interface matrix or list.

Action Item 99-004-010 (Benegas): Page 4, item 3.2.1, Dr. Ziada recommended that Table 3-1 be referenced in this item. The DRG also recommended the last sentence be deleted and the reference to Table 3-1 be included.

Action Item 99-004-011 (Benegas): Page 4, item 3.2.1, Dr. Ziada suggested that the safety class of the pump be identified.

Action Item 99-004-012 (Benegas): Page 4, item 3.2.2.1.1, delete the viscosity values.

Action Item 99-004-013 (Benegas): Page 4, item 3.2.2.2.1, Mr. C. P. Shaw pointed out that there is a requirement that the Reynolds number for fluid flow in piping is required to be greater than 20,000, per WHC-SD-OCD-15, to prevent plugging. The performance numbers in the design requirements may not reach the Reynolds number requirements. Mr. Reed asked if there is an ability to unplug the line, should it become plugged. The project agreed to add the requirements in WHC-SD-OCD-15 and address the unplugging issue.

Action Item 99-004-014 (Benegas): Page 4, item 3.2.2.2.2, Mr. C. P. Shaw expressed a concern that the maximum discharge head on the pump could exceed the design pressure of the transfer lines and jumper connections. The DRG recommended the pressure limit on the system be 230 psig and that pressure protection shall be considered.

Action Item 99-004-015 (Benegas): Page 4, item 3.2.2.2.2, Mr. Reed recommended that the NPSH requirements be added to this item.

Action Item 99-004-016 (Benegas): Page 5, item 3.2.2.2.3, the flow rate was discussed and the recommendation is to change it to 130 gpm to 180 gpm.

Action Item 99-004-017 (Benegas): Page 5, item 3.2.2.3.1, the DRG recommended that the maximum dilution range or factor requiring control and adjustment, the extent of the dilution, the total transfer volume, and the impact on tank waste volumes all be added to this item. In addition, the DRG recommended that the statement "Provide dilution at pump suction side" be added to this item.

Action Item 99-004-018 (Benegas): Page 5, item 3.2.2.4, the DRG recommended that the statement "either isolated or Class 1, Div. 1, Group B" replace "...non-classified..." and add "Below the PPP, pump design must meet Class 1, Div. 1, Group B".

Action Item 99-004-019 (Benegas): Page 5, item 3.2.2.5, first paragraph, this paragraph is not a design criteria, therefore it should be deleted.

Action Item 99-004-020 (Benegas): Page 6, item 3.2.2.5, the chairman suggested that the term "liquids" be replaced with "fluid media" to include solids being transported. In addition, the statement "up to 5%" needs to be deleted.

Action Item 99-004-021 (Benegas): Page 6, item 3.3.1, Mr. Brown suggested that another bullet be added: Provide drain-back to tank.

Action Item 99-004-022 (Benegas): Page 6, item 3.3.2.1, the DRG asked if the riser has been surveyed to verify the dimensions. The project agreed to provide a requirement in the text to perform a survey and as-build the riser.

Action Item 99-004-023 (Benegas): Page 6, item 3.3.2.1, the DRG recommended that the dimension 2.44 m be replaced with "junction of the primary and secondary tank walls".

Action Item 99-004-024 (Benegas): Page 7, item 3.3.2.1.2, the DRG recommended deletion of this item as it is not a design criteria.

Action Item 99-004-025 (Benegas): Page 7, item 3.3.2.1.3, the DRG recommended that this item should only state "The design of the PPP shall not amplify the pump resonant frequencies."

Action Item 99-004-026 (Benegas): Page 7, item 3.3.2.2.2, the DRG recommended that the statement "...shall not exceed...riser flange" be replaced by "shall not damage the riser or the tank", and the statement "shall not be" in the last sentence be replaced with "are considered as part of the TWRS authorization basis".

Action Item 99-004-027 (Benegas): Page 7, item 3.3.2.2.2, Dr. Ziada recommended that a new item 3.7 be added to require a structural design criteria be developed. Dr. Ziada provided the suggested wording as follows:

"3.7 Structural Design

The applied loads (Dead weight, pressure, vibration, seismic, wind, ...etc.) and load combinations for each component and structures are defined in the structural design criteria (SDC) document (TBD). The natural phenomena loadings shall be a function of the safety classes of the SSCs and evaluated in accordance with HNF-PRO-097 and DOE-6430.1A.

The SDC also provides codes and standards that are used to evaluate and qualify the SSCs of the waste transfer system."

Action Item 99-004-028 (Benegas): Page 7, item 3.3.2.2.3, the DRG suggested that the references for the cyclic reaction forces and the "existing analysis" be identified.

Action Item 99-004-029 (Benegas): Page 8, Table 3-1, Mr. C. P. Shaw expressed the concern that the waste viscosity is too high >>30 cP to properly lubricate and maintain the stability of the pump bearings. This issue needs to be addressed.

Action Item 99-004-030 (Benegas): Page 8, item 3.3.2.2.4, the DRG recommended this item be deleted. The wording should be used to prepare the new item 3.7 (see Action Item 99-004-027).

Action Item 99-004-031 (Benegas): Page 8, item 3.3.2.3.1, the DRG recommended replacing the phrase "by gravity...transfer pump" with "without plugging or be capable of being unplugged. The seal loop fluid shall be environmentally and waste compatible".

Action Item 99-004-032 (Benegas): Page 9, item 3.3.2.3.3, add the phrase "monitoring and" after the word "remote".

Action Item 99-004-033 (Benegas): Page 9, item 3.3.2.3.4, the DRG recommended deletion of this item. It is not a design criteria.

Action Item 99-004-034 (Benegas): Page 9, item 3.3.2.5, the DRG recommended the title Leak Detector be changed to Transfer System Leak Detector and that a global change also be made to the document.

Action Item 99-004-035 (Benegas): Page 9, item 3.3.2.5, the DRG recommended the statement "The drain design shall allow for adequate accumulation of waste for leak detection and for consequences given a 20 gpm leak per TSR AC 5.12."

Action Item 99-004-036 (Benegas): Page 9, item 3.3.2.6, the DRG recommended the term "Dog House Cover" be globally replaced by the term "Transfer System Cover", to reflect the term used in the authorization basis.

Action Item 99-004-037 (Benegas): Page 9, item 3.3.2.6.2, the DRG recommended the term "purging" be replaced with "venting" to reflect the actual function.

Action Item 99-004-038 (Benegas): Page 10, item 3.3.2.8, the DRG recommended that a new item under 3.3.2.8 be added for the design to prevent solids accumulation during pump shutdown.

Action Item 99-004-039 (Benegas): Page 10, item 3.3.2.8.7, the DRG recommended that where the piping material 304L is identified, it be replaced by "300L".

Action Item 99-004-040 (Benegas): Page 10, item 3.3.2.9, the DRG recommended that the 12" size requirement be deleted and the statement "minimum diameter to accommodate the safety function of the encasement" be added after "...transfer line..." in the last sentence.

Action Item 99-004-041 (Benegas): Page 11, item 3.3.2.10, Dr. Ziada recommended that the phrase "...with safety factor of 3...PPP assembly Design..." be deleted. In addition, insert the phrase "and below hook lifting" in the third sentence between "points" and "shall".

Action Item 99-004-042 (Benegas): Page 11, item 3.4.1, the DRG recommended that all of this item after the first sentence be deleted. Insert the phrase "double-encased transfer lines not physically connected to other active or inactive waste transfer lines" between "dedicated" and "transfer". Delete the phrase "...riser 13...SY-102".

Action Item 99-004-043 (Benegas): Page 12, item 3.4.2.1.3, Mr. Jensen pointed out that ASME B&PVC Section IX does not provide approved weld connection, it does provide qualification requirements for welders and welding processes. This item should be revised to state "Welders and welding procedures shall be qualified to ASME B&PVC Section IX."

Action Item 99-004-044 (Benegas): Page 12, item 3.4.2.1.4, Mr. Jensen recommended that the current edition of ASME B31.3 be corrected to 1996.

Action Item 99-004-045 (Benegas): Page 12, item 3.4.2.1.5, the chairman pointed out that the bend radius of "2R" is incorrect and should be 5 diameters. In addition, the DRG could not identify what the acronym "DRIP" is intended to represent.

Action Item 99-004-046 (Benegas): Page 12, item 3.4.2.1.6, DRG recommended that the phrase "...compatible with..Note #5)" be replaced by "to prevent precipitation of solids". The DRG also recommended including the waste temperatures in this item as well.

Action Item 99-004-047 (Benegas): Page 12, item 3.4.2.1.7, the DRG recommended deletion of this item and the last sentence be moved to item 3.4.2.18.

Action Item 99-004-048 (Benegas): Page 13, item 3.4.2.1.8, the DRG recommended adding the sentence from Action Item 99-004-046 to this item and replace the phrase "...as required...working pressure" with "to be tested in accordance with ASME B31.3".

Action Item 99-004-049 (Benegas): Page 13, item 3.4.2.1.9, the DRG recommended that this item be moved to the flush system item.

Action Item 99-004-050 (Benegas): Page 13, items 3.4.2.1.10 and 3.4.2.2.3, the DRG recommended deletion of these item as they are not considered design criteria.

Action Item 99-004-051 (Benegas): Page 13, item 3.4.2.2.1, the DRG recommended replacing "containment in the event" with "routing of waste to a leakage collection and detection pit".

Action Item 99-004-052 (Benegas): Page 13, item 3.4.2.2, the DRG recommended adding the statement "A leak detector system which complies with WAC 173.303 requirements shall be provided for the encasement".

Action Item 99-004-053 (Benegas): Page 13, item 3.4.2.2.2, the DRG recommended revising this item to be similar to item 3.4.2.1.4 except referencing the design code as ASME B&PVC Section III or authorized equivalent.

Action Item 99-004-054 (Benegas): Page 14, items 3.4.2.3.1, 3.4.2.3.2, 3.4.2.3.3, and 3.4.2.4.1, the DRG recommended the deletion of these items as they are not considered design criteria.

Action Item 99-004-055 (Benegas): Page 14, item 3.4.2.3.4, the DRG recommended the first sentence be deleted and the second sentence be revised by replacing "Hanford" with "design" and replacing "in accordance" with "compatible".

Action Item 99-004-056 (Benegas): Page 14, item 3.4.2.4.3, the DRG recommended deletion of the second sentence and the first sentence be revised as follows: "Drop leg discharge to the tank shall be accomplished without damage to dropleg or attachments. Drop leg attachments shall be designed with appropriate requirements."

Action Item 99-004-057 (Benegas): Page 14, item 3.4.2.4.4, the DRG recommended this item be revised to read the same as 3.3.2.10 (see Action Item 99-004-040).

Action Item 99-004-058 (Benegas): Page 15, item 3.5, the DRG recommended that the accuracy ranges are not required for design criteria and should be removed.

Action Item 99-004-059 (Benegas): Page 15, item 3.5, the DRG recommended addition of statements for encasement leak detector flammable gas controls. The encasement is open to the pit where there may be flammable gas controls, requiring the same classification of the encasement, with respect to flammable gas controls, as the pit. This should be identified in the interface control matrix (see Action Item 99-004-009 above). In addition, a statement "Any leak detector within an area requiring ignition controls shall be have the appropriate ignition control requirements." should be added to this item.

Action Item 99-004-060 (Benegas): Page 19, item 3.6.2.2.2, the DRG recommended wording be added to explain the reasons for limiting the amount of dilution/flush water. This explanation should include minimizing waste generation, prevention of tank over filling, and maintaining tank chemistry within acceptable limits to prevent corrosion.

Action Item 99-004-061 (Benegas): Pages 21 to 33, the DRG recommended deletion of these pages as they are facility descriptions from the TWRS BIO.

Action Item 99-004-062 (Benegas): Pages 34 to 39, the DRG recommended adding a reference to DOE Order 6430.1A.

Action Item 99-004-063 (Benegas): Page 36, item 6.6, Mr. McElroy recommended referencing NQA-1 and ASME B&PVC Section III within this item.

Action Item 99-004-064 (Benegas): Page 36, item 6.6.3, Mr. McElroy recommended rewording in accordance with the design codes to be used. As it is written now, it does not meet the requirements of NQA-1 and ASME B&PVC Section III.

Action Item 99-004-065 (Benegas): The DRG recommends that the terms service water, filtered water, and filtered service water be replaced by raw water to reflect the current term usage within TWRS.

Action Item 99-004-066 (Benegas): The DRG recommends that a design requirements matrix be developed.

Action Item 99-004-067 (Benegas): The DRG recommends that a waste chemistry compatibility determination be performed.

The chairman explained that the DRG will need to be re-convened to address the closure of these action items next week.

The meeting was adjoured.

APPENDIX C

30% CONCEPTUAL DESIGN REVIEW AGENDA, MEETING MINUTES, AND REVIEW COMMENT RECORDS

101-SY TRANSFER SYSTEM DESIGN REVIEW AGENDA/PRESENTATIONS 2/16/99

8:00am **Introduction (C. Hanson)**

8:10am **Process (B. Barton)**
- Objective
- Process Flow

8:30am **Design Definition Documents**
- ETP – T. Benegas
- DRD – S. Shaw

8:50 am **Overall Integrated System (General Overview) T. Benegas**
- P&ID
- General Arrangement
- Drawing Tree
- Interface Drawing

9:00am **Dose Rate Calculations/ALARA Overview (R. Pierson)**

9:10am **Pump (K. Morris)**
- Procurement
- Test Plan

9:30am **BREAK**

9:40am **P3 (P. Titzler)**
- Site Layout
- P3 Arrangement
- Concrete Enclosure
- Installation/Removal

10:30am **Transfer Line (S. Shaw)**
- Transfer Line
- Drop Leg
- Jumpers

11:00am **I&C (J. Wilk)**

11:30am **Power (R. Merriman)**
- Electrical Distribution

12:00pm **LUNCH**

1:00pm **Water Supply/Skid (K. Witwer)**

1:30pm **Design Documents**

- Structural (J. Strehlow)
- MEL and SDD (K. Morris)
- SEL (K. Morris)

2:00pm **BREAK**

2:10pm **Safety and Licensing (G. Ryan)**

- Hazop's
- BIO Issues

2:30pm **Questions/Directions (R. Schlosser)**

241-SY-101 TRANSFER RAPID MITIGATION SYSTEM CONCEPTUAL (30%) DESIGN REVIEW

MEETING MINUTES

Prepared by C. E. Jensen

1163 BLDG, CONFERENCE ROOM 274

February, 16-17, 1999

Design Review Team Members

R. L. Schlosser, Chairman
C. E. Jensen, Secretary/Mechanical Engineering
M. G. Al-Wazani, Electrical
M. H. Brown, Cognizant Engineer
M. F. Erhart, Chemical Engineer
R. J. Giordano, Radcon
J. D. Guberski, Environmental Compliance
R. A. Huckfeldt, Safety
D. C. Larsen, Operations Representative
D. E. McElroy, Cognizant QA
L. Pokos, Maintenance Engineering
W. J. Powell, Design Authority
R. E. Raymond, Project/KINGS
R. W. Reed, Cognizant Manager
D. A. Reynolds, Process Engineering
G. W. Ryan, Nuclear Safety and Licensing
C. C. Scaief, I&C Engineer
F. A. Schmorde, Operations Representative
C. P. Shaw, Pump Engineering
H. H. Ziada, Structural and Rigging

Design Review Guideline/Introductions

Mr. Schlosser introduced the design review committee. Mr. Hanson introduced the design team. The ground rules were explained as to the schedule, objectives, and expectations. The design team provided presentations on the 30% design.

SY-101 Transfer System Overview

Mr. Hanson provided an overview of the SY-101 Transfer system. A question on why 100,000 gallons of waste was chosen as the volume to be transferred to SY-102. It was pointed out that the operational limit is 406 inches and the projected level after the 100,000 gallons is pumped is approximately 420 inches – well above the 406 inch level. The response was with the required dilution, the total volume transferred will be approximately 200,000 gallons. Furthermore, it is expected that there will be additional transfers when the waste rises again. The 100,000 comes from the desire to reduce the level by 36 inches, to avoid overfilling the tank to a level above the primary/secondary tank interface. The project team will continue to evaluate what is required to be pumped out (Action Item 99-005-001).

Process

Mr. Barton introduced the process presentation and the objectives of the process engineering activities.

Mr. Estes provided the presentation on the process flow. A question on the viscosity was raised in that the presented waste viscosity expected is 50 to 200 cP, and the waste in the tank could be greater than 1000 cP at the pump inlet. In addition, the requirements for waste transfers requires Reynolds number of greater than 20,000. The raising of the pump suction could resolve the issue. The project team agreed to further evaluate (Action Item 99-005-002).

A question on the possibility of the 101-SY waste solidifying in the tank 102-SY was raised. The project responded that the issue is being evaluated at the 222-S laboratory. When the results are known, they will be included in the design of the system (Action Item 99-005-003).

The issue of the lack of a waste compatibility report was discussed. Concern over proceeding down a design path without knowing the compatibility of the waste is very risky. Mr. Hanson pointed out that this project is proceeding at risk with several normally series activities being performed in parallel to assure completion before the tank overflows. Mr. Barton explained that although the waste in 102-SY is not what will be there when the waste is transferred, the waste expected in the tank will be from salt well pumping. The salt well waste looks like it will be compatible at this time. Modeling is being done at this time and is expected to be complete on April 22, 1999, with a draft completed somewhere around the first of April. The project assured the review committee that one will be prepared (Action Item 99-005-004). In addition, this activity is captured in the test plan.

It was pointed out that a schedule that pulls all the activities in this project is needed. Without the waste compatibility study, required dilution of the 101-SY waste is not well known.

It was pointed out that a vapor flow chart is required to determine emissions from this activity. This is required to determine what permitting will be required. It is needed as soon as possible to get the permitting activity underway so the pumping can begin as soon as possible. The project explained that it is being prepared at this time (Action Item 99-005-005).

Design Definition Documents

It was asked if an evaluation was performed on the decision to proceed at risk. It was explained that it was identified and evaluated as part of the TBR process.

The maintenance of the pump and "bumping" to ensure subsequent use after the initial pumping was discussed. It was suggested that a "maintenance requirements document" be prepared to address this issue. It was pointed out that this issue is part of the ABU checklist in the Engineering Task Plan, HNF-4044, which is provided to the committee for review. It is necessary for the committee to review the ETP by the end of the week, including the ABU (Action Item 99-005-006).

Overall Integrated System

It was pointed out that the 100% design will be completed by April 20, 1999.

Dose Rate Calculations/ALARA Overview

Mr. Greenborg presented the dose rate calculations for the project and Mr. Pierson provided the presentation on ALARA.

It was pointed out that a probe was inserted into riser 7 in the MIT on 101-SY. The dose inside the MIT in the waste was found to be 200 R/hr. The design basis used is 400 R/hr. The committee discussed this and pointed out that this can be used as a basis for reducing the amount of the shielding and consequently the dome load from this project. The committee suggested that the measured levels be considered in the design process (Action Item 99-005-007).

A concern was raised as to the capability of the canned pump motor to withstand the radiation levels. The canned pump is designed to with stand 1000 M Rad.

A concern over the exposure from waste buildup on the equipment from operation and the affect on maintenance activities and subsequent operation of the pump was expressed. Mr. Greenborg explained that this was not considered in the evaluation. The committee suggested that this be considered by the project (Action Item 99-005-008).

Pump

Ms. Morris provided the presentation on the design and operation of the pump.

The design of the pump provides a screen on the inlet to the pump. A concern on screen plugging was raised. There are nozzles providing a screen cleaning and dilution flow. The nozzles are located on the downstream side of the screen and are directed toward the screen, clearing the screen of any debris.

A concern over the mixing of the waste in the pump resulting in excessive vibration. Mr. Hanson pointed out that this is being evaluated by PNNL and the results will be available when completed (Action Item 99-005-009).

A concern on if any debris greater than 0.25-inch diameter, such as a long small diameter wire, pass through the screen. The project agreed to evaluate this issue (Action Item 99-005-010).

The committee asked if the structural loads on the pump have been considered. It was explained that such loads will be identified in the structural design criteria document (Action Item 99-005-011).
Additional discussion on the pump stability at low speeds occurred. It was explained that the operational speeds of the pump are within a stable operating region.

Pre-Fabricated Pump Pit

Mr. Titzler provided the discussion of the pre-fabricated pump pit.

The issue of dome loading and the PPP was raised. The current design indicated a load of approximately 36,000-lb. This weight will preclude core-sampling operation in the future, due to dome loading limits. The committee requested that the design be further optimized to allow the core sampling operation to be performed in the future (Action Item 99-005-012).

The P&ID indicated that there is no double isolation of flush and dilution systems from the waste. The committee recommended that additional valves be added to V-3, V-4, V-5, and V-11 (Action Item 99-005-013).

There was a concern on the human factors and the necessity for special tooling to operate or maintain the equipment in the PPP. The project agreed to address this issue (Action Item 99-005-014).

The design of the vertical drop out of the pump assemble concerned the committee. The vertical drop provides an environment for line plugging from the waste, should the flow be stopped for some length of time. In addition, the design puts a low point in the discharge system, allowing waste or water to accumulate, potentially leading to corrosion failure. The project agreed to evaluate this issue (Action Item 99-005-015).

Transfer Line

Mr. S. Shaw provided the presentation for this item.

The committee was concerned that the tie in to an existing line could result in Washington Department of Health issues, if the line has been used or contaminated. A notice of construction and contamination control issues associated with the welding of contaminated materials would come into play. The project agreed to address the issue (Action Item 99-005-016).

A concern that there is no overpressure protection of the transfer lines. The issue revolves around the use of the variable frequency drive (VFD) unit as the method of preventing overpressure by controlling the pump speed. The project agreed to determine if the VFD meets the requirements for pressure protection and document it or provide appropriate overpressure protection to the transfer line (Action Item 99-005-017).

A concern on why the three inch line was selected in lieu of an available 2 inch line. It was explained that the 2-inch line is not a dedicated route and would need to be shared with other transfer activities. The existing 3-inch line and the new 3-inch line to it would provide a dedicated transfer route to 102-SY. In addition, based on available documentation, the line has not been used to transfer waste.

The issue of critical velocity precipitation of solids in the line was raised. The design requirement is to maintain a 6-fps velocity to prevent precipitation of solids in the line. The committee requested that the use of the 3-inch line will maintain a sufficient velocity to prevent precipitation of solids in the line and subsequent plugging (Action Item 99-005-018).

It was also pointed out that process documentation for this project is essential.

The use of the piping codes was discussed. The SY farm used ASME B31.1, the Power Piping Code. The other code used for transfer systems in TWRS is ASME B31.3, Process Piping Code. The use of the appropriate code and reconciliation between the original and the code to be used needs to be done. In addition, proper quality assurance requirements need to be incorporated for the containment piping which is a safety class component (Action Item 99-005-019).

There was a concern on the integrity of the existing 3-inch line. It was installed with the farm and as indicated by existing documentation not used or tested. It is not clear if the line has been cathodically protected over the years. The project agreed to check on the operation of the cathodic protection system and the integrity of the line and assess the risk of using the existing line (Action Item 99-005-020).

The potential plugging of the down leg in tank 102-SY is a concern. The lower temperature of the waste in 102-SY around the down leg could lead to solidification of the waste from 101-SY. Or could the line plug from the waste crystallizing from 102-SY. The project agreed to evaluate this issue (Action Item 99-005-021).

Instrument and Control

Mr. Wilk provided the presentation on this subject.

The committee questioned that there are no interlocks from the leak detectors to the waste pump and the water skid pumps. The accident prevention and mitigation use of the leak detectors will be accomplished through operator action. The operators have 30 minutes in which to shut down the pumps. This is within the authorization basis. This, however, requires alarms to be safety class. The selected SC alarms have not been identified. The project will identify the appropriate SC alarms (Action Item 99-005-022).

A concern on how the effectiveness of dilution within the pump is determined. The committee recommended that the project evaluate a method such as measuring specific gravity or mass. The project agreed to evaluate (Action Item 99-005-023).

It was recommended that the local instrument read out panels be oriented to be read out of direct sunlight. In addition, the instrumentation needs to be relocated to away from the PPP or, for those that cannot be removed, provision for placement of temporary shielding be provided (Action Item 99-005-024).

A question was asked about the transfer of 101-SY waste into 102-SY and if that will cause 102-SY to become classified as a hydrogen-generating tank. The project assumption is that it will not become a hydrogen-generating tank.

Power

Mr. Merriman provided the presentation on this subject.

The design of the PPP electrical penetrations needs to be changed due to radiological concerns over streaming through the penetrations. It was suggested that the penetrations be placed at an appropriate angle to prevent unnecessary exposure (Action Item 99-005-025).

Water Supply/Skid

Mr. Witwer provided the presentation on this subject.

The committee asked that the design limits and bases be provided. This includes the temperature limits (upper and lower), flow ranges, critical velocities, and dilution rates for the dilution and flush water (Action Item 99-005-026).

The committee requested that a "horn" be added as an audible alarm in addition to the visual alarms. And that the action on low water tank level be shut down the heat trace system and not the pumps, to prevent precipitation and subsequent plugging of the transfer lines and pump (Action Item 99-005-027).

The committee also recommended that check valves be added to the discharge of the pumps to prevent recirculation of water to the shut down parallel pump (Action Item 99-005-028).

The committee requested that heat tracing be added to the skid (Action Item 99-005-029).

The committee was concerned with the head and flow rates supplied by the skid pumps. The head that can be generated by the pumps exceed the design limits of the transfer piping. The committee recommended that design flow rates be determined for the dilution and flushing and the pumps sized appropriately (Action Item 99-005-030).

It was requested that consideration be made to not place the water skid on a trailer and just left on a skid to eliminate the need to bring a truck into the farm to move it. The project agreed to look at this issue (Action Item 99-005-031).

It was pointed out that a LCO or engineered feature be used to prevent the dilution/flush water from accidentally being left on to run into 101-SY and cause, by dissolving the waste crust, a GRE. The preferred method is an engineered feature. The project agreed to evaluate this issue (Action Item 99-005-032).

Design Documents

Mr. Strehlow discussed structural design.

The assumption of the use of the plastic hinge for the pump assembly was explained. He further explained that the pump assembly cannot withstand the current UBC 1997 seismic requirements. The pump assembly was built to withstand UBC 1994 requirements (the required code at time of design). The pump will yield during the current design seismic load requirements. It was pointed out that the plastic hinge design limits the loads on the tank and the PPP, protecting them from damage due to pump assembly seismic response.

It was asked if we can accept a plastic hinge in the pump assembly. It was explained that the point of the plastic hinge only contains process, dilution, and flush piping. There is no pump shaft. There should not be a problem from a hypothetical plastic hinge.

A concern was raised on the fact that the current codes and standards required by HNF-PRO-097 and the DOE Orders may not be met by the current design. There may be a need for an exemption to the HNF-PRO-097 and DOE Orders. This design code issue above also needs to be identified and discussed in the structural design criteria document. The project agreed to resolve this issue (Action Item 99-005-033).

The committee recommended that the structural design criteria document include a discussion on the use of "beyond design basis accident" design loads in the analysis, vibration loads on the pump assembly, and the use of the plastic hinge analysis (Action Item 99-005-034).

It was asked if there is a requirement to consider the effect of a burn event on the pump assembly and the PPP. The project agreed to address this issue (Action Item 99-005-035).

The structural analysis of the drop leg was not significantly discussed. The structural analysis of the drop leg in 102-SY needs to be provided (Action Item 99-005-036).

It was asked if the computer codes being used in the structural analysis have been properly validated. It was explained that there are several methods of validation and that the project will validate the analysis in accordance with procedures (Action Item 99-005-037).

The location of the PPP is just above two existing transfer lines. If the analysis demonstrates the need for a "protective bridge" to take the load off the transfer lines, an independent review of the design will be required, by an independent qualified registered professional engineer, as defined in the Washington Administrative Code, Section 173.303. The project agreed to resolve this issue, should it become an issue (Action Item 99-005-038).

Ms. Morris provided a presentation on the SDD, MEL, and the SEL.

The committee suggested that the critical characteristics be included in the SEL for safety class and safety significant components (Action Item 99-005-039).

Safety and Licensing

Mr. Van Keuren provided the presentation on HAZOPs and BIO.

There were no actions as a result of this subject.

Questions/Directions

Mr. Schlosser requested any further discussion or questions.

The committee suggested that a pump startup management plan be provided for the water skid and the transfer pump (Action Item 99-005-040).

The committee suggested that the existing transfer lines being used be tested to determine the integrity. This needs to be included in the test plan for the project (Action Item 99-005-041).

It was pointed out that on the water skid there are high-pressure gas bottles designed for forcing flush water into the piping and transfer pump. The high-pressure gas, when released into the piping, will expand and freeze the water line or the waste line. The committee recommended that the system be analyzed and the lowest pressure gas be used (Action Item 99-005-042).

The committee recommended that the project re-consider cutting down the 42-inch riser and routing the new transfer line to eliminate the vertical drop plugging and the low points issues (Action Item 99-005-043).

The issue of heat load reduction in 101-SY due to removing waste also needs to be addressed by the project (Action Item 99-005-044).

The committee strongly recommends a contingency plan be developed and ready to go in the event that the proposed design has a failure in the existing transfer line being used (Action Item 99-005-45).

Mr. Schlosser explained the importance of completing the discipline reviews by Monday, February 21, 1999. Comments are to be sent to Mr. Schlosser and Mr. Zaman for incorporation into an official Review Comment Record.

The meeting was adjourned.

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 1 of 27

5. Document Number(s)/Title(s)	6. Program/Project/ Building Number	7. Reviewer	8. Organization/Group	9. Location/Phone
SY101 RAPID Mitigation System 30 % Design Review	TWRS	Design Review Team	TWRS	2750E/A114 376-7725

17. Comment Submittal Approval:

Organization Manager (Optional)

10. Agreement with indicated comment disposition(s)

Date

Reviewer/Point of Contact

Author/Originator

11. CLOSED

Date

Reviewer/Point of Contact

Author/Originator

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
	GENERAL			
1.	It was pointed out that the operational limit is 406 inches and the projected level after the 100,000 gallons is pumped is approximately 420 inches – well above the 406 inch level. The 100,000 comes from the desire to reduce the level by 36 inches, to avoid filling the tank to a level above the primary/secondary tank interface. Provide the waste volume to be removed from SY-101 and the rationale for selection (Action Item 99-005-001).		The SLRRP was tasked with removing a volume of waste from tank 241-SY-101of 100 to 150 Kgal (HNF-3824, Tank 241-SY-101SLRRP Plan). There was no requirement placed upon the initial transfer to achieve a waste level of 406 inches in the tank. The premise of the initial transfer was to create sufficient operational volume in tank 241-SY-101 to permit back dilution with a volume of water roughly equivalent to the volume of waste removed. It is believed that this back dilution should dissolve most of the nitrite solids within the crust (82100-99-0125, DILUTION STUDIES OF TANK 241-SY-101 WASTE PRELIMINARY REPORT). It is also believed that this dissolution of nitrite solids within the crust will sufficiently alter the structure of the crust to allow the discrete gas bubbles located in the lower regions of the crust to be released.	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No.	**4. Page**
N/A	2 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
1.	(continued)		The actual volume of waste to be removed during by the initial transfer, per the recent revision to HNF-IP-1266, will be determined and transmitted via Process Memo immediately prior to transfer operations.	
2.	The presented waste viscosity expected is 50 to 200 cP, but the waste in the tank could be greater than 1000 cP at the pump inlet. With a requirement for waste transfers to have a Reynolds number of greater than 20,000, the required flow velocity has a wide variability. Raising of the pump suction could resolve the issue (Action Item 99-005-002).		Accept, Pump Suction Elevation raised 8'-6" above the tank floor.	Closed
3.	A question on the possibility of the 101-SY waste solidifying in tank 102-SY was raised. The issue requires evaluation and incorporation of results in the design of the system (Action Item 99-005-003).		The waste solidification issue has been analyzed in the 222S Lab's dilution studies supporting the SLRRP (82100-99-015). The minimum dilution for transfer of tank 241-SY-101 wastes to tank 241-SY-102 is 1 part water:2 parts waste. At this dilution, about 70% of the mass of solids in the transferred waste will ultimately be dissolved. Further dilution and subsequent dissolution of solids will occur when the transferred waste slurry is placed in tank 241-SY-102. The end result is that there will always be some 241-SY-101 solids that will not dissolve and will eventually settle out in tank 241-SY-102, but the mass of solids will be small (~<5%). An additional concern involves the phosphate concentrations in the inflowing SST salt will wastes to tank 241-SY-102. At the start of the tank 241-SY-101 transfer, the bulk phosphate concentration in the tank 241-SY-102 supernate may be sufficient to create phosphate precipitation concerns when the concentrated salt wastes from tank 241-SY-101 come in contact with the supernate (HNF-SD-OCD-015, Waste Transfer Compatibility Program). The SLRRP transfer system minimizes these concerns via the design of the drop-leg in tank 241-SY-102. The slurry distributor at the end of the drop-leg is located 160 in above the tank bottom with the flow outlets creating a large horizontal	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No.	**4. Page**
N/A	3 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
3.	(continued)		velocity component to the discharged slurry wastes. CFFD modeling by PNNL indicates that the incoming tank 241-SY-101 waste slurry streams will be rapidly diluted with large volumes o f tank 241-SY-102 supernate. This statement can be interpreted that within a few seconds of discharge from the slurry distributor, any volume of tank 241-SY-101 slurry will be diluted with >10 volumes of tank 241-SY-102 supernate. This dilution is rapid enough such that any conditions conducive to phosphate precipitation (>0.1Mphosphate + 8.0Msodium) will not exist long enough to result in solids precipitation.	
4.	A waste compatibility report has not been prepared to support the current design. Proceeding with design without knowing the compatibility of the waste is very risky. It was explained that the waste in 102-SY will be transferred prior the transfer from 101-SY and that the waste expected in 102-SY is anticipated to be from salt well pumping. The projected salt well waste appears to be compatible at this time. Modeling is being done with an expected completion of April 22, 1999, with a draft of the waste compatibility report anticipated for early April (Action Item 99-005-004).		Reject: Waste Compatibility Assessment is scheduled in the Project Plan (Activity ID 3Y47ECE). (SDE)	Closed
5.	It was pointed out that a vapor flow chart is required to establish projected emissions from this activity to determine what permitting will be required. Permitting activity may become a timely process, therefore, identification of emissions is critical for success of the design (Action Item 99-005-005).		Accept: If requested, Process Engineering can provide air emission material balances if ESH&QA supplies Process Engineering the methodology to determine VOC and airborne contamination emissions (e.g., W-320 lessons learned?). Estimating ammonia emission can be performed via known physical laws and Hanford modeling work. (SDE)	Closed
6.	Maintenance of the pump and "bumping" to ensure subsequent operability after the initial pumping was discussed. It was suggested that a "maintenance requirements document" be prepared to address this issue. It was pointed out that this issue is part of the ABU checklist in the Engineering Task Plan, HNF-4044, which has been provided to the committee for review. It is necessary for the committee to review the ETP including the ABU (Action Item 99-005-006).		Accept (TRB 3/19/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 4 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
7	The dose inside the MIT in riser 7 of 101-SY in the waste was found to be 200 R/hr. The design basis used is 400 R/hr. The committee suggested that the measured levels be considered to reduce required shielding and consequent dome loading (Action Item 99-005-007).		Accept (PAT 3/17/99)	Closed
8	Commercial Grade Item dedication documentation is required for all Safety Class SSCs (MGA).		Partially Accept – Only for Commercial Items – Not Engineered Equipment (TRB 3/17/99)	Closed
9	Permanent and temporary portions of the system need to be clearly identified. Applicable documentation requirements for each category of change should be specified (MLM).		Accept – To be identified in SDD (TRB 3/17/99)	Closed
10	A pump startup management plan should be provided for the water skid and the transfer pump (Action Item 99-005-040).		Accept: Process Engineering provides system operational direction via the Process Control Plan (scheduled in the Project Plan; Activity ID 3Y47CL). (SDE)	Closed
11	Reconsider cutting down the 42-inch riser to allow routing of the new transfer line to eliminate the vertical drop and associated potential for plugging and an undrained low point (Action Item 99-005-043).		N/A Design Changed to aboveground Line.	Closed
12	The issue of heat load reduction in 101-SY due to removing waste also needs to be addressed (Action Item 99-005-044).		Accept: Process Engineering provides technical justification via the Process Control Plan Plan (scheduled in the Project Plan; Activity ID 3Y47CL). The general idea is that while heat load reduction will cause more solidification of remaining waste, the 100 kgal back dilution will more than make up for any adverse affect of tank cooling. Additionally, annulus ventilation rates may be reduced thus reducing tank heat loss. (SDE)	Closed
13	A contingency plan should be developed and ready if the existing transfer line to be used is not acceptable (Action Item 99-005-45).		The 30% below ground design has been abandoned. Based on the meeting of Feb. 22, 1999 (Meeting minutes TBD-003), the RAPID system design will now pursue the contingency overground design as the only available option that will meet existing criteria and resolve uncertainties associated with the below ground design. (SWS 3/5/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 5 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
14	The design needs to be evaluated for critical spares. In addition to spare components and assemblies, recommended spares need to include consumable gaskets, fasteners, and other items necessary to remove or install components and assemblies (RLS).		Accept (TRB 3/17/99)	Closed
15	The design needs to include all special tools, fixtures, and hardware necessary for installation and removal of components and assemblies (RLS).		Accept (TRB 3/17/99)	Closed
16	What would be the action taken in the event the crust fractures and falls to the bottom of the tank and blocks suction (RJG)?		The pump is now well above the bottom of the tank so this scenario is unlikely to affect the pump. If the crust fractures and blocks pump suction, dilution water flow will continue, ensuring continued pump flow. The transfer would be stopped based on material balance. (KHM 5/12/1999)	Closed
17	Is crust fracture and pump suction blockage a credible event, see FMEA comment for transfer pump (RJG)?		See item 16 answer. This is actually a safety analysis question. John VanKeuren has conducted HAZOP analyses against the system rather than FMEA. This method is within the requirements of Hanford Procedure, HNF-PRO-704, *Hazard and Accident Analysis Process* (KHM 3/5/1999)	Closed
18	The suction point in SY-101 needs to be specified, various levels have been mentioned (RJG).		Accept See comment/disposition on #7.	Closed
19	If there were a need to shift position during the course of this activity, how would this be accomplished (RJG)?		Pump intake has been moved to 8'-6". Since this is significantly below the level of the mixer pump suction and the transfer is limited to not exposing the mixer pump suction, there is no requirement to shift the position of the pump. (TRB 5/12/99)	Closed
	TRANSFER PUMP			
20	Exposure from waste buildup on the equipment from operation and the effect on maintenance activities and subsequent operation of the pump needs to be addressed (Action Item 99-005-008).		Waste Buildup on the transfer pump is being addressed through design and procedures. A spray ring to decontaminate the outside is designed for transfer pump removal. Procedures for periodic flushing of the interior are being written. The pump will be installed and filled with water in the dilution, discharge, and purge lines and periodically flushed until use. After use, it will also be flushed periodically. (KHM 5/10/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 6 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
21	The project should address mixing of the waste in the pump that could result in excessive vibration (Action Item 99-005-009).		The pump operation was witnessed during testing and it is apparent through engineering judgement that vibration is not an issue with this pump. When the pump is run at shutoff, so that the hydraulic noise was removed from the process lines, there is no noise or motion coming from the pump. In order to determine the pump is operating (besides reading output from the VFD and the accelerometer) one needed to place a hand on the pump column to discern a slight hum. The pump was tested with dilution flow added, again with no apparent vibration. The test report will document this; the report is due from the test vendor in mid-May, after which it will be released as a Hanford supporting document. (KHM 5/10/1999)	Closed
22	Debris greater than 0.25-inch diameter, such as a long small diameter wire, could pass through the pump suction screen. This should be evaluated for impact on pump and system performance (Action Item 99-005-010).		A small wire, less than or equal to 0.25" in diameter, would be chopped up by the pump impellers. It may nick the impeller, but would not hinder operation of the pump. (KHM 5/10/1999)	Closed
23	Structural loads on the pump need to be addressed in the applicable design criteria (Action Item 99-005-011).		Accept. The structural loads, load combinations and acceptance criteria for the PPP will be contained in a Structural Design Criteria document. Structural loads from the pump will be defined in this document. (JPS 3/5/99).	Closed
24	Do the pump, variable frequency drive, or any of their components have a limited shelf life, requiring replacement prior to operation? The 702-AZ ventilation system drives had component (capacitor) failures when initially placed in service due to shelf life limitations (MGA).		The pump has no components with limited shelf-lives. It is a single unit designed for 10 year service. The VFD has preventive maintenance requirements (i.e., dust components, check fuses) which are recommended. There are parts, when not used, whose life is reduced. Two spares are on order. (KHM 3/19/1999)	Closed
25	Are there any specific ventilation requirements for the VFDs (MGA)?		The VFD requires 512 cfm. (KHM 3/5/1999. The VFD chassis has a fan built into it, which the vendor said is rated for up to a 250 HP Drive. Vendor is design building the VFD cabinet we will be using and will size the enclosure inlet and outlet opening. (REM 3/16/99) .	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.	3. Project No.	4. Page
3-4-99 (5/13/99 Status)	99-005	N/A	7 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
26	Provide the manufacturers' test data for the pump motors and the VFDs as part of the certified vendor information (MGA).		Accept. CVI 50071 will contain the following: 1) Test Report, 2) Design Report, 3) Complete Vendor drawings (on AutoCAD) 4) Robicon Operation and Maintenance Manual, and 5) the Operation and Maintenance Manual for the Pump system (Pump and VFD). (KHM 3/5/1999)	Closed
27	Install the VFDs to meet specified vendor requirements (MGA).		Accept – Installation will be per the Manufactures recommendation and will be inspected by the vendor technical represenative. (REM 3/16/99)	Closed
28	Based on potential use of the VFD to provide overpressure protection for the transfer lines, should it be designated Safety Class or Safety Significant (MGA)?		The pressure regulation problem (limit of 230 psig in the old underground line) is gone now that the overground line is to be used. Note that the transfer line is general service and the overpressure protection would have been to meet code, not safety classification requirements. (KHM 3/5/1999)	Closed
29	Have potential circuit board failures in the VFD been considered (MGA)?		There's two spares. (KHM, REM 3/19/1999)	Closed
30	Reconcile use of a pump constructed to 1994 Uniform Building Code (UBC) requirements with installation subject to the 1997 UBC. A comparison matrix indicating changed requirements and the method by which the design is acceptable as compliant would suffice (MLM).		The 1994 version of the UBC is to be followed at the Hanford Site for applications that call for the use of the UBC. The 1996 PHMC contact specifies the codes and standards that will be followed, which includes DOE Order 5480.28, *Natural Phenomenon Hazards Mitigation*. Therefore, compliance with the DOE Order 5480.28 is required. This Order in turn specifies the use of DOE-STD-1020, *Natural Phenomenon Hazards Design and Evaluation Criteria*, which was based on the 1991 version of the UBC. HNF-PRO-97, *Engineering Design and Evaluation*, was developed to ensure compliance with DOE Order 5480.28 and DOE-STD-1020. During the development of HNF-PRO-97, it was decided to use the most recent version of the UBC (1994 version) rather than the 1991 version. The 1994 version of the UBC is similar in content to the 1991 version of the UBC and it meets the requirements contained in DOE Order 5480.28 and DOE-STD-1020. Therefore the 1994 version of the UBC is the current PHMC baseline. (JPS 3/1999)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 8 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
31	The electrical feeders for the pump (at least the second pump) should be extended such that the junction box for the pump is external to the PPP structure. The first pump connection should be reviewed to determine if connections can be made external to the concrete structure. This will eliminate complicated, time-consuming pit entries (RJG, RLS).		The motor connection cable is 20 feet long and the motor termination will be made outside the PPP for the original and second pump. (REM 3/19/99)	Closed
32	Has a Failure Modes and Effects Analysis been performed for the pump to determine risk (RJG)?		There is no FMEA for the pump. See response to item 17. (KHM 5/12/1999)	Closed
33	Please indicate expected crud traps that will not be easily flushed (e.g., thrust bearing area) and determine expected dose on pump when removed for maintenance or disposal to confirm the 300 mr/hr value stated in the review (RJG).		Accept, analysis in progress. (KHM 3/5/99)	Closed
34	Please provide the drawings/references to show the true path of the water dilution in the transfer pump (WJP).		A good reference for this is from the Design Report (CVI 50071), Table 5-15 and Figure 5-18. These are the "Transfer Pump Internal Circulation Results - Dilution Line Analysis," and the "Transfer Pump Hydraulic Circuit Model - Dilution Line Operation," respectively. I will get you a copy. (KHM 3/5/1999)	Closed
35	What are the critical dimensions of the liquid passageways (WJP)? Why do we think that <1/4 inch solids will not plug the line (WJP)? Has the transport of ¼ inch solids been tested or can the condition be tested for the pump (RLS)?		Part 1. The critical dimension for not plugging the pump is 0.25 inch based on the smallest dimension in the pump. Part 2 and Part 3. The 0.25 inch restriction is based on the dimensions in the pump and not testing (dimensions are well known). Plugging with smaller particles (#110 sand) has been done and shown to be purged (see Design Report, Section 12.0). Testing in 1/4" solids is not being pursued for schedule reasons. It could be done, but I don't recommend it, since the pump will pass items smaller than 0.25 inch, but at what concentrations? Is this a single particle at a time or several or hundreds? What would be the basis for concentration of particles of the agreed-upon size? The samples to date have shown none this large and the number that fall outside 2 sigma are still not very large (see Onishi's handouts for transport discussions). (KHM 3/5/1999)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 9 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
36	It is recommended that the transfer pump inlet be raised to about the distance of the mixer pump inlet. This will allow the transfer pump to not get into solids on the bottom of the tank. Also the viscosity should be less in the chewy center of this little nugget (WJP).		Accept, see disposition to comment #7.	Closed
37	Has a review of this pump been done for the system operating conditions? This review should have included materials of construction, finishes, flow and performance data review, among others. Provide or reference documentation (WJP).		The contents of the CVI file contain this review (see Item 26). The pump was designed to provide transport of fluids between 1 to 30 Cp with minimum conditions of 53 gpm at system head of 19 ft to 140 gpm at system head of 450 ft. With reduced efficiency, the pump can provide transfer of higher viscosity fluids and other conditions. How high viscosity / high specific gravity is being investigated and a letter report from the manufacturer's analysts is expected by the end of March 1999. For a more detailed information on the existing analysis, see the design files. (KHM 3/5/1999)	Closed
38	For testing of the pump, add testing/operation with dilution water in 1.7 specific gravity liquid if we can find anyone that will do it (WJP).		Currently, the above-mentioned analysis is planned rather than testing due to schedule restraints and lack of vendors willing to test in simulants; indications the pump experts the risk associated with this approach is manageable. (KHM 3/5/1999)	Closed
39	Can we determine if the pump can pump SY-101 waste through our system without overpressurizing the line (WJP)?		Yes. See comment 13 above. By use of the overground transfer line, the primary line can be designed with a working pressure rating sufficient to accommodate the maximum discharge pressure of the pump. In addition the pump speed is controlled and cannot "run away" past the frequency at which it is set. (SWS 3/5/99, KHM 3/19/1999)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 10 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
155	The design needs to provide estimates of the waste flow rate due to the pump and system, or system flows and pressure. Provide system flow and pressure curves, and the appropriate pump and performance curves. Estimated dimensions for the flow paths and pressure losses due to fittings and specific gravity of solutions are required to determine flow rates and pressures.	H	This is planned, but the design and system conditions must be defined. For instance, a system curve is possible assuming SY-102 completely full or completely empty because the drop-leg is in the waste. Right now, the level of SY-102 at the time of transfer has not been defined. Note that, a true system "curve" is a differential equation during operation (loss of head in SY-101 and gain in head in SY-102). These curves will be provided when the design is finalized and are estimated until then. (KHM 3/19/1999)	Closed
156	Give flow path dimensions of the pumps to determine: 1. What size of "needle shaped particle" could get through the pump (WJP). 2. What size of particle could plug the flow path in the pump. The two flow paths critical are internal to cooling/lubricating the pump and plugging the main flow paths (WJP).	H	See also the response to comment number 22. Item 1. A needle shaped particle, not small enough to pass through the pump's passages, would be chopped up by the pump impellers. Item 2. Many particles > 0.25 inches in diameter would be necessary to plug the pump. A single particle would not suffice. In the *Tank Characterization Report for Double-Shell Tank 241-SY-101*, the particle size distribution from the worst case sample shows a mean particle size of 18 microns with a standard deviation of 37.6 microns. If two standard deviations are added to 18 microns, a very rare particle of 93.2 microns would result. This is far smaller than the 0.25 inch particle (0.635 cm) particle needed to plug the pump, and because of its rarity, it is apparent there would be very few particles in even the 100 micron (0.01 cm) range. Particles of this size cannot plug the pump. No particles were measured greater than 18 microns according to the report. (KHM 5/10/1999)	Closed
	PREFABRICATED PUMP PIT			
40	The current design of the PPP will add a dome load of approximately 36,000 pounds. The design needs to be further optimized to allow the core sampling operations to be performed in the future (Action Item 99-005-012).		Accept - Design has been changed to a metal box to reduce the total weight. (PAT 3/17/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date 3-4-99 (5/13/99 Status)	2. Review No. 99-005
3. Project No. N/A	4. Page 11 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
41	The P&ID provides single valve isolation of flush and dilution systems from the waste. The committee recommended that double isolation valves be added at the locations of V-3, V-4, V-5, and V-11 (Action Item 99-005-013).		Accept – Valves have been installed in all locations to provide double isolation. (PAT 3/17/99)	Closed
42	Human factors and the necessity for special tooling to operate or maintain the equipment in the PPP need to be addressed (Action Item 99-005-014).		Accept – Human factors have been considered in valve locations and operation. See disposition of comment 15 for applications requiring special tooling. (TRB 5/12/99)	Closed
43	The vertical drop from the pump assembly provides an environment for line plugging from the waste, should flow be stopped for some length of time. In addition, the design puts a low point in the discharge system, allowing waste or water to accumulate, potentially leading to corrosion failure (Action Item 99-005-015).		Accept – new transfer line design initiated.	Closed
44	Incorporate a decontaminable lining or coating and rounded internal corners in the PPP design. This will be beneficial for maintenance as well as terminal clean out and decommissioning (MLM, RJG, RLS).		Accept – Decontaminable coating can be added if required. Rounded internal corners have been included in the design. (PAT 3/17/99)	Closed
45	Replacement of the pump is a critical should seismic or other conditions warrant. The design needs to include provisions (including removal hardware) for pump removal and replacement. Also, procedures and training need to be developed to enable timely pump replacement (MLM).		Partially Accept. The installation of the transfer pump into SY-101 will be preceded by the insertion of a water lance, which will assure that the pump can be installed without hitting any obstructions. This will assure that the pump will not need to be removed during the installation process. After the pump is installed, if a need should arise for removing the pump, Operations will prepare a Pump Removal Work Package. This package will cover how the pump will be removed. The current plan is NOT to use the Long Length Contaminated Equipment (LLCE) System.	Open

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 12 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
45.	(continued)		The pump has a very smooth outer surface, making it very easy to decon, using the built-in spray ring that is part of the PPP design. Prior to pulling the pump out, flush water hoses will be mounted onto the three discharge points of the pump the waste line, the pump flush line, and the dilution line, and the package will be written so that the internal surfaces of the pump can be flushed using these lines during removal.The pump will be lifted out of the tank, flushing both the external surfaces as well as the internal surfaces. It will be pulled up into plastic sleeving material. The pump will be laid down in an appropriate place in the farm. A decision will have been made regarding whether to cut up the pump for disposal, dispose of in w/o cutting it up, or try to save a part of the pump for re-use. This process is very similar to that used by the Saltwell Pumping program.	
46	The PPP structure needs to include design provisions for addition of temporary shielding to reduce streaming, minimize exposure during routine operations and maintenance, and facilitate decontamination. The structure should provide mounting or anchor points for temporary shielding placement (RLS, RJG).		Accept - The current design includes provision for additional temporary shielding. (PAT 3/17/99)	Closed
47	PPP penetrations should be at an angle to prevent radiation streaming. There appears to be a device/panel installed on the structure internal wall (H-14-100501). This should be confirmed to be an absolute need since access to this area after operation would be highly complicated and decontamination could be required (RJG).		Accept - Radiation streaming has changed due to the adoption of a metal enclosure. Temporary shielding will be added when needed. Internal box has been reviewed and is still required. (PAT 3/17/99).	Closed
48	Based on dose analysis, temporary shielding designs should be provided wherever conventional shielding such as lead blankets do not provide effective dose reduction for personnel (RLS).		Accept - The new design has provisions for temporary shielding as needed. (PAT 3/17/99)	Closed
49	The PPP structure should be designed for removal. Pick points should be installed, preferably external and the same as the temporary shielding supports (RJG).		Accept (PAT 3/17/9)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 13 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
50	The method of sealing the PPP penetrations should be specified (RJG).		Accept (PAT 3/17/99)	Closed
51	The area inside the PPP annular support should be particularly designed to support decontamination, since the soft seal may be the weak point in the contamination control path from the riser/tank internal spaces (RJG).		The soft seals in question between the enclosure and shield plug has been eliminated in the current design. (PAT 3/17/99)	Closed
52	The type of "soft seal" should be described. What is service life of seal intended to be? This is the prime contamination barrier for spray leaks in the PPP. Maintenance activities to replace this seal should be understood and addressed by the design (RJG).		This seal has been eliminated. (PAT 3/17/99)	Closed
53	The PPP design includes a low points must be pumped to remove accumulated fluid. If leakage occurs, this low point could retain a significant radiation source. Shielding design needs to accommodate this potential hot spot (RLS).		Low point has been removed as a new transfer line design is in place. (PAT 3/17/99, SWS 3/5/99)	Closed
54	The PPP design includes a low points must be pumped to remove accumulated fluid. The capacity of the sump pump must be sufficient to remove leakage corresponding to the Authorization Basis analyses. Does the sump pump meet the current analyzed leak rate (RLS)?		N/A- new transfer line design initiated.	Closed
55	The discharge piping flush connections should include a lateral to the low point elbow to reduce hot spot collection/crud trap point. If the discharge line itself could be a 45, this would also reduce this crud trap (RJG). The flushing line should be ¾" or 1" diameter (WJP).		N/A- new transfer line design initiated.	Closed
56	The discharge piping and encasement low points should be designed to allow drainage (RLS).		N/A- new transfer line design initiated.	Closed
57	Provision should be made to mechanically affix a transfer sleeve to the top of PPP assembly to support removal of the transfer pump in a contained environment. Removal of leaking flex connections can also be contained using this same capability. The pit cover (or an alternate pit cover) could be designed to support engineered containment for work in the PPP (RJG).		Accept – A space to install transfer sleeve has been provided. (PAT 3/17/99).	Closed
58	Should an objective of the design be to remove the PPP assembly and restore Riser 007 to the as-found condition that exists today when this activity is finished? If this is an objective, the PPP structure should be equipped with lifting connections (RLG).		Accept, lifting point provided (PAT 3/17/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.	3. Project No.	4. Page
3-4-99 (5/13/99 Status)	99-005	N/A	14 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
59	If an above ground transfer option is selected, the design should reconsider the PPP orientation shown on drawing H-14-103504. It may have to be rotated to support desire to run line to northeast to get off dome area as soon as possible instead southwest orientation currently shown (RJG). For long term installation, it may be desirable to orient the pit to be squared with existing pits (WJP)		Accept – will be considered. (PAT 3/17/99)	Closed
60	How is operations supposed to maintain water in the drain within the 42 inch riser? Provide a fill port, or equal (WJP).		Accept (PAT 3/17/99)	Closed
61	Use the design of the encasement plug that has been approved and is in use in tank farms on drawing H-14-103452 (WJP).		Reject -The encasement plug is not used in the new design. (PAT 3/17/99)	Closed
62	Use (2) 45 degree elbows instead of (2) 90 degree elbows on drawing H-14-103431 to assure that the system does not plug (WJP).		N/A- new transfer line design initiated.	Closed
63	Add a valve next to the 1" or ½" flush line next to the 90 degree bend in the waste line in the metal pit shown on H-14-103502 (WJP).		N/A- new transfer line design initiated.	Closed
	TRANSFER LINES			
64	Tie-in to an existing line could result in Washington Department of Health issues if the line has been used or is contaminated. A notice of construction and contamination control associated with the welding need to be addressed (Action Item 99-005-016).		N/A- new transfer line design initiated.	Closed
65	The design provides no overpressure protection devices for the transfer lines. If the variable frequency drive (VFD) unit is used to prevent overpressure by controlling the pump speed, the design must be demonstrated and documented to be compliant with design code requirements for pressure protection (Action Item 99-005-017).		The new design precludes the need to limit the pressure to 230 psig. However, should the VFD be used, the Factory Mutual representative, John Densley, said the use of the VFD was within code. (communication with F. M. Hauck, 2/23/99) (KHM 3/19/1999)	Closed
66	The critical velocity to prevent precipitation of solids in the line was taken to be a maintained 6-fps. This velocity has not been validated (Action Item 99-005-018).		This velocity (in fact a minimum of 4 FPS) was established via process engineering memo: Estey, S. D., 1999, "Anticipated Dynamic Viscosity and Solids Concentration of Slurries Produced During the Dilution and Transfer of Tank 241-SY-101 Wastes to Tank 241-SY-102," (Internal Memo number 74B50-99-017, to W. J. Powell, Feb. 11), Lockheed Martin Hanford Company, Richland, WA	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 15 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
66	(continued)		And Conner, J. M., 1999, "Estimated Properties of Tank 241-SY-101 Waste Affecting Dilution and Transfer," (Internal Memo, DRAFT, to W. J. Powell, Feb. 26), Lockheed Martin Hanford Company, Richland, WA. (SWS 3/5/99)	
67	The SY farm was designed to ASME B31.1, the other code used for transfer systems in TWRS is ASME B31.3. Use of the appropriate code and reconciliation between the original code and the code to be used needs to be performed. In addition, proper quality assurance requirements need to be incorporated for the containment piping which is a safety class component (Action Item 99-005-019).		Accept. HNF-3885 specifies code requirements (B31.3 for overground line) and QA requirements. (SWS 3/5/99)	Closed
68	The existing 3-inch line has not been verified. It was installed with the farm and, as indicated by existing documentation, not used or tested. It is not clear whether cathodic protection has been continuously operated over the years. The use of an existing line should be verified by checking operation of the cathodic protection system and integrity of the line (Action Item 99-005-020).		N/A- new transfer line design initiated.	Closed
69	The existing transfer lines being used must be tested to determine the integrity. This needs to be included in the test plan for the project (Action Item 99-005-041).		N/A- new transfer line design initiated.	Closed
70	The potential for plugging of the down leg in tank 102-SY due to the lower temperature of the surrounding waste due to solidification of the 101-SY waste or crystallizing 102-SY waste needs to be addressed (Action Item 99-005-021).		Accept. Design will be in accordance with the guidance of Lockheed Martin's Process Engineering organization. (SWS 3/5/99)	Closed
71	With reliance on the flushing system to clear the transfer lines, the design should incorporate suitable redundancy to ensure flushing operation. The design needs to provide appropriate redundancy based on evaluation of operational needs, equipment reliability, and critical nature of service (MLM).		Accept. The storage tank ensures an adequate source of heated water is available for flushing. Redundant pumps ensure that for the 20 hours of expected use, an "on-line" prime mover is available for use in an "emergency flush" condition. (SWS 3/5/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 16 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
72	On slide titled "Interface Description" in 30% design review package, is the encasement stub 6" rather than 3", see H-14-103506 (RJG)?		I think the slide and the drawing show the encasement stub at 3" (correct value). Note that this interface will change with the change to an over ground transfer line. (SWS 3/5/99)	Closed
73	If encasement is to be "split and seam welded," the seam weld should be above centerline to eliminate a potential crud trap on this rough surface should a leak occur. This may also make for an easier split/weld (RJG).		Accept	Closed
74	What standard for post-installation pressure testing will be specified for primary and encasement lines? Does seam weld portion of line complicate standard used (RJG)?		Plan for overground line is to use B31.3 for pressure testing of encasement. (SWS 3/5/99)	Closed
75	Can any heat tracing be introduced on drop leg into SY-102 to avoid plugging issues associated with low temperatures?		Per the guidance provided by LMHC Process Engineering, when diluted, the "freeze" temperature where we might expect solidification to occur is approx 60 degrees. Even should some method of safely providing a heat trace be designed, the most likely point of plugging is at the liquid-liquid interface in the reduced diameter of the discharge nozzles. Short answer is, don't see a need, nor desire to heat trace the drop leg. (SWS 3/5/99)	Closed
76	Is there any way to route hot flush water into the line other than through the entire transfer line (RJG)?		The design currently has only one route for hot water flushing of the transfer line. Other routes are possible but are not planned or anticipated. (SWS 3/5/99)	Closed
77	How do we learn that drop leg is plugged (RJG?		Flow through the transfer line goes to zero. (SWS 3/5/99)	Closed
78	Has potential contamination spread due to back pressure associated with plugging of the drop leg (RJG)?		System is closed from the transfer pump inlet, to the below surface discharge of the drop leg. No potential for contamination is envisioned as a result of the drop leg back pressure. (SWS 3/5/99)	Closed
79	How is 2 ½ inch pipe drop leg sealed to the 3" nozzle if this is a "slip-through" configuration? This is important as a contamination seal (RJG).		N/A- new transfer line design initiated.	Closed
80	If the drop leg plugs, can we sever 2 ½ " pipe at the riser and let it fall into the tank, allowing insertion of a new 2 ½ " pipe (RJG)?		N/A. New transfer line drives new drop leg design.	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 17 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
81	Minimize vertical drops in the waste lines. This applies to at least 3 places. 1. The pump riser, 2. The metal pit. 3 the drop leg in SY-102. Minimizing these places will reduce an unacceptable plugging risk in the system were the flow to stop and flush water not be immediately available (WJP).	H	Accept -- new transfer line design initiated. (SWS 3/5/99)	Closed
82	Increase to the maximum the radius of bends in the vertical lines, in fact - all the lines (WJP). Five diameter bends are the minimum appropriate for transfer of wastes with suspended solids (RLS).	H	Accept - For the transfer line. (SWS – 3/5/99). Partially Accept – Maximum bend radius will be provided. However, not all bends in the PPP will meet the five diameter minimum bend radius due to space constraints. (PAT 3/17/99).	Closed
83	The hydraulic diagram is not acceptable for the transfer of slurry. It is recommended that this routing be abandoned and an above ground transfer line be pursued (WJP).	H	Accept – new transfer line design initiated.	Closed
84	Why is the drop leg at 160 inches? Justify and document the length (WJP).		Accept: The 160" position is specified to achieve a balance between: 1) Concerns against minimizing agitation of the TRU settled solids in 102-SY while optimizing mixing of incoming 101-SY slurry with 102-SY supernate indicate the dropleg outlet should be located as high off the bottom as possible. 2) Desiring to maximize the operating volumes in 102-SY indicates a location as close to the bottom as possible. This would allow larger batch transfers out of 102-SY without exposing the dropleg nozzles to atmosphere - a situation not desired because of the ammonia issues associated with 101-SY wastes. 3) Adhering to a 160" minimum liquid level for 101-SY transfer satisfies Operations requirement to keep 102-SY level higher than 130". Documentation will be provided in the Process Control Plan (Project Plan; Activity ID 3Y47CL). (SDE)	Open
85	If possible, the drop leg should be insulated and heat taped to prevent cooling and precipitation of the liquid (WJP).		Reject. No technical basis for requirement per Process Engineering. (SWS 3/5/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 18 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
86	Do not allow the drop leg to expel liquid inside of the ALC shroud. This would cause either the liquid to flow out the top or the bottom of the ALC. Both are unacceptable. The first would cause the transuranic wastes to mix with the organic wastes, the second would cause increased TOC and ammonia emissions (WJP).	H	Accept. Assume ALC is Air Lift Circulator. (SWS 3/5/99)	Closed
87	Consider using the 3-4 inch riser in the SY-102 pit instead of the ALC complex riser for the drop leg (WJP).		Accept – new transfer line design initiated.	Closed
88	The line sizes should not change anywhere in the line if possible. This will help prevent plugging of the line. If the line size must change to get into the tank then keep it as close as possible to the major line size (WJP).		Accept for transfer line. (SWS 3/5/99) For PPP line size at the pump discharge line – Purex connector changes from a 3" to 2" to interface with the transfer line. (PAT 3/17/99)	Closed
89	On drawing H-14-103460, down leg design is not acceptable, there are too many plugging possibilities. Use the modified design with 4 elongated holes (WJP).		Accept (SWS 3/5/99)	Closed
157	Consider re-rating the existing lines to 400 psi. Re-rating the lines (Schedule 40, cathodically protected, never used) would allow the transfer to be done without overpressure protection (WLW)		Design changed to overground, existing transfer lines no longer used.	Closed
	INSTRUMENTATION & CONTROL			
90	The use of the leak detectors for accident prevention and mitigation will be accomplished through operator action. The selected Safety Class alarms have not been identified (Action Item 99-005-022).		Accept: The individual safety class alarms will be identified by drawing P&ID number at the completion of the detailed design. (JLW 3/11/99).	Closed
91	Effectiveness of dilution within the pump has not been determined. A method such as measurement of specific gravity or mass flow should be evaluated (Action Item 99-005-023).		Accept. Various meetings with PNNL and design engineers have been held to discuss the effectiveness of dilution. It has been resolved to not be a problem and the meeting minutes will be issued. The dilution lines will be tested as part of the overall pump test (Test Spec HNF-4186) (KHM 3/19/1999)	Closed
92	It is recommended that the local instrument read-out panels be oriented to be read out of direct sunlight. In addition, the instrumentation needs to be relocated away from the PPP or temporary shielding design provided for those instruments that cannot be removed (Action Item 99-005-024).		Accept, The instrument panel that the operator sees will be pointing north with the operator looking south at the panel. The design now has the electrical/instrument panels about 4 to 5 feet away from the PPP. (JLW 3/11/99).	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 19 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
93	Design limits and bases including temperature limits (upper and lower), flow ranges, critical velocities, and dilution rates for the dilution and flush water need to be provided (Action Item 99-005-026).		Accept: These issues are provided by FR&TC and its associated References and Supporting Documentation and/or will be provided in the Process Control Plan (Project Plan; Activity ID 3Y47CL). (SDE)	Open
94	The committee requested that a "horn" be added as an audible alarm in addition to the visual alarms. The action on low water tank level should be to shut down the heat trace system rather than the flush/dilution pumps to prevent precipitation and subsequent plugging of the transfer lines and pump (Action Item 99-005-027).		Accept: General I&C - Ronan annunciation with horns is being added to the design. Water Skid - The tank level measuring system will shut down the heat tracing on the tank rather than the transfer pump. Rotating light and enunciator will go off in the event of a High-High or Low-Low condition. (JLW 3/11/99).	Closed
95	The design should utilize existing intrinsically safe leak detectors installed in the 02A and SY-B valve pit that currently alarm at the 242-S control room. If additional or redundant leak detection is required, it should be tied in with the existing detection system (MGA).		N/A new transfer line design initiated so no existing leak detection units will be encountered. At present there is no plans to annunciate new leak detection in the 242-S control room. (JLW 3/11/99).	Closed
96	Are test ports required on the transfer line to permit instrument testing (MGA)?		No test ports are planned for the present instrumentation. Isolation valves will be used for a pressure switch and pressure transducer with ports provided to flush those sense lines. If a device needs calibration it will have to be removed from the PPP and replaced in the interim with a spare calibrated device. (JLW 3/11/99).	Closed
97	It is desirable to provide the capability to interlock the leak detection system to trip the transfer pump (MGA).		Operations has voiced a desire not to interlock the leak detection with the pump. Reference item 90. (JLW 3/11/99).	Closed
98	Instrumentation needs to reflect the logic of operations developed in the Process Control Plan as well as critical characteristics and interactions of the system and its components (RLS).		The instrumentation and logic of operations have been developed based on the current process control plan information. Upon release of the final process control plan, a verification of consistency will be performed. (TRB 5/12/99).	Open
99	If possible, remove the junction box and other potential maintenance access items from within the PPP (RJG).		REJECT, Need junction box to control the entry of the various instrumentation cables. (JLW 3/11/99).	Closed
100	If junction boxes must be in the PPP, ensure enclosures are designed to protect from potential leaking fluid connections (RJG).		The junction box will be rated NEMA 4X (JLW 3/11/99).	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 20 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
101	Incorporate an interlock on low dilution water flow to shut down the waste transfer pump. When the dilution water flow goes to less than 0.5:1 (water to waste), the waste pump must shut down. Provide a keyed manual over-ride switch for the pump interlock shut down (WJP).		The flow meter near the PPP, on the valve stand, will provide a signal to the indicator on the operator panel near the PPP. At a preset low flow value (approximately 15 gallons/min or .5:1 ratio at 6 ft/s waste transfer rate) the indicator will send a low trip signal to shut off the transfer pump. A keyed manual over-ride of this interlock can be added and will be considered. (KSW 3/5/99)	Closed
102	Provide redundant flow, temperature, and pressure instrumentation on the waste line on drawing H-14-103524 (WJP).		REJECT, Due to space limitations on the PPP waste line it will not be possible to install redundant flow or pressure. Redundant temperature is more feasible. (JLW 3/11/99).	Closed
103	In general, installed spare or redundant instrumentation should be used for critical applications so that replacement is not required prior to starting or continuing the transfer if one instrument fails (WJP, RLS).		REJECT, Due to space limitations on the PPP waste line it will not be possible to install redundant flow or pressure. Redundant temperature is more feasible. (JLW 3/11/99).	Closed
104	Provide redundant flow, temperature, and pressure instrumentation in the inlet water line prior to the manifold shown on drawing H-14-103524 (WJP).		ACCEPT, Temperature, pressure, and water total/flow will be read at the outlet of the water skid and at the inlet prior to the manifold in the PPP. (JLW 3/11/99).	Closed
	ELECTRICAL & POWER			
105	The design of the PPP electrical penetrations needs to be changed to reduce or eliminate streaming through the penetrations. It was suggested that the penetrations be placed at an appropriate angle to prevent unnecessary exposure (Action Item 99-005-025).		See Answer to Item 47 (PAT 3/17/99)	Closed
106	A calculated load test needs to be performed and documented (MGA).		Accept, a load calculation (Dapper Program) will be performed for the system. (REM 3/17/99)	Closed
107	A revision to the SY farm wire list (Cable Schedule) needs to be prepared for all new cables and raceway information (MGA).		Accept, previous ECN's (57) have been incorporated into the wire list drawings. This project will incorporate it's wire changes into the wire list drawings. (REM 3/17/99)	Closed
108	An EYS connector needs to be provided to all leak detector conduits, see H2-34965 (MGA).		Accept, an EYS type sealoff fitting will be utilized for all electrical penetrations at the PPP and for leak detectors at other locations where called for by ISC Set #2. (REM 3/17/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 21 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
109	Cables located within the pits along the transfer route must be rated for the radiation field determined for each pit (MGA).		Accept Factors of box distance from the transfer line (TL), length of time (100 Hr) of exposure, and shielding of the TL are all factors that minimize exposure to electrical equipment in boxes along the route of the TL.. Existing electrical components were procured for installation in Tank Farm radiation service. Assuming a maximum of 600 mrem @ 1 meter from the shielded transfer line equates to 60 Rad exposure per year. This is a very low exposure to the withstand capability of thermoplastic type insulation. (REM 3/17/99)	Closed
110	Heat trace should be redundant on all new transfer piping (WJP).		Reject: Two circuits will supply the heat trace (HT). The period of use is short, 100 hours pumping time. HT is reliable and suitable for this service without additional redundancy. (REM 3/17/99)	Closed
	WATER SKID			
111	Check valves should be added to the discharge of the dilution/flush pumps to prevent recirculation of water through the shut down parallel pump (Action Item 99-005-028).		Accept – Check valves added to system specification and isolation valves on standby pump will now be left "Normally Open". (KSW 3/5/99).	Closed
112	The water supply skid should be designed with heat tracing (Action Item 99-005-029).		Accept – Heat tracing/insulation added to skid components. (KSW 3/5/99).	Closed
113	The head that can be generated by the pumps should not exceed the design limits of the transfer piping. The design flow rates be determined for dilution and flushing need to be delineated and the pumps sized appropriately (Action Item 99-005-030).		Accept - Pumping requirements are determined by system losses on both dilution side of system as well as flush side. With current drop leg nozzle arrangement, the dilution system losses are bounding. Pump shall have capability to deliver approx. 100 psi @ 100 gpm, which is approximately 25% over required max flow/pressure needed. Transfer hose is rated 400 psi, flush hose is rated 150 psi – water pump pressure max is 110 psi. Pump max capacity still falls within allowable water addition rate with 2000 gallon tank. (KSW 3/5/99).	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 22 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
114	In addition to the design flow rates for dilution and flushing, design temperature limits and the operating temperature range need to be delineated (MLM).		Accept – Water skid specification delineates both water operating temperature range of 120+/- 5° F and water temperature limits at 110 to 130° F. (KSW 3/5/99).	Closed
115	The water skid should not be designed as integral with a transport trailer (Action Item 99-005-031).		Accept – The trailor portion has been eliminated. The design is for a skid only. (KSW 3/5/99).	Closed
116	A LCO or engineered feature should be used to prevent the dilution/flush water from accidentally being left on to run into 101-SY and cause a GRE by dissolving the waste crust. The preferred method is an engineered feature (Action Item 99-005-032).		Accept- Transfer pump "off " condition shuts off water feed to skid surge tank. This can be overridden with a keyed switch for initial tank fill, but is normally not overridden. With surge tank capacity of 2000 gallons, we cannot run long enough at the pumps max flow rate to be a GRE problem (per recent PNNL/Chuck Stewart studies – see Mike Grigsby). (KSW 3/5/99).	Closed
117	The water skid includes high-pressure gas bottles designed for forcing flush water out of the piping and transfer pump. The high-pressure gas, when released into the piping, will expand and freeze the water line or the waste line (Action Item 99-005-042).		Accept – An air charged, heated and insulated, 75 gallon water accumulator tank will be used instead. This will provide 3X necessary quantity to flush transfer line. (KSW 3/5/99).	Closed
118	Consideration should be given to designing the skid and its components to be able to be released from the contaminated farm at the conclusion of the work (RJG).		Components are open to the weather and will be designed for easy replacement and could be pressure washed if necessary. (KSW 3/5/99).	Closed
119	Evaluate skid positioning in event above ground transfer line is used to ensure personnel exposures for those working on the skid are minimized (RJG).		Accept – Once exact routing of overground transfer line is revealed, I can give a precise number, but the skid should be more than 20 ft away from the transfer line. (KSW 3/5/99).	Closed
120	Add a redundant inlet line to the P-2 pump and valves to use either line on drawing H-14-103525 (WJP).		Accept	Closed
121	Add a redundant outlet line to the process including instrumentation OR add redundant instrumentation to the existing line on drawing H-14-103525 (WJP).		I believe this requirement has gone away after discussion with Bill Powell. A set of spares for instrumentation will be available rather than redundant instrumentation. (KSW 3/5/99).	Closed
122	Assure that the pumps can reach the maximum pressure required throughout the temperature range required and at least the re-suspension velocity through the waste transfer lines (WJP).		Accept – See item 113.	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 23 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
123	Call out the pipeline rated pressure at the design temperature of 140° F for the existing process line codes. This should be above 230 psi (WJP).		Accept	Closed
124	Show where the skid gets its water on both affected P & ID drawings, H-14-103525 and H-2-822409 (WJP, RLS).		Existing 4" line in the farm will be excavated and a 2 inch, below grade, valve will be installed. H-14-103535 (now H-14-103657) will referenceH-14-100587 on input flag to skid once the excavation has been made. H-14-100587, H-2-82409 and any other affected drawings which show the 4" line will also be updated". (KSW 3/5/99).	Closed
125	Add the Design Authority and change the Cognizant Manager to Ron Reed for approval signature on the water skid specification (WJP).		Accept – Added/Changed	Closed
126	Provide the applicable design and analysis requirements from HNF-PRO-097 OR add HNF-PRO-097 to the requirements in the water skid specification (WJP, RLS).		Accept - Added	Closed
127	The 2000 gallon tank should be specified as transportable and designated of appropriate material, such as steel, or the appropriate codes used to design a fiberglass tank. Fiberglass tanks can stress crack when transported/loaded with point sources (WJP).		Accept – ASTM D3299-95a design requirement (Fiberglass Tanks) added to spec. D3299 also delineates handling/shipping requirements. Also, the tank manufacturer will provide stamped PE calculations showing ability of tank to withstand structural requirements per John Strehlow's guidance. (KSW 3/5/99).	Closed
128	In the water skid specification, assure that we get both prints and CAD files that can be converted to Hanford drawings after receipt OR prints that can be modified to CAD drawings and issued as Hanford drawings after receipt. (WJP, RLS).		Accept- Prints and Cad files are required in specification. (KSW 3/5/99).	Closed
129	In Section 3.2.1.2 of the water skid specification, require motors to be TEFC if possible, this is a grade higher and is usually standard in the chemical and nuclear industry (WJP).		Accept – TEFC spec added. (KSW 3/5/99).	Closed
130	In the specification for the skid, Section 3.2.2.1, it is assumed that the citation of 24VAC is a typographical error. Please verify inclusion of the correct voltage (RAH).		Accept – Corrected to 240 VAC. (KSW 3/5/99).	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 24 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
131	In Section 3.2.2.2 of the water skid specification, require that all hoses and piping shall have freeze protection, including heat tape and insulation or area heaters. Why specify 2.5 inch hose? Why not 3 inch? This may be a flow restriction that is not necessary. Provide calculations to show that the desired flow is attainable with the specified equipment (WJP).		Accept – Requirement for freeze protection added to spec. With new reduced flow requirements, 2" hose will be used instead. Calculations show less than 10 psi pressure drop up to PPP with 2" line. (KSW 3/5/99).	Closed
132	In the specification for the skid, Section 3.2.2.8, provide validated siphon break air accumulator per comment on expansion and potential freeze plugging of lines (RAH). Consider changing the N2 bottles for 2 small air compressors with an accumulator tank (WJP).		Accept – see item 117 above	Closed
133	In the specification for the skid, recommend adding 3.2.2.9.10 "Loss of Heat Trace". Also, an operations manual should be provided (RJG).		Accept – This will be in the form of Heat Trace "ON" lights for the different subsystems. Operations and Maintenance manual have been added to required documentation in specification. (KSW 3/5/99).	Closed
134	In the specification for the skid, Section 3.5.2, Verify need for a fire extinguisher or remove from the requirements (RAH).		Accept – Fire extinguisher has been removed from skid specification per TWRS Safety RCR. (KSW 3/5/99).	Closed
	STRUCTURAL			
135	The current codes and standards required by HNF-PRO-097 and the DOE Orders may not be satisfied by the design. An exemption to the HNF-PRO-097 and DOE Orders may be required. Code application needs to be addressed in the structural design criteria document (Action Item 99-005-033).		Accept in part. The codes and standards requirements by HNF-PRO-97 will be documented in a Structural Design Criteria document. Design of transfer pump installation will comply with these requirements and all applicable DOE Orders and Standards. An exemption is not expected to be necessary. See disposition to item 30. (JPS 3/5/99)	Closed
136	The structural design criteria document should include a discussion of "beyond design basis accident" loads, vibration loads on the pump assembly, and the use of the plastic hinge analysis (Action Item 99-005-034).		Accept (TRB 3/19/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 25 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
137	Is there a requirement to consider the effect of a burn event on the pump assembly and the PPP (Action Item 99-005-035)?		There is no requirement. The hazard evaluation performed for the transfer of waste from SY-101 to SY-102 (HNF-3966) identified flammable gas deflagrations [including deflagrations in the PPP as potential hazardous conditions requiring controls. Controls [existing and new] have been identified to prevent flammable gas deflagrations in the pump assembly and the PPP, and, therefore, there is no requirement to consider the effect of a deflagration. (TRB 3/19/99)	Closed
138	Structural analysis of the drop leg in 102-SY needs to be provided (Action Item 99-005-036).		Accept (TRB 3/19/99)	Closed
139	The computer codes used in the structural analysis need to be properly validated in accordance with procedures (Action Item 99-005-037).		Accept, where computer analysis codes are used or referenced, they will be validated. (TRB 3/19/99)	Closed
140	Independent review of the design by an independent qualified registered professional engineer, as defined in the Washington Administrative Code, Section 173.303 is required if the analysis demonstrates the need for a "protective bridge" to take the load off existing transfer lines (Action Item 99-005-038).		N/A- new transfer line design initiated.	Closed
141	Provide calculations for the PPP metal boot, this is a unique application. Assure that this design is checked ASAP (WJP).		Metal boot has been eliminated in the current design. (PAT 3/17/99).	Closed
	HAZARD & SAFETY ANALYSIS			
142	Critical characteristics need to be included in the SEL for safety class and safety significant components (Action Item 99-005-039).		Accept. (KHM 3/19/1999)	Closed
143	If design detailing requires location of portion of the system near or above grade, the HAZOP evaluation needs to be revisited and revised appropriately (MLM).		Accept - John VanKueren has completed. (TRB /17/99)	Closed
144	The Waste FIT may need to be safety significant to assure a mass balance for transfers from SY-101. The accident is overfilling a tank or misrouting (WJP).		There is currently no accident that I remember related to overfilling a tank. However, if this is needed, the controls decision board will determine this and the results will be included in the SEL (KHM 3/19/1999)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 26 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
145	It is not obvious why the backflow prevention valves were SS instead of redundant pressure switches. The backflow preventors (check valves) are not reliable-and are usually assumed to fail. Therefore they are not usually specified to be SS. Recommend changing the pressure switches to SS, and deleting the BP. Justify or change (WJP). NOTE: Current Authorization Basis reliance on backflow preventors as safety significant is based on use of approved backflow preventors that are specifically designed to provide isolation and drainage should a backflow initiate (RLS).		Accept – Backflow preventors (Check Valves) in the P3 are not SS. There are two pressure switches between the process and water flush blocking valves that are SC. (PAT 3/17/99)	Closed
	ACCEPTANCE FOR BENEFICIAL USE			
146	Please ensure that a validation of capability to perform installation, maintenance and disassembly is conducted to ensure this is a field usable design. It is recommended that an inexpensive full-scale mockup (wood) of the PPP assembly be constructed to identify design flaws (RJG).		Accept - Mock up in project plan. (TRB 3/17/99).	Closed
147	It seems that a construction specification would be needed to address such items as excavation, unidentified buried lines (RJG).		Accept. In the work packages, these issues are addressed as part of the procedure compliance for excavation. If work belongs to construction forces , this will also be a requirement. (TRB 3/17/99).	Closed
148	This is considered a high-risk evolution and Health Physics documentation in accordance with HNF-PRO-1621, -1622, and -1633 are required as a minimum. Should the ABU consider this need (RJG)?		Accept, these requirements will be considered in the ABU (TRB 3/17/99).	Closed
149	The listed item "Walk-down by Ops, Eng., Maint. & HP as appropriate" has been more formalized. It needs to be somewhere, and here is probably a good spot (RJG).		Accept	Closed
150	An ALARA review is appropriate, and should be included as part of the ABU (RJG).		Accept, we will list R. Piersons ALARA review documents (TRB 3/17/99).	Closed
151	It appears that some training manuals and some training (operators, maintenance, and RPT/Industrial Safety may be required. A Training plan would seem in order, unless another ABU list is developed by Operations as well (RJG).		Agree, and can be listed in the ABU. However, training is in the Operations area of responsibility. Engineering, of course must provide guidance as required under the direction of Operations (TRB 3/17/99)	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
3-4-99 (5/13/99 Status)	99-005
3. Project No. N/A	4. Page 27 of 27

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
	DOSE RATES, SHIELDING, & ALARA			
152	Provide the basis for source terms and dose rates expected for the different configurations encountered. Design basis dose rates should consider recent survey data (RJG).		Accept – R. Pierson and J. Greenborg are working together to provide analysis. (TRB 3/17/99).	Closed
153	The dose rate values need to consider the levels that will be encountered as waste lower in the tank is brought to the transfer lines. This may take into consideration the relatively homogeneous character of the 101-SY waste resulting from several years of mixer pump operation (RJG).		Accept, will be considered as required and where appropriate. (TRB 3/17/99).	Closed
154	Crud traps, contamination control risk points, access control, operation and maintenance exposure hours, and transfer line routing are not sufficiently defined. All of these should be revisited at a point between the 30% and 100% design to assure the design is acceptable and procedures are consistent (RJG).		Accept – The Design Authority or the Cognizant Engineering Manager will determine when additional design reviews will be held. (TRB 5/10/99).	Closed

APPENDIX D

DESIGN REVIEW MEETING MINUTES
SPECIFICATION HNF-4169
PREFABRICATED PUMP PIT

241-SY-101 TRANSFER RAPID MITIGATION SYSTEM SPECIFICATION FOR SY-101 PREFABRICATED PUMP PIT, HNF-4169, DESIGN REVIEW

MEETING MINUTES

Prepared by C. E. Jensen

1163 BLDG, CONFERENCE ROOM 274

March 9, 1999

Design Review Team Members

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W. J. Powell, Design Authority
R. W. Reed, Cognizant Manager
D. A. Reynolds, Process Engineering
J. W. Bloom, Nuclear Safety and Licensing
C. C. Scaief, I&C Engineer
J. R. Biggs, Operations Representative
C. P. Shaw, Pump Engineering
H. H. Ziada, Structural and Rigging

DESIGN REVIEW

Mr. Titzler provided the presentation of the proposed Prefabricated Pump Pit (PPP). Only those comments that were not incorporated into the document during the meeting and not resolved are identified in these meeting minutes.

A concern as to the spray leak accident from the cover sitting on the PPP. The project agreed to evaluate the overfilling of the PPP to demonstrate that it will not result in a spray leak scenario. If there is a spray leak scenario, it will be evaluated to determine if it remains within the analyzed accident. In addition, the committee recommended that a lip be provided to prevent, in the event of a spray leak or overfilling, any spray from the lid (Action Item 99-007-001).

It was pointed out that the Washington Administrative Code (WAC) requires an independent corrosion engineer to review pit coatings, dissimilar material connections, and other corrosion issues. The project agreed to evaluate and determine the necessity of such an independent review (Action Item 99-007-002).

Reference 5 on page 4, ANSI/ASME B36.19M needs to verified as the correct standard for the reference. The project agreed (Action Item 99-007-003).

Bolting standards need to be identified. The project agreed to provide in this specification (Action Item 99-007-004).

The committee agreed that a compliance matrix is required for all the specifications. The committee also agreed that the matrix is not required before the specifications are issued. It was pointed out that not having the matrix requires the project to proceed at risk. The project agreed to provide this information at a later date (Action Item 99-007-005).

The O-ring seals for the PPP mounting on the riser need to be provided with the means to test the seals at 3 psig. The project agreed to provide a test port (Action Item 99-007-006).

A compliance matrix is required for fabrication. If waivers are required, they need to be generated or changes to the design and fabrication requirements need to be made. The project agreed to provide a compliance matrix (Action Item 99-007-007).

The safety classification of the PPP and the effect on natural phenomena hazards (NPH) analysis is not clear and the effect on the original USQ needs to be evaluated. The PPP is above grade, implying the classification may be safety class. Mr. Bloom agreed to review the USQ Determination to clarify effect on the USQ (Action Item 99-007-008).

The design of the PPP cover needs to include all the applicable NPH loads. The project agreed to consider the appropriate NPH loads in the design of the PPP (Action Item 99-007-009).

The electrical power junction box needs to be re-designed due to potential contamination and gas accumulation concerns with the current proposed design. It was recommended that the design use a type CGB connector through the wall and the junction box be installed on the exterior of the PPP, allowing access to the terminal block. It was further recommended that the CGB connector be placed above any expected liquid levels to prevent any waste or liquid from contaminating the junction box and any conduit. The project agreed to perform this task (Action Item 99-007-010).

It was recommended that one of the access ports in the PPP cover be placed over the PPP drain, to allow placement and removal of the dam and to allow clean out of the drain, if needed. The project agreed to place an access port over the drain (Action Item 99-007-011).

The PPP drawings lack the appropriate weld symbols for fabrication. The committee recommended that the all weld symbols be included on the drawings. The project agreed to do this (Action Item 99-007-012).

There was a significant discussion on the installation of the PPP on the riser. Concerns were raised on how loading of the riser would be prevented. The concrete piers supporting the PPP that prevent loading of the tank riser, can not be guaranteed not to settle. This could result in damage to the riser, should the loading be excessive. It was required that the project address and resolve this issue. The project agreed to resolve the loading issue (Action Item 99-007-013).

The committee requires that all critical dimensions have tolerances identified on the drawings. The project agreed to add the tolerances to the drawings (Action Item 99-007-014).

Discussion on the problems of using the shield plug inserts occurred. After much discussion of potential streaming concerns without the inserts and installation risks with the inserts, the committee agreed the inserts were not necessary and suggested they be removed, along with the shield counter-boring. The project agreed to eliminate the shield plugs (Action Item 99-007-015).

The committee recommended that the project ensure that there are extra gaskets and O-rings provided for spare parts. The project agreed to ensure additional gaskets and O-rings are on site for the transfer operation (Action Item 99-007-016).

The committee identified the need for provisions to allow visual inspection of the exterior O-ring. This inspection is required to comply with WAC requirements since the O-rings provide a barrier to leakage (Action Item 99-007-017).

The committee recommended that a painting specification be provided to ensure proper coating materials and application is done. The project agreed to provide this specification after HNF-4169 is issued (Action Item 99-007-018).

The committee recommended that a template for the top of the PPP cover be provided to ensure proper valve line-up. The project agreed to provide the template (Action Item 99-007-019).

The committee recommended provisions be included in the design to ensure that the seal loop maintain isolation between the PPP and the SY-101 tank dome region. This can be accomplished by inclusion of filling provisions and, possibly, a loop seal level sensor (Action Item 99-007-020).

As stated earlier, the committee identified several items related to design, material specification, machining and fabrication controls, documentation requirements, and finishing requirements that were resolved and the acceptable resolution incorporated in the specification during the review.

The meeting was adjourned.

APPENDIX E

DESIGN REVIEW MEETING MINUTES
SPECIFICATION HNF-4170
TRANSFER PUMP PIPING

241-SY-101 TRANSFER RAPID MITIGATION SYSTEM SPECIFICATION FOR SY-101 TRANSFER PUMP PIPING, HNF-4170, DESIGN REVIEW

MEETING MINUTES

Prepared by C. E. Jensen

1163 BLDG, CONFERENCE ROOM 274

March 9, 1999

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J. R. Biggs, Operations Representative
H. H. Ziada, Structural and Rigging

DESIGN REVIEW

Mr. J. R. Buchanan provided the presentation of the transfer pump piping specification.

There was discussion on the necessity of pressure switch/gauge threadolets. The committee recommended the removal of unnecessary taps. The project agreed to remove the taps (Action Item 99-008-001).

The location of V-10 was discussed. The committee recommended that the valve be located as close to the process line as possible, with out valve handle interference. The project agreed to make this change (Action Item 99-008-002).

A concern as to the seismic loading on the pump and flush line connections was raised. The only anchor point is on the connections because the lines are not anchored. The project agreed to evaluate the seismic stresses separate from this specification (Action Item 99-008-003).

The committee recommended that the standard design for the valve operators be included in the specification so the valve operator cones will be consistent with the TWRS standard. The project agreed to attach the standard design drawings to the specification (Action Item 99-008-004).

The seal loop pipe assembly drawing needs to identify the maximum discharge leg dimension and the correct orientation. The project agreed to make the changes (Action Item 99-008-005).

It was pointed out that the flatness and parallel tolerances of the bulkhead flanges on the PPP needs to be specified on the PPP drawings. The project agreed to provide this information (Action Item 99-008-006).

The critical dimension tolerances (+/- 1/32") need to be identified on the drawings. This includes critical dimensions and tolerances for the purex head as well. The project agreed to include the critical dimension tolerances on the drawings (Action Item 99-008-007).

The flush or the dilution water connection is recommended to be a flex connection to the purex head at the pump. Support of the purex head may be required. The project agreed to include this on the drawings (Action Item 99-008-008).

In addition to the action items above, the committee identified several items related to design, material specification, fabrication controls, documentation requirements, and finishing requirements. These items were resolved and the acceptable resolution incorporated in the specification during the review.

The meeting was adjourned.

APPENDIX F

DESIGN REVIEW MEETING MINUTES
SPECIFICATION HNF-4043
MOBILE WATER SUPPORT SKID

241-SY-101 TRANSFER RAPID MITIGATION SYSTEM SPECIFICATION FOR SY-101 MOBILE WATER SUPPORT SKID, HNF-4043, DESIGN REVIEW

MEETING MINUTES

Prepared by C. E. Jensen

1163 BLDG, CONFERENCE ROOM 274

March 10, 1999

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D. A. Reynolds, Process Engineering
J. W. Bloom, Nuclear Safety and Licensing
C. C. Scaief, I&C Engineer
C. P. Shaw, Pump Engineer
J. R. Biggs, Operations Representative
H. H. Ziada, Structural and Rigging

DESIGN REVIEW

The review group previously reviewed this specification and there were significant changes made to the document as a result of the initial review and other inputs. Therefore, it was decided that a second review was merited.

Mr. K. S. Witwer provided the presentation of the specification.

Only those comments that were not incorporated into the document during the meeting and not resolved are identified in these meeting minutes.

The P&ID require a change to the location of the relief valve on the accumulator to show the correct relief valve location and discharge path. The project agreed to make the change (Action Item 99-010-001).

The P&ID requires changing. Valves V-10 and 11 are identified as "normally closed". The project agreed to make the change (Action Item 99-010-002).

The P&ID requires changing. Relief valves be installed between the P-1 an V-4 and between P-2 and V-6. The relief valves are to discharge into Tank T-1. The project agreed to make the change (Action Item 99-010-003).

The committee recommended that the P&ID be checked to ensure that the symbols and terminology are consistent with drawing H-14-020000 (Action Item 99-010-004).

The alarm panel alarm lenses require engraving. The committee recommended a schedule for engraving to be provided to the vendor for engraving. The project agreed to make the change (Action Item 99-010-005).

The control panel on the P&ID does not identify the instrumentation indicators. The committee recommended that the indicators be provided on the P&ID. The project agreed to make the change (Action Item 99-010-006).

The specification needs to provide insulation requirements or specifications for the insulation of the piping. The project agreed to make the change (Action Item 99-010-007).

The P&ID should not specify line sizing for safety and relief valve inlets and discharges. For the design and build specification, the supplier is responsible for providing the valves and the piping needs to be sized based on applicable Code and Standard requirements based on the valves selected (Action Item 99-010-007).

As stated earlier, the committee identified several items related to design, material specification, machining and fabrication controls, and documentation requirements that were resolved and the acceptable resolution incorporated in the specification during the review.

The meeting was adjourned.

APPENDIX G

DESIGN REVIEW MEETING MINUTES
33.33% CONCEPTUAL DESIGN REVIEW
TEMPORARY OVERGROUND TRANSFER LINE

241-SY-101 TRANSFER RAPID MITIGATION SYSTEM CONCEPTUAL (33.33%) DESIGN REVIEW FOR A TEMPORARY OVERGROUND TRANSFER LINE

MEETING MINUTES

Prepared by C. E. Jensen

1163 BLDG, CONFERENCE ROOM 274

March 11, 1999

Design Review Team Members

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C. C. Scaief, I&C Engineer
J. R. Biggs, Operations Representative
C. P. Shaw, Pump Engineering
H. H. Ziada, Structural and Rigging

Design Review

Mr. S. Shaw provided the presentation on the re-design of the transfer system for the RAPID mitigation system project. The review was required due to the significant issues with the proposed buried transfer line proposed in the 30% review.

An issue on the classification of the SY-102 transition from the temporary overground transfer line (OGT) to the drop-leg was a concern. There are significant differences in requirements for pits, tank riser extensions, and continuation of the containment system. The project agreed to determine which classification to be used and make the appropriate changes to the design (Action Item 99-009-001).

The OGT will result in additional exposure in the SY farm. The review group discussed the issue of routine activities that are performed such as operator rounds and maintenance activities. Suggestions included the use of remote methods such a optical devices, performance of required surveillances prior to transfer operations, or delay the routine activities until completion of the transfer operations. Mr. Biggs agreed to evaluate activities requiring performance during OGT transfers (Action Item 99-009-002).

It was recommended that the use of a narrow "purex" head could be used in place of the flanged connection on the flexible line at the SY-102 end. This would allow ease of removal through the encasement line back at the PPP, and be less likely to bind up in the encasement at the curves. It was also pointed out that a custom design closure cap would be required to prevent contamination of the encasement (existing "purex" head blanks include a large closure fitting). The project agreed to evaluate this suggestion (Action Item 99-009-003).

With the proposed OGT elevated, the environmental requirements for daily inspection for leakage are a requirement. It is not clear that this is required for the enclosure. The project agreed to evaluate the issue to ensure inspection capability if required (Action Item 99-009-004).

The OGT will have lead shielding applied to lower doses, requiring a 4-meter fenced high radiation corridor along the length of the OGT. This corridor will need alternative access for operations personnel. Those areas requiring access for operations activities need to have the shielding maximized, consistent with the dome loading requirements. The project agreed to evaluate this recommendation (Action Item 99-009-005).

It was recommended that the spacing of the OGT supports be optimized to reduce dome loading, resulting from the weight of the supports. The project agreed to optimize the spacing (Action Item 99-009-006).

It was pointed out that on page 6, note 1, needs to identify the applicable documents such as ASME B31.3. The project agreed to include any applicable documents (Action Item 99-009-007).

Since the flexible hose is contained in a rigid encasement, a concern on the movement of the flexible line damaging the encasement from a hammer event, such as pump start. Such movement or reaction may require the use of restraints to prevent thrusting of the OGT. The project agreed to evaluate (Action Item 99-009-008).

On page 8 notes, it is recommended that a reference to testing in accordance with ASME 31.3. The project agreed to include (Action Item 99-009-009).

The leak detector tape will be required to meet ignition control set 2 requirements. The project agreed to ensure this occurs (Action Item 99-009-010).

A concern on damage to the leak detector tape during installation and operation by movement of the flex line in the encasement was raised. The project agreed to evaluate and protect the tape if necessary (Action Item 99-009-011).

Any "doghouse" design for the terminal ends of the OGT should include provisions for the attachment of glove bags for removal of equipment. The project agreed (Action Item 99-009-012).

The flex line should be designed to be removed in one piece, designed to allow removal of waste from inside the line or prevent leakage from the line upon removal, and any internal appurtenances to guide or center the line in the encasement not impede the removal of the flex line through the PPP. The project agreed (Action Item 99-009-013).

A concern was raised as to the meaning of this OGT being "temporary". The project agreed to establish some end of activity to begin D&D activities (Action Item 99-009-014).

It was also recommended that a survey plan for the D&D process be developed. The project agreed (Action Item 99-009-015).

The design of the dropleg nozzles needs to be reconsidered. The design shown would have a tendency to plug. The Project agreed to evaluate (Action Item 99-009-016).

It was pointed out that the "doghouse" and the OGT encasement will be subject to flammable gas controls. Consideration for this needs to be included in the design (Action Item 99-009-017).

On pages 11 and 12, the drawing needs to be corrected to show the correct piping configuration at SY-102 inlet. The project agreed (Action Item 99-009-018).

There needs to be a detail on how the lead blankets shall be attached to the encasement. In addition, the insulation attachment details also need to be detailed. The project agreed (Action Item 99-009-019).

The concern over binding of the flex line during installation and removal was discussed. The recommendation was to use sweeping bends rather the bends identified. This will reduce the risk of jamming the flex line during installation and removal. The Project agreed (Action Item 99-009-020).

Remote exposure readouts should be provided for the PPP to provide better control of operator exposure at the PPP. The project agreed to evaluate (Action Item 99-009-021).

The meeting was adjourned.

APPENDIX H

DESIGN REVIEW MEETING MINUTES
SPECIFICATION
ANTI-SYPHONING SLURRY
DISTRIBUTOR ASSEMBLY

241-SY-101 TRANSFER RAPID MITIGATION SYSTEM SPECIFICATION FOR ANTI-SYPHONING SLURRY DISTRIBUTOR ASSEMBLY

MEETING MINUTES

Prepared by C. E. Jensen

1163 BLDG, CONFERENCE ROOM 274

March 25, 1999

Design Review Team Members

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W. J. Powell, Design Authority
R. W. Reed, Design Authority Manager
D. Reynolds, Process Engineer
C. C. Scaief, Instrument Engineer
J. S. Schofield, Operations Representative
C. P. Shaw, Pump Engineer
H. H. Ziada, Structural and Rigging

Other Attendees

G. A. Barnes, SY-101 RAPID Engineer
S. H. Rifaey, Manager, Equipment Engineering
S. W. Shaw, Project Engineer

DESIGN REVIEW

This review was done with the document changes made during the meeting. Those that could not be incorporated into the document or require additional actions are identified below. Mr. S. Shaw provided the discussion on the drop leg.

It was recommended that the bulkhead connector in the riser extension be changed to remove the test flange. An inflatable plug will be used in lieu of a flanged connection. Mr. Shaw agreed to make that change (Action Item 99-013-001).

A concern about the streaming of radiation through the vent ducts was raised. It was recommended that the vent ducts in the shield plug have a "jog" in them to eliminate radiation streaming. Mr. Shaw agreed to make this change (Action Item 99-013-002).

A concern was raised on how much ammonia generation will occur due to the design of the drop leg. Mr. Reynolds agreed to provide the generation numbers before the installation (Action Item 9-013-003).

The committee requested that the documentation verifying the drop leg will not plug be provided, to ensure the structural design is satisfactory. Mr. Shaw agreed to provide the documentation (Action Item 99-013-004).

A concern was raised that the actual structural load criteria is in a referenced document rather than spelled out in the specification. Mr. Shaw agreed to include the actual information into the specification (Action Item 99-012-005). This item is a HOLD until it is included into the specification.

The risk of having a single drop leg design was discussed. It was suggested that a second design be developed and procured, to reduce the risk of failure. Mr. Reed agreed to discuss this issue with Mr. Raymond and resolve (Action Item 99-013-006).

The design authority stated that the current drop leg design being considered is not adequate and represents a high-risk design. Mr. Powell agreed to work with Mr. Shaw to develop a more acceptable design (Action Item 99-013-007). This item is a HOLD item to be resolved before approval of the design.

It was suggested that the shield plug attachment be changed from threaded holes to studs to reduce the potential of contamination collecting in the holes. Mr. Shaw agreed to make the changes (Action Item 99-013-008).

A discussion on the leak detectors and the ability to detect a leak occurred. The design of the vents is to be changed to add a 1-inch lip to collect waste to be detected on 3 of the 4 vents. The fourth vent line will have a removable plug to drain the riser extension. In addition, the access hole in the riser extension cover will be located to facilitate the removal of the plug. Mr. Shaw agreed to make the changes (Action Item 99-013-009).

A discussion on the necessity of the o-ring gaskets verses regular gaskets occurred. Mr. Reed agreed to evaluate the need for o-ring gaskets and determine if standard gaskets can be used (Action Item 99-013-010).

It was suggested that radiation and environmental requirements be added to all material specifications. Mr. Shaw agreed to include this item (Action Item 99-013-011).

There was a concern that the specification does not require the drawings be submitted for review and approval by the buyer prior to fabrication. It was suggested that a critical design-drawing list be provided to the seller to permit the buyer a review of critical components. Mr. Powell agreed to provide such a list to Mr. Shaw (Action Item 99-013-012).

It was suggested that the proper dimensions be provided for the riser flange bolt hole arrangement. Mr. Shaw agreed to provide this information on the drawing(s) (Action Item 99-013-013).

It was pointed out that inspection of the welds needs to be more specific. The weld examination needs to be specified as a "5X" visual exam or a liquid penetrant. Mr. Shaw agreed to include this in the specification (Action Item 99-013-014).

It was suggested that the leak detector be set up similar to the PPP set up, except that the junction box will be on the outside of the riser extension. Mr. Scaief agreed to review this item and provide the wording to Mr. Shaw for incorporation into the specification (Action Item 99-013-015).

In sections 3.3, 4.2, and 4.3, the welding and inspection codes and standards need to be specified. Mr. Shaw agreed to incorporate this item and have it reviewed by Dr. Ziada, prior to issuing the specification (Action Item 99-013-016).

Chris E. Jensen
05/17/99
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Item 4.10.2 needs to be re-written to include minimum requirements for performing required calculations. Mr. Shaw agreed to include this item (Action Item 99-013-017).

Item 4.10.4 needs to be re-written to identify which components are required to have certified material and test reports provided to the buyer. Mr. Shaw agreed to include this item (Action Item 99-013-018).

The meeting was adjourned.

Chris E. Jensen
05/17/99
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APPENDIX I

DESIGN REVIEW MEETING MINUTES
HNF-4252
STRUCTURAL DESIGN CRITERIA

241-SY-101 TRANSFER RAPID MITIGATION SYSTEM STRUCTURAL DESIGN CRITERIA – HNF-4252

MEETING MINUTES

Prepared by C. E. Jensen

1163 BLDG, CONFERENCE ROOM 274

March 26, 1999

Design Review Team Members

T. C. Oten, Acting Chairman
C. E. Jensen, Secretary/Mechanical Engineering
J. W. Bloom, Nuclear Safety and Licensing
M. F. Erhart, Cognizant Engineer
M. L. McElroy, Cognizant QA
W. J. Powell, Design Authority
H. H. Ziada, Structural and Rigging

Other Attendees

G. A. Barnes, SY-101 RAPID Engineer
T. R. Benegas, Project Engineer
S. H. Rifaey, Manager, Equipment Engineering
J. P. Strehlow, Structural Engineer
P. A. Titzler, Engineer, 101-SY

DESIGN REVIEW

This review was done with the document changes made during the meeting. Those that could not be incorporated into the document or require additional actions are identified below. Mr. Strehlow provided the discussion of the structural design criteria.

A discussion on the leak detectors and their function occurred. It was recommended that the leak detectors be procured as Safety Class to provide a conservative approach. Mr. Benegas agreed to make this happen (Action Item 99-014-001).

It was pointed out that all referenced and checked analyses need to be identified in this document. In addition, it was suggested that the analysis of the pump be reviewed to ensure the pump will withstand the PC-3 event. Dr. Ziada and Mr. Powell agreed to review the analysis (Action Item 99-014-002).

A concern on the requirements discussed in the structural design criteria with respect to ASME B&PVC Section III and ANSI N690 and the other design specifications reviewed to date. It is not clear if these requirements have been identified in the other documents. Mr. Benegas agreed to review the previously reviewed documents to ensure the criteria is identified and incorporated (Action Item 99-014-003).

The meeting was adjourned.

APPENDIX J

DESIGN REVIEW MEETING MINUTES
ECN 647721
ELECTRICAL INSTALLATION

241-SY-101 TRANSFER RAPID MITIGATION SYSTEM ELECTRICAL INSTALLATION ECN - #647721

MEETING MINUTES

Prepared by T. C. Oten

1163 BLDG, CONFERENCE ROOM 274

April 9, 1999

Design Review Team Members

T. C. Oten, Acting Chairman
M. G. Al-Wazani, Electrical Engineer
P. L. Bartley, Safety
M. F. Erhart, Cognizant Engineer
L. S. Krogsrud, Safety
M. L. McElroy, Cognizant QA
W. J. Powell, Design Authority
R. W. Reed, Design Authority Manager
S. H. Rifaey, Manager, Equipment Engineering
C. C. Scaief, Instrumentation Engineer

Other Attendees

R. E. Merriman, Electrical Engineer
J. L. Wilk, Instrumentation Engineer

DESIGN REVIEW

Page 1

- Prepare a new USQ for this ECN, remove the USQ reference from block 13a and place the USQ number in Block 4.
- Revise the date in Block 5.
- Enter the Work Package No. in Block 12b.
- Add the following note to Block 14b:" Formal Design Review was selected in accordance with HNF-IP-0842, Vol. IV, Section 3.14."
- Add M. H. Brown and T. C. Oten to Block 15, and verify that MSINs are correct.

Page 2

- In Block 19, check the box for Safety Equipment List, and remove the check in the box for Electric Circuit Schedule.
- In Block 20, add a reference to HNF-SD-WM-SEL-040, Rev. 1, and the note, "Project to modify documents checked in Block 19.
- In Block 20, add M. F. Erhart next to "Other," verify that MSINs are correct, and replace R. L. Schlosser with T. C. Oten.

Page 3 - Add a discussion of the "HOLDs" in the ECN and explain why they are required.

Page 7 - Add a "HOLD" cloud around the Variable Frequency Drive (VFD).

Page 8
- Add the 225A breaker (BKR-115) to the Parts List, including the Mfg./Model number.
- Add a "HOLD" cloud around the VFD, Item 3.

Page 9
- Note 8 of "ECN REFERENCE NOTES" will be added to the existing notes on the drawing and will be revised to read " New grounding cables shall be 4/0 bare copper cadwelded to existing 5/8" steel cable unless otherwise noted. Install buried ground cable a minimum of 24" below grade." Additionally, a notation stating " SEE NOTE 8 " will be added to the section of the drawing that depicts the new ground cable. The first seven notes identified under "ECN REFERENCE NOTES" will be deleted from this page since they are already notes on the drawing.
- Revise the drawing to show the instrument panel and the leak detection enclosure on two separate support structures.

Page 10 - Label the Fire Alarm Panel.

Page 11
- Specify that RTV will be used to seal new conduit access openings in trenway.
- Correct spelling of " burial " in the Reference Note.

Page 16 - Revise the Phase A power subtotal in the Table.

Page 17 - Show the Phase A power requirement for the SY 101 transfer pump control panel on this Table.

Page 18
- Revise the LDSTA tag number.
- Revise the drawing to indicate that the LD-CABLE is "BY OTHERS."
- Show location of the leak detection box adjacent to transfer pipe.

Page 19
- Add a Reference Note to "Coordinate installation of conduit with the installation of the transfer line."
- Revise the LDSTA tag number.
- Verify that the size is correct for conduit SY-564-NL.
- Show the new conduit routing and enclosure on the drawing.

Page 20
- Add the Load Center identification number.
- 6.00 should read 6" for the depth below grade.

Page 22 - 6.00 should read 6" for the depth below grade.

Page 24 - Show conduit SY-135 as being deleted.

Page 26 - Add a ECN Reference Note to hold installation of wire runs until the related piece of equipment is installed and the wire can be terminated.

Timothy C. Oten
04/12/99
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OTHER COMMENTS

- "HOLDS" are only required to be placed on the variable speed drive installation, pages 7 and 10.
- Redundant pressure switches will be required in the PPP to sense leakage between the water system and the waste transfer system piping (Action Item 99-015-001).
- The leak detection panel in the DACS trailer will be Safety Class to provide redundant annunciation for Operations (Action Item 99-015-002).

The meeting was adjourned.

Timothy C. Oten
04/12/99
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APPENDIX K

DESIGN REVIEW MEETING MINUTES
ECN 653826
REVISION TO SPECIFICATION FOR MOBILE WATER SUPPORT SKID

241-SY-101 TRANSFER RAPID MITIGATION SYSTEM ECN 653826 REVISION TO SPECIFICATION FOR SY-101 MOBILE WATER SUPPORT SKID, HNF-4043, DESIGN REVIEW

MEETING MINUTES

Prepared by R. L. Schlosser

1163 BLDG, CONFERENCE ROOM 274

April 13, 1999

Design Review Team Members

R. L. Schlosser, Chairman, Session Secretary
M. L. McElroy, Cognizant QA
W. J. Powell, Design Authority
R. W. Reed, Cognizant Manager
H. H. Ziada, Structural and Rigging

Other Attendees

P. Bartley,
T. Benegas, SY-101 Design Lead
J. R. Biggs, Operations Representative
R. Merriman, SY-101 Design Engineer
G. Wilk, SY-101 Design Egineer
K. S. Witwer, SY-101 Design Engineer

DESIGN REVIEW

Keith Witwer presented changes to the Mobile Water Support Skid Specification, HNF-4043, included in a proposed Engineering Change Notice, ECN 653826. The major change encompassed by this ECN is the addition of a remotely located valve stand and location of various safety-related components at the valve stand. In addition, the ECN incorporates several minor modifications including equipment numbering and reworded text.

The committee requested that the ECN distribution be extended to include appropriate personnel including Mark H Brown, SY Tank Farm Cognizant Engineer, Operations Procedure writers, and Maintenance Engineering to ensure that appropriate interface requirements are satisfied. The design team agreed. (Action Item 990413-1)

The committee questioned coordination of the ECN changes with ECN 647721 for electrical changes. Ray Merriman, design engineer for the electrical ECN provided assurance that the two ECNs were coordinated. (Action Item 990413-2)

The committee requested that the connection hose lengths be added at the hose reel (HR1 and HR2) locations and the connection to the Rapid Mitigation System P&ID on Drawing H-14-103657, Sheet 1. The design team agreed. (Action Item 990413-3)

The committee recommended removal of a drain line with drain valve V-412. The location identified is not a low point of the system, low point drainage is provided through drain valve V-411. The design team agreed. (Action Item 990413-4)

The committee recommended that testing of the skid and low point drains be added to the system Acceptance Test Procedure. The design team agreed. (Action Item 990413-5)

The committee required text changes in Section 3.3 of the specification, to include re-evaluation of the structural analysis performed by the Buyer to provide design configuration sketches for the remote valve stand. The design team agreed. (Action Item 990413-6)

The committee required specification of submittals required to complete the Buyer supplied re-analysis identified in Section 3.3. The design team agreed. (Action Item 990413-7)

Since component identification tagging is applied based on reference Hanford drawings, the committee suggested that component tagging requirements be removed from the scope of the specification, in particular as required by the Water Supply Valve & Instrument Stand and Water Supply Spool Piece sketches. It was recommended that tagging be performed after the vendor submitted drawings were converted to Hanford drawings. The design team agreed. (Action Item 990413-8)

The committee required addition of flange bolting requirements to the remote valve stand specification requirements to control assembly of various government furnished equipment. The design team agreed to add a requirement to assemble the flowmeter and pressure transducer using manufacturer's recommended torque requirements. (Action Item 990413-9)

The committee recommended that the specification require the weight of the valve stand assembly be permanently marked on the completed assembly. The design team agreed. (Action Item 990413-10)

The design review chairman summarized the action items and polled the review team, identifying no HOLD point items. The review team members agreed that the action items could be closed by review of the modified ECN by the chairman, with the chairman's signature on the ECN as record of acceptable closure. The meeting was adjourned.

APPENDIX L

DESIGN REVIEW AGENDA, MEETING MINUTES AND REVIEW COMMENT RECORDS RAPID SYSTEM DESIGN REVIEW

RAPID SYSTEM DESIGN REVIEW
AGENDA/PRESENTATIONS
1163 Building/Rm. 274
4/29/99

8:00am	**Introduction (R. L. Schlosser)**
8:10 am	**Control Decision Record (J. M. Grigsby)**
8:30am	**System Drawings (T. R. Benegas)** • P&ID's • Loop • Elementaries • One Line
8:45am	**Installation Drawings (P. A. Titzler)**
9:00 am	**Miscellaneous Electrical Drawings (J. L. Wilk)**
9:10am	**Design Compliance Matrices (G. D. Pierce)**
9:40am	**Transfer Line Spec (S. W. Shaw)**
10:00am	**BREAK**
10:15am	**Continue Transfer Line Spec (S. W. Shaw)**
12:00am	**LUNCH**
3:00pm	**Approve Transfer Line Spec (S. W. Shaw)**

CONTINUE WITH RAPID SYSTEM DESIGN REVIEW
AGENDA/PRESENTATIONS (IF REQUIRED)
1163 Building/Rm. 274
8am-4:30pm
2/29/99

241-SY-101 RAPID MITIGATION SYSTEM, FORMAL DESIGN REVIEW

MEETING MINUTES

Prepared by Shakir Zaman

Building 1163, CONFERENCE ROOM 272

April 29-30, 1999

Design Review Team Members

R. L. Schlosser, Chairman
S. U. Zaman, Secretary/Equipment Engineering
M. G. Al-Wazani, Electrical Engineering
R. W. Reed, Cognizant Engineering Manager
L. S. Krogsrud, Nuclear Safety
T. Oten, Equipment Engineering
H. H. Ziada, Structural and Rigging
Lou. Pokos, Equipment Engineering
Michael McElroy, Quality Engineering
Rick Huckfeldt, Safety
Joe Meacham, Nuclear Safety and Licensing
W.J. Powell, Design Authority
Mark H. Brown, Cognizant Engineer
Shafik Rifaey, Equipment Engineering
Tim. Oten, Equipment Engineering
Michaell Erhart, Cognizant Engineer
Daniel A. Reynolds, Process Control
Craig Shaw, Retrieval Engineering
Bob. Giordano, Radiological Engineering

Other Attendees

Jerry Wilk, I&C
Carl Hanson, Engineering Manager
Peter Titzler, Design Engineer
Glenn Pierce, Compliance Matrices
Carl W. Holmes, Electrical/I&C
Gary L. Hickman, I&C
Larry Kripps, Nuclear Safety and Licensing

DESIGN REVIEW

The chairman presented an overview of the two day design review for the 241-SY-101 RAPID Mitigation System Final design, the approach to review, comments, resolution in relationship to the Performance Agreement (PA) of June 1st. 1999. He stated that presently there are 19 unresolved items from the previous design review meeting; 9 of them are awaiting response from the process engineering. Some critical issues and hold points such as pump performance should be closed through this final design review. He also stated that the remaining issues need team consensus. Any additional comments should be submitted no later than Tuesday, the May 4th. In order to meet the PA milestone.

The Nuclear Safety and Licensing presented the new controls associated with the RAPID Mitigation design. It was the team consensus that these controls have already be subjected to a review and approval by Nuclear Safety and Licensing with the appropriate review by other departments and therefore are outside the purview of this design review team i.e. no approval by this design review team is required. Furthermore, these new controls are not to be a part of the Authorization Basis (AB) and no approval is required from the DOE. These controls are voluntary, contractor imposed internal controls and will be incorporated in HNF-1266 manual as required over and above the AB controls.

It was the team consensus that the control for the water addition should remain as manual.

An issue, raised by Craig Shaw, is that the waste temperature trapped in the pump may rise to a high temperature due to high winding/oil temperature. This has not been analyzed yet. This analysis needs to be performed.

The rest of the open items are included in the attached RCR

REVIEW COMMENT RECORD (RCR)

	1. Date 4-29-99 (5/16/99 status)	2. Review No. 99-015
	3. Project No. N/A	4. Page 1 of 8

5. Document Number(s)/Title(s)	6. Program/Project/ Building Number	7. Reviewer	8. Organization/Group	9. Location/Phone
SY101 RAPID Mitigation System - System Design Review	TWRS	Design Review Team (RL Schlosser, chairman)	TWRS	2750E/A110 376-7725

17. Comment Submittal Approval:

Organization Manager (Optional)

10. Agreement with indicated comment disposition(s)

Date

Reviewer/Point of Contact

Author/Originator

11. CLOSED

Date

Reviewer/Point of Contact

Author/Originator

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
1	The temperature of the waste trapped in the pump may be high. This needs to be analyzed.		222-S Lab's preliminary dilution/viscosity study report (82100-99-015) indicated that the viscosity of the solids-free liquid from SY-101 convective waste diluted 1:1 with water is about 3 cP at the in-situ tank waste temperature and at shear rates > 50 sec^{-1}. Memo 74B50-99-017 estimated the effect of the solids present in the 1:1 diluted waste will raise the viscosity to a value of about 7.5 cP, with an estimated upper bound of 15 cP. The April WEMD test results presentation showed the MWST (max winding surface temperature) at this viscosity to be about 80 °C, with a fluid temperature rise across the pump of about 2 °C.	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
4-29-99 (5/16/99 status)	99-015
3. Project No.	**4. Page**
N/A	2 of 8

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
1	(continued)		If the pump were to shutdown with 1:1 diluted slurry without flushing, the decay of thermal gradients within the pump may cause the 1:1 diluted waste to temporarily peak at some value between 50 °C and 80 °C. The majority of the solids within 101-SY waste show a positive solubility vs temperature correlation meaning that the volume of solids in the waste decrease with increasing temperature. Additionally, 80 °C is not hot enough to cause the waste components to decompose to more intractable materials. Transfer pump internal temperatures should not cause any problems for the small transfer.	
2	H-14-103647, Hose-in-hose assembly layout; why the berm is located by the SY-102; investigate. The routing of the hose may be affected by the presence of the berm.		Accept.	Closed
3	How is ASME B31.1 applied? What testing is applied to ensure hose does not leak in actual application? How do you show equivalency to ASME Section III requirements? We also need an analysis for evaluating the tensile strength. It was suggested that a group evaluate all aspects of HAHA design.		Pressure testing to 150% of rated working pressure meets the requirements of B31.1/3. Hose end fittings are being welded in accordance with B31.3, and inspected per ASME, that leads you to B31.3. ASME Section III does not apply to rubber hose (which, for the purpose of the encasement is under a potential 6 INWC vacuum). Recall that 6430.1A that speaks to an ASME Section III compliance or equivalence, also stipulates that Professional Engineering Judgement shall also be applied.	Open
4	Provide heat transfer analysis for heat trace and airflow effects on the primary and secondary hose.		Accept. The final calculations will be included in the calculation supporting document.	Open
5	For anti-static rubber hose a specific requirement should be delineated so that the presence of an ignition source is precluded. (action for Rick Huckfeldt)		The value was changed based on Rick's input	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
4-29-99 (5/16/99 status)	99-015
3. Project No.	4. Page
N/A	3 of 8

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
7	A requirement for an engineering evaluation for the hose assembly stress evaluation will be added to the SDC in HNF-4252.		Accept in part. The analysis of the hose assembly will be limited to fluid flow reaction forces that occur during steady state and transient (slug flow) conditions. However, the analysis will include support structures and constraints needed to prevent unacceptable movement of the hose assembly due to the reaction loads and other applicable natural phenomenon loads. Criteria for these analyses will be added to the SDC in HNF-4252.	Closed
8	Any welding performed at the ends of the encasement hose assembly will comply with the ASME B31.3 and ASME Section III equivalency requirements. The primary hose connections will comply with the ASME B31.1 requirements.		The end fittings are being fabricated in accordance with B31.3 criteria. It is assumed that the reference to B31.1 is a typo, as this was never a criteria for hose in pipe, where both were in accordance with 31.3.	Closed
9	H-14-103656, P&ID; the emergency stop button is located within the limited access, high radiation area. The other stop button is located in the DACS trailer (MO 461). This stop button is active during the automatic mode only. This needs to be evaluated. (see also Comment 19)		The "stop" and "E-Stop" control circuits have been designed to shutdown the VFD if in either the Automatic or Manual Mode.	Closed
10	Add local alarms for the leak detectors on the P&ID.		Local alarms have been added to P&ID but trying to get confirmation from Configuration Engineering, Mr. Douka on how this affects their criteria.	Open
11	MEL shall include the instrument set points and accuracy as well as should reference any calculations. This shall be referenced as a note in the drawing.		Accept, Calculations could be reference back to HNF-4359. A back reference from the P&ID to the MEL could be added as a note.	Open
12	For redundancy, add one more safety class pressure switch using different tap with a different orientation. Running of the wires for the two pressure switches within the same conduit is acceptable.		A second pressure switch, installed in a separate port, has been included in the design. Since the switch itself is designed for vertical installation, and this orientation is less susceptible to damage, orientation of both switches is identical (vertical, atop pipe). While a horizontal installation was suggested to ease the impact of adding this second switch on the piping manifold design, a vertical orientation has been accommodated.	Closed
13	HNF- 3885 needs to be revised. This shall also include the limits of the VFD drive.		Partially accept. Limits on the VFD will be added to HNF-3885 only so far as state criteria but not to list operating features.	Open

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
4-29-99 (5/16/99 status)	99-015
3. Project No. N/A	4. Page 4 of 8

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
13	HNF- 3885 needs to be revised. This shall also include the limits of the VFD drive.		Partially accept. Limits on the VFD will be added to HNF-3885 only so far as state criteria but not to list operating features.	Open
14	SEL needs to be completed and issued as a project SEL on or before May 28th 1999.	H	Accept	Closed
15	SY-102 drop leg does not have a trap. Change the P&ID. Show a spray ring.		Accept. Changes have been incorporated into the drawing.	Closed
16	The strobe light for the leak detector and one of the enunciators shall be safety class items.		Strobe light Micro III 495S-1280 by Tomar is CGI evaluated before installation in the leak detector enclosures.	Closed
17	Add drawing reference for remote devices for the leak detectors.		Will add to dwg. H-14-103649 sht 1 and h-14-103656 sht 1 reference.	Closed
18	Add a note for VFD control station on drawing H-14-103655.		The VFD control station has been referenced on this drawing.	Closed
19	For VFD in any mode, the capability to shut down the pump from any control station shall be maintained. This needs to be evaluated. This may have to be rewired to set it in the manual mode. Action by Ray Merriman and *confirmation by Mazen Al-Wazani.*		The "stop" and "E-Stop"control circuits have been designed to shutdown the VFD if in either the Automatic or Manual Mode.	Closed
20	Use the standard convention for symbols including for de-energized contacts.		Symbols for relay contracts shall reflect shelf condition "de-energized," and have been corrected on applicable drawings. Will show all contacts in ladder logic circuit in a de-energized state.	Closed
21	H-14-103641: Comments by Mazen need to be resolved by May 28th. 1999.	~~H~~	Mazen comments are being incorporated. /Jerry Wilk	Open
22	The drawings shall be labeled as for construction or for project use only. After construction, as built drawings will be developed and incorporated through an ECN process.		A construction note and stamp has been added to Rapid Mitigation System drawings.	Closed
23	H-14-103610: The interference with respect to other projects needs to be evaluated.		Accept, Ron Reed to evaluate.	Closed
24	H-14-103652: The drawing needs a reference to supporting calculations and documents. The same comment is applicable to Drawing H-14-103649 and other Drawings for seismic and wind loading.	H	Note added to H-14-103643, 649, 652, 653, and 760 referencing HNF-4359 containing the calculations and other seismic and wind loading information.	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
4-29-99 (5/16/99 status)	99-015
3. Project No.	**4. Page**
N/A	5 of 8

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
25	Electrical power load analysis shall be completed to show adequacy of power to meet system demand. The load analysis shall be prepared as a revision to the facility loading analysis. Both the 252-S facility load analysis and the revision ECN shall be completed and issued by May 28th.	H	The updated Electrical System power analysis calculations have been completed. Copies and originals (hardcopies) and an electronic copy of the calculation file have been distributed to Jay Roberts and Mazen Al-Wazani. Release is expected before the May 28 date.	Open
26	An evaluation shall be performed whether a lightening protection is warranted for the new 101-SY to 102-SY transfer line and its associated components. (MGA)		All components of the Rapid Mitigation System are low to the ground. Lighting protection is not required for the Mixer Pump or other equipment at this elevation due to the low lighting frequency in this area.	Open
27	A red line mark up of the electrical drawings has been provided to Jerry Wilk. These comments need to be resolved. (MGA)		Accept in general, but still must get all of MGA's mark ups.	Open
28	H-14-103641 sheet 2, Zone D-6: Wiring for the flow loop is shown incorrectly at ITB2. (TCO)		Accept and corrected.	Closed
29	H-14-103641 sheet 1, 2, and 3: Show where shield wire is grounded. (TCO)		Reject – On drawing H-14-103654 sht 1 under general notes: note 1: All instrument shields are tied together as required at terminal block 1 TB1 and grounded.	Closed
30	H-14-103641 sheet 3, Zone C-6: Shield for PI-368 at ITB2 is shown at terminal 43, which is also used for the signal to FIY-419. (TCO)		Accept and corrected.	Closed
31	H-14-103607: Item J is shown in the Table but is not identified on the drawing. (TCO)		See item #40. Item J on table shall be deleted.	Closed
32	H-14-103651, Zone B-4: ground for shield should be terminated at terminal 31 of ITB2, but not at terminal 32. (TCO)		Accept and corrected.	Closed
33	The following changes should be made to the P&ID for the water skid: TI-410 and TC-410 should be TIC-410 TI-414 and TC-414 should be TIC-414 TI-415 and TC-415 should be TIC-415 These are singular instruments instead of two as shown on the current P&ID. (JL)		Accept and corrected per conversation with Keith Witwer.	Closed
34	General comment, include the SY drawing index reference on all prints. WJP		Accept	Closed

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
4-29-99 (5/16/99 status)	99-015
3. Project No.	4. Page
N/A	6 of 8

12. Item	13. Comment(s)/Discrepancy(s) (*Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.*)	14. Hold Point	15. Disposition (*Provide justification if NOT accepted.*)	16. Status
35	103559, and –103610, the pit labeled " valve pit" is either the raw water service pit.. or something else I can't tell. The detail III water connection is *not adequate, not accurate. The existing ball valve* and 2 inch line may be valve SYSP-RW-V-117, which is a 1 or ¾ inch gate valve. The existing "2 inch quick disconnect" looks like a 1 or ¾ inch quick disconnect. Revise, WJP.		Accept. The print will be labeled "Raw water supply service pit." Connection will be made to a new hose fitting above SYSP-RW-V-117. This is a 1" line with a male camlock, 2" fitting, newly installed – per ECN 652946, dated 4/27/99.	Closed
36	103616, To allow the waste flowmeter to operate full, there is space in the spool piece following it to put an offset-- to allow a high point in the system. This change is simple, inexpensive and fast, it would do a lot of good for process control. It is recommended for good engineering and process control improvement, if we do not have time this goes away. If the next comment (37) is implemented this could go away. WJP		Not accepted. This comment addresses a concern with a transient condition at start-up. This condition is expected to be sufficiently brief to have no significant impact on pumping operations. Further, flow meter accuracy is not expected to be high, due to uncertainties of calibration for the wide range of dilution flow expected. Therefore, modifications to enhance accuracy of the flow meter are not efficacious.	Open
37	103616, To allow the waste flowmeter to operate full we could put in a valve between valves v-354, -355 and pressure switch PS-370. This would allow a operational high point purge and allow us to recycle diluted waste to AY-101. This could be a possible solution to some of the problem of crust level rise and is recommended - if time allows. WJP		Not accepted. As with the justification for comment 37, the transient nature of the concern related to the flow meter, and the high uncertainty of flow meter accuracy make the suggested change unwarranted. Also, *a high point to allow aspiration of* transfer piping after a pumping evolution is provided in the current design, and the recycling of diluted waste through this aspiration line raises significant concerns about potential generation of ammonia vapor in the tank head space.	Open
38	*103590, The dropleg is shown at 160 inches above the tank bottom.* The lower administrative level for the tank level is 130 inches. Modify the dropleg to add 30 inches to extend it to 130 inches from the tank bottom. This will allow the dropleg to be covered whenever the next cross-site transfer is done. This will allow us flexibility in this and other transfers.		Reject. Drop leg discharge elevation was input by process engineering based on PNNL Calculations to optimize in-tank mixing.	Open
39	103607, the identifier C, D and J do not appear to be accurate. The C identifier, primary transfer line, should be 370 psi working pressure, and 60 psi working pressure for the encasement. Both at 155 F, per HNF-4407. What does SST mean? Is this appropriate in identifier C? Identifier J does not exist with hose in hose line design. Revise. WJP		Partial accept. Per HNF-4407 Pp=375 psi Ps=60 psi Tp= 130°F max Tsa=155°F max Delete Item J	Open

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
4-29-99 (5/16/99 status)	99-015
3. Project No. N/A	4. Page 7 of 8

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
40	103607, we missed adding the water skid as utility upgrades to this print, revise. WJP		Accept. The water skid will be added as item "K" – utility upgrade.	Closed
41	10360, show siphon break elevation on this print. WJP		Accept.	Closed
42	103640, transfer line flush limits are not internally consistent in that they give flow velocity and Flow rates which are not consistent, i.e. 4 to 6 ft/sec and <70 gpm. Recommend that they be amended to say >45 gpm. We can measure gpm, can't measure ft/sec. WJP		Drawing H-14-103640 will be changed to state that the transfer line flush and back-flush will be specified with a flow rate range of 40 to 60 gpm.	Closed
43	Same comment for pump outlet line flush, and Pump Internal Flush. The Pump internal flush, how did we get 10 gpm? Is it a limit? Best estimate? Sounds low for the pump internals. WJP		The pump purge value of 10 gpm at 90 psig is a design requirement from the original specification for purge flow. Analysis shows the purge line will met this requirement.. This flow path can take more flow and does when the pump is operating. At 140 gpm discharge the internal recirc (which is the purge line flow when the pump is not operating) takes ~30 gpm.	Open
44	Add a note saying that these tables do not apply for off normal conditions, see the PCP. Preferentially the line and the pump must be flushed with the 75 gal, emergency water if the transfer is lost and no water from the 2000 gal tank is available. WJP		Drawing H-14-103640 will be changed to state that the given flush rates and volumes do not apply for off-normal flushes supplied by ACC-401.	Closed
45	-103656, P&ID, we need something to slow down the flow of water, from the 75 gal. tank, *during emergency conditions* (loss of power at the water skid). This will allow the operator time to monitor the flush water to the pump and to the transfer line. The option recommended is an orifice at he outlet of the 75 gal. tank that could fit between two flanges. The rate needs to be reduced to about 45 gal/min. This will allow half of the volume to be flushed to the pump (47 sec.) and half to the line. ~~HOLD POINT~~ WJP	~~H~~	Reject. The original approved design spec called for a flush of the transfer line, not the transfer pump.	Open

REVIEW COMMENT RECORD (RCR)

1. Date	2. Review No.
4-29-99 (5/16/99 status)	99-015
3. Project No.	4. Page
N/A	8 of 8

12. Item	13. Comment(s)/Discrepancy(s) (Provide technical justification for the comment and detailed recommendation of the action required to correct/ resolve the discrepancy/problem indicated.)	14. Hold Point	15. Disposition (Provide justification if NOT accepted.)	16. Status
46	The process flow meter MUST have a totalizer on it. H-14-103652 shows FIT-367 to be a "LCD INDICATOR/TOTALIZER." This is what is necessary for process control. H-14-103656 does not show the totalizer function for FE-367. ~~HOLD point~~. (DJR)	~~H~~	Reject It is agreed that a flow totalizer could be useful. However, the addition of the instrument is not necessary to the design objective, i.e., pump ~100,000 gallons in September. This is based on the System Design Review on 4/29/-4/30. Although this issue did not specifically came up at the design review. An issue closely related to it was raised. That issue was the need for a waste flowmeter at all. The point initiating the discussion was the accuracy of the flowmeter, the required accuracy, the effect of air in the flow or channel flow. The discussion can be summarized as follows: A.) Transients, i.e. start up, is not an issue since they were expected to be short - 30 minutes to an hour (a period somewhere in that range). Our instruments of choice would be the ENRAF and water flowmeter. B.) No calibration is possible on the flowmeter unless the fluid in question is used, (waste at varying degrees of dilution). C.) The flowmeter could be off by 50% and would meet our requirements. Therefore, based on that discussion, the accuracy of the waste flowmeter will be questionable. Operations will not rely on the waste flowmeter. Therefore readings from the flowmeter will also be questionable, i.e., a flow totalizer. The instruments that will be used are the ENRAF and the water flowmeter and water totalizer. Operations may use a waste totalizer instrument after the ENRAF/water flowmeter correlation is established. A counterproposal is to include a waste flow totalizer at a later date via an ECN if still requested	Open

APPENDIX M

DRAFT CONTROL DECISION RECORD

DRAFT

CONTROL DECISION RECORD

TANK 241-SY-101 WASTE TRANSFER

MAY 1999

LJKripps
4/27/99

CONTROL DECISION RECORD
TANK 241-SY-101 WASTE TRANSFER

1.0 Introduction

Control decision meetings for the transfer of waste from Tank 241-SY-101 to Tank 241-SY-102 were held on March 15 and 16, 1999. The agenda for the control decision meetings is included in Enclosure 1, and a list of meeting attendees is included in Enclosure 2.

The purpose of the control decision meetings was to identify existing controls and/or select new controls to protect the public, onsite workers, facility workers, and the environment from potential hazardous conditions and postulated accidents for a Tank 241-SY-101 waste transfer. Controls include safety-class and safety-significant structures, systems, and components (SSCs); technical safety requirements (TSRs); and other controls that provide defense-in-depth or environmental protection.

The scope of the control decision meetings covered waste transfers from Tank 241-SY-101 to Tank 241-SY-102 that are planned to remediate the Tank 241-SY-101 surface-level rise condition (see *Tank 241-SY-101 Surface-Level-Rise Remediation Project Plan*, HNF-3824). The first waste transfer will move approximately 380,000 to 570,000 liters (100,000 to 150,000 gallons) of waste and is schedule for September 1999. The possible back dilution of Tank 241-SY-101 waste with water following the waste transfer was not within the scope of the control decision meetings.

The control decision meetings were conducted in accordance with the established and approved process and criteria described in the Tank Waste Remediation System (TWRS) Basis for Interim Operation (HNF-SD-WM-BIO-001). A summary of the control decision process and criteria was presented at the start of the control decision meetings and is included in Enclosure 3. Control decisions were based on the best available information from the waste transfer hazard and accident analyses and on the technical expertise and experience of the meeting participants. Decisions were made by consensus.

Subsequent to the March 15 and 16, 1999 control decision meetings, several revisions to controls occurred. Control revisions were based on the results of actions assigned at the meetings (i.e., a subsequent design decision to provide a passive siphon break and a subsequent decision on the specific instrument systems that will be used to measure the quantity of waste transferred from Tank 241-SY-101). A revision also resulted from the resolution of a subsequent safety classification issue raised by the TWRS Design Authority (i.e., safety-class versus safety-significant SSC instrument systems to measure the quantity of waste transferred from Tank 241-SY-101). These control revisions and their bases are specifically identified in the summary of the control decision discussions in Section 3.

In addition, the control decisions were reviewed against the final waste transfer design and the final documented waste transfer hazard and accident analyses since these were not completed until after the March 15 and 16, 1999 meetings. *(Insert sentence, if required, identifying any control revisions based on this review – e.g., ammonia controls?).* These control revisions and their bases are also specifically identified in the Section 3 summary of the control decision discussions. *(Replace the latter sentence with one that states "No control revisions resulted from these reviews" depending on review results.)*

Section 2 is an overview of the meeting presentations. The presentations described the Tank 241-SY-101 waste transfer system design and operation and the results of the waste transfer hazard and accident analyses. The presentations provided the background and the basis for the subsequent control decision discussions. Copies of the presentations are included in the enclosures to this Control Decision Record.

Section 3 is a summary of the control decision discussions on the representative accidents and the associated represented hazardous conditions that were considered at the March 15 and 16, 1999 meetings. The discussion summary identifies the controls that were considered, and the reasons why specific controls were selected or not selected.

Attachment 1 is a summary of new controls for the Tank 241-SY-101 waste transfer. Attachments 2-7 contain the individual control decision records of the selected safety SSCs, TSRs, and defense-in-depth controls for each representative accident, and the associated represented hazardous conditions, considered at the control decision meetings.

2.0 Overview of Presentations on the Waste Transfer System Design and Operation and the Hazard and Accident Analyses

The first presentation described the current design and planned operation of the Tank 241-SY-101 waste transfer system (see Enclosure 4). This design and operation information was used as the basis for the control decisions at the March 15 and 16, 1999 meetings. Subsequent to the control decision meetings, the waste transfer system design was finalize at the final waste transfer system design review on April 29 and 30, 1999 *(To be confirmed)*. The final design of the waste transfer system was reviewed to determine whether any design revisions occurred subsequent to March 15 and 16, 1999 that could affect the control decisions. The results of this review are included in the Section 3.0 control decision discussion summary.

The next presentations provided an overview (Enclosure 5) and the results (Enclosure 6) of the hazard analysis performed on the Tank 241-SY-101 waste transfer. The hazardous conditions resulting from the hazard analysis included the following.

1. Hazardous conditions having potential onsite or offsite consequences addressed by the Authorization Basis, but presenting control allocation concerns (i.e., hazardous conditions that after the allocation of existing controls were either a) judged to

potentially require additional controls or b) determined to pose issues with respect to the application of existing controls). (See Enclosure 6, Part 1)

2. Hazardous conditions having potential onsite or offsite consequences addressed by the Authorization Basis (i.e., hazardous conditions that after the allocation of existing controls were judged to be acceptably prevented or mitigated). (See Enclosure 6, Part 2)

3. Hazardous conditions having no consequences or consequences impacting only the facility worker. (See Enclosure 6, Part 3)

Analyses demonstrating that existing controls acceptably prevent or mitigate hazardous conditions for the Tank 241-SY-101 waste transfer (i.e., hazardous conditions in the second group above) were presented (see Enclosures 7 and 8). These analyses were finalized subsequent to the control decision meeting and are documented in *Transfer Accident Analysis for 101-SY Small Transfers* (HNF-4302). HNF-4302 was reviewed to determine whether any revisions occurred subsequent to the control decision meetings that could affect the control decisions. The results of this review are included in the Section 3.0 control decision discussion summary.

Note: Prior to the March 15 and 16, 1999 control decision meetings, a group of individuals with knowledge of the existing Authorization Basis and the Tank 241-SY-101 waste transfer hazard analysis met to review all of the hazardous conditions with potential onsite or offsite consequences (S2 and S3, respectively). At this meeting, existing controls were allocated to these hazardous conditions and the hazardous conditions were placed in either the first or second group above. This enabled the control decision meetings to focus on hazardous conditions that required control determinations. Subsequent to the control decision meetings, another group of knowledgeable individuals reviewed all of the hazardous conditions with facility worker consequences that are anticipated (S1, F3), and all of the hazardous conditions with potentially significant environmental consequences (E2 and E3). The purpose of this review was to identify the need for additional controls to protect facility workers or the environment for the Tank 241-SY-101 waste transfer. No new facility worker or environmental controls were identified from this review (i.e., existing controls in the Authorization Basis and new Tank 241-SY-101 controls acceptably provide for protection of facility workers and environment).

Presentations were then made providing the results of accident analyses of representative flammable gas accidents for the Tank 241-SY-101 waste transfer. These included presentations on the following.

- The estimated risk (i.e., frequency and consequences) of representative flammable gas accidents from the existing Authorization Basis (Enclosure 9)

- Postulated gas release mechanisms from the Tank 241-SY-101 crust, and gas release models developed for estimating potential crust gas releases from waste transfer operations and activities (Enclosure 10)

- Tank 241-SY-101 waste transfer flammable gas accident results from the Refined Safety Analysis Tool (Enclosure 11)

The above accident analyses were finalized subsequent to the control decision meetings and are documented in *Flammable Gas Calculation Note for 101-SY Small Transfer* (HNF-4333). HNF-4333 was reviewed to determine whether any revisions occurred subsequent to the control decision meetings that could affect the control decisions. The results of this review are included in the Section 3.0 control decision discussion summary.

3.0 Control Decision Discussion Summary

Based on the Tank 241-SY-101 waste transfer hazard and accident analyses, control decisions were required for the following three new representative flammable gas accident scenarios, and the potential hazardous conditions that these accident scenarios represented.

- Flammable gas deflagration - induced gas release from crust disturbance
- Flammable gas deflagration - induced gas release from crust dissolution
- Flammable gas deflagration - buoyant displacement gas release event plus additional gas release from the crust

In addition, control decisions were required for potential hazardous conditions that were represented by the following existing representative accidents, but where issues were identified concerning whether existing controls acceptably prevented and/or mitigated the hazardous conditions.

- Flammable gas deflagration – general
- Spray leak in structure or from overground transfer line
- Surface leak resulting in pool

A summary of the March 15 and 16, 1999 control decision meeting discussions (and subsequent reviews and revisions, as appropriate) for these representative accidents and the potential hazardous conditions that they represented is presented in the rest of this section.

3.1 Flammable Gas Deflagration –Induced Gas Release from Crust Disturbance

The representative accident is a flammable gas deflagration due to an induced gas release caused by operations and activities that disturb the Tank 241-SY-101 crust (e.g., waste transfer pump installation, crust disturbance as the waste level falls during the transfer) with subsequent ignition. A list of existing controls that may prevent or mitigate this representative accident was made, and then possible new controls were identified and evaluated. Following the selection of controls for the representative accident, the potential hazardous conditions represented by this accident (see Enclosure 6, Part 1) were reviewed and additional controls were selected, if necessary. The control decision discussions are summarized below, and the selected controls are presented in Attachment 2.

Existing Controls

Safety SSCs - Safety Class (SC): DST/AWF Ventilation
SC: Tank 241-SY-101 Hydrogen Monitor (7500 ppm*)
SC: Tank 241-SY-101 Ammonia Monitor (3000 ppm*)

* Maximum gas concentrations in the LA-UR-92-3196 Level I controls for mixer pump operation

TSRs - Limiting Condition for Operation (LCO) 3.2.1: DST and AWF Ventilation System
Administrative Control (AC) 5.9: Flammability Controls (LA-UR-92-3196 Level I mixer pump controls)

Supplemental Controls (Wagoner 1998)

Note: For this representative accident, the mixer pump controls were assumed to effectively control gas retention at depth and, therefore, the only postulated gas releases are from the crust.

Possible New Controls

Waste level – This control was proposed to protect accident analysis assumptions. This control was not selected based on a consensus that the accident analysis should include sensitively studies for expected waste levels, and if the waste levels assumed in the accident analysis were exceeded, an Unreviewed Safety Question (USQ) evaluation would be triggered.

Minimum Ventilation System Flowrate (400 cfm or higher) – The LA-UR-92-3196 Level II controls include a 400 cfm minimum ventilation system flowrate requirement. The Refined Safety Analysis Tool analysis showed that the risk from a flammable gas deflagration was not sensitive to ventilation flowrate (analyses performed for 200, 400 and 600 cfm – see Enclosure 11 and HNF-4333). The consensus was that this control should remain as a Level II control.

Flammable gas monitoring (during tank operations and activities that could disturb the crust) – The existing TSR AC 5.11 flammable gas monitoring controls are not applicable to Tank 241-SY-101, and the LA-UR-92-3196 Level I controls on hydrogen and ammonia monitoring are associated with mixer pump operation. The consensus was that flammable gas monitoring be selected as a TSR-level control (i.e., to expand the applicability of AC 5.11 to include Tank 241-SY-101 and/or elevate and augment the LA-UR-92-3196 Level II flammable gas monitoring controls). There was some discussion on whether there should be an LCO on the hydrogen and ammonia monitoring systems, but the consensus was for a flammable gas monitoring program (i.e., an AC) consistent with other TWRS facilities.

Ignition Controls – The existing TSR AC 5.10 ignition controls are not applicable to Tank 241-SY-101. Ignition controls were selected by consensus as a TSR-level control (i.e., to expand the applicability of AC 5.10 to include Tank 241-SY-101 and/or elevate and augment the LA-UR-92-3196 Level II ignition controls).

Water Addition Controls (location, rate, volume, temperature) – The consensus was that water addition controls should remain as LA-UR-92-3196 Level II controls. Flammable gas monitoring was the preferred control because it provides a direct measure of the gas release hazard and addresses all gas release mechanisms from the crust. There was some discussion of an interlock to automatically stop water addition on high hydrogen concentration, but the discussion was deferred to the representative flammable gas deflagration crust dissolution accident (see Section 3.2).

Mixer Pump Not Operating (during operations and activities that could disturb the crust) - This control was proposed to protect accident analysis assumptions. This is a LA-UR-92-3196 Level II control, and the consensus was that it should remain as a Level II control because flammable gas monitoring, which was selected as a control, addresses cumulative gas release mechanisms.

Waste Disturbance Size Limits – The difficulty in limiting the size of a waste disturbance, and the impracticality of monitoring for compliance, led to a consensus not to select this control.

Inerting – Although information on the feasibility of inerting Tank 241-SY-101 included in Enclosure 12 was not formally presented at the meeting, the cost and time to implement an inerting system for Tank 241-SY-101 were recognized as major factors against this control. The cost estimate in Enclosure 12 is close to $2 million dollars, and implementation of an inerting system would add significant complexity and risk to the efforts to remediate the Tank 241-SY-101 surface level rise condition. In addition, the Refined Safety Analysis Tool analysis showed that an inerted tank does not significantly reduce the risk of a flammable gas deflagration (see Enclosure 11 and the HNF-4333). Based on these considerations, the consensus was that inerting Tank 241-SY-101 not be selected as a control.

Video Camera Monitoring – The consensus was that video camera monitoring should be implemented as a defense-in-depth control recognizing the value of observing crust behavior, but the difficulty of defining criteria that would prompt ceasing operations and activities.

Time Delay from Mixer Pump Operation - The LA-UR-92-3196 Level II controls include an intrusive control that requires that there be at least a 4 hour waiting period following the last activity that can induce a gas release. The consensus was that this control should remain as a Level II control, because flammable gas monitoring, which was selected as a control, addresses the potential for overlapping gas release events.

Dome Pressure Monitoring – This is a LA-UR-92-3196 Level II control to detect large, rapid gas release events [i.e., a buoyant displacement gas release event (BD GRE)]. While dome pressure monitoring provides a faster indication of a BD GRE than flammable gas monitoring, the consensus was that it would likely not detect gas releases due to crust disturbances since these would not be expected to significantly increase the tank dome pressure.

Attachment 2 is the control decision record of the safety SSCs, TSRs, and defense-in-depth controls selected to prevent potential flammable gas deflagration hazardous conditions and postulated accidents caused by induced gas releases from crust disturbance.

3.2 Flammable Gas Deflagration – Induced Gas Release from Crust Dissolution

The representative accident is a flammable gas deflagration due to an induced gas release caused by dissolution of the Tank 241-SY-101 crust from planned or inadvertent water addition with subsequent ignition. A list of existing controls that may prevent or mitigate this representative accident was made (including the controls selected above for the flammable gas deflagration crust disturbance accident), and then possible new controls were identified and evaluated. Following the selection of controls for the representative accident, the potential hazardous conditions represented by this accident (see Enclosure 6. Part 1) were reviewed and additional controls were selected, if necessary. The control decision discussions are summarized below, and the selected controls are presented in Attachment 3.

Existing Controls

Safety SSCs - SC: DST/AWF Ventilation
SC: Tank 241-SY-101 Hydrogen Monitor (7500 ppm*)
SC: Tank 241-SY-101 Ammonia Monitor (3000 ppm*)

* Maximum gas concentrations in the LA-UR-92-3196 Level I controls for mixer pump operation

TSRs - LCO 3.2.1: DST and AWF Ventilation System
AC 5.9: Flammability Controls (LA-UR-92-3196 Level I mixer pump controls)
Supplemental Controls (Wagoner 1998)
Tank 241-SY-101 Ignition Controls
Tank 241-SY-101 Flammable Gas Monitoring Controls

Note: For this representative accident, the mixer pump controls were assumed to effectively control gas retention at depth and, therefore, the only postulated gas releases are from the crust.

Possible New Controls

Maximum Dilution Flow Rate – Based on the developed gas release model, the maximum water addition flow rate would have to be around 20 gpm or less to ensure that the Lower Flammability Limit (LFL) would not be exceeded. (The actual flow rate is dependent on the crust bubble slurry void fraction – see HNF-4333.) This low dilution water flow rate would place a significant constraint on the Tank 241-SY-101 waste transfer. The consensus was that flammable gas monitoring was the preferred control because it provides a direct measure of the gas release hazard and addresses all gas release mechanisms from the crust.

Maximum Dilution Quantity Without Waste Flow – This control was to limit the total quantity of dilution water that could inadvertently be added to Tank 241-SY-101. The control was based on the developed gas release model that showed it takes more than 1000 gallons of water added under the crust to reach the LFL. (The actual quantity of water is dependent on the water flow rate and the crust bubble slurry void fraction – see HNF-4333.) The concept for this control was to make the capacity of the water reservoir on the waste transfer dilution water skid the same as the maximum quantity of dilution water that could be added without waste transfer flow, and to provide an automatic interlock that shut off the service water supply to the dilution water skid on detecting loss of waste transfer flow. The design for this control would have been complex to address all of the postulated inadvertent water addition scenarios. It would also have required bypass of the interlock to refill the dilution skid water reservoir prior to each waste transfer pump startup. This would have introduced the opportunity for human errors. The consensus was that flammable gas monitoring with operator action to isolate water sources to Tank 241-SY-101 on high flammable gas concentration was the preferred control (see below).

Flammable Gas Monitoring – This selected control requires flammable gas monitoring whenever there is a planned water addition or whenever there is a potential for an inadvertent water addition to Tank 241-SY-101. If high flammable gas concentrations are detected (i.e., 25% of the LFL), water sources that are or could be adding water to Tank 241-SY-101 would be isolated (i.e., valves closed and/or lines disconnected). There was considerable discussion on whether isolation of the waste transfer dilution water line should be automatic or could be done by operator action. The gas release model showed that there should be at least 30 minutes between when 25% of the LFL is reached and when 100% of the LFL is reached. (The actual time is dependent on the water flow rate and the crust bubble slurry void fraction – see HNF-4333.) Based on these conservative gas release model results, the consensus was that operator action to isolate the dilution water line was acceptable. Operator action also allowed the ability to backflush the waste transfer line into Tank 241-SY-102 while still isolating the dilution water line to Tank 241-SY-101. The Tank 241-SY-101

Surface-Level-Rise Remediation Project, however, assigned an action to develop a parallel path for the possible incorporation of an automatic dilution water line isolation interlock.

Minimum Ventilation System Flowrate (400 cfm or higher) – See the discussion for the flammable gas deflagration crust disturbance accident.

Attachment 3 is the control decision record of the safety SSCs, TSRs, and defense-in-depth controls selected to prevent potential flammable gas deflagration hazardous conditions and postulated accidents caused by induced gas releases from crust dissolution.

3.3 Flammable Gas Deflagration – Buoyant Displacement Gas Release Event plus Additional Gas Release from the Crust

The representative accident is a flammable gas deflagration due to an operation or activity that causes the mixer pump to become inoperable with a resulting subsequent BD GRE and ignition. A list of existing controls that may prevent or mitigate this representative accident was made (including controls selected above for the flammable gas deflagration crust disturbance and dissolution accidents), and then possible new controls were identified and evaluated. Following the selection of controls for the representative accident, the potential hazardous conditions represented by this accident (see Enclosure 6, Part 1) were reviewed and additional controls were selected, if necessary. The control decision discussions are summarized below, and the selected controls are presented in Attachment 4.

Existing Controls

Safety SSCs - SC: DST/AWF Ventilation
SC: Tank 241-SY-101 Hydrogen Monitor
SC: Tank 241-SY-101 Ammonia Monitor

TSRs - Tank 241-SY-101 Ignition Controls
Tank 241-SY-101 Flammable Gas Monitoring Controls

Possible New Controls

Waste Volume Transfer – This control was selected by consensus. The control requires the calculation of the quantity of waste that can be transferred and maintain mixer pump operability (i.e., maintain a sufficient distance between the bottom of the crust and the mixer pump suction to ensure that the mixer pump continues to perform its safety function of controlling gas retention at depth and preventing BD GREs). Based on analysis presented at the control decision meeting (Enclosure 13 – see also HNF-333), mixer pump operability should not be affected as long as the bottom of the crust is at least one (1) foot above the mixer pump suction. However, there are uncertainties in measuring the bottom of the crust, including level monitoring system accuracy, and downward growth of the crust subsequent to the waste transfer that must be considered in calculating the maximum permissible waste transfer. The Tank 241-SY-101 waste transfer must then be monitored, and the transfer of waste limited to the maximum calculated quantity.

Tank 241-SY-101 Waste Level – This control has the same objective as the selected control on calculating, monitoring, and limiting waste transfer volume. However, the consensus was that the selected control was preferred versus simply establishing a lower limit on the level of the crust bottom.

Mixer Pump Performance – Since it was judged as providing significant defense-in-depth with respect to ensuring mixer pump operability, the consensus was to elevate the monitoring of mixer performance to a TSR-level control. The control requires monitoring of mixer pump performance, including monitoring parameters such as pump motor current, pump discharge pressure, and the response of waste thermocouples to mixer pump operation. The monitoring results are to be reviewed periodically (at least quarterly) by the Test Review Group (TRG) for signs of mixer pump performance degradation (i.e., loss of mixer pump capability to control gas retention at depth and the prevent BD GREs). If signs of degraded mixer pump performance are detected, the TRG would direct corrective action to restore mixer pump performance, such as the addition of water to Tank 241-SY-101.

Instrument Systems – At the March 15 and 16, 1999 control decision meetings, instrument systems required to implement the selected TSR-level control on calculating, monitoring, and limiting waste transfers from Tank 241-SY-101 to Tank 241-SY-102 (see above) were identified as safety-significant SSCs. Subsequent to the control decision meetings, the safety-significant classification was questioned by the TWRS Design Authority. On the basis that these instrument systems are essential to implement a control that protects against an accident with consequences that could exceed offsite risk evaluation guidelines, the instrument system classification was revised to safety-class. Also, the selection of the specific instrument systems to implement the control was made by cognizant design and operations personnel subsequent to the meeting (i.e., the Tank 241-SY-102 level detection system and the dilution water flow totalizer). Because there is no installed system that can directly measure the bottom of the crust, no specific instrument system was identified as safety-class for this measurement. However, existing TSR AC 5.19 on process instrumentation and measuring and test equipment will ensure the performance of whatever instrument system(s) is(are) used to measure the level of the bottom of the crust.

Siphon Break –Siphoning of waste from Tank 241-SY-101 to Tank 241-SY-102 is a concern since it could lead to the inadvertent transfer of waste and mixer pump inoperability. At the time of the control decision meetings, the waste transfer system design required operator action to initiate a siphon break following shutdown of the waste transfer pump. With this design, the time to initiate the siphon break (30 minutes) was required to be accounted for in the implementation of the selected waste volume transfer control (see above). The Tank 241-SY-101 Surface-Level-Rise Remediation Project was assigned an action to assess the possibility of including a passive siphon break in the waste transfer system design. Based on the Project assessment, the waste transfer system design was revised to incorporate a passive siphon break. The passive siphon break was designated safety-class since its failure could lead to inoperability of the mixer pump which could cause the representative accident whose consequences could exceed offsite risk evaluation guidelines.

Attachment 4 is the control decision record of the safety SSCs, TSRs, and defense-in-depth controls selected for this representative accident.

3.4 Flammable Gas Deflagration – General

The waste transfer hazard analysis resulted in a hazardous condition that was represented by the existing representative flammable gas deflagration accident for double-shelled tanks (DSTs) (see Enclosure 6, Part 1). Because the existing TSR AC 5.10 ignition controls and AC 5.11 flammable gas monitoring controls do not apply to Tank 241-SY-101, this hazardous condition was identified for consideration at the control decision meetings. With the existing flammability controls and the new Tank 241-SY-101 TSR-level ignition and flammable gas monitoring controls selected above for other Tank 241-SY-101 flammable gas deflagration accident scenarios, the control decision meeting consensus was that these controls (see Attachment 5) were sufficient to control this potential hazardous condition.

3.5 Spray Leak in Structure or from Overground Transfer Line

The waste transfer hazard analysis resulted in a number of hazardous conditions that were represented by the existing representative spray leak accident, but where issues were identified concerning whether existing controls acceptably prevented and/or mitigated these hazardous conditions (see Enclosure 6, Part 1). The concerns generally resulted because the Tank 241-SY 101 waste transfer design included an above ground Prefabricated Pump Pit (P3) and a special Tank 241-SY-102-007 riser drop leg enclosure design where the overground transfer line entered Tank 241-SY-102. Attachment 6 presents the consensus on controls that are unique to the Tank 241-SY-101 waste transfer. The safety-functions for the P3, overground transfer encasement and connections, and the riser 241-SY-102-007 drop leg enclosure were taken from the safety functions in the TWRS Final Safety Analysis Report (FSAR) for the above ground portion of waste transfer associated structures (e.g., pits).

There was discussion on whether the P3, overground transfer encasement and connections, and riser 241-SY-102-007 drop leg enclosure were required to maintain their safety function for design basis high wind and seismic events. The structures were already being designed to meet design basis high wind (and associated missiles) criteria and, therefore, this requirement was imposed. The consensus was that these structures need not be seismically qualified, leaving only the existing TSR AC 5.14 emergency preparedness control to mitigate the potential consequences of a seismic event. This was justified for several reasons. First, there is a low likelihood of a seismic event during a Tank 241-SY-101 waste transfer. Second, designing the P3 and the riser 241-SY-102-007 drop leg enclosure to meet seismic criteria would be difficult, with potentially significant cost and schedule impacts.

Leak detectors in the riser 241-SY-102-007 drop leg enclosure were also discussed, but the consensus was that they were not required for safety. A requirement was imposed, however, that the riser 241-SY-102-007 drop leg enclosure and the overground transfer encasement and connections be designed to withstand the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the overground transfer encasement to the P3.

3.6 Surface Leak Resulting in Pool

See the control decision meeting discussion of the spray leak accident in Section 3.5 and Attachment 7 for the resulting safety SSCs, TSRs, and defense-in-depth controls that are unique to the Tank 241-SY-101 waste transfer.

4.0 References

FDNW, 1999, *Transfer Accident Analysis for 101-SY Small Transfers*, HNF-4302, Rev. 0, Fluor Daniel Northwest, Inc., Richland, Washington.

FDNW, 1999, *Flammable Gas Calculation Note for 101-SY Small Transfer*, HNF-4333, Rev. 0, Fluor Daniel Northwest, Inc., Richland, Washington.

LMHC, *Tank Waste Remediation System Basis for Interim Operation*, HNF-SD-WM-BIO-001, Lockheed Martin Hanford Corporation, Richland, Washington.

LMHC, *Tank Waste Remediation System Final Safety Analysis Report*, HNF-SD-WM-SAR-067, Lockheed Martin Hanford Corporation, Richland, Washington.

LMHC, 1999, *Tank 241-SY-101 Surface-Level-Rise Remediation Project Plan*, HNF-3824, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

LANL, 1996, *A Safety Assessment for Proposed Pump Mixing Operations to Mitigate Episodic Gas Releases in Tank 241-SY-101: Hanford Site, Richland, Washington*, LA-UR-92-3196, Rev. 14a, Los Alamos National Laboratory, Los Alamos, New Mexico.

Wagoner, J. D., 1998, *Contract Number DE-AC06-96RL13200 – Supplemental Controls for Continued Operations in Tank 241-SY-241* (Letter 98-SCD-140 to R. D. Hanson FDH), U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Attachment 1

Summary of New Tank 241-SY-101 Waste Transfer Controls

Consists of 6 Pages
(Including this Coversheet)

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SUMMARY OF NEW CONTROLS FOR THE TANK 241-SY-101 WASTE TRANSFER[1]

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement	Comments
	Description	SC	SS		
Flammable Gas Deflagration	Siphon break	X	-		**Siphon break:** The safety function of the siphon break is to prevent the siphoning of waste from Tank 241-SY-101 to Tank 241-SY-102 when the waste transfer pump is not operating. (See Note 2)
	Tank 241-SY-102 Level Detection System	X	-		**Tank 241-SY-102 Level Detection System:** The safety function of the Tank 241-SY-102 level detection system is to provide tank waste level for implementation of the Tank 241-SY-101 Waste Transfer Control. (See Note 2)
	Dilution Water Flow Totalizer	X	-		**Dilution water flow totalizer:** The safety function of the dilution water flow totalizer is to provide the quantity of water used to dilute the waste transferred from Tank 241-SY-101 to Tank 241-SY-102 for implementation of the Tank 241-SY-101 Waste Transfer Control. (See Note 2)
				AC: Tank 241-SY-101 Mixer Pump Performance	Program key elements are: • Mixer pump performance (e.g., pump motor current, pump discharge pressure, waste thermocouple response) shall be monitored, and the Test Review Group (TRG) shall review of the data quarterly for signs of degradation that could affect continued control of gas retention at depth and prevention of buoyant displacement gas release events (BD GREs) • The TRG shall direct corrective actions to restore mixer pump performance, as necessary.
				AC: Tank 241-SY-101 Ignition Controls	Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.

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SUMMARY OF NEW CONTROLS FOR THE TANK 241-SY-101 WASTE TRANSFER[1]

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement	Comments
	Description	SC	SS		
Flammable Gas Deflagration (Continued)				AC: Tank 241-SY-101 Flammable Gas Monitoring Controls	Expand applicability of existing TSR AC 5.11 flammable gas monitoring controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II flammable gas monitoring controls. Note: The flammable gas monitoring controls for Tank 241-SY-101 shall specify: 1. When the LA-UR-92-3196 Level I mixer pump hydrogen and ammonia monitoring controls are applicable, and 2. That flammable gas monitoring is required whenever water sources are connected to Tank 241-SY-101, and that all sources of water shall be isolated on high flammable gas concentrations.
				AC: Tank 241-SY-101 Waste Transfer Control	Program key elements are: • For waste transfers from Tank 241-SY-101, the maximum quantity of waste that can be transferred and maintain a minimum of one (1) foot between the mixer pump suction and the bottom of the crust shall be calculated. The calculation shall consider uncertainties in measuring the bottom of the crust, including level monitoring system accuracy, and the growth of the crust subsequent to the transfer. • The waste transfer from Tank 241-SY-101 shall then be monitored and limited to this maximum quantity.

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SUMMARY OF NEW CONTROLS FOR THE TANK 241-SY-101 WASTE TRANSFER[1]

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement	Comments
	Description	SC	SS		
Spray Leak in Structure or from Overground Transfer Line	Prefabricated Pump Pit (P3) OGT encasement and connections Riser 241-SY-102-007 drop leg enclosure	X X X	- - -	None	*P3:* The safety function of the PS is to knock down spray and limit release of aerosols to the environment. The P3 shall be designed to withstand design basis high wind. (See Note 2) *OGT Encasement and Connections:* The safety function of the OGT encasement and connections is to confine a leak from the primary piping and ensure that the leak is directed to Tank 241-SY-102 or, if the drain to Tank 241-SY-102 is plugged, to the P3 which contains a leak detection system. The OGT encasement and connections shall be designed to withstand (1) the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the OGT encasement to the P3 and (2) design basis high wind. (See Note 2) ***Riser 241-SY-102-007 Drop Leg Enclosure:*** Same as OGT encasement and connections. (See Note 2)

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SUMMARY OF NEW CONTROLS FOR THE TANK 241-SY-101 WASTE TRANSFER[1]

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement	Comments
	Description	SC	SS		
Surface Leak Resulting in Pool	Prefabricated Pump Pit (P3) OGT encasement and connections Riser 241-SY-102-007 drop leg enclosure	X X X	X - -	None	*P3:* The *safety-class safety function* of the P3 is to provide an intact boundary for the leaked waste, and when leak detector alarms and appropriate operator response times to shut off the transfer pump are credited, to prevent premature P3 overflow and the formation of a surface pool. The *safety-significant safety function* of the P3, including cover, is to limit release of aerosols generated by splatter inside the P3, and limit shine and skyshine dose to onsite receptors. (See Note 2) *OGT Encasement and Connections:* The safety function of the OGT encasement and connections is to provide secondary confinement for a leak from the primary line and route the leak to Tank 241-SY-102 or, if the drain to Tank 241-SY-102 is plugged, back to the P3 which contains a leak detection system. The OGT encasement and connections shall be designed to withstand (1) the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the OGT encasement to the P3 and (2) design basis high wind. (See Note 2) *Riser 241-SY-102-007 Drop Leg Enclosure:* Same as OGT encasement and connections. (See Note 2)

Notes:

1. This summary lists only the new controls selected for the Tank 241-SY-101 waste transfer.
2. The safety function for a safety-class or safety-significant SSC states the preventive and/or mitigative safety function(s) that the safety SSC is required to meet. Unless specifically stated in the safety function, the safety SSC is not required to perform its safety function during or following design basis natural phenomena (e.g., seismic events, high winds and associated missiles).

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DEFENSE IN DEPTH CONTROLS

The only new defense-in-depth control identified for the Tank 241-SY-101 waste transfer:

- Video camera monitoring during the waste transfer and during associated activities that involve crust disturbance or dissolution

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Attachment 2

Control Decision Record for Tank 241-SY-101 Waste Transfer for Flammable Gas Deflagration – Induced Gas Release from Crust Disturbance

Consists of 3 Pages
(Including this Coversheet)

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CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER

HAZARD/ACCIDENT: Flammable Gas Deflagration – Induced gas release from crust disturbance

Structures, Systems, and Components (SSCs)

Note: The list of safety SSCs below does not include the Tank 241-SY-101 mixer pump, level monitoring system, pressure monitoring system, ventilation flowmeter, and temperature monitoring system which are required to implement the Los Alamos National Laboratory (LANL) Safety Assessment (SA) Level I mixer pump controls (LA-UR-92-3196, Rev. 14a., Table 6-3) since they do not directly prevent or mitigate potential hazardous conditions and postulated accidents related to the Tank 241-SY-241 waste transfer. Operation of the 241-SY-101 mixer pump to reduce the frequency of a flammable gas deflagration by mixing and releasing flammable gases generated and trapped in the waste is assumed in the hazard and accident analyses of the Tank 241-SY-101 waste transfer. The safety analysis of the waste transfer does, however, identify hazardous conditions and postulated accidents that could result in failure of the mixer pump to perform its safety function (see flammable gas deflagrations – buoyant displacement GRE plus additional crust release from the crust).

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
*DST/AWF Ventilation	X		Maintain flammable gas concentrations in tank dome spaces, due to steady state releases, below 25% of the LFL.	The DST and AWF ventilation systems also reduce the "time at risk" following a large gas release event (GRE).
*SY-101 Hydrogen Monitor	X		Provide indication and alarm for hydrogen gas concentration in the Tank 241-SY-101 vapor space to the operations staff.	An additional safety function of the SY-101 hydrogen monitor is to provide an interlock to stop mixer pump operation if hydrogen concentration reaches 0.75% (7,500 ppm) by volume.
*SY-101 Ammonia Detection System	X		Detect ammonia in the tank headspace/exhaust gas and alarm on the data acquisition system (DACS) when a high level of ammonia exists.	--

SC is safety class
SS is safety significant

- Existing control

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Technical Safety Requirements (TSRs)

Note: New controls appear in ***bold italics***.

Control	Safety Function	Comments
•DST and AWF Tank Ventilation (LCO 3.2.1)	Assure that steady state release of flammable gas does not accumulate in flammable concentrations in vapor spaces of TWRS facilities and structures.	DST and AWF ventilation system operation also reduces the "time at risk" following a large gas release event (GRE).
•Flammability Controls (i.e., LA-UR-92-3196 Level I mixer pump controls including supplemental controls) (AC 5.9)	Assure effective mitigation and safe operations of Tank 241-SY-101 with respect to flammable gas hazards.	The LA-UR-92-3196 Level I controls are primarily related to mixer pump operation. The Level I control on gas concentrations (i.e., maximum hydrogen concentration and maximum ammonia concentration) is the only control directly applicable to preventing or mitigating potential hazardous conditions and postulated accidents from the Tank 241-SY-101 waste transfer.
Ignition controls (Revision to AC 5.10)	*Prevent the ignition of flammable gases that may be present.*	*Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.*
Flammable Gas Monitoring Controls (Revision to AC 5.11)	*Ensures flammable conditions caused by steady-state accumulation or as a results of a recent gas release event are not present in the work space before and during manned work activities and ensures that flammable conditions are not produced by waste intrusive activities in Tank 241-SY-101. This reduces frequency of flammable gas deflagrations.*	*Expand applicability of existing TSR AC 5.11 flammable gas monitoring controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II flammable gas monitoring controls.* *Note: The flammable gas monitoring controls for Tank 241-SY-101 shall specify (1) when the LA-UR-92-3196 Level I mixer pump hydrogen and ammonia monitoring controls are applicable, and (2) that flammable gas monitoring is required whenever water sources are connected to Tank 241-SY-101, and that all sources of water shall be isolated on high flammable gas concentrations.*
•Emergency Preparedness (AC 5.14)	Mitigate the consequences of a flammable gas deflagration.	--
•HEPA Filter Controls (AC 5.18)	Reduce consequences from a possible HEPA filter failure by limiting the inventory available for release.	--
•Process Instrumentation and Measuring and Test Equipment (AC 5.19)	Ensures instrumentation used to monitor the concentration of flammable gases is maintained.	--

- Existing control

Defense-in Depth Controls

Note: New controls appear in ***bold italics***

Control	Safety Function	Comments
Video camera monitor	*Visual monitoring during waste transfers and during activities that could involve crust disturbance or dissolution to detect significant unexpected effects.*	--

Attachment 3

Control Decision Record for Tank 241-SY-101 Waste Transfer for
Flammable Gas Deflagration – Induced Gas Release from Crust Dissolution

Consists of 3 Pages
(Including this Coversheet)

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CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER

HAZARD/ACCIDENT: Flammable Gas Deflagration – Induced gas release from crust dissolution

Structures, Systems, and Components (SSCs)

Note: The list of safety SSCs below does not include the Tank 241-SY-101 mixer pump, level monitoring system, pressure monitoring system, ventilation flowmeter, and temperature monitoring system which are required to implement the LANL SA Level I mixer pump controls (LA-UR-92-3196, Rev. 14a., Table 6-3) since they do not directly prevent or mitigate potential hazardous conditions and postulated accidents related to the Tank 241-SY-241 waste transfer. Operation of the 241-SY-101 mixer pump to reduce the frequency of a flammable gas deflagration by mixing and releasing flammable gases generated and trapped in the waste is assumed in the hazard and accident analyses of the Tank 241-SY-101 waste transfer. The safety analysis of the waste transfer does, however, identify hazardous conditions and postulated accidents that could result in failure of the mixer pump to perform its safety function (see flammable gas deflagrations – buoyant displacement GRE plus additional crust release from the crust).

Structures, Systems, and Components	*Classification*		*Safety Function*	*Comments*
	SC	SS		
*DST/AWF Ventilation	X		Maintain flammable gas concentrations in tank dome spaces, due to steady state releases, below 25% of the LFL.	The DST and AWF ventilation systems also reduce the "time at risk" following a large gas release event (GRE).
*SY-101 Hydrogen Monitor	X		Provide indication and alarm for hydrogen gas concentration in the Tank 241-SY-101 vapor space to the operations staff.	An additional safety function of the SY-101 hydrogen monitor is to provide an interlock to stop mixer pump operation if hydrogen concentration reaches 0.75% (7,500 ppm) by volume.
*SY-101 Ammonia Detection System	X		Detect ammonia in the tank headspace/exhaust gas and alarm on the data acquisition system (DACS) when a high level of ammonia exists.	--

SC is safety class
SS is safety significant

* Existing control

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Technical Safety Requirements (TSRs)

Note: New controls appear in *bold italics*.

Control	Safety Function	Comments
•DST and AWF Tank Ventilation (LCO 3.2.1)	Assure that steady state release of flammable gas does not accumulate in flammable concentrations in vapor spaces of TWRS facilities and structures.	DST and AWF ventilation system operation also reduces the "time at risk" following a large gas release event (GRE).
•Flammability Controls (i.e., LA-UR-92-3196 Level I mixer pump controls including supplemental controls) (AC 5.9)	Assure effective mitigation and safe operations of Tank 241-SY-101 with respect to flammable gas hazards.	The LA-UR-92-3196 Level I controls are primarily related to mixer pump operation. The Level I control on gas concentrations (i.e., maximum hydrogen concentration and maximum ammonia concentration) is the only control directly applicable to preventing or mitigating potential hazardous conditions and postulated accidents from the Tank 241-SY-101 waste transfer.
Ignition controls (Revision to AC 5.10)	*Prevent the ignition of flammable gases that may be present.*	*Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.*
Flammable Gas Monitoring Controls (Revision to AC 5.11)	*Ensures flammable conditions caused by steady-state accumulation or as a results of a recent gas release event are not present in the work space before and during manned work activities and ensures that flammable conditions are not produced by waste intrusive activities in Tank 241-SY-101. This reduces frequency of flammable gas deflagrations.*	*Expand applicability of existing TSR AC 5.11 flammable gas monitoring controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II flammable gas monitoring controls.* *Note: The flammable gas monitoring controls for Tank 241-SY-101 shall specify (1) when the LA-UR-92-3196 Level I mixer pump hydrogen and ammonia monitoring controls are applicable and (2) that flammable gas monitoring is required whenever water sources are connected to Tank 241-SY-101, and that all sources of water shall be isolated on high flammable gas concentrations.*
•Emergency Preparedness (AC 5.14)	Mitigate the consequences of a flammable gas deflagration.	--
•HEPA Filter Controls (AC 5.18)	Reduce consequences from a possible HEPA filter failure by limiting the inventory available for release.	--
•Process Instrumentation and Measuring and Test Equipment (AC 5.19)	Ensures instrumentation used to monitor the concentration of flammable gases is maintained.	--

• Existing control

Defense-in Depth Controls

Note:New controls appear in *bold italics*

Control	Safety Function	Comments
Video camera monitor	*Visual monitoring during waste transfers and during activities that could involve crust disturbance or dissolution to detect significant unexpected effects.*	

Attachment 4

Control Decision Record for Tank 241-SY-101 Waste Transfer for Flammable Gas Deflagration – Buoyant Displacement GRE Plus Additional Gas Release from the Crust

Consists of 4 Pages
(Including this Coversheet)

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CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER

HAZARD/ACCIDENT: Flammable Gas Deflagration –Buoyant displacement GRE plus additional gas release from the crust

Structures, Systems, and Components (SSCs)

Notes: 1. The list of safety SSCs below does not include the Tank 241-SY-101 mixer pump, level monitoring system, pressure monitoring system, ventilation flowmeter, and temperature monitoring system which are required to implement the LANL SA Level I mixer pump controls (LA-UR-92-3196, Rev. 14a., Table 6-3) since they do not directly prevent or mitigate potential hazardous conditions and postulated accidents related to the Tank 241-SY-241 waste transfer. Operation of the 241-SY-101 mixer pump to reduce the frequency of a flammable gas deflagration by mixing and releasing flammable gases generated and trapped in the waste is assumed in the hazard and accident analyses of the Tank 241-SY-101 waste transfer. The safety analysis of the waste transfer does, however, identify hazardous conditions and postulated accidents that could result in failure of the mixer pump to perform its safety function (see flammable gas deflagrations – buoyant displacement GRE plus additional crust release from the crust).
2. New controls appear in ***bold italics***.

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
*DST/AWF Ventilation	X		Maintain flammable gas concentrations in tank dome spaces, due to steady state releases, below 25% of the LFL.	The DST and AWF ventilation systems also reduce the "time at risk" following a large gas release event (GRE).
*SY-101 Hydrogen Monitor	X		Provide indication and alarm for hydrogen gas concentration in the Tank 241-SY-101 vapor space to the operations staff.	An additional safety function of the SY-101 hydrogen monitor is to provide an interlock to stop mixer pump operation if hydrogen concentration reaches 0.75% (7,500 ppm) by volume.
*SY-101 Ammonia Detection System	X		Detect ammonia in the tank headspace/exhaust gas and alarm on the data acquisition system (DACS) when a high level of ammonia exists.	--
Siphon Break	***X***		***The safety function of the siphon break is to prevent the siphoning of waste from Tank 241-SY-101 to Tank 241-SY-102 when the waste transfer pump is not operating.***	***The siphon break is a passive design feature.***
Tank 241-SY-102 Level Detection System	***X***		***The safety function of the Tank 241-SY-102 level detection system is to provide tank waste level for implementation of the Tank 241-SY-101 Waste Transfer Control.***	***The SY-102 level monitoring system is a safety-significant SSC for other potential hazardous conditions and postulated accidents in the existing TWRS Authorization Basis.***
Dilution Water Flow Totalizer	***X***		***The safety function of the dilution water flow totalizer is to provide the quantity of water used to dilute the waste transferred from Tank 241-SY-101 to Tank 241-SY-102 for implementation of the Tank 241-SY-101 Waste Transfer Control.***	--

SC is safety class
SS is safety significant

* Existing control

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Technical Safety Requirements (TSRs)

Note: New controls appear in ***bold italics***.

Control	Safety Function	Comments
*DST and AWF Tank Ventilation (LCO 3.2.1)	Assure that steady state release of flammable gas does not accumulate in flammable concentrations in vapor spaces of TWRS facilities and structures.	DST and AWF ventilation system operation also reduces the "time at risk" following a large gas release event (GRE).
*Flammability Controls (i.e., LA-UR-92-3196 Level I mixer pump controls including supplemental controls) (AC 5.9)	Assure effective mitigation and safe operations of Tank 241-SY-101 with respect to flammable gas hazards.	The LA-UR-92-3196 Level I controls are primarily related to mixer pump operation. The Level I control on gas concentrations (i.e., maximum hydrogen concentration and maximum ammonia concentration) is the only control directly applicable to preventing or mitigating potential hazardous conditions and postulated accidents from the Tank 241-SY-101 waste transfer.
Tank 241-SY-101 Mixer Pump Performance (Revision to AC 5.9)	***Identify and mitigate degradation of Tank 241-SY 101 mixer pump performance caused by interaction of the pump and the crust to ensure that the safety function of the mixer pump (control gas retention at depth and prevent buoyant displacement GRE) is maintained..***	***Program key elements are:*** • ***Mixer pump performance (e.g., pump motor current, pump discharge pressure, waste thermocouple response) shall be monitored, and the Test Review Group (TRG) shall review of the data quarterly for signs of degradation that could affect continued control of gas retention at depth and prevention of buoyant displacement gas release events (BD GREs)*** • ***The TRG shall direct corrective actions to restore mixer pump performance, as necessary (e.g., add water).***
Ignition controls (Revision to AC 5.10)	***Prevent the ignition of flammable gases that may be present.***	***Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.***
Flammable Gas Monitoring Controls (Revision to AC 5.11)	***Ensures flammable conditions caused by steady-state accumulation or as a results of a recent gas release event are not present in the work space before and during manned work activities and ensures that flammable conditions are not produced by waste intrusive activities in Tank 241-SY-101. This reduces frequency of flammable gas deflagrations.***	***Expand applicability of existing TSR AC 5.11 flammable gas monitoring controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II flammable gas monitoring controls.*** ***Note: The flammable gas monitoring controls for Tank 241-SY-101 shall specify (1) when the LA-UR-92-3196 Level I mixer pump hydrogen and ammonia monitoring controls are applicable, and (2) that flammable gas monitoring is required whenever water sources are connected to Tank 241-SY-101, and that all sources of water shall be isolated on high flammable gas concentrations.***

Control	Safety Function	Comments
Tank 241-SY-101 Waste Transfer Controls *(Revision to AC 5.9 or AC 5.12)*	*Limit the quantity of waste transferred from Tank 241-SY-101 to ensure that the mixer pump continues to perform its safety function (control gas retention at depth and prevent buoyant displacement GRE).*	*Program key elements are:* • *For waste transfers from Tank 241-SY-101, the maximum quantity of waste that can be transferred and maintain a minimum of one (1) foot between the mixer pump suction and the bottom of the crust shall be calculated. The calculation shall consider uncertainties in measuring the bottom of the crust, including level monitoring system accuracy, and the growth of the crust subsequent to the transfer.* • *The waste transfer from Tank 241-SY-101 shall then be monitored and limited to this maximum quantity.*
*Emergency Preparedness (AC 5.14)	Mitigate the consequences of a flammable gas deflagration.	--
*HEPA Filter Controls (AC 5.18)	Reduce consequences from a possible HEPA filter failure by limiting the inventory available for release.	--
*Process Instrumentation and Measuring and Test Equipment (AC 5.19)	Ensures instrumentation used to monitor the concentration of flammable gases is maintained.	--

* Existing control

Defense-in Depth Controls

Control	Safety Function	Comments
None identified		

Attachment 5

Control Decision Record for Tank 241-SY-101 Waste Transfer for Flammable Gas Deflagration – General

Consists of 3 Pages
(Including this Coversheet)

LJKripps
4/27/99

CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER

HAZARD/ACCIDENT: Flammable Gas Deflagration – General

Structures, Systems, and Components (SSCs)

Note: The list of safety SSCs below does not include the Tank 241-SY-101 mixer pump, level monitoring system, pressure monitoring system, ventilation flowmeter, and temperature monitoring system which are required to implement the LANL SA Level I mixer pump controls (LA-UR-92-3196, Rev. 14a., Table 6-3) since they do not directly prevent or mitigate potential hazardous conditions and postulated accidents related to the Tank 241-SY-241 waste transfer. Operation of the 241-SY-101 mixer pump to reduce the frequency of a flammable gas deflagration by mixing and releasing flammable gases generated and trapped in the waste is assumed in the hazard and accident analyses of the Tank 241-SY-101 waste transfer. The safety analysis of the waste transfer does, however, identify hazardous conditions and postulated accidents that could result in failure of the mixer pump to perform its safety function (see flammable gas deflagrations – buoyant displacement GRE plus additional crust release from the crust).

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
*DST/AWF Ventilation	X		Maintain flammable gas concentrations in tank dome spaces, due to steady state releases, below 25% of the LFL.	The DST and AWF ventilation systems also reduce the "time at risk" following a large gas release event (GRE).
*SY-101 Hydrogen Monitor	X		Provide indication and alarm for hydrogen gas concentration in the Tank 241-SY-101 vapor space to the operations staff.	An additional safety function of the SY-101 hydrogen monitor is to provide an interlock to stop mixer pump operation if hydrogen concentration reaches 0.75% (7,500 ppm) by volume.
*SY-101 Ammonia Detection System	X		Detect ammonia in the tank headspace/exhaust gas and alarm on the data acquisition system (DACS) when a high level of ammonia exists.	--

SC is safety class
SS is safety significant

* Existing control

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Technical Safety Requirements (TSRs)

Note: New controls appear in ***bold italics***.

Control	Safety Function	Comments
*DST and AWF Tank Ventilation (LCO 3.2.1)	Assure that steady state release of flammable gas does not accumulate in flammable concentrations in vapor spaces of TWRS facilities and structures.	DST and AWF ventilation system operation also reduces the "time at risk" following a large gas release event (GRE).
*Flammability Controls (i.e., LA-UR-92-3196 Level I mixer pump controls, including supplemental controls) (AC 5.9)	Assure effective mitigation and safe operations of Tank 241-SY-101 with respect to flammable gas hazards.	The LA-UR-92-3196 Level I controls are primarily related to mixer pump operation. The Level I control on gas concentrations (i.e., maximum hydrogen concentration and maximum ammonia concentration) is the only control directly applicable to preventing or mitigating potential hazardous conditions and postulated accidents from the Tank 241-SY-101 waste transfer.
Ignition controls (Revision to AC 5.10)	***Prevent the ignition of flammable gases that may be present.***	***Expand applicability of existing TSR AC 5.10 ignition controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II ignition controls.***
Flammable Gas Monitoring Controls (Revision to AC 5.11)	***Ensures flammable conditions caused by steady-state accumulation or as a results of a recent gas release event are not present in the work space before and during manned work activities and ensures that flammable conditions are not produced by waste intrusive activities in Tank 241-SY-101. This reduces frequency of flammable gas deflagrations.***	***Expand applicability of existing TSR AC 5.11 flammable gas monitoring controls to Tank 241-SY-101; elevate and augment LA-UR-92-3196 Level II flammable gas monitoring controls.*** ***Note: The flammable gas monitoring controls for Tank 241-SY-101 shall specify (1) when the LA-UR-92-3196 Level I mixer pump hydrogen and ammonia monitoring controls are applicable, and (2) that flammable gas monitoring is required whenever water sources are connected to Tank 241-SY-101, and that all sources of water shall be isolated on high flammable gas concentrations.***
*Transfer Controls – Waste Compatibility Controls (AC 5.12)	Ensure final tank states remain within analyzed topography of the flammable gas deflagrations accident.	--
*Emergency Preparedness (AC 5.14)	Mitigate the consequences of a flammable gas deflagration.	--
*Excavation Controls (AC 5.17)	Prevent ignition of flammable gases.	--
*HEPA Filter Controls (AC 5.18)	Reduce consequences from a possible HEPA filter failure by limiting the inventory available for release.	--
*Process Instrumentation and Measuring and Test Equipment (AC 5.19)	Ensures instrumentation used to monitor the concentration of flammable gases is maintained.	--

* Existing control

Defense-in Depth Controls

Control	Safety Function	Comments
*Flush transfer lines after use	Reduce waste material in transfer lines to limit the production of flammable gases.	--

* Existing control

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Attachment 6

Control Decision Record for Tank 241-SY-101 Waste Transfer for
Spray Leak in Structure or from Overground Transfer Line

Consists of 2 Pages
(Including this Coversheet)

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CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER

HAZARD/ACCIDENT: Spray Leak in Structure or from Overground Transfer (OGT) Line

Note: The below listed safety structures, systems, and components (SSCs), technical safety requirements (TSRs), and defense-in-depth controls only include those that are unique to the Tank 241-SY-101 waste transfer.

Structures, Systems, and Components (SSCs)

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
Prefabricated Pump Pit (P3)*	X		Knock down spray and limit release of aerosols to the environment.	The P3 shall be designed to withstand design basis high wind.
OGT encasement and connections*	X		Confine a leak from the primary piping and ensure that the leak is directed to Tank 241-SY-102 or, if the drain to Tank 241-SY-102 is plugged, to the P3 which contains a leak detection system.	The OGT encasement and connections shall be designed to withstand (1) the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the OGT encasement to the P3 and (2) design basis high wind.
Riser 241-SY-102-007 Drop Leg Enclosure*	X		Same as OGT encasement and connections.	Comments for OGT encasement and connections above are also applicable to the riser 241-SY-102 drop leg enclosure.

SC is safety class
SS is safety significant

* Additional temporary shielding and administrative controls shall be used to maintain facility worker radiation exposures ALARA.

Technical Safety Requirements (TSRs)

Control	Safety Function	Comments
None Note: The P3 cover is considered a transfer system cover and existing LCO 3.1.1 and AC 5.22 apply.	--	--

Defense-in Depth Controls

Control	Safety Function	Comments
None identified	--	--

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Attachment 7

Control Decision Record for Tank 241-SY-101 Waste Transfer for Surface Leak Resulting in Pool

Consists of 3 Pages
(Including this Coversheet)

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CONTROL DECISION RECORD FOR TANK 241-SY-101 WASTE TRANSFER

HAZARD/ACCIDENT: Surface Leak Resulting in Pool

Note: The below listed safety structures, systems, and components (SSCs), technical safety requirements (TSRs), and defense-in-depth controls only include those that are unique to the Tank 241-SY-101 waste transfer.

Structures, Systems, and Components (SSCs)

Structures, Systems, and Components	Classification		Safety Function	Comments
	SC	SS		
Prefabricated Pump Pit (P3)*	X		The safety-class safety function of the P3 is to provide an intact boundary for the leaked waste, and when leak detector alarms and appropriate operator response times to shut off the transfer pump are credited, to prevent premature P3 overflow and the formation of a surface pool.	The P3 shall be designed to withstand design basis high wind.
		X	The safety-significant safety function of the P3, including cover, is to limit release of aerosols generated by splatter inside the P3, and limit shine and skyshine dose to onsite receptors.	
OGT encasement and connections*	X		Provide secondary confinement for leaks from the primary line and route the leak to Tank 241-SY-102 or, if the drain to Tank 241-SY-102 is plugged, back to the P3 which contains a leak detection system.	The OGT encasement and connections shall be designed to withstand (1) the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the OGT encasement to the P3 and (2) design basis high wind.
Riser 241-SY-102-007 Drop Leg Enclosure*	X		Same as OGT encasement and connections.	Comments for OGT encasement and connections above are also applicable to the riser 241-SY-102 drop leg enclosure.

SC is safety class
SS is safety significant

- Additional temporary shielding and administrative controls shall be used to maintain facility worker radiation exposures ALARA.

Technical Safety Requirements (TSRs)

Control	Safety Function	Comments
None Note: The PPP cover is considered a transfer system cover and existing LCO 3.1.1 and AC 5.22 apply.	--	--

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Defense-in Depth Controls

Control	Safety Function	Comments
PPP and Riser 241-SY-101 drop leg enclosure drains	Allow leak to drain back to Tanks 241-SY-101 or 241-SY-102.	--

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APPENDIX N

DRAFT HNF-4264
PROCESS CONTROL PLAN

DISTRIBUTION SHEET

To	From	
Distribution	Process Control	Page 1 of 2
		Date 03/29/99
Project Title/Work Order: HNF-4264, Rev. 0, "Process Control Plan for Tank 241-SY-101 Surface Level Rise Remediation"		EDT No. EDT-611460
		ECN No. N/A

DRAFT

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>COGEMA</u>					
T. R. Benegas	G1-54	X			
C. E. Hanson	G1-54	X			
K. L. Morris	G1-54	X			
P. A. Titzler	G1-54	X			
J. L. Wilk	G1-54	X			
<u>DE&S Hanford, Inc.</u>					
R. E. Bauer	S7-73	X			
G. D. Johnson	S7-73	X			
<u>U. S. Department of Energy - Richland Field Office</u>					
DOE/RL Reading Room	H2-53	X			
<u>E2</u>					
J. R. Biggs	T4-08	X			
<u>Fluor Daniel Northwest</u>					
G. W. Ryan	B4-47	X			
<u>G&P Consulting, Inc.</u>					
J. M. Grigsby	R1-49	X			
<u>Lockheed Martin Hanford Corp.</u>					
W. B. Barton	R2-12	X			
J. M. Conner	R2-12	X			
M. F. Erhart	R1-56	X			
S. D. Estey	R2-11	X			
K. D. Fowler	R2-11	X			
D. C. Hedengren	R2-11	X			
N. W. Kirch	R2-11	X			
W. J. Powell	S5-13	X			
R. W. Reed	T4-07	X			
R. L. Schlosser	R1-56	X			
L. M. Sasaki	R2-12	X			
L. A. Stauffer	R2-11	X			
T.C.S.R.C.	R1-10	X			
<u>Lockheed Martin Services, Inc.</u>					
Central Files	B1-07	X			
<u>Merrick & Company</u>					
S. W. Shaw	G1-54	X			

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N.W. Kirch

A-6000-135 (01/93) WEF067

DISTRIBUTION SHEET

To	From	Page 2 of 2
Distribution	Process Control	Date 03/29/99
Project Title/Work Order		EDT No. EDT-611460
HNF-4264, Rev. 0, "Process Control Plan for Tank 241-SY-101 Surface Level Rise Remediation"		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>Numatec Hanford Corp.</u>					
K. S. Witwer	L6-13	X			
<u>Pacific Northwest National Laboratory</u>					
J. W. Brothers	K9-20	X			
P. A. Meyer	K7-15	X			
C. W. Stewart	K7-15	X			

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ENGINEERING DATA TRANSMITTAL

1. EDT № 611460

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) Process Control	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: Tank 241-SY-101/Waste Management/PC/Process Engineering	6. Design Authority/ Design Agent/Cog. Engr.: S. D. Estey	7. Purchase Order No.: N/A
8. Originator Remarks: This document is being released into the supporting document system for retrievability purposes.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 241-SY-101
11. Receiver Remarks: 11A. Design Baseline Document? [X] Yes [] No For release. DRAFT		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: 03/29/99

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No	(C) Sheet No	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	HNF-4264	N/A	0	Process Control Plan for Tank 241-SY-101 Surface Level Rise Remediation	E,S,Q	2	1	1

16. KEY

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

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A.E. Young [signature] 3-29-99 Signature of EDT Originator Date	N/A Authorized Representative for Receiving Organization Date	N.W. Kirch Design Authority/ Cognizant Manager Date	Ctrl. No. [] Approved [] Approved w/comments [] Disapproved w/comments

BD-7400-172-2 (05/96) GEF097

BD-7400-172-1

DRAFT

Process Control Plan for Tank 241-SY-101 Surface Level Rise Remediation

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EDT/ECN: EDT-611460 UC: 2070
Org Code: 74B50 CACN/COA: 108963/BA10
B&R Code: EW 3120074 Total Pages:

Key Words: Tank 241-SY-101, Tank SY-101, SY-101, SY Farm, Mitigation, Transfer, Overground, Pump, PPP, Piping, Pump Pit, Drop Leg, New Generation Transfer Pump, NGTP, Prefabricated Pump Pit

Abstract:

Release Approval Date Release Stamp

Approved for Public Release

Process Control Plan for Tank 241-SY-101 Surface-Level Rise Remediation

Table of Contents

1.0 Introduction....1

2.0 Process Description....2
2.1 Waste Characteristics....2
2.1.1 Waste Solids Composition Dependence on Waste Dilution and Temperature....2
2.1.2 Waste Viscosity Dependence on Waste Dilution and Temperature....3
2.1.3 Waste Critical Velocity Dependence on Waste Dilution and Temperature....6
2.1.4 Waste Compatibility with Tank 241-SY-102 Wastes....7
2.2 Process Flowsheet....8
2.3 Equipment Descriptions....17
2.3.1 Water Support Skid (WSS)....17
2.3.2 Tank 241-SY-101 Prefabricated Pump Pit (PPP) and NGTP (P-350)....19
2.3.3 Waste Transfer Line....20
2.3.4 Tank 241-SY-102 Drop Leg....20
2.3.5 Transfer Control System....21

3.0 Process Control....23
3.1 System Operational Configurations....25
3.1.1 System Vent....25
3.1.2 Normal Transfer Line Flush or Preheat....26
3.1.3 Normal P-350 Outlet Line Flush or Preheat....27
3.1.4 Normal P-350 Dilution Line Flush or Preheat....28
3.1.5 Normal Vent Header Flush to Tank 241-SY-101....29
3.1.6 Normal Vent Header Flush to Transfer Line....30
3.1.7 Normal P-350 Internal Flush....31
3.1.8 Emergency Transfer Line Flush....32
3.1.9 Emergency P-350 Outlet Line Flush....33
3.1.10 Normal Waste Transfer....34
3.2 Process Control Issues....35
3.2.1 Control of Slurry Transfer....36
3.2.1.1 Operational Control Devices....37
3.2.1.2 Operational Monitoring Parameters....37
3.3 Transfer Operations Plan....38
3.3.1 Transfer System Preheat....38
3.3.2 System Startup Management Plan....38
3.3.2.1 Magnetic Flow Meter (FE-367 & FE-374) Calibration Testing....38
3.3.2.2 Ammonia and VOC Emissions Testing....39
3.3.2.3 Testing to Optimize System Flow Rates....39
3.3.3 Transfer Operations....39
3.3.3.1 Transfer Start-Up....39
3.3.3.2 Controlled Transfer Shut-Down....40
3.3.3.3 Emergency Transfer Shut-Down and Flushing....40
3.4 Process Sampling Requirements and Schedule....41

4.0 Off-Normal Conditions....42
4.1 Loss of Electric Power....42
4.2 Loss of Dilution Water....42
4.3 Loss of P-350....42
4.4 Excessive SY-Farm Ventilation System Ammonia or VOC Emissions....42
4.5 Loss of SY-Farm Primary Ventilation....42
4.6 Loss of SY-Farm Annulus Ventilation....42

4.7 Transfer Line Leak....42
4.8 Transfer Line Plug....43

5.0 References....44

Appendix A: Index of Technical Operating Requirements

List of Tables

2.1.2.1 In-Situ Tank 241-SY-101 Apparent Viscosity....5
2.1.2.2 In-Situ Tank 241-SY-101 Physical Properties....5
2.1.2.3 In-Situ Tank 241-SY-101 Apparent Viscosity....5
2.1.2.4 Slurry Viscosity Behavior at 120°F and 50 sec^{-1} Shear Rate....6
2.1.4.1 Preliminary FY-99 Core Sample Characterization....7
2.2.1A Permissible Process Limits for Normal Waste Transfer....10
2.2.1B Estimated Stream Characterization Ranges for Normal Waste Transfer....11
2.2.2 Permissible Process Limits for Transfer Line Flush....12
2.2.3 Permissible Process Limits for P-350 Outlet Line Flush....13
2.2.4 Permissible Process Limits for P-350 Internal Flush....14
2.2.5 Permissible Process Limits for System Vent Flush....15
2.2.6 Permissible Process Limits for System Vent....16
2.3.1: Water Support Skid Valve Functions....18
2.3.2: PPP Valve Functions....19
2.3.5 Transfer System Controls, Indications, Interlocks & Alarms....22
3.0 Transfer System Valve Nomenclature....24

List of Figures

2.2.1 Process Flowsheet....8
2.3.1 Water Support Skid....17
2.3.2: Prefabricated Pump Pit and P-350....19
3.0 Tank 241-SY-101 Transfer System Schematic....23

List of Acronyms

AC - Administrative Control
ASSD – Anti-Siphoning Slurry Distributor
DCP - DACS Control Panel
DST - Double-Shell Tank
FCP - Farm Control Panel
gpm – gallons per minute
kgal – thousand gallons
MCC – Motor Control Center
NGTP – New Generation Transfer Pump
ppm - parts per million
PPP – Prefabricated Pump Pit
SST - Single Shell Tank
TSR - Technical Safety Requirement
VFD – Variable Frequency Drive
WSS – Water Support Skid
WSCP – Water Skid Control Panel

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1.0 Introduction

The tank 241-SY-101 transfer system was conceived and designed to address the immediate needs presented by rapidly changing waste conditions in tank 241-SY-101. Within the last year or so, the waste in this tank has exhibited both unexpected and extreme behavior (Rassat et al. 1999) in the form of rapidly increasing crust growth. This growth has been brought about by a rapidly increasing rate of gas entrapment within the crust. It has been conceived that the lack of crust agitation beginning upon the advent of mixer pump operations may have set-up a more consolidated, gas impermeable barrier when compared to a crust regularly broken up by the prior buoyant displacement events within the tank. A contributing factor may also be ongoing radioactive decay reducing average tank waste temperatures and producing more solids precipitation in the form of crust.

The crust growth rate is such that by September 1999, the waste level within the tank will violate regulatory definitions of a double-shell tank (DST). The immediate, short-term mitigation activity is to transfer 100 kgal of convective wastes from this tank into tank 241-SY-102 beginning in September 1999. Additional mitigation activities are also planned on less constrained schedules. The net affect of the 100 kgal transfer and follow-on mitigation activities for tank 241-SY-101 is strongly believed to be the remediation of tank 241-SY-101 as a flammable gas safety concern.

To facilitate design, construction, and operation, the transfer system conveys waste from tank to tank via a transfer line composed of an overground, flexible hose. The transfer system utilizes an off-the-shelf waste transfer pump, known alternately as the new generation transfer pump (NGTP) or P-350. Instrumentation and control features are kept as simple as possible to facilitate the mitigation activity yet comply with the necessary safety constraints. The design incorporates a pressurized, heated water supply to provide a high degree of operational flexibility and reliability by limiting the concentration of waste slurries in transfer. The design incorporates features to limit the uncontrolled introduction of water into tank 241-SY-101 and to limit the uncontrolled introduction of undiluted waste into the transfer system.

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2.0 Process Description

2.1 Waste Characteristics

From a physical standpoint, the bulk behavior of the convective wastes from tank 241-SY-101 is of great concern to a transfer system. These wastes are a supersaturated, high-salt material with a high specific gravity and high viscosity. These properties exist at the normal in-situ waste temperature of 120°F. This transfer system poses the potential to, upon a process upset, to allow the waste to be cooled to ambient (i.e., approximately atmospheric) temperatures. At these low temperatures, both the degree of waste supersaturation and viscosity sky-rockets, posing the scenario of essentially freezing solid in the transfer line. Driven by these concerns, both water dilution and temperature control are specified for the transfer of tank 241-SY-101 wastes.

As a result of these estimated behaviors, the volumetric dilution range specified for the waste transfer system varies from 2 parts waste to 1 part water to 1 part waste to 2 parts water. The mean dilution ratio is specified as 1 part waste to 1 part water. The low dilution limit is specified due to concerns about the build-up of high salt concentrations in tank 241-SY-102. Some of the 200 West area SST saltwell wastes possess high concentrations of phosphate. Interim stabilization activities accumulate these wastes in tank 241-SY-102. By limiting the nitrate/nitrite salt concentrations in tank 241-SY-102, the probability of phosphate precipitation will be minimized. The high dilution limit is specified from a desire to limit the impact of tank 241-SY-101 transfer activities on operational DST volume.

2.1.1 Waste Solids Composition Dependence on Waste Dilution and Temperature

The volume percent precipitated solids contained in the in-situ convective regions of tank 241-SY-101 are stated as 5% to 25% with a mean of 15%. This corresponds to the solids concentration at 120°F. During the actual transfer of waste from tank 241-SY-101 to tank 241-SY-102, the waste will be in the piping system for only a few seconds. It is prudent to assume that no dissolution of precipitated solids occurs during slurry transfer. Therefore, the solids concentrations in the transferred waste are diluted proportional the dilution volume of water. Assuming that tank 241-SY-101 waste with 25 vol% solids is diluted with water at the low dilution limit, the maximum expected solids concentration in the transfer line is:

$$[2(25 \text{ vol } \%) + 1(0 \text{ vol } \%)] \div (2 + 1) = 17 \text{ vol } \%$$

Likewise, the mean slurry solids concentration derived the mean value of 241-SY-101 convective waste solids concentration and the mean water dilution yields:

$$[1(15 \text{ vol } \%) + 1(0 \text{ vol } \%)] \div (1 + 1) = 7.5 \text{ vol } \%$$

The resulting slurry solids concentration is the transfer line is expected to range from about 2 vol% to 17 vol% with 7.5 vol% as the mean.

<u>Insoluble Solids</u>

The insoluble solids concentration of 241-SY-101 the convective layer is estimated to be 3 weight percent or less. This is consistent with laboratory data and expert opinion. The concentration would be slightly lower on a volumetric basis because of the higher density of solids. The lab data (Steen 1999) indicate insoluble metals (Ca, Cr, Fe, Mn, Ni, Si, and U) are present at around 0.5 weight percent. This corresponds to approximately 1 to 1.5 weight percent as metal oxides in the waste. The remainder of the solids is at least partially soluble, depending on temperature and concentration.

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Dissolution/Precipitation Kinetics

The overall kinetics of dissolution will be measured in the dilution and mixing study (Estey 1999a). The consensus of tank waste chemistry experts is that dissolution of the nitrate, nitrite, carbonate, and phosphate solids should be fairly rapid (minutes). This may not have much effect on transfer properties, as the transit time to tank 241-SY-102 will be less than one minute. Dissolution of oxalate is expected to take longer (hours).

Some precipitation of aluminum hydroxide is expected to occur because of the reduced pH of the diluted waste. This is known to be a slow process (days) and will not affect the pipeline behavior of the waste during the transfer. Although not expected to be a problem in the pipeline because of dilution, the precipitation of phosphates might occur within minutes and precipitation of oxalate and fluoro-phosphates within hours. The phosphate concentration in 241-SY-101 waste is fairly low at around 0.5 weight percent (Steen 1999). Precipitation of phosphates or fluoro-phosphate double salts may occur upon mixing with high phosphate saltwell liquors in 241-SY-102. However, this is neither a pumping nor a pipeline transfer issue.

The effect of the water dilution ratio on solids dissolution has been studied using OLI Systems Inc. Environmental Simulation Program (ESP). The simulations indicate that dissolution of soluble salts is 87 percent complete at a dilution of 35 parts water to 100 parts waste and 98 percent complete at 50 parts water to 100 parts waste (Reynolds 1998). Further dilution actually results in a slight increase in solids because of pH-induced precipitation of aluminum hydroxide.

These data support the preliminary conclusion that a dilution of 35 parts water to 100 parts waste is adequate, but a ratio of at least 50 parts water to 100 parts waste is desired. The target dilution range is from 50 to 150 parts water to 100 parts waste. Experimental results using actual waste samples are expected in April 1999 (Estey 1999a).

The effect of dilution water temperature on solubility has also been modeled (Reynolds 1998). Increasing the temperature of the dilution water does not have as great an effect as increasing the dilution ratio. At a dilution ratio of 30 parts water to 100 parts waste, approximately 25% more soluble solids are present using 85 °F dilution water than 130 °F water. The target temperature range for dilution water has been specified as 110-130 °F to allow operational flexibility. Any dilutions using water in this temperature range will result in lower overall solids concentrations.

A specific regards the net effect of diluting 241-SY-101 waste with water at a nominal 1:1 ratio and allowing the mixture to equilibrate and cool to 65 °F (which could happen in the discharge drop leg in 241-SY-102 if a siphon break occurred before line flushing). Although not modeled, it is anticipated that the final solids concentration would be lower than the initial, just-mixed concentration. That is, dissolution with the diluent is expected to have a stronger effect than the reduction in temperature. Figure 1 indicates that a 1:1 dilution is about 3 times more dilution water than is necessary to dissolve all $NaNO_3$ at the temperature of 241-SY-101 (120 °F). Even upon cooling to 65 °F, much more $NaNO_3$ will be dissolved in the diluted waste than in the original 241-SY-101 waste.

2.1.2 Waste Viscosity Dependence on Waste Dilution and Temperature

The question of the viscosity of slurries is highly complex and essentially indeterminate. The viscosity and viscosity behavior of many liquids, such as water, is well defined. However, when suspended solids are included in a liquid (i.e., a slurry), no universally known method exists to specify the viscosity of a slurry, even if other physical properties of the slurry are well known. For example, whereas most liquids can be considered Newtonian fluids, most slurries cannot. The only way the viscosity of an actual slurry in a specific application can be positively determined is to measure it in that application. Such a measurement cannot be made in the application of the transfer from tank 241-SY-101.

The best known means of estimating a slurry viscosity from other known slurry parameters is via an "Einstein" type relationship. This relationship can at best be considered as only a rough rule-of-thumb. In its simplest form, this relationship expresses the slurry viscosity as a linear function of the carrier liquid viscosity and an exponential function of the solids loading or slurry density. Some terms are useful to define:

- c = carrier or liquid phase of a slurry
- d = dispersed or solid phase of a slurry
- m = bulk property of a slurry
- α = phase volume fraction in a slurry (dimensionless)
- ρ = phase density of a slurry (units of mass per volume)
- μ = dynamic viscosity (units of mass per length per time)

The following relationships apply:

$$\alpha_c + \alpha_d = 1$$
$$\rho_m = \alpha_c \rho_c + \alpha_d \rho_d$$
$\rho_\infty = \rho_m$ at infinite dilution, where $\rho_m = \rho_c$

α_d must be distinguished from the volume fraction of settled solids. Settled solids always contain void volumes occupied by the liquid phase so that the volume fraction of settled solids will be greater than the volume fraction of dispersed solids, AKA true solids.

The desired quantity is the slurry viscosity μ_m. A simplified "Einstein" relationship can then be defined as:

$$\mu_m = \mu_c \exp[k(\frac{\rho_m - \rho_\infty}{\rho_\infty})] \quad \text{where "k" is an arbitrary constant}$$

Therefore, the slurry viscosity becomes a function of the carrier liquid viscosity and the difference in density between the slurry and its carrier liquid.

To determine the constant in the "Einstein" relation, the value of μ_m must be known for at least one set of μ_c, ρ_c, and ρ_m values. ρ_m is a value nailed down fairly well for the waste in question. The range of ρ_m values for tank 241-SY-101 convective wastes at 120°F is stated as 1.45 to 1.75 gm/cc with a mean of 1.60 gm/cc. For tank 241-SY-101 wastes, the value of ρ_c at any non-infinite dilution is not known with much precision. The only thing that can be positively stated for tank 241-SY-101 waste is that at infinite dilution, $\rho_m = \rho_c = 1.0$ gm/cc.

Tingey et al. (1994) and Stewart (1996) document viscosity analyses performed on tank 241-SY-101 wastes. The former investigated material from core 22 taken during Window C while the latter reported results from ball rheometer testing in tank 241-SY-101. Both references report Non-Newtonian, shear-thinning (thixotropic) behavior of the tank wastes.

Analyses documented in Tingey et al. (1994) looked at parameters of ρ_m, settled solids density, settled solids volume fraction, filtered solids weight fraction, and viscosity at a 400 sec^{-1} shear rate at a 0, 10, 20, 35, and 50 vol % 2M NaOH dilution and 50, 70, and 90 °C. The results indicate that little difference could be noted between ρ_m and the settled solids density at any dilution or temperature. Differences in viscosity, volume percent settled solids, and weight percent filtered solids showed much more variation at differing dilutions and temperatures. In this application, 2M NaOH can be considered equivalent to water.

Tingey et al. (1994) reported a dynamic viscosity of 40 cP at a 400 sec^{-1} shear rate for undiluted waste at 50 °C. Stewart (1996) reported ball rheometer viscosity behavior with an uncertainty factor of two, shown in Table 2.1.2.1.

Table 2.1.2.1 In-Situ Tank 241-SY-101 Apparent Viscosity

Shear rate (sec^{-1})	1	10	100	400
Viscosity (cP)	~600	~150	~80	~40

The viscosity results from both references for undiluted wastes at tank temperature and a 400 sec^{-1} shear rate show good agreement. When shear rate is expressed as the pipe flow velocity divided by the pipe inner radius, a 6 ft/sec flow velocity corresponds to a shear rate of about 50 sec^{-1}.in a 3" ID pipe. At this shear rate, Stewart (1996) indicates an in situ waste viscosity of about 100 cP

A summary of selected data for tank 241-SY-101 waste at 50 °C at various water dilutions from Tingey et al. (1994) is shown in Table 2.1.2.2.

Table 2.1.2.2 In-Situ Tank 241-SY-101 Physical Properties

Dilution ▸ Property ▾	0 vol%	10 vol%	20 vol%	35 vol%	50 vol%
Apparent Viscosity at 400 sec^{-1} (cP)	39.4	35.8	12.3	6.8	2.9
Vol% settled solids	100	100	96	89	34
Wt% filtered solids	83	60	68	40	25
Settled solids density	1.72	1.68	1.59	1.51	1.42
Slurry density	1.72	1.68	1.60	1.48	1.34

The value of 50 vol% dilution corresponds to the minimum dilution specified for the waste transfer system. Based on the shear viscosity behavior reported by Tingey et al. (1994), the viscosity at 50 sec^{-1} shear rate would appear to be 2.4 times larger than the value at 400 sec^{-1}. The viscosity of water at 50°C is 0.55 cP.

For a 50 sec^{-1} shear rate, tank 241-SY-101 waste viscosities can be derived from data in Tingey et al. (1994) and Stewart (1996). These are shown in Table 2.1.2.3:

Table 2.1.2.3 In-Situ Tank 241-SY-101 Apparent Viscosity

Dilution ▸ Property ▾	0 vol%	10 vol%	20 vol%	35 vol%	50 vol%
Apparent Viscosity at 50 sec^{-1} (cP)	100	85	30	16	7.0

This suggests a slurry viscosity expression in the form of:

$$\mu_m = 0.55cP * \exp[k(\frac{\rho_m - 1.0 \, gm/cc}{1.0 \, gm/cc})]$$ where

$$100cP = 0.55cP * \exp[k(\frac{1.6 \, gm/cc - 1.0 \, gm/cc}{1.0 \, gm/cc})]$$

since μ_m = 100 cP when ρ_m= 1.6 gm/cc. This yields k = 8.67.

Therefore, at 50°C, (~120°F) and a shear rate of 50 sec^{-1}, the expression for the slurry viscosity produced by the waste transfer system becomes:

$$\mu_m = 0.55cP * \exp[8.67 * (\frac{\rho_m - 1.0 \, gm/cc}{1.0 \, gm/cc})]$$

This expression yields the results shown in Table 2.1.2.4.

Table 2.1.2.4 Slurry Viscosity Behavior at 120°F and 50 sec^{-1} Shear Rate

Slurry Density (gm/cc)	Mean Viscosity (cP)	Maximum Viscosity (cP)
1.6 (corresponding to no dilution)	100	200
1.4 (corresponding to minimum specified dilution of 1 part water to 2 parts waste)	18	36
1.3 (corresponding to mean dilution of 1 part water to 1 part waste)	7.4	15
1.2 (corresponding to maximum dilution of 2 parts water to 1 part waste)	3.1	6.2
1.0 (corresponding to infinite dilution)	0.55	0.55

From the above table, at the specified waste transfer system operating temperature of 120°F, the minimum specified dilution of 1 part by volume water to 2 parts by volume waste yields a slurry with an estimated viscosity of less than 30 cP. Only in the extreme of low dilution at the high viscosity bound does it exceed 30 cP. At the mean 1:1 dilution, the expected slurry viscosity is about 7.5 cP with an expected maximum of 15 cP.

2.1.3 Waste Critical Velocity Dependence on Waste Dilution and Temperature

Critical velocity in slurry flow is an estimated fluid flow velocity at which the effects of random, turbulent fluid motions provide enough agitation to keep individual solid particles in the slurry suspended in the slurry. The idea is that if the velocity of slurry transport is kept above the critical velocity, that solids deposition and the attendant potential of line plugging, can be avoided. The concept of a critical velocity is generally acknowledged as having no hard scientific definition, but rather results from experimental data fits as determined from various researchers.

A review of many critical velocity corellations as applied to Hanford tank wastes has been performed (Estey & Hu 1998). Specific application of the concept to the tank 241-SY-101 transfer has also been performed by PNNL (Onishi & Recknagle 1999). Both analysis surveys indicate that a specified slurry flow velocity of 6 ft/sec meet all practical requirements for critical velocity, provided some amount of water dilution of the waste is performed.

The specific analyses documented by PNNL indicate that there are values of water dilution and slurry temperature that optimize (i.e., minimize) the resultant critical velocity. The concept behind this finding is that high carrier liquid viscosities are more efficient at momentum transfer to solid particles, yet impose

DRAFT

higher pressure drops in piping and require larger velocities to achieve turbulent flow. In contrast, low carrier liquid viscosities make possible turbulent flow at lower velocities, yet are less efficient ant transferring momentum to the solid particles in a slurry.

Both increasing water dilution and, to a lesser extent, increasing slurry temperature, lower the carrier liquid viscosity in a slurry. At higher values of changes in water dilutions and temperatures, the affect on critical velocity is small. However, very evident in the PNNL findings is that no water dilution of tank 241-SY-101 wastes results in a significant carrier liquid viscosity. The net effect is to require extremely high flow velocities to achieve turbulent flow in the transport of undiluted wastes. This result is strong evidence for the need of at least some water dilution of tank 241-SY-101 wastes.

2.1.4 Waste Compatibility with Tank 241-SY-102 Wastes

The tank 241-SY-101 level-rise remediation project acknowledges the need to perform a waste compatibility assessment (Fowler 1995; Mulkey 1997) for this transfer. This assessment must be successfully compcted.in order for the 100-kgal waste transfer to occur in September 1999. At this time, any abnormal or limiting findings are not anticipated for this waste compatibility assessment.

Table 2.2.4.1 shows the preliminary chemical compound distribution based on FY-99 core sample of tank 241-SY-101.

Table 2.1.4.1 Preliminary FY-99 Core Sample Characterization

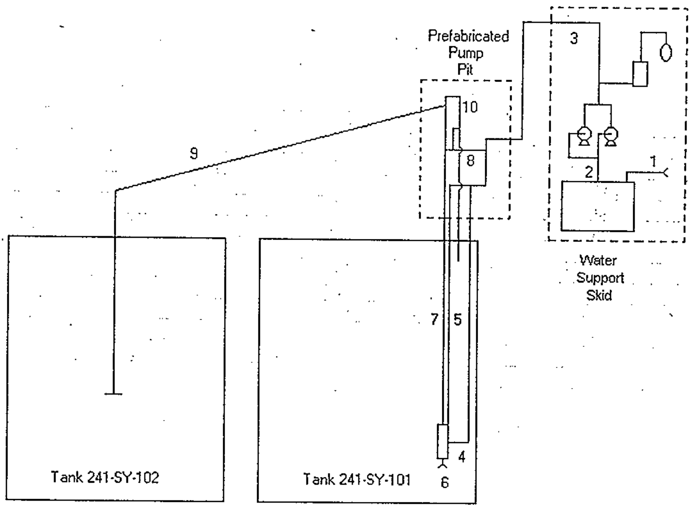
Chemical Species	Mass Percentage of Waste Reported to Two Significant Figures	Mass Percentage of Waste Normalized to Two Significant Figures
H_20	40	39
Na	19	18
$Al(OH)_4$	12	12
NO_3	11	11
NO_2	11	11
OH	2.8	2.7
CO_3	2.2	2.1
C_2O_4	1.3	1.3
Cl	0.85	0.82
CHO_2	0.75	0.72
SiO_2	0.64	0.62
PO_4	0.55	0.53
Cr_2O_3	0.50	0.48
SO_4	0.35	0.34
K	0.35	0.34
$C_2H_3O_2$	0.18	0.17

2.2 Process Flowsheet

TANK 241-SY-101 Transfer System Process Lines

1) Water Support Skid Inlet
2) Water Support Skid Outlet
3) PPP Water Supply Line
4) P-350 Internal Flush Line
5) P-350 Dilution Water Line
6) P-350 Waste Inlet
7) P-350 Outlet
8) Flush Cross Connect
9) Transfer Line
10) System Vent

Figure 2.2.1 Process Flowsheet



Tank 241-SY-101 Transfer System Process Flow Modes

Normal Waste Transfer

Normal Flush and/or Preheat Modes

- Transfer Line Flush
- P-350 Outlet Line Flush
- P-350 Dilution Line Flush
- Vent Header Flush to 241-SY-101
- Vent Header Flush to Transfer Line
- P-350 Internal Flush

Emergency Flush Modes

- Transfer Line Flush
- P-350 Outlet Line Flush

System Vent

Explanation of Flowsheet Symbols

(N/A): not applicable, as this section of process piping is valved out from the piping sections in active use - or - this parameter has no meaning for the flow mode in question.

(–): Process piping is in active use but the parameter value is not of specific concern to the process. However, specification of parameter value/limits requires prudent engineering judgement

(R): symbol used for waste transfer operations expressing the required transfer flow rate as a variable to be optimized depending upon determination of the process piping diameter. Waste transfer flow control is specifically stated as a flow velocity requirement as opposed to a flow rate requirement. Specifying the transfer flowrate as a variable allows the convenient expression of the allowable waste and dilution water flowrates.

For process line flushes, the primary objective is to simply displace process waste fluid from the lines and replace it with fresh water. Prudent engineering suggests that additional requirements be stated to maximize the efficiency of the flush within the limits of the transfer system infrastructure (i.e., a volumetric flush water flow rate of 70 gpm). The specified process line flush volume is equal to the larger of either:

-Two times the volume of the process line being flushed
-Two minutes of flow at the specified line flow velocity

Where permissible within the equipment performance limits, the process line flush velocity is recommended to exceed 4 $^{ft}/_{sec}$. This velocity is estimated to exceed typical critical velocities for the process lines and would therefore maximize the effectiveness of a flush.

The P-350 internal flush requirement is stated as flow rate of approximately 10 gpm. The P-350 internal flush volume and temperature limits are then defined by the limits on water addition to tank 241-SY-101 (i.e., a volume not to exceed the capacity of the water skid tank that is within the water addition temperature limits of 110°F to 130°F).

Tables 2.2.1 through 2.2.6 show the estimated flow parameters and compositions associated with the various transfer system process flow modes.

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Table 2.2.1A Permissible Process Limits for Normal Waste Transfer

Fluid/Flow Parameter	Water Skid Inlet (1)	Water Skid Outlet (2)	PPP Water Supply Line (3)	P-350 Internal Flush Line (4)	P-350 Water Dilution Line (5)	P-350 Waste Inlet (6)	P-350 Outlet (7)	Flush Cross-Connect (8)	Transfer Line (9)	Vent Line (10)
Flow Rate	–	$^{1}/_{3}$ R to $^{2}/_{3}$ R not to exceed 70 gpm	$^{1}/_{3}$ R to $^{2}/_{3}$ R not to exceed 70 gpm	N/A	$^{1}/_{3}$ R to $^{2}/_{3}$ R not to exceed 70 gpm	$^{1}/_{3}$ R to $^{2}/_{3}$ R	R	N/A	R	N/A
Flush Volume	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flow Velocity ($^{ft}/_{sec}$)	–	–	–	N/A	–	–	≥ 6	N/A	≥ 6	N/A
Temperature (°F)	–	110 to 130	110 to 130	N/A	110 to 130	–	110 to 130	N/A	110 to 130	N/A
Viscosity (cP)	–	0.50 to 0.62	0.50 to 0.62	N/A	0.50 to 0.62	50 to 200	2 to 15	N/A	2 to 15	N/A
Density ($^{grams}/_{cc}$)	< 1	< 1	< 1	N/A	< 1	1.45 to 1.75	1.16 to 1.50	N/A	1.16 to 1.50	N/A
Mass % Non-Soluble Solids	0	0	0	N/A	0	1 to 3	0 to 2	N/A	0 to 2	N/A

DRAFT

Table 2.2.1B Estimated Stream Characterization Ranges for Normal Waste Transfer

Fluid/Flow Parameter	Water Skid Inlet (1)	Water Skid Outlet (2)	PPP Water Supply Line (3)	P-350 Internal Flush Line (4)	P-350 Water Dilution Line (5)	P-350 Waste Inlet (6)	P-350 Outlet (7)	Flush Cross-Connect (8)	Transfer Line (9)	Vent Line (10)
Volume % Solids	< 0.01	< 0.01	< 0.01	N/A	< 0.01	5 to 25	2 to 17	N/A	2 to 17	N/A
Mass % Water	100	100	100	N/A	100	27.8 to 46.2	40 to 81	N/A	40 to 81	N/A
Mass % Sodium	0	0	0	N/A	0	14.2 to 23.8	7 to 17	N/A	7 to 17	N/A
Mass % Nitrate	0	0	0	N/A	0	8.2 to 13.8	4 to 10	N/A	4 to 10	N/A
Mass % Nitrite	0	0	0	N/A	0	8.2 to 13.8	4 to 10	N/A	4 to 10	N/A
Mass % Hydroxide	0	0	0	N/A	0	4 to 12	2 to 9	N/A	2 to 9	N/A
Mass % Carbonate	0	0	0	N/A	0	2 to 6	1 to 4	N/A	1 to 4	N/A
Mass % Aluminum	0	0	0	N/A	0	1.5 to 4.5	0 to 3	N/A	0 to 3	N/A
Mass % Chloride + Sulfate + Phosphate	0	0	0	N/A	0	1 to 3	0 to 2	N/A	0 to 2	N/A
Mass % TOC	0	0	0	N/A	0	0 to 2	0 to 1	N/A	0 to 1	N/A
Mass % Other Constituents	0	0	0	N/A	0	2 to 6	1 to 4	N/A	1 to 4	N/A

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Table 2.2.2 Permissible Process Limits for Transfer Line Flush

Fluid/Flow Parameter	Water Skid Inlet (1)	Water Skid Outlet (2)	PPP Water Supply Line (3)	P-350 Internal Flush Line (4)	P-350 Water Dilution Line (5)	P-350 Waste Inlet (6)	P-350 Outlet (7)	Flush Cross-Connect (8)	Transfer Line (9)	Vent Line (10)
Flow Rate	–	< 70 gpm	< 70 gpm	N/A	N/A	N/A	N/A	< 70 gpm	< 70 gpm	N/A
Flush Volume	2xline volume or 2 minutes of flow, which-ever is greater	2xline volume or 2 minutes of flow, which-ever is greater	2xline volume or 2 minutes of flow, which-ever is greater	N/A	N/A	N/A	N/A	2xline volume or 2 minutes of flow, which-ever is greater	2xline volume or 2 minutes of flow, which-ever is greater	N/A
Flow Velocity (ft/sec)	–	–	–	N/A	N/A	N/A	N/A	4 to 6	4 to 6	N/A
Temperature (°F)	–	110 to 130	110 to 130	N/A	N/A	N/A	N/A	110 to 130	110 to 130	N/A
Viscosity (cP)	–	0.50 to 0.62	0.50 to 0.62	N/A	N/A	N/A	N/A	0.50 to 0.62	0.50 to 0.62	N/A
Density (grams/cc)	< 1	< 1	< 1	N/A	N/A	N/A	N/A	< 1	< 1	N/A
Volume % Solids	< 0.01	< 0.01	< 0.01	N/A	N/A	N/A	N/A	< 0.01	< 0.01	N/A
Mass % Water	100	100	100	N/A	N/A	N/A	N/A	100	100	N/A
Mass % Non-Soluble Solids	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A

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Table 2.2.3 Permissible Process Limits for P-350 Outlet Line Flush

Fluid/Flow Parameter	Water Skid Inlet (1)	Water Skid Outlet (2)	PPP Water Supply Line (3)	P-350 Internal Flush Line (4)	P-350 Water Dilution Line (5)	P-350 Waste Inlet (6)	P-350 Outlet (7)	Flush Cross-Connect (8)	Transfer Line (9)	Vent Line (10)
Flow Rate	–	< 70 gpm	< 70 gpm	N/A	N/A	< 70 gpm	< 70 gpm	< 70 gpm	N/A	N/A
Flush Volume	2xline volume or 2 minutes of flow, which-ever is greater	2xline volume or 2 minutes of flow, which-ever is greater	2xline volume or 2 minutes of flow, which-ever is greater	N/A	N/A	2xline volume or 2 minutes of flow, which-ever is greater	2xline volume or 2 minutes of flow, which-ever is greater	2xline volume or 2 minutes of flow, which-ever is greater	N/A	N/A
Flow Velocity ($^{ft}/_{sec}$)	–	–	–	N/A	N/A	–	4 to 6	4 to 6	N/A	N/A
Temperature (°F)	–	110 to 130	110 to 130	N/A	N/A	110 to 130	110 to 130	110 to 130	N/A	N/A
Viscosity (cP)	–	0.50 to 0.62	0.50 to 0.62	N/A	N/A	0.50 to 0.62	0.50 to 0.62	0.50 to 0.62	N/A	N/A
Density ($^{grams}/_{cc}$)	< 1	< 1	< 1	N/A	N/A	< 1	< 1	< 1	N/A	N/A
Volume % Solids	< 0.01	< 0.01	< 0.01	N/A	N/A	< 0.01	< 0.01	< 0.01	N/A	N/A
Mass % Water	100	100	100	N/A	N/A	100	100	100	N/A	N/A
Mass % Non-Soluble Solids	0	0	0	N/A	N/A	0	0	0	N/A	N/A

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Table 2.2.4 Permissible Process Limits for P-350 Internal Flush

Fluid/Flow Parameter	Water Skid Inlet (1)	Water Skid Outlet (2)	PPP Water Supply Line (3)	P-350 Internal Flush Line (4)	P-350 Water Dilution Line (5)	P-350 Waste Inlet (6)	P-350 Outlet (7)	Flush Cross-Connect (8)	Transfer Line (9)	Vent Line (10)
Flow Rate	–	~10 gpm	~10 gpm	~10 gpm	N/A	~10 gpm	N/A	N/A	N/A	N/A
Flush Volume	–	–	–	–	N/A	–	N/A	N/A	N/A	N/A
Flow Velocity ($^{ft}/_{sec}$)	–	–	–	–	N/A	–	N/A	N/A	N/A	N/A
Temperature (°F)	–	110 to 130	110 to 130	110 to 130	N/A	110 to 130	N/A	N/A	N/A	N/A
Viscosity (cP)	–	0.50 to 0.62	0.50 to 0.62	0.50 to 0.62	N/A	0.50 to 0.62	N/A	N/A	N/A	N/A
Density ($^{grams}/_{cc}$)	< 1	< 1	< 1	< 1	N/A	< 1	N/A	N/A	N/A	N/A
Volume % Solids	< 0.01	< 0.01	< 0.01	< 0.01	N/A	< 0.01	N/A	N/A	N/A	N/A
Mass % Water	100	100	100	100	N/A	100	N/A	N/A	N/A	N/A
Mass % Non-Soluble Solids	0	0	0	0	N/A	0	N/A	N/A	N/A	N/A

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Table 2.2.5 Permissible Process Limits for System Vent Flush

Fluid/Flow Parameter	Water Skid Inlet (1)	Water Skid Outlet (2)	PPP Water Supply Line (3)	P-350 Internal Flush Line (4)	P-350 Water Dilution Line (5)	P-350 Waste Inlet (6)	P-350 Outlet (7)	Flush Cross-Connect (8)	Transfer Line (9)	Vent Line (10)
Flow Rate	–	< 70 gpm	< 70 gpm	N/A	N/A	N/A	N/A	< 70 gpm	N/A	< 70 gpm
Flush Volume	2xline volume or 2 minutes of flow, which-ever is greater	2xline volume or 2 minutes of flow, which-ever is greater	2xline volume or 2 minutes of flow, which-ever is greater	N/A	N/A	N/A	N/A	2xline volume or 2 minutes of flow, which-ever is greater	N/A	2xline volum e or 2 minute s of flow, which-ever is greater
Flow Velocity ($^{ft}/_{sec}$)	–	–	–	N/A	N/A	N/A	N/A	4 to 6	N/A	4 to 6
Temperature (°F)	–	110 to 130	110 to 130	N/A	N/A	N/A	N/A	110 to 130	N/A	110 to 130
Viscosity (cP)	–	0.50 to 0.62	0.50 to 0.62	N/A	N/A	N/A	N/A	0.50 to 0.62	N/A	0.50 to 0.62
Density ($^{grams}/_{cc}$)	< 1	< 1	< 1	N/A	N/A	N/A	N/A	< 1	N/A	< 1
Volume % Solids	< 0.01	< 0.01	< 0.01	N/A	N/A	N/A	N/A	< 0.01	N/A	< 0.01
Mass % Water	100	100	100	N/A	N/A	N/A	N/A	100	N/A	100
Mass % Non-Soluble Solids	0	0	0	N/A	N/A	N/A	N/A	0	N/A	0

Table 2.2.6 Permissible Process Limits for System Vent

Fluid/Flow Parameter	Water Skid Inlet (1)	Water Skid Outlet (2)	PPP Water Supply Line (3)	P-350 Internal Flush Line (4)	P-350 Water Dilution Line (5)	P-350 Waste Inlet (6)	P-350 Outlet (7)	Flush Cross-Connect (8)	Transfer Line (9)	Vent Line (10)
Flow Rate	–	–	–	N/A	N/A	N/A	–	N/A	–	–
Flush Volume	–	–	–	N/A	N/A	N/A	–	N/A	–	–
Flow Velocity (ft/sec)	–	–	–	N/A	N/A	N/A	–	N/A	–	–
Temperature (°F)	–	–	–	N/A	N/A	N/A	–	N/A	–	–
Viscosity (cP)	–	–	–	N/A	N/A	N/A	–	N/A	–	–
Density (grams/cc)	–	–	–	N/A	N/A	N/A	–	N/A	–	–
Volume % Solids	–	–	–	N/A	N/A	N/A	–	N/A	–	–
Mass % Water	–	–	–	N/A	N/A	N/A	–	N/A	–	–
Mass % Non-Soluble Solids	–	–	–	N/A	N/A	N/A	–	N/A	–	–

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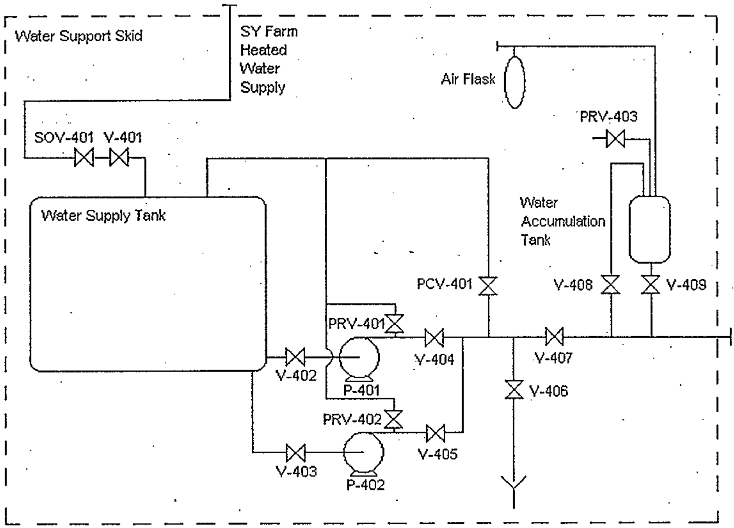
2.3 Equipment Descriptions

2.3.1 Water Support Skid

A dedicated water supply for dilution and flushing is provided with the transfer system. The major features are two water supply pumps, a 2000-gallon supply tank, and a 75-gallon air pressurized emergency flush accumulation tank. The latter supplies the capability to flush the system in the event of loss of electrical power. Figure 2.3.1 shows a schematic of the Water Support Skid.

Figure 2.3.1 Water Support Skid



The Water Support Skid contains the process routing values listed in Table 2.3.1

Table 2.3.1: Water Support Skid Valve Functions

Valve Identifier	Description of Valve Function
SOV-401	Water Supply Tank NTK-401 Solenoid Shutoff Valve
V-401	Water Supply Tank NTK-401 Isolation Valve
V-402	Water Pump P-401 Inlet Isolation Valve
V-403	Water Pump P-402 Inlet Isolation Valve
PRV-401	Water Pump P-401 Relief Valve
V-404	Water Pump P-401 Outlet Isolation Valve
PRV-402	Water Pump P-402 Relief Valve
V-405	Water Pump P-402 Outlet Isolation Valve
PCV-401	Water Supply Line Pressure Regulating Valve
V-406	Water Supply Line Drain Valve
V-407	Water Supply Line Isolation Valve
V-408	Emergency Flush Accumulation Tank ACC-401 Upstream Isolation Valve
PRV-403	Emergency Flush Accumulation Tank ACC-401 Relief Valve
V-409	Emergency Flush Accumulation Tank ACC-401 Downstream Isolation Valve

During steady-state dilution flow operation the water skid is capable of providing water skid is capable of providing water at 110 °F to 130 °F. The maximum flow rate of 70 gpm is specified. This flow rate can be maintained for the duration required to accomplish the specified transfer of 100 to 150 kgal of tank 241-SY-101 waste.

The design of the water support skid ensures that in the event of a component failure, no more than 2000 gallons of raw water could be added to either tank 241-SY-101 or 241-SY-102. Upon a loss of electric power, the air pressurized water flush accumulation tank provides a means to clear the process lines of waste slurry.

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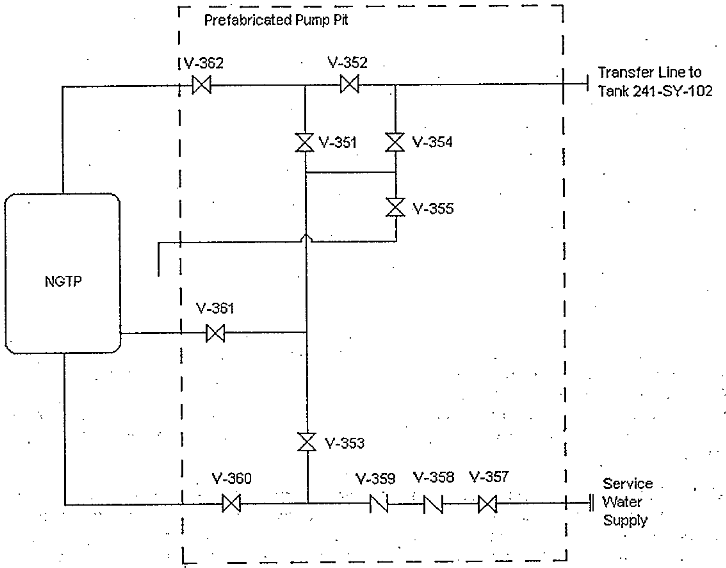
2.3.2 Tank 241-SY-101 Prefabricated Pump Pit (PPP) and NGTP (P-350)

The PPP at tank 241-SY-101 contains waste and water supply routing valves for the transfer system, various instrumentation, and the mounting for the P-350. The PPP also provides for a drain, seal loop, and system high-point vent as a siphon break, which return to tank 241-SY-101. The PPP is capable of operating with a drain flow rate of 20 gpm. A representation of the PPP and P-350 is shown in Figure 2.3.2.

Figure 2.3.2: Prefabricated Pump Pit and P-350



The PPP contains the process routing values listed in Table 2.3.2

Table 2.3.2: PPP Valve Functions

Valve Identifier	Description of Valve Function
V-351	Transfer Line Flush Isolation Valve
V-352	Transfer Line Isolation Valve
V-353	Flush Water Isolation Valve
V-354	Upstream Vacuum Break Valve
V-355	Downstream Vacuum Break Valve
V-357	Upstream Service Water Isolation Valve
V-358	Upstream Service Water Check Valve
V-359	Downstream Service Water Check Valve
V-360	Downstream Service Water Isolation Valve
V-361	P-350 Internal Flush Isolation Valve
V-362	P-350 Dilution Water IsolationValve

2.3.3 Waste Transfer Line

The waste transfer line is an overground, 2 in ID, armored hose conveying system wastes at velocities of 6 ft/sec (60 gpm) or greater. The transfer line incorporates bends with radii no less than five line diameters to minimize flow disruptions and associated probability of solids deposition. The pipeline is approximately 125 ft long, the slope of 1/33 to 1/16.

2.3.4 Tank 241-SY-102 Drop Leg

A submerged drop leg at tank 241-SY-102 is incorporated to minimize SY-Farm ventilation system ammonia and VOC concentrations. This device is known as the anti-siphoning slurry distributor (ASSD). The primary purpose of the ASSD is to minimize the direct contact of tank 241-SY-101 convective wastes with tank atmosphere. This purpose was indicated as justified based on ammonia characterization information for tank 241-SY-101 wastes (101-SY TCR) and engineering analysis of subsequent waste ammonia behavior when exposed to a tank atmosphere (Hedengren 1999). Minimizing the direct contact of the tank 241-SY-101 wastes with the air minimizes the mass transfer of ammonia from the waste slurry to the tank atmosphere. Additionally, by submerging the dropleg discharge, the ammonia in the transferred wastes will seek to enter liquid phase equilibria with the large amount of aqueous tank 241-SY-102 supernate. By being rapidly absorbed into this supernate, the probability of large, immediate ammonia releases from tank 241-SY-102 will be minimized.

Along with its primary function, the design of the ASSD incorporates other performance enhancing features.

The drop leg discharge design injects the transferred wastes into tank 241-SY-102 horizontally at a depth of 160 inches. To accomplish this, the drop leg outlet has openings in the horizontal direction, diverting the flow from the axial to the radial direction in the tank. This design and location minimizes the probability of disturbing the presently settled solids of high TRU activity while providing reasonable mixing of the incoming wastes considering the waste volumes and flow rates involved. The horizontal openings at the discharge are sized to maintain a total flow cross-sectional area at least equivalent to that of the 2 inch transfer line.

The ASSD also serves as a siphon break device for the transfer system. At the top of the 4 inch dropleg, the diameter transitions to 2 inches through a nozzle. In the vicinity of the nozzle are a number of siphon-break holes in the 4-inch pipe. The combination of the hole location and the nozzle provides for a vacuum break to prevent tank-to-tank siphoning while minimizing the amount of process fluid entering the tank headspace through the holes.

The drop leg outlet is positioned at 160 inches for the following reasons:

The 160" position is specified to achieve a balance between:

1) Concerns against minimizing agitation of the TRU settled solids in 102-SY while optimizing mixing of incoming 101-SY slurry with 102-SY supernate indicate the dropleg outlet should be located as high off the bottom as possible.

2) Desiring to maximize the operating volumes in 102-SY indicates a location as close to the bottom as possible. This would allow larger batch transfers out of 102-SY without exposing the dropleg nozzles to atmosphere - a situation not desired because of the ammonia issues associated with 101-SY wastes.

3) Adhering to a 160" minimum liquid level for 101-SY transfer satisfies Operations requirement to keep 102-SY level higher than 130".

2.3.5 Transfer Control System

Control of the waste transfer system is achieved by the manual positioning of the system routing values and operation of the system pumps.

The pumps are P-350 and the water supply pumps (P-401 and P-402) on the Water Support Skid. Control of the water pumps is via on/off switches. P-350 incorporates a VFD so in addition to the on/off switches, the pump speed is controlled via a locked keypad.

Limited instrumentation capability is provided with the system. Mass flow/flow density capabilities are not included in the design because of the short runs of system lines and the short transit times incorporated with them severely limit the response time required to control the composition of the transfer line slurry. Cost and schedule limitations also precluded the incorporation of this sort of instrumentation. Controlling the volumetric ratio of the transfer line flowrate to the dilution water flowrate (dilution water pressure and/or valve position and/or P-350 speed) provides control of mass flow and density.

The prime operational concerns are protected by a limited system of interlocks and design features. These operational concerns and the associated interlocks/alarms/design features (shown in parenthesis) are listed below:

1) Do not to fill the transfer line with undiluted waste or water supply lines with any waste upon an electrical or mechanical failure (protective features include (a) interlock to shutdown P-350 upon detection of low dilution water flow at the farm control panel; (b) interlock to shutdown of the P-350 upon detection of high dilution water flow at the farm control panel, (c) alarm indicating high pressure upstream the flush water isolation during transfer operations; (d) two service water check valves V-358 and V-359 in the PPP; (e) the air pressurized emergency water flush tank on the water support skid)
2) Do not allow an electrical or mechanical failure to result in uncontrolled water addition to tanks 241-SY-101 or -102 (protective features include (a) 2000 gal capacity of the water skid supply tank ensures no more than this volume of water can be added to the tanks upon loss of electrical power).

Instrumentation and/or controls are provided at three locations for the transfer system. These are:

The PPP (Farm control panel) where the field operator is stationed. At this location, the PPP routing and control valves are positioned and operated, and an emergency P-350 shutdown switch is provided. Local leak detection alarms are provided for the PPP and transfer line.

The Remote control location (DACS control console) where the DACS operator is stationed. The P-350 on-off switch is located here. A summary alarm is provided for all leak detection systems.

The water skid (Water Skid control console) where another operator is stationed. This location provides the water supply valve and pump controls.

The MCC where the P-350 VFD is located and the P-350 speed is controlled/set (this location is not permanently manned).

Table 2.3.5 Transfer System Controls, Indications, Interlocks & Alarms

Type	Description	Location
Control	P-350 on/off	DCP
	P-350 emergency shutoff	FCP, DCP
	P-350 speed control/setting	MCC
	Transfer system valve position administrative control	PPP, WSS
Indication	P-350 on/off	FCP, DCP
	P-401/P-402 on/off	WSCP
	Transfer line volumetric flow indication	FCP, DCP
	Transfer line temperature indication	FCP, DCP
	Transfer line pressure indication	FCP
	Service water volumetric flow indication	WSCP, FCP
	Service water volumetric flow totalizer	WSCP, FCP
	WSS inlet hose temperature	WSCP
	NTK-401 temperature	WSCP
	WSS outlet hose temperature	WSCP
	WSS accumulator temperature	WSCP
	Service water supply pressure at WSS	WSCP
	Service water supply pressure at PPP	FCP
	Service water supply temperature at PPP	FCP, DCP
Interlock	Service water high/low flow rate shuts down P-350	FCP
	NTK-401 low water level shuts off NTK-401 heat trace	WSS
Alarm	PPP & transfer line/drop leg leak detection indication	FCP, DCP, local
	Low service water supply temperature	FCP, DCP
	Low seal loop level	FCP, DCP
	PPP transfer mode V-353 leak-by pressure switch	FCP, DCP
	NTK-401 low water level	WSCP
	NTK-401 high water level	WSCP

DCP = DACS Control Panel
FCP = Farm Control Panel
MCC = Motor Control Center
WSS = Water Support Skid
WSCP = Water Skid Control Panel

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3.0 Process Control

The transfer system valve arrangement is indicated in Figure 3.0 with the nomenclature described in Table 3.0. This listing of valves constitutes all valves in the transfer system and is used in describing the modes of operation.

Figure 3.0 Tank 241-SY-101 Transfer System Schematic

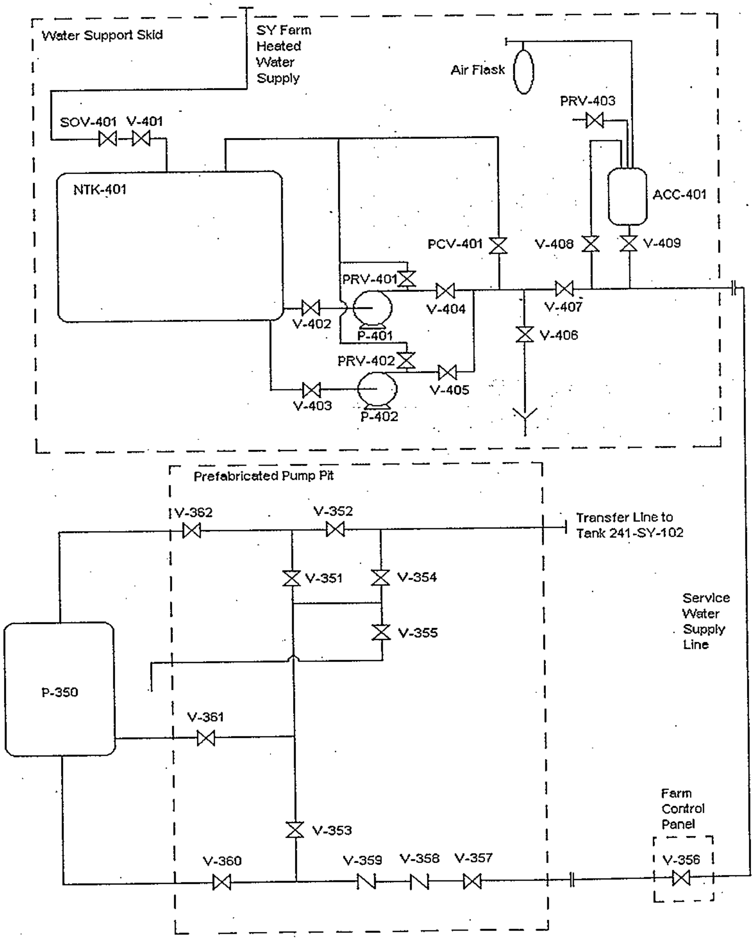

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Table 3.0 Transfer System Valve Nomenclature

Valve Description	Valve Function
SOV-401	WSS: Water Supply Tank NTK-401 Solenoid Shutoff Valve
V-401	WSS: Water Supply Tank NTK-401 Isolation Valve
V-402	WSS: Water Pump P-401 Inlet Isolation Valve
V-403	WSS: Water Pump P-402 Inlet Isolation Valve
PRV-401	WSS: Water Pump P-401 Relief Valve
V-404	WSS: Water Pump P-401 Outlet Isolation Valve
PRV-402	WSS: Water Pump P-402 Relief Valve
V-405	WSS: Water Pump P-402 Outlet Isolation Valve
PCV-401	WSS: Water Supply Line Pressure Regulating Valve
V-406	WSS: Water Supply Line Drain Valve
V-407	WSS: Water Supply Line Isolation Valve
V-408	WSS: Emergency Flush Accumulation Tank ACC-401 Upstream Isolation Valve
PRV-403	WSS: Emergency Flush Accumulation Tank ACC-401 Relief Valve
V-409	WSS: Emergency Flush Accumulation Tank ACC-401 Downstream Isolation Valve
V-351	PPP: Transfer Line Flush Isolation Valve
V-352	PPP: Transfer Line Isolation Valve
V-353	PPP: Flush Water Isolation Valve
V-354	PPP: Upstream Vacuum Break Valve
V-355	PPP: Downstream Vacuum Break Valve
V-356	FCP: Service Water Throttle Valve
V-357	PPP: Upstream Service Water Isolation Valve
V-358	PPP: Upstream Service Water Check Valve
V-359	PPP: Downstream Service Water Check Valve
V-360	PPP: Downstream Service Water Isolation Valve
V-361	PPP: P-350 Internal Flush Isolation Valve
V-362	PPP: P-350 Dilution Water IsolationValve

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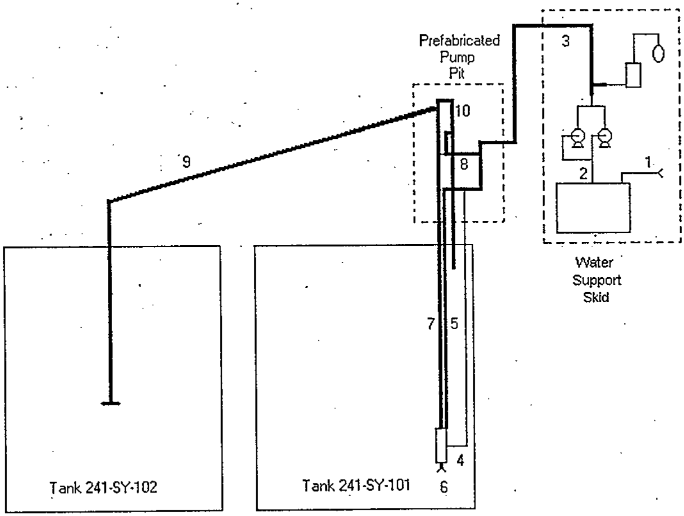
3.1 System Operational Configurations

3.1.1 System Vent

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
System Vent	This mode constitutes the normal, de-energized, or stand-by lineup of the transfer system. P-350, P-401, P-402 are de-energized <u>Valves in Open Position</u> WSS: SOV-401, V-402, V-403, V-404, V-405, V-406 FCP: V-356 PPP: V-351, V-352, V-354, V-355 <u>Valves in Shut Position</u> WSS: V-401, PRV-401, PRV-402, PCV-401, V-407, V-408, PRV-403, V-409 PPP: V-353, V-357, V-360, V-361, V-362



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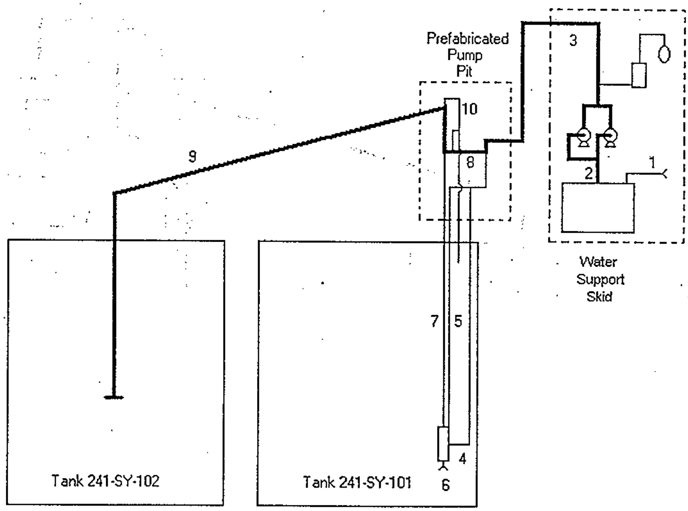
3.1.2 Normal Transfer Line Flush or Preheat

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
Normal Transfer Line Flush or Preheat	This mode is established immediately prior to or immediately following waste transfer operations, to either flush or pre-heat system lines. P-350 is de-energized P-401 and/or P-402 are energized and running as necessary to provide flush water pressure/flow rate as needed. <u>Valves in Open Position</u> WSS: SOV-401, V-401, V-402, V-403, V-404, V-405, V-407 FCP: V-356 PPP: V-352, V-353, V-357, V-360 <u>Valves in Shut Position</u> WSS: PRV-401, PRV-402, PCV-401, V-406, V-408, PRV-403, V-409 PPP: V-351, V-354, V-355, V-361, V-362



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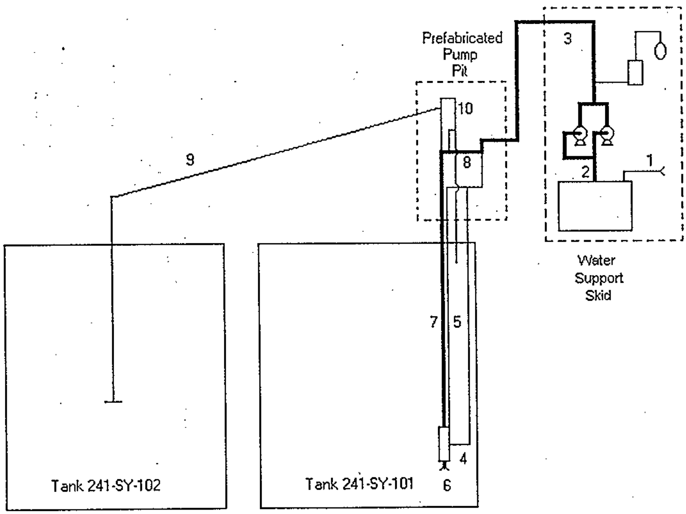
3.1.3 Normal P-350 Outlet Line Flush or Preheat

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
Normal P-350 Outlet Line Flush Or Preheat	This mode is established immediately prior to or immediately following waste transfer operations, to either flush or pre-heat system lines. P-350 is de-energized P-401 and/or P-402 are energized and running as necessary to provide flush water pressure <u>Valves in Open Position</u> WSS: SOV-401, V-401, V-402, V-403, V-404, V-405, V-407 FCP: V-356 PPP: V-351, V-353, V-357, V-360 <u>Valves in Shut Position</u> WSS: PRV-401, PRV-402, PCV-401, V-406, V-408, PRV-403, V-409 PPP: V-352, V-354, V-355, V-361, V-362



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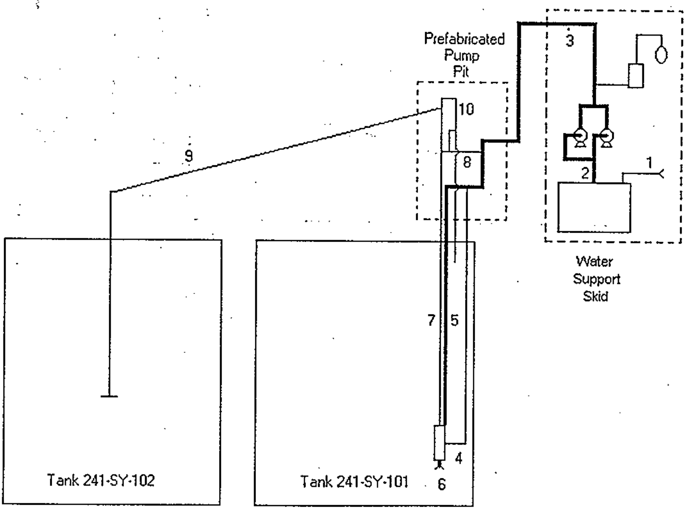
3.1.4 Normal P-350 Dilution Line Flush or Preheat

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
Normal P-350 Dilution Line Flush Or Preheat	This mode is established immediately prior to or immediately following waste transfer operations, to either flush or pre-heat system lines. P-350 is de-energized P-401 and/or P-402 are energized and running as necessary to provide flush water pressure <u>Valves in Open Position</u> WSS: SOV-401, V-401, V-402, V-403, V-404, V-405, V-408 FCP: V-356 PPP: V-357, V-362 <u>Valves in Shut Position</u> WSS: PRV-401, PRV-402, PCV-401, V-406, V-408, PRV-403, V-409 PPP: V-351, V-352, V-353, V-354, V-355, V-360, V-361



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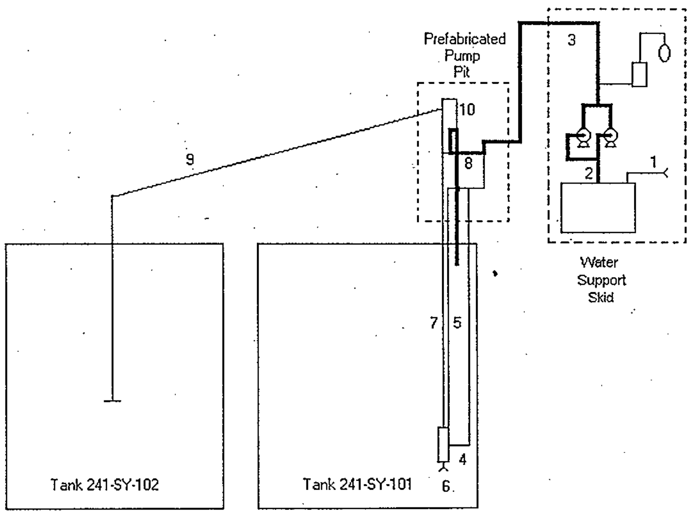
3.1.5 Normal Vent Header Flush to Tank 241-SY-101

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
Normal Vent Header Flush to Tank 241-SY-101	This mode is used to clear the system vent line of potential contamination with outlet to tank 241-SY-101. P-350 is de-energized P-401 and/or P-402 are energized and running as necessary to provide flush water pressure <u>Valves in Open Position</u> WSS: SOV-401, V-402, V-403, V-404, V-405, V-406 FCP: V-356 PPP: V-351, V-352, V-355, V-357, V-360 <u>Valves in Shut Position</u> WSS: V-401, PRV-401, PRV-402, PCV-401, V-407, V-408, PRV-403, V-409 PPP: V-353, V-354, V-361, V-362



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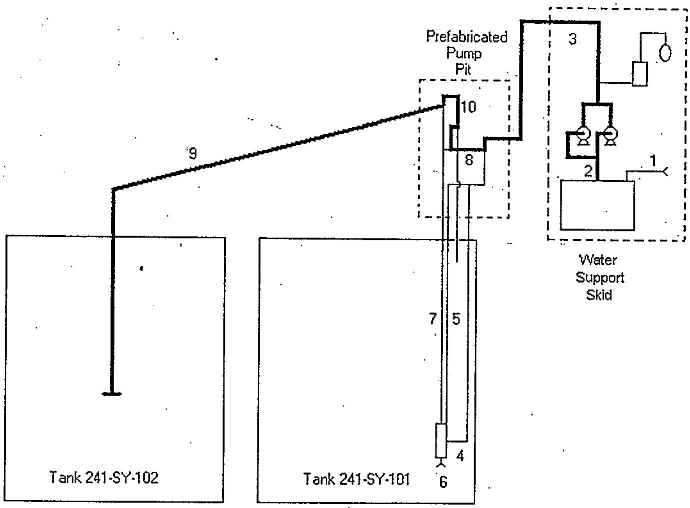
3.1.6 Normal Vent Header Flush to Transfer Line

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
Normal Vent Header Flush to Transfer Line	This mode is used to clear the system vent line of potential contamination with routing to tank 241-SY-102 via the transfer line. P-350 is de-energized P-401 and/or P-402 are energized and running as necessary to provide flush water pressure <u>Valves in Open Position</u> WSS: SOV-401, V-402, V-403, V-404, V-405, V-406 FCP: V-356 PPP: V-351, V-352, V-354, V-357, V-360 <u>Valves in Shut Position</u> WSS: V-401, PRV-401, PRV-402, PCV-401, V-407, V-408, PRV-403, V-409 PPP: V-353, V-355, V-361, V-362



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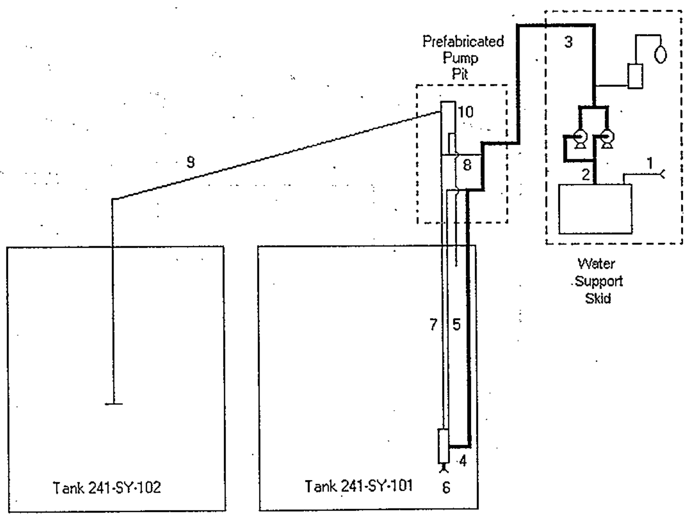
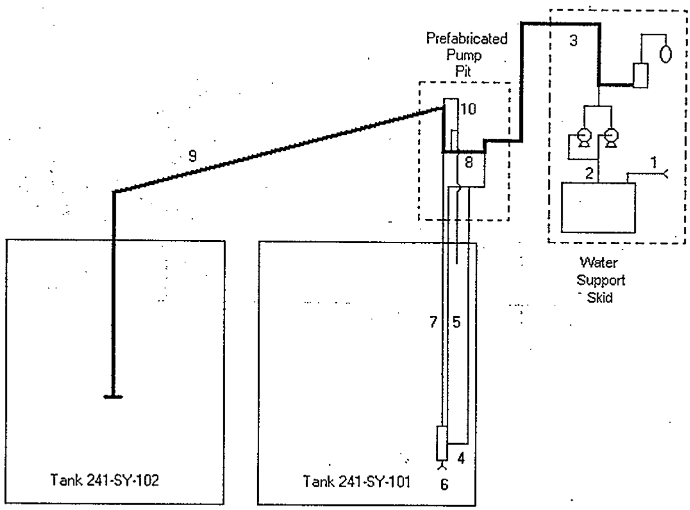
3.1.7 Normal P-350 Internal Flush

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
Normal P-350 Internal Flush	This mode is established immediately following P-350 operations in accordance with manufacturer recommendations. P-350 is de-energized P-401 and/or P-402 are energized and running as necessary to provide flush water pressure <u>Valves in Open Position</u> WSS: SOV-401, V-402, V-403, V-404, V-405, V-406 FCP: V-356 PPP: V-357, V-360, V-361 <u>Valves in Shut Position</u> WSS: PRV-401, PRV-402, PCV-401, V-406, V-408, PRV-403, V-409 PPP: V-351, V-352, V-353, V-354, V-355, V-362



3.1.8 Emergency Transfer Line Flush

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
Emergency Transfer Line Flush	This mode is established immediately upon loss of electrical power, P-350, or dilution water supply. P-350, P-401 and P-402 are de-energized <u>Valves in Open Position</u> WSS: SOV-401, V-401, V-402, V-403, V-404, V-405, V-409 FCP: V-356 PPP: V-352, V-353, V-357, V-360 <u>Valves in Shut Position</u> WSS: PRV-401, PRV-402, PCV-401, V-406, V-407, V-408, PRV-403 PPP: V-351, V-354, V-355, V-361, V-362



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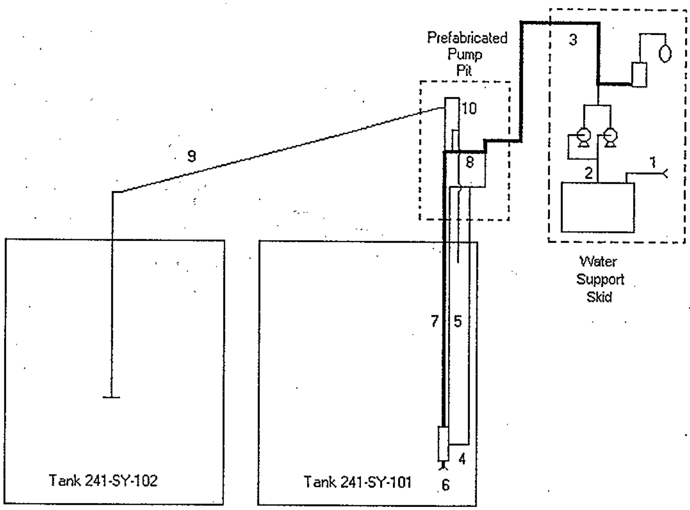
3.1.9 Emergency P-350 Outlet Line Flush

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
Emergency P-350 Outlet Line Flush	This mode is established immediately prior to or immediately following waste transfer operations, to either flush or pre-heat system lines. P-350, P-401 and P-402 are de-energized Valves in Open Position WSS: SOV-401, V-401, V-402, V-403, V-404, V-405, V-409 FCP: V-356 PPP: V-351, V-353, V-357, V-360 Valves in Shut Position WSS: V-351, V-354, V-355, V-361, V-362 PPP: V-352, V-354, V-355, V-361, V-362



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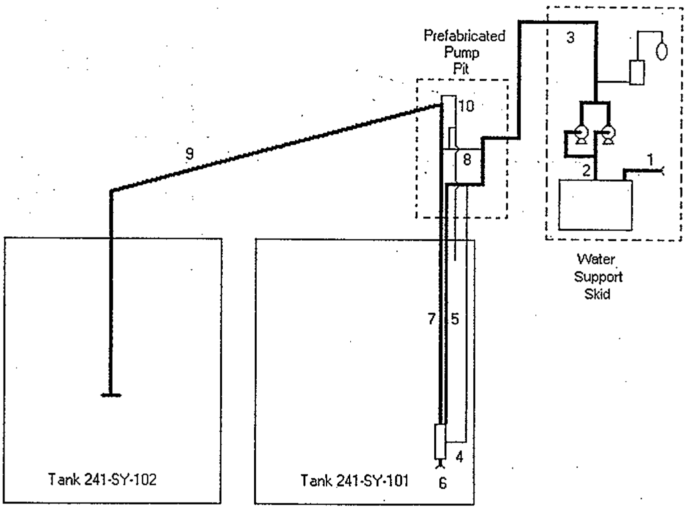
3.1.10 Normal Waste Transfer

Transfer System Process Flow Mode	Line-Up Notes and General Procedure
Normal Waste Transfer	This mode is used to generate, control, and transfer waste slurry from tank 241-SY-101 to tank 241-SY-102. P-350 is energized and running as necessary to provide a specified volumetric flow rate through the transfer line. P-401 and/or P-402 are energized and running as necessary to provide dilution water flow to the P-350 inlet. <u>Valves in Open Position</u> WSS: SOV-401,V-4012, V-402, V-403, V-404, V-405, V-407 FCP: V-356 PPP: V-351, V-352, V-357, V-362 <u>Valves in Shut Position</u> WSS: PRV-401, PRV-402, PCV-401, V-406, V-408, PRV-403, V-409 PPP: V-353, V-354, V-355, V-360, V-361



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3.2 Process Control Issues

The operational limit of tank 241-SY-101 is 406 inches and the projected level after the 100 kgal transfer is approximately 420 inches – well above the 406-inch level. The 100,000 kgal value comes from the desire to reduce the level by 36 inches, to avoid filling the tank to a level above the primary/ secondary tank interface. The100 kgal waste transfer is specified for three reasons:

1) 100 kgal is about the largest transfer without untoward impacts on DST operational volume and planning

2) 100 kgal represents about a 10% volume reduction allowing a 10% water back-dilution. Current thinking holds that this should be enough to dissolve the crust and eliminate gas retention problem.

3) Any more than 100 kgal for the transfer system will create interference problems between the crust and the P-350 inlet

It is currently estimated that the in-situ viscosity of the convective wastes in tank 241-SY-101 are expected to be in the range of 50 to 200 cP at a 50 per second shear rate. Although the P-350 would have the most versatility if the inlet were placed as low in the tank as possible. However, concerns about the physical properties of settled solids in this tank and uncertainties about corresponding waste viscosities has dictated placing the pump inlet well above the settled solids layer in the well mixed convective regions of the waste at an elevation of 8 ft above tank bottom.

The removal of 100 kgal of waste from tank 241-SY-101 wills both reduce the heat load in the tank while increasing the surface area to volume ratio of the waste contained in the tank. Both of these effects work to lower the bulk waste temperatures in the tank. The result of such a temperature reduction, in the absence of any water dilution, may be to precipitate additional salts resulting in additional crust growth, potentially negating the benefit of the waste removal. This issue has been analyzed (Antoniak 1998). Results show that initially, the removal of 100 kgal of waste should lower the bulk temperature of the tank wastes by 5°F. Additionally, removal of 150 kgal of waste from the tank should cause the precipitation of solids might amount to the equivalent of 18 inches of waste depth, but that the convective waste temperature would be largely unaffected. Additional operational actions will serve to alleviate concerns over additional solids precipitation. Back dilution is specified as the next step in remediation activities for this tank, and it is known that the affects of planned water dilution greatly outweigh the opposing physical effects of cooling of tank wastes (Conner 1999; Reynolds 1998). Further reduction of tank 241-SY-101heat-loss rate via reduction of the tank annulus ventilation rate remains a viable option.

The waste transfer controls for the transfer system have been identified (Krips, 1999). New controls have been identified as requiring four TSR revisions, designation of one new safety class and a few new safety significant pieces of equipment, and the application of some existing TSR controls to the transfer activity. Analyzed accidents include various flammable gas deflagration scenarios, spray leaks from transfer system structures or the overground transfer line, surface leaks resulting in a pool. Identified safety structures, systems, and components include:

- Tank 241-SY-101 level monitoring systems
- Tank 241-SY-101 level detection system
- Service water flow totalizer
- Transfer line flow monitoring system
- Instrumentation required to implement new Tank 241-SY-101 Waste Transfer Controls
- The PPP
- The over ground transfer line encasement and connections
- The drop leg enclosure on riser 241-SY-102-007.

The TSRs were specified as required revisions to ACs 5.9 (Tank 241-SY-101 Mixer Pump Performance), 5.10 (Ignition Controls), 5.11 (Flammable Gas Monitoring Controls), and 5.12 (Tank 241-SY-101 Waste Transfer Controls). In specific to tank 241-SY-101 waste transfer activities, these AC revisions include:

- Identifying when mixer pump hydrogen and ammonia controls are applicable

- Define the termination of activities upon detection of a high hydrogen or ammonia concentration to include all waste intrusive activities including water addition, activities in the dome space, and activities anywhere in the SY-Farm
- Monitor tank 241-SY-101 mixer pump performance for signs that changing tank waste conditions may degrade its safety function, and if this degradation is due to crust interference, add water to the tank
- The maximum waste transfer permitted from the tank is that which would result in a one-foot separation between the mixer pump inlet and the bottom of the crust. This requirement entails an orchestration of multiple measurement uncertainties and waste behavior estimations.
- The PPP, the over ground transfer line encasement and connections, and the drop leg enclosure all constitute physical barriers that function to confine leakage, limit aerosol emissions, and route leakage back to the waste tanks.

Newly identified defense-in-depth controls are limited to video camera monitoring of tank 241-SY-101 waste when remediation-related, waste intrusive activities are involved, and to control the water addition temperature within the specified 110°F to 130 °F band.

3.2.1 Control of Slurry Transfer

The primary operational concern of the transfer system is to prevent line plugging due to inadvertent cooling of undiluted waste within the system transfer lines. The transfer system incorporates multiple features to protect against this occurrence:

1) Heat tracing on the Water Support Skid and the overground transfer line to protect against temperature induced solids precipitation within transfer lines.
2) Multiple temperature indication incorporated throughout the transfer system.
3) Maximum permitted water flow rates based upon support infrastructure heating capabilities.
4) Heated water dilution and flush capabilities to either protect against the insertion of saturated salt solutions in system transfer lines - or - to remove these solution immediately should an upset condition introduce them to the transfer lines.
5) An emergency, air powered, 75 gallon heated water flush accumulation tank to provide flush capability to the system should a loss of electric power occur.
6) Water supply line and waste transfer line magnetic flow meters providing volumetric flow indication. These flow rates are the primary indication of the dilution ratio achieved within the P-350 and are the primary operational control parameters. P-350 pump speed, transfer control valve positions, and the Water Support Skid regulation pressure are all adjusted to maintain the desired waste transfer and dilution water supply flow rates.

Operationally, the primary objective is achieved by diluting tank 241-SY-101 wastes with heated water and controlling the dilution ratio (flow rate of dilution water/flow rate of undiluted waste). The design of the P-350 assures that the dilution ratio is expressed by:

$$DR = \frac{TF}{DF} = \frac{(SF - DF)}{DF}$$

Where,

DR = dilution ratio
TF = tank 241-SY-101 waste flow rate
DF = dilution water flow rate
SF = slurry flow rate

During steady state transfer operations, the value of DR is maintained in the range of 0.5 to 2.0. The 2.0-DR limit has significant short-term implications since violating this limit produces the immediate result of filling the transfer line with concentrated salt solution. This is undesired since conceivable upset conditions could result in solids precipitation and potential plugging of the transfer line. The 0.5-DR limit is not as time critical as the low-end limit since this results in the addition of unneeded volume into the DST system.

During start-up and shutdown of the transfer system, the high end of the steady-state DR range must be exceeded. In fact, immediately at the point of intended P-350 start/stop, the value of DR must be in the range of $0 \leq DR \leq 0.5$. This range is achieved by ensuring that the P-350 outlet flow rate is less than the dilution water flow rate (SF < DF) at P-350 start-up or shut down. When shutting down the P-350, the DR value, as close to 0.0 as possible, must be maintained for a sufficient period of time. This time period should constitute a few tens of seconds and will ensure that the transfer lines contain essentially infinitely diluted waste (i.e., water). A DR value of 0.0 is achieved when SF = DF.

3.2.1.1 Operational Control Devices

Control of Flush Water Flow to PPP

- WSS outlet pressure regulation valve V-9
- FCP service water throttle valve V-356

Control of Dilution Water Flow to PPP

- WSS outlet pressure regulation valve V-9
- FCP service water throttle valve V-356

Control of Transfer Line Flow

- P-350 VFD

3.2.1.2 Operational Monitoring Parameters

Flush Water Flow Rate to PPP

Service Water Line Magnetic Flow Meter
- Primary: FCP Indication FI-374A
- Secondary: DCP Indication FI-367B

Service Water Line Flow Temperature
- Primary: FCP Indication TI-373A
- Secondary: DCP Indication TI-373B

Service Water Line Supply Pressure: FCP Indication PI-372

Control of Dilution Water Flow to PPP

Service Water Line Magnetic Flow Meter
- Primary: FCP Indication FI-374A
- Secondary: DCP Indication FI-367B

Service Water Line Flow Temperature
- Primary: FCP Indication TI-373A
- Secondary: DCP Indication TI-373B

Service Water Line Supply Pressure: FCP Indication PI-372

Control of Transfer Line Flow

Transfer Line Magnetic Flow Meter
- Primary: FCP Indication FI-367A
- Secondary: DCP Indication FI-367B

P-350 Outlet Flow Temperature
- Primary: FCP Indication TI-369A
- Secondary: DCP Indication TI-369B

Transfer Line Pressure: FCP Indication PI-368

Other Control Devices and Methods

Service water volumetric flow totalizer (FQI-374)

WSS inlet hose; NTK-401; outlet hose; accumulator temperatures (TI-410, -412, -414; -415)

PPP & transfer line/drop leg leak detection indication alarms (ANN-365, ANN-366)

Low seal loop level alarm

PPP transfer mode V-353 leak-by pressure alarm (ANN-370)

NTK-401 low/low-low water level alarms (LAL-416/LALL-416)

NTK-401 high/high-high water level alarms (LAH-416/LAHH-416)

ESH&Q Ammonia and VOC Monitoring in SY-Tank Farm
- Detection of 25 ppm ammonia or TBD ppm VOC at ground level requires mask use in-farm
- Detection of 300 ppm ammonia or TBD ppm VOC at ground level requires transfer system shutdown

3.3 Transfer Operations Plan

3.3.1 Transfer System Preheat

Immediately prior to waste transfer operations, those portions of the transfer line that will see waste slurry are preheated by performing a heated water flush. These line sections include the transfer line and the P-350 outlet line. These flushes will add assurance and a smoothing effect to the line temperature profiles before the introduction of wastes.

Once the system lines have been preheated, transfer operations must begin immediately or the preheat operation must be repeated.

3.3.2 System Startup Management Plan

The system startup management plan or pre-operational testing accomplishes a number of goals for transfer system operations. These include

- Magnetic Flow Meter Calibration Testing
- Ammonia and VOC Emissions Testing
- Testing to Optimize System Flow Rates

Ideally, each of these objectives will be accomplished in the same series of tests.

3.3.2.1 Magnetic Flow Meter (FE-367 & FE-374) Calibration Testing

This test serves to calibrate the transfer system magnetic flow meters (FE-367 & FE-374) to actual system conditions. The general technique will be to compare integrated flow meter readings against actual tank level changes. The indicated dilution water and waste slurry flow rates from the respective magnetic flow meters are integrated over the pump run times and calibrated against the level rise in tank 241-SY-102. Practical level measurement difficulties in tank 241-SY-101 preclude its level change from being used as a volumetric measurement.

3.3.2.2 Ammonia and VOC Emissions Testing

Ammonia is indicated as being an extensive problem for the tank 241-SY-101 transfer effort (Hedengren 1999). The estimated ammonia concentrations in tank 241-SY-101 waste, and the estimated behavior of ammonia in those wastes when exposed to air, has driven incorporation of the ASSD into the transfer system. The primary purpose of the ASSD is to minimize the direct contact of tank 241-SY-101 convective wastes with tank atmosphere.

3.3.2.3 Testing to Optimize System Flow Rates

An additional part of this test will be to set the P-350 VFD for the desired steady-state waste transfer slurry flow rate. A minimum transfer rate of 60 gpm is needed to achieve a flow velocity of 6 ft/sec. The dilution water flow can be supplied to the PPP at a rate of up to 70 gpm. While not to exceed 70 gpm, efficient operation indicates a steady state dilution water flow rate close to the high capacity limit is desired. The desired DR is one part waste to one part water by volume. At a dilution water flow rate of 60 gpm, the allowed waste flow rate would range between 30 gpm and 120 gpm within dilution limits. This would result in a transfer flow rate of 90 gpm to 180 gpm. Therefore, specifying a dilution water flow rate of 60 gpm and a transfer flow rate of 120 gpm is a good balance between transfer efficiency and operating margin. The P-350 VFD should be set to produce a 120 gpm flow rate at the 60 gpm dilution water flowrate.

3.3.3 Transfer Operations

The transfer system is designed to be a simple system to minimize training requirements and the probability of component/interface requirements that could compromise the system's operating reliability.

3.3.3.1 Transfer Start-Up

In order to initiate a waste transfer from tank 241-SY-101 to tank 241-SY-102, the waste level in tank 241-SY-102 must be greater than 180 inches (500 kgal) to limit ammonia emissions from the surface of the supernate. Additionally, upon completion of the 100 kgal of tank 241-SY-101 waste transfer, the resulting supernate level in tank 241-SY -102 cannot exceed 270 inches (750 kgal) in order to provide reserve operational volume for ongoing salt well pumping activities. This adds the constraint that the 100 kgal waste transfer at a nominal 1:1 water dilution cannot result in the addition of more than 250 kgal to tank 241-SY-102.

Initiating the waste transfer operations refers to the transition from the stand-by vent condition to the normal transfer operation condition. This transition is achieved by first warming any section of system piping which, if not performed, could subject tank wastes to temperatures below 110°F. This preheat is accomplished by performing three system flushes/preheats in rapid succession. These are:

1) Normal Transfer Line Flush or Preheat (Section 3.1.2)
2) Normal P-350 Outlet Line Flush or Preheat (Section 3.1.3)
3) Normal P-350 Dilution Line Flush or Preheat (Section 3.1.4)

Next, the Normal Waste Transfer (Section 3.1.10) is established. To do this, the dilution water flow is first started. Throttle valve V-356 at the FCP is adjusted to the desired dilution water flow rate of 60 gpm. P-350 is then started at its pre-selected speed. If needed, this speed can be adjusted to obtain the desired slurry transfer flow rate. The specifications of the transfer system that at no time during normal transfer operations can the waste transfer flow rate exceed twice the dilution water flow rate. Therefore, the slurry transfer flow rate should never exceed three times the dilution water flow rate.

3.3.3.2 Controlled Transfer Shut-Down

A controlled system shutdown is essentially the reverse of the normal transfer start-up. The idea is to adjust dilution water and P-350 flow rates to minimize the waste concentration in the transfer line prior to stopping P-350. Once the maximum dilution has been achieved in the transfer line and P-350 has been shut down, the three standard system flushes are performed followed by placing the system in the System Vent line-up (Section 3.1.1). The flushes to be performed are:

1) Normal Transfer Line Flush or Preheat (Section 3.1.2)
2) Normal P-350 Outlet Line Flush or Preheat (Section 3.1.3

In order to minimize waste concentrations in the transfer line to shut down P-350, the dilution water flow rate is set to at least 60 gpm. Next, the speed of P-350 is slowly adjusted downwards until the transfer line flow rate is 60 gpm (or equal to the dilution water flow rate). Once the 60-gpm transfer flow rate is achieved, pumps P-350 , P-401 and/or P-402 are stopped. At this point, the flush sequence above is performed, followed by establishing the System Vent line-up.

3.3.3.3 Emergency Transfer Shut-Down and Flushing

Emergency transfer shut down and flushing is the evolution that is serviced by ACC-401 on the WSS. This accumulator and its supporting equipment is used to respond to a major upset condition that requires the uncontrolled shut down of P-350. This condition might result from a loss of service water, a loss of electric power, or detection of high airborne contaminant concentrations. The objective is to clear the transfer line of tanks wastes and is achieved by flushing this line to both tanks 241-SY-102 and 241-SY-101. This is achieved by establishing in the following order:

1) Emergency Transfer Line Flush (Section 3.1.8)
2) Emergency P-350 Outlet Line Flush (Section 3.1.9)

To make the transition from normal transfer operations to these flush evolutions, the following are performed. Upon the occurrence of the necessary upset condition, immediately stop pumps P-350, P-401 and/or P-402. The FCP operator will then shut or check shut V-354, V-355, V-356, V-360, V-361, and V-362. The FCP operator then opens or checks open V-351, V-352, V-353. Next the WSCP operator shuts V-407 and opens V-409. When approximately two-thirds of the ACC-401 volume has been flushed, V-409 is shut. Then the FCP operator then shuts V-352 and opens V-362. Next, the WSCP operator again opens V-409 to flush the remaining one-third of ACC-401 volume, followed by shutting V-409. At this point the System Vent line-up (Section 3.1.1) is established. Subsequently, ACC-401 can be recharged to repeat emergency flushing sequences if necessary.

3.4 Process Sampling Requirements and Schedule

Since the actual transfer rate of 100 kgal of tank 241-SY-101 should occur at 60 pgm. This means that the total transfer should be completed on the order of about 30 hours of continuous run time. Once the process has started and is running smoothly, there is no reason to shut the system down until the transfer is complete. As such, the time scale is so short that grab sampling and subsequent analysis of tank 241-SY-102 wastes could not be used as a process control feature. Once the transfer is complete, or if a system shutdown followed by significant downtime occurs due to some off-normal condition, grab sampling may be warranted. The need for such sampling and analysis may be dictated by process engineering or other oversight/management authority during actual transfer operations.

Otherwise, sampling requirements will be stated as standard grab-sample waste-compatibility analysis, both prior and subsequent to the 100-kgal waste transfer. Such analyses will provide information on supernate compositional changes that can be related to a volume of transferred tank 241-SY-101 wastes required to effect such a composition change.

4.0 Off-Normal Conditions

4.1 Loss of Electric Power

This concern of this condition is to minimize the probability of line plugging. In this case, the action is to manually activate the Water Support Skid water accumulation tank and perform emergency system flushing as soon as possible.

4.2 Loss of Dilution Water

Upon loss of dilution water supply, the low water supply pressure detected at the PPP should trip the P-350 to minimize the amount of undiluted slurry pumped into the transfer line. If this interlock does not operate properly, the operation onus is to stop the P-350 as soon as possible. This will be immediately followed by manual activation of the Water Support Skid water accumulation tank to perform emergency system flushing as soon as possible. Both of these actions are designed to minimize the probabilities of salt precipitation in the transfer line resulting in a line plug.

4.3 Loss of P-350

Upon loss of dilution water supply, the low water supply pressure detected at the PPP should trip the P-350 to minimize the amount of undiluted slurry pumped into the transfer line. If this interlock does not operate properly, the operation onus is to stop the P-350 as soon as possible. This will be immediately followed by manual activation of the Water Support Skid water accumulation tank to perform emergency system flushing as soon as possible. Both of these actions are designed to minimize the probabilities of salt precipitation in the transfer line resulting in a line plug.

4.4 Excessive SY-Farm Ventilation System Ammonia or VOC Emissions

This condition is the result of the agitation and chemical alteration of the 241-SY-101 wastes as they commingle with the wastes in tank 241-SY-102. Therefore, the recovery action will be either a controlled reduction of the rate or shutdown of 241-SY-101 waste transfer. Ideally, if a correlation between the rate of waste transfer and concentration of off gases can be demonstrated, the corrective action for an undesired gas concentration or rate of concentration change may be to reduce the rate of waste transfer. A reduction in the rate of waste transfer would be preferable to a controlled shutdown of transfer operation. A controlled shutdown is preferable to an evacuation of the tank farm with the consequent emergency shutdown of the transfer system.

4.5 Loss of SY-Farm Primary Ventilation

The concern here is the uncontrolled build-up of gas and vapor concentrations within the tank headspaces. Initiating a controlled shutdown of the 241-SY-101 waste transfer will minimize this buildup.

4.6 Loss of SY-Farm Annulus Ventilation

The concern here is the loss of leak detection capability. Initiating a controlled shutdown of the tank 241-SY-101 waste transfer minimizes consequences.

4.7 Transfer Line Leak

Responses to this condition may be dictated by the severity of the leak. A primary safety concern will be to minimize the amount of a potential environmental release. Upon detection of a small-contained leak, a controlled shutdown of the waste transfer system with subsequent water flushes will be specified. Upon a major leak or line break, an immediate P-350 shutdown is desired.

4.8 Transfer Line Plug

Recovery from pipeline plugging will utilize heated, pressurized water. Water pressure is gradually cycled on the plug. The slow nature of the pressure cycling prevents packing of the plug. The reapplication of the heated water increases the driving force for dissolution of soluble solids. The pressure can be cycled up to the system rating. If the plug is not immediately removed, the effect is to eventually create a small flow path through the solids plug. Eventually, the flow path will be enlarged through erosion and or dissolution, and the plug should fail under the applied pressure, clearing the line.

This pressurized, heated water can be supplied by either the normal water supply pumps (P-401 / -402), or the air pressurized water accumulation tank (ACC-1). Both sources can cycle water pressure to a plug. In the case of the water supply pumps, this can be accomplished with the pressure control valve PCV-401, or for ACC-1, by recharging its air flask. The PPP valve arrangement is such as to allow pressure to be applied to cause flow in the transfer line to either tank.

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Appendix A: INDEX OF TECHNICAL OPERATING REQUIREMENTS

A.1 Basis for Interim Operations (BIO) Controls
A.2 Operating Specification Document (OSD) Controls
A.3 Environmental Controls
A.4 Industrial Safety (Tank Farm HASP) Controls
A.5 Waste Compatibility/Waste Acceptance Controls - TBD

Table A.1.1. Safety SSCs and TSRs and Defense-in Depth for Representative Accidents.

#	Representative Accidents BIO Addendum	Structures, Systems, and Components	Technical Safety Requirements	Defense-in-Depth Controls
1	Nuclear Criticality (3.4.2.1)	None required	SL: None required LCS: None required LCO: None required AC 5.7 Nuclear Criticality Safety - Establish CPSs based on CSERs - Recovery actions if limits exceeded - Criticality training program	None
2	HEPA Filter Failure-Exposure to High Temperature or Pressure (3.4.2.2)	SS: Continuous air monitor-interlock on 241-702-A ventilation system SS: Continuous air monitor-interlock on 241-702-AZ ventilation system SS: Continuous air monitor-interlock on 296-P-16 ventilation system SS: Continuous air monitor-interlock on 296-C-006 ventilation system	SL: None required LCS: None required LCO 3.1.4 Ventilation Stack CAM Interlock Systems AC 5.12 Transfer Controls - Material Balance (every 24 hours during transfer operations) AC 5.18 HEPA Filter Controls - Periodic (frequency established based on rate of accumulation) radiation surveillance - Replacement at □ 2 mSv/h (200 mrem/h)	HEPA Filter Delta P - Low Delta P interlock across the HEPA filters on the ventilation system (where provided) - High Delta P alarm across the HEPA filters on the ventilation system - Periodic surveillance of HEPA Delta P and continuous air monitor HEPA Filter Testing - Testing of filters after installation and annually thereafter Record Sampler Heater Over Temperature - Interlock/alarm (where provided) HEPA Filter Replacement - Typically performed at 1 mSv/h (100 mrem/h)
3	Unfiltered Release (3.4.2.3)	SS: Continuous air monitor-interlock on 241-702-A ventilation system SS: Continuous air monitor-interlock on 241-702-AZ ventilation system SS: Continuous air monitor-interlock on 296-P-16 ventilation system SS: Continuous air monitor-interlock on	SL: None required LCS: None required LCO: None required AC 5.24 Ventilation Controls - Visual inspections of aboveground recirculation ventilation ductwork for Tank 241-C-106 every 24 hours during sluicing (only applies after new 296-C-006 ventilation system is installed)	Transfer Controls: - Waste compatibility controls Ignition Controls - Speed Limit Controls Plastic Sleeves on aboveground ventilation flanges

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Table A.1.1. Safety SSCs and TSRs and Defense-in Depth for Representative Accidents.

#	Representative Accidents BIO Addendum	Structures, Systems, and Components	Technical Safety Requirements	Defense-in-Depth Controls
		296-C-006 ventilation system	TSR controls in BIO Addendum Section 3.4.2.2 (HEPA Filter Failure) and 3.4.2.11 (Tank Bump) also apply	
4	Fire in Contaminated Area (3.4.2.4)	None required	SL: None required LCS: None required LCO: None required AC 5.10 Ignition Controls - Vehicle fuel system protection - Physical barriers outside tank farms - Speed limit controls AC 5.14 Emergency Preparedness - Response procedures	Fire Protection Program Radiation Protection Program Contamination Control Program Vehicle positioning spotters Tank Farm fences Vegetation Control Program
5	Caustic Spray Leak (3.4.2.5)	None required	SL: None required LCS: None required LCO: None required AC 5.23 Caustic Transfer Controls - Plastic sleeving around delivery piping - Caustic delivery system transfer pressure □ 125 psig or below sodium hydroxide cargo tanks specified maximum allowable operating pressure whichever is lower - Piping thickness - Sodium hydroxide cargo tanks meet applicable DOT specifications	Operator training TWRS Hazardous Material Protection Program Emergency response plans and procedures
6	Tank Failure Due to Excessive Loads (3.4.2.6)	None required	SL: None required LCS: None required LCO: None required AC 5.16 Dome Loading Controls - Hanford Site Hoisting and Rigging Manual for critical lifts - Limits on load height - Uniform and concentrated load limits	Shutdown of operations during high wind Load absorber material placed around riser when very heavy loads are installed Radiation Protection Program Health and Safety Plan Job Control System Operator training

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Table A.1.1. Safety SSCs and TSRs and Defense-in Depth for Representative Accidents.

#	Representative Accidents BIO Addendum	Structures, Systems, and Components	Technical Safety Requirements	Defense-in-Depth Controls
				Operating procedures Emergency response plans and procedures
7	Tank Failure Due to Excessive Vacuum (3.4.2.7)	None required	SL: None required LCS: None required LCO: None required AC: None required	None
8	Flammable Gas Deflagrations (3.4.2.8)	SC: DST/AWF ventilation SC: Primary tank leak detection systems SC: SST ventilation	SL: None required LCS: None required LCO 3.2.1 DST and AWF Tank Ventilation Systems LCO 3.2.2 SST Ventilation Systems - Active LCO 3.2.6 Primary Tank Leak Detection Systems AC 5.9 Flammability Controls - JCO Controls AC 5.10 Ignition Controls - JCO Controls AC 5.11 Flammable Gas Monitoring Controls - JCO Controls AC 5.14 Emergency Preparedness	Monitor dome pressure in tank C-106 and AY-102 during sluicing. Periodic video monitoring of the waste in tank AY-102. Measure background concentrations in both tanks for 3-4 weeks prior to sluicing. Monitor the ventilation flow rates in both tanks during and after sluicing. Monitor level growth and use barometric pressure evaluation after sluicing.
9	Organic Solvent Fire (3.4.2.9)	None required	SL: None required LCS: None required LCO: None required AC 5.10 Ignition Controls - Lightning (stop intrusive work, secure elevated equipment) - Barrier for hot metal during flame cutting - Vehicle fuel system protection - Physical barriers outside tank farms - Speed limit controls AC 5.12 Transfer Controls - Evaluate impact on organic solvent transfer - Material balance every 24 hours during transfer	Vehicle positioning spotters Tank farm fences HEPA filter replacement typically performed at 1 mSv/h (100 mrem/h)

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Table A.1.1. Safety SSCs and TSRs and Defense-in Depth for Representative Accidents.

#	Representative Accidents BIO Addendum	Structures, Systems, and Components	Technical Safety Requirements	Defense-in-Depth Controls
			operations AC 5.18 HEPA Filter Controls - Periodic (frequency established based on rate of accumulation) radiation surveillance - Replacement based on accumulation	
10	In-Tank Fuel Fire/Deflagration (3.4.2.10)	None required	SL: None required LCS: None required LCO: None required Note: This accident credits the same controls as the Organic Solvent Fire above (3.4.2.9)	
11	Tank Bump (3.4.2.11)	SC: Primary ventilation systems SC: Annulus ventilation systems	SL: See main text of the BIO LCS/LCO 3.3.1: SST Waste Temperature Controls (prior to start of sluicing) - Temperature □ 205□F LCS/LCO 3.3.2 DST and AWF Tank Waste Temperature Controls - Temperature □ 195□F (or 195/215 based on waste level) AC 5.12 Transfer Controls - incremental transfer with material balance every 24 hours during transfer operations - Ensure final tank state within analyzed conditions AC 5.19 Process instrumentation and Measuring and Test Equipment - Calibrate and properly maintain AC 5.2425 Ventilation Controls - Provide cooling capability for AY-102 after 2 ft of waste added (primary and annulus ventilation systems) AC 5.2526 Tank 241-C-106 Waste Temperature Controls: - Predict saturation temperatures at the bottom of Tank 241-C-106. Use predicted height of the waste throughout the incremental transfer and periodically monitor the waste temperature. - During the first two 0.3 m transfer increments, the liquid level established before start of each sluicing increment will be maintained throughout the increment.	ALCs will be disabled prior to the start of sluicing Communications between the C-106 and AY-102 control trailers will be maintained during sluicing operations Pump pit and sluice pit cover blocks (including removable plugs) will be in place prior to any sluicing operations and prior to enabling of the sluice or slurry pumps The transfer pumps associated with the sluice and slurry lines will be administratively locked out except, as necessary, the actual sluicing operations Emergency Response Plan/Procedures: - Will be in place and implemented in response to emergency conditions resulting from a tank bump - Will be in place and implemented in response to emergency conditions resulting from sitewide emergencies such as a seismic event
12	Liner Breach due to Steam between Steel Liner and Concrete Shell in Tank 241-C-		SL: None required LCS/LCO 3.3.1 SST Waste Temperature Controls (prior to start of sluicing) - Temperature □ 205□F	Active ventilation or other heat removal mechanisms will be maintained. Pump pit and sluice pit cover blocks (including

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Table A.1.1. Safety SSCs and TSRs and Defense-in Depth for Representative Accidents.

#	Representative Accidents BIO Addendum	Structures, Systems, and Components	Technical Safety Requirements	Defense-in-Depth Controls
	106 (3.4.2.12)		AC 5.12 Transfer Controls - Ensure final tank state within analyzed conditions AC 5.19 Process Instrumentation and Measuring and Test Equipment - Calibrate and properly maintain AC 5.~~25~~26 Tank 241-C-106 Waste Temperature Controls - Establish temperature controls that are □ T_{sat} for existing tank conditions (applies during and after sluicing)	removal plugs) will be in place whenever the conditions for initiation of a liner breach are present (i.e. leaking liner, active ventilation system down indefinitely) Emergency response plan/procedures - Will be in place and implemented in response to emergency conditions resulting from a liner breach. - Will be in place and implemented in response to emergency conditions resulting form sitewide emergencies such as a seismic event. A material balance every 24 hours during transfer operations Level monitoring to identify leakage into the liner of Tank 241-C-106 Communication between the C-106 and AY-102 control trailers will be maintained during sluicing operations Raw water is metered Design feature - The hose is engineered to maintain integrity Design feature - Positive mechanical stops are provided to limit nozzle travel to 115 degree vertically.
13	Subsurface Leak Remaining Subsurface (3.4.2.13)	SS: Pipe-in-pipe encasements SS: Transfer leak detection systems SS: Tank level detection systems	SL: None required LCS: None required LCO 3.1.3 Transfer Leak Detection Systems AC 5.12 Transfer Controls - Establish communication between control rooms for Tanks 241-C-106 and 241-AY-102 during sluicing	Pressure/leak testing of transfer route before material transfer Operator training

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Table A.1.1. Safety SSCs and TSRs and Defense-in Depth for Representative Accidents.

#	Representative Accidents BIO Addendum	Structures, Systems, and Components	Technical Safety Requirements	Defense-in-Depth Controls
			operations - Material balance every 24 hours during transfer operations - Configuration management - Independent transfer route verification AC 5.13 Encasement Seal Loop Controls - Encasement drain line valve not closed AC 5.17 Excavation Controls (see 3.4.2.17) AC 5.20 Transfer Pump Administrative Lock Controls	Operating procedures Emergency response plan/procedures
14	Subsurface Leak Resulting in Pool (3.4.2.14)	SC: Pipe-in-pipe encasements SS: Tank level detection systems	SL: None required LCS: None required LCO: None required AC 5.12 Transfer Controls - Material balance every 24 hours during transfer operations - Establish communications between C-106 and AY-102 control room during sluicing operations - Configuration management - Independent route verification during transfer setup AC 5.14 Emergency Preparedness - response procedures	Walkdowns are performed once/shift to detect surface leaks from transfer line WRSS transfer lines are equipped with encasement leak detectors
15	Surface Leak Resulting in Pool (3.4.2.15)	SC: Transfer leak detector alarms SS: Transfer system covers SS: Tank level detection systems SS: Primary tank leak detection system SC: Pipe-in-pipe encasements SC: Leak detectors in interfacing pits and their alarms	SL: None required LCS: None required LCO 3.1.4 Transfer Leak Detection Systems AC 5.12 Transfer Controls - Material Balance every 24 hours during transfer operations - Establish communication between control rooms for Tank 241-C-106 and 241-AY-102 during sluicing operations - Configuration management - Cap/blank nozzles when not in use - Vehicle restrictions around transfer lines AC 5.14 Emergency Preparedness - Response procedures AC 5.17 Excavation Controls (see 3.4.2.17)	Tank farms are visually surveyed by operators at least once a day. Pit drains, where open Encasement leak detectors Backflow preventers Material balance every 24 hours during transfer operations, including total material transferred and solids loading calculation

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Table A.1.1. Safety SSCs and TSRs and Defense-in Depth for Representative Accidents.

#	Representative Accidents BIO Addendum	Structures, Systems, and Components	Technical Safety Requirements	Defense-in-Depth Controls
		SS: Backflow preventers	AC 5.20 Transfer Pump Administrative Lock Controls AC 5.22 Transfer System Cover Removal Controls	
16	Spray Leak from Structure or Overground Waste Transfer Line (3.4.2.16)	SC: Transfer system covers SS: Backflow preventers SC: Pipe-in-pipe encasements SC: Stack CAM and interlock	SL: None required LCS: None required LCO 3.1.1 Transfer System Covers - Removable plug installed LCO 3.1.4 Ventilation Stack CAM Interlock Systems AC 5.12 Transfer Controls - Configuration management - Independent transfer route verification - Vehicle restrictions AC 5.13 Encasement Seal Loop Controls - Encasement drain line valve not closed AC 5.20 Transfer Pump Administrative Lock Controls AC 5.22 Transfer System Cover Removal Controls	Repositioned jumpers are in service tested during initial sluicing. Cameras lowered through penetrations in the cover block are used to verify initial jumper integrity during the leak test. Process pit and vault pit leak detectors Material balance every 24 hours during transfer operations, including total material transferred and solids loading calculation Encasement leak detectors Isolation valves; manual valve is closed to isolate the flush system when not in use Backflow preventers
17	Spray Leak from an Underground Waste Transfer Line (3.4.2.17)	None required	SL: None required LCS: None required LCO: None required AC 5.12 Transfer Controls - Encased pipe outside of the tank farm boundaries will be identified with permanent aboveground labels AC 5.17 Excavation Controls - Excavation permit including Composite map, radiological evaluation, physical marking of ground surface, activity approval - Excavations within 15' of waste transfer are prohibited - Restrictions on waste transfer through uncovered/excavated lines (prohibited or compensatory measures) - Waste transfers will not be conducted in transfer lines located within approximately 15 ft of ongoing excavation activities	Access Control - T-bars and chains Material balance every 24 hours during transfer operations, including total material transferred and solids loading calculation

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Table A.1.1. Safety SSCs and TSRs and Defense-in Depth for Representative Accidents.

#	Representative Accidents BIO Addendum	Structures, Systems, and Components	Technical Safety Requirements	Defense-in-Depth Controls
			- Establish emergency response actions and communication between operations and excavation personnel	
18	Natural Phenomena - Seismic Events (3.4.2.18)		SL: None required LCS: None required LCO: None required AC: None required None: Refer to BIO main text	Seismic Shutdown Switch

AC = administrative control
ALC = air lift circulator
AWF = aging waste facility
BIO = Basis for Interim Operation
CAM = continuous air monitor
DOT = Department of Transportation
DST = double-shell tank
HEPA = high-efficiency particulate air (filter)
JCO = Justification for Continued Operation
LCO = Limiting Condition for Operation
LCS = Limiting Condition for Safety
SC = safety class
SL = safety limit
SS = safety significant
SST = single-shell tank
TSR = Technical Safety Requirement
TWRS = Tank Waste Remediation System

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Table A.2.1. Operating Specification Document (OSD) Controls for Tanks 241-SY-101 and 241-SY-102

REQUIREMENT	CONTROL PARAMETER	CONTROL LIMIT	METHOD OF CONTROL	SOURCE DOCUMENT[1,2]
Tank Composition	Temperature □ 212□F For [NO3⁻] □ 1.0M [NO3⁻]/[OH⁻ + NO2⁻] For 1.0M □ [NO3⁻] □ 3.0 M For [NO3⁻] > 3.0M	0.01M □ [OH⁻] □ 5.0M 0.011M □ [NO₂⁻] □ 5.5M < 2.5 [for solutions below 167□F, the [OH⁻] limit is 8.0M] 0.1 ([NO3⁻]) □ [OH⁻] < 10M [OH⁻] + [NO2⁻] □ 0.4 ([NO₃⁻]) 0.3M □ [OH⁻] < 10M [OH⁻] + [NO2⁻] □ 1.2M [NO3⁻] □ 5.5M	Waste sampling & verification of compliance of waste transfers. Note: LCO 3.3.2 restricts the waste temperature to 195□F for the upper 15 feet of waste and 215□F for the waste below 15 feet.	OSD-T-151-00007 7.2.1.A
Liquid Levels	Primary Tank Liquid Level Minimum Leak detection pit liquid level	Min. 6 in. (when annulus vent system is operating) ≤ 74 inches (AZ & SY)	Liquid level taken per procedure TO-040-180 Auto liquid level measuring device and/or manual tape Dip tubes used to monitor liquid level in leak detection pit. Alarm activated if liquid level exceeds predetermined level.	OSD-T-151-00007 7.2.2
Vapor Space Pressure	No limits currently specified.			OSD-T-151-00007 7.2.5
Solution Temperatures	Waste Temperature Temperature Changeover Time for Solution in Temperature gradients of soln. in tanks solution soln/vapor interface	≤ 195°F in all levels of waste or ≤ 195°F in the top 15 ft. of waste and ≤ 215°F in the waste below 15 ft. <125°F: ≤ 10°F/hr ≥ 125°F: ≤ 20°F/day ≤ 55°F/ft ≤ 55°F/ft	Thermocouple trees installed in tanks. Temperatures taken per procedure TO-040-660 Note: Average bulk temperature. These temperature constraints are not applicable during initial tank filling.	HNF-SD-WM-TSR-006 LCO 3.3.2 OSD-T-151-00007 7.2.6
Total Fuel Concentration	Maximum total fuel concentration	480 joules/gram (dry basis)	Waste samples analyzed per appropriate sample	OSD-T-151-00007 7.2.12

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Table A.2.1. Operating Specification Document (OSD) Controls for Tanks 241-SY-101 and 241-SY-102

REQUIREMENT	CONTROL PARAMETER	CONTROL LIMIT	METHOD OF CONTROL	SOURCE DOCUMENT[1,2]
	(Energetics)		analysis plan (SAP)	
Ventilation System				
HEPA Filters				
Pressure Drop Across Filters at rates Flow	Pressure drop across first filter in a series	≤ 5.9 in. w.g.	Calibrated differential pressure gauges are used for each filter to monitor the pressure drop. The gauges are checked per SOP TO-060-240 for SY Farm. Gauges are read daily.	OSD-T-151-00007 7.3.1
	Pressure drop across any other filter	≤ 4.0 in. w.g.		
	Total pressure drop across filters in a series	≤ 5.9 in. w.g.		
Air Inlet Temperature	Air Inlet Temperature to HEPA Filter	≤ 230°F	Temperatures are checked to determine the operating condition of the heater per applicable procedures, work plans, work packages or other documentation.	
Filter Efficiency	Single HEPA Filter System	99.95% of particles between 0.1		
	Multiple HEPA Filter System			
Gaseous Discharges from Ventilation System				
Maximum permissible concentration of radionuclides	Annual Average Concentrations*	Not to exceed 1 time the DCG-Public Value of WHC-CM-7-5, Appendix C, at point of release.	*Except for krypton-85: Not to exceed a combined release of 4E+06 Ci/yr.	
	Weekly Average concentrations*	Not to exceed 10 times the annual average administrative control value (ACV) concentrations for that stack at point of release.	A Radiation Analyzer (RAN) and Effluent Record Sampler samples the air contained in the K1 and K2 Exhaust stacks. The sample is analyzed to determine conformance with DCG-Public limits.	
	Instantaneous Concentration	Not to exceed 5,000 times the DCG-Public Value of WHC-CM-7-5, Appendix C, averaged over any 4-hr period at point of release.		

[1]LMHC, 1997, *Operating Specifications of the 241-AN, AP, AW, AY, AZ & SY Tank Farms*, OSD-T-151-00007, Rev. H-21, Lockheed Martin Hanford Corporation, Richland, Washington.

[2]Noorani, Y. G., 1997, *TWRS Technical Safety Requirements*, HNF-SD-WM-TSR-006, Rev. 0E, DE&S Hanford, Inc., Richland, Washington.

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Table A.2.1. Operating Specification Document (OSD) Controls for Tanks 241-SY-101 and 241-SY-102

REQUIREMENT	CONTROL PARAMETER	CONTROL LIMIT	METHOD OF CONTROL	SOURCE DOCUMENT[1,2]

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REFERENCES

Table A.4.2 Industrial Safety (Tank Farm HASP) Controls for Tanks 241-SY-101 and Tank 241-SY-102

Hazard	Control Limit	Method of Control	Source Document[1]
Noise	No stationary high-sources present in AY Farm. Only required if specified in work packages or permits to control intermittent noise sources from any equipment brought into the farm.	Work packages or permits	Appendix F, III.B.1
Chemicals Caustic Additions	Prevent and mitigate the consequences of caustic spray leaks.	Delivery piping encased in transparent plastic sleeving. Maximum operating pressure $\leq$ 125 psig. Steel pipe with a wall thickness of no less than *schedule 10*. Proper eye, face, skin protection and emergency wash facilities.	Section 2.8.24
Confined Spaces	Listing in Table F-1 of Appendix F. See Section 10 of HASP		Appendix F, III.B.3
Asbestos	Anything painted pink is assumed to contain asbestos. This material is not to be disturbed.	Warning signs at AY farms alert workers that asbestos materials are present.	Appendix F, III.B.4
Lighting		Adequate lighting shall be provided when operations are to be performed in low light situations.	Appendix F, III.B.5
Tank-Based Hazards		Found in work packages & work permits developed for specific tank as part of work control process.	Appendix F, III.C Section 2.0

[1]Carls, D. R., 1995, *Tank Farms Health and Safety Plan*, WHC-SD-WM-HSP-002, Rev. 2J, Westinghouse Hanford Company, Richland, Washington.

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Waste Compatibility/Waste Acceptance Controls - TBD

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SUMMARY OF TANK 241-SY-101 WASTE TRANSFER HAZARD AND ACCIDENT ANALYSES; SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS; AND TECHNICAL SAFETY REQUIREMENTS

Note: The below listed safety structures, systems, and components (SSCs) and technical safety requirements (TSRs) only include those that are new for the Tank 241-SY-101 waste transfer.

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement	Comments
	Description	SC	SS		
Flammable Gas Deflagration - General	None	-	-	AC: 5.10 (Revision) Ignition Controls	Elevate and augment LANL SA Level II ignition controls for Tank 241-SY-101.
				AC: 5.11 (Revision) Flammable Gas Monitoring Controls	Elevate and augment LANL SA Level II flammable gas monitoring controls for Tank 241-SY-101. The flammable gas monitoring controls for Tank 241-SY-101 shall specify: 1. When the LANL SA Level I mixer pump hydrogen and ammonia monitoring controls are applicable (i.e., during dome and waste intrusive activities), and 2. That termination of activities on a high hydrogen or ammonia concentration encompasses all ex-tank, dome, and waste intrusive activities, including all water additions to the tank.

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SUMMARY OF TANK 241-SY-101 WASTE TRANSFER HAZARD AND ACCIDENT ANALYSES; SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS; AND TECHNICAL SAFETY REQUIREMENTS

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement	Comments
	Description	SC	SS		
Flammable Gas Deflagration – Buoyant Displacement GRE plus additional gas release from the crust	Siphon break	X		AC: 5.9 (Revision) Tank 241-SY-101 Mixer Pump Performance	Add as a key program element monitoring Tank 241-SY 101 mixer pump performance for any signs of degradation that could affect its safety function (prevent buoyant displacement GRE), analyzing any identified degradation of pump performance, and, if degradation is determined to be the result of interaction of the pump with the crust, add water to the tank to restore pump performance.
	*SY-101 Level Monitoring System(s)		X		
	*Tank Level Detection System (Tank 241-SY-102)		X		
	*Service Water Flow Totalizer		X	AC: 5.10 (Revision) Ignition Controls	See above.
	*SY-101 Transfer Line Flow Monitoring System		X	AC: 5.11 (Revision) Flammable Gas Monitoring Controls	See above.
	*This list of safety-significant SSCs shall include all instrumentation required to implement the new Tank 241-SY-101 Waste Transfer Controls			AC: 5.12 (Revision) Tank 241-SY-101 Waste Transfer Controls	Add as program key elements: 1. Calculate at the time of the transfer the maximum quantity of waste that can be transferred from Tank 241-SY-101 and maintain a minimum of one (1) foot between the mixer pump suction and the bottom of the crust. The calculation shall consider uncertainties in measuring the bottom of the crust, including measuring instrument accuracy, and the growth of the crust subsequent to the transfer. 2. Monitor and limit the transfer of waste from Tank 241-SY-101 to the maximum quantity calculated above.

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SUMMARY OF TANK 241-SY-101 WASTE TRANSFER HAZARD AND ACCIDENT ANALYSES; SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS; AND TECHNICAL SAFETY REQUIREMENTS

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement	Comments
	Description	SC	SS		
Flammable Gas Deflagration – Induced gas release from waste disturbance, including the crust	None	-	-	AC: 5.10 (Revision) Ignition Controls AC: 5.11 (Revision) Flammable Gas Monitoring Controls	See above. See above.
Flammable Gas Deflagration – Induced gas release from waste dissolution, including the crust	None	-	-	AC: 5.10 (Revision) Ignition Controls AC: 5.11 (Revision) Flammable Gas Monitoring Controls	See above. See above.

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SUMMARY OF TANK 241-SY-101 WASTE TRANSFER HAZARD AND ACCIDENT ANALYSES; SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS; AND TECHNICAL SAFETY REQUIREMENTS

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement	Comments
	Description	SC	SS		
Spray Leak in Structure or from Overground Transfer Line	Prefabricated Pump Pit (PPP)	X	-	None	*PPP:* The safety functions of the PPP, including cover, are to provide an impaction surface that prevents a waste leak from jetting directly into the atmosphere and to limit the release of waste aerosols to the atmosphere by means of tortuous air passages between adjacent surfaces that promote impingement and condensation.
	OGT encasement and connections	X			*OGT Encasement and Connections:* Confine leak from the primary piping and ensure that a leak is directed to Tank 241-SY-102 or, if the drain to Tank 241-SY-102 is plugged, to the PPP which contains a leak detection system. The OGT encasement and connections shall be designed to withstand the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the OGT encasement to the PPP.
	Riser 241-SY-102-007 drop leg enclosure	X			***Riser 241-SY-101-007 Drop Leg Enclosure:*** Same as OGT encasement and connections.

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SUMMARY OF TANK 241-SY-101 WASTE TRANSFER HAZARD AND ACCIDENT ANALYSES; SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS; AND TECHNICAL SAFETY REQUIREMENTS

Analyzed Accident	Safety Structures, Systems, and Components			Technical Safety Requirement	Comments
	Description	SC	SS		
Surface Leak Resulting in Pool	Prefabricated Pump Pit (PPP)	X	X	None	*PPP:* The *safety-class safety functions* of the PPP are to provide an intact boundary for the leaked waste, and when leak detector alarms and appropriate operator response times to shut off the transfer pump are credited, to prevent premature PPP overflow and the formation of a surface pool. The *safety-significant safety functions* of the PPP, including cover, are to limit the aerosol release generated by waste leak splattering and splashing in the PPP, and to limit shine dose from the waste leak.
	OGT encasement and connections	X	–		*OGT Encasement and Connections:* Provide secondary confinement for leaks from the primary line and route the leak to Tank 241-SY-102 or, if the drain to Tank 241-SY-102 is plugged, back to the PPP which contains a leak detection system. The OGT encasement and connections shall be designed to withstand the maximum pressure resulting if the drain to Tank 241-SY-102 is plugged and the waste backs up the OGT encasement to the PPP.
	Riser 241-SY-102-007 drop leg enclosure	X	–		*Riser 241-SY-102-007 Drop Leg Enclosure:* Same as OGT encasement and connections.

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DEFENSE IN DEPTH CONTROLS

The only new defense-in-depth controls identified for the Tank 241-SY-101 waste transfer are:

Video camera monitoring during the waste transfer and during associated activities that involve crust disturbance or dissolution

Dilution water temperature

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