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DESIGN REVIEW CLOSURE REPORT FOR THE SY-101 RAPID TRANSFER SYSTEM

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Richland, WA 99352
U.S. DOE Contract DE-AC06-96RL13200

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Abstract:
The purpose of this report is to document closure of design review open items resulting from design reviews conducted of the SY-101 Respond And Pump In Days (RAPID) Transfer System.

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RPP-5354
DESIGN REVIEW CLOSURE REPORT FOR THE SY-101 RAPID TRANSFER SYSTEM

William J. Powell

November 18, 1999

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RPP-5354
DESIGN REVIEW CLOSURE REPORT FOR THE SY-101 RAPID TRANSFER SYSTEM

1.0 SCOPE

1.1 OVERVIEW

The purpose of this report, is to document closure of design review open items, resulting from design reviews conducted for the SY-101 Respond And Pump In Days (RAPID) Transfer System. Results of the various design reviews were documented in the *Design Review Report for The SY-101 Rapid Mitigation System,* HNF-4519. In that report, twenty-three open items were identified. In this report the 23 items are reviewed and statused.

A list of the important project documents, including Design Baseline Documents are included in Appendix A. This report assists in completing the technical turnover of the project from the Project Design Authority to the Plant Design Authority.

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 allow 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.

1.3 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., "Process Control Plan for Tank 241-SY-101 Surface Level Rise Remediation, HNF-4264," dated October 1999.

Fein, K. O., et al., "Tank 241-SY-101 Safety Basis for Remediation Activities and Operations Before Closure of the Unreviewed Safety Question on Waste Surface Change, HNF-3737, Fluor Daniel Hanford, Inc." dated October1999.

Goetz, T. G., "Tank Waste Remediation System Final Safety Analysis Report, HNF-SD-SAR-067, R-1," October 8, 1999.

Jones, G. L., "Tank Waste Remediation System Technical Safety Requirements, Revision O-R, HNF-SD-WM-TSR-006," dated March 10, 1999.

Noorani, Y. G., "Tank Waste Remediation System Basis for Interim Operation, Revision 1-C, HNF-SD-WM-BIO-001," dated March 4, 1999.

Schlosser, R. L., "Design Review Report for The SY-101 Rapid Mitigation System, HNF-4519," dated May 24, 1999.

1.4 CLOSURE 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.

Detailed component level design to implement the system design basis has been finalized. With the exception of transfer line slope, the detailed design has been finalized both for initial transfer operation and for subsequent transfers, if required. The use of a transfer routing without slope for complete drainage has been accepted for the initial transfer. For subsequent use of the system, actual dose rates and the time required to remove waste from the secondary containment requires further evaluation.
Review comments for which dispositions have not been accepted were placed into 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 closure of the system design review open items, the SY-101 Surface-Level-Rise Remediation Project waste transfer system is found to meet the applicable requirements related to system design. All comments are closed for the initial transfer out of SY-101 and the first back dilution. Subsequent transfers and back dilutions may require more safety analysis and documentation in contractor prudent controls. Continued USQ evaluations will be used to assure that the existing, or modified design, is appropriate for these transfers.

For those open items related to options as reported in HNF-4519, the design has been refined to reflect selection of a specific option. Of the two designs reviewed for the transfer line, the hose in encasement hose option was selected after issuance of HNF-

4519. The hose and hose on the ground will be used for the first transfer, or set of transfers. An analysis is ongoing to determine if the encasement should be replaced with other material or sloped to drain. Plant Engineering will develop the analysis.
Of the two electrical power design options, the design solution provided by the facility was an upgraded distribution system.

3.0 REVIEW ACTION ITEMS

This Section summarizes closure of remaining 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 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. Closure of the remaining open action items is summarized below:

- **RCR 45:** "Replacement of the pump is 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.

  Training is most efficiently done just prior to performance of the activity. The equipment to be used would probably be the W151 pump installation and removal equipment. Generally removal of tank farm pumps has been performed many times in the past. Removal of the pump will utilize new W151 equipment that has been used before. The training and procedure development will be performed when required. The timing of the change out has gotten much less restrictive since this comment was made, as the crust level has not moved since April. It is anticipated that we will never have to replace this pump quickly to avoid a safety consequence, comment closed.

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

  A minimum waste level in Tank 241-SY-102 has been specified in HNF-4264 (PCP). The drop leg is installed at 149 inches from the bottom of the tank. This item is closed.

- **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 HNF-4264. In addition, HNF-4359, (Calculation for the ...) has specified the information. This item has been resolved.

- **RCR 98:** "Instrumentation needs to reflect the logic of operations developed in the Process Control Plan, as well as critical characteristics, 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 and HNF-4264. The PCP does integrate the system design and operation. This item has been resolved.

3.3.2 Prefabricated Pump Pit, HNF-4169

Twenty action items were identified in meeting minutes on March 9, 1999. Closure of 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.

  Protective coatings have been applied to the carbon steel portions of the Prefabricated Pump Pit per Drawing H-14-103571. This item is closed.

3.3.3 Overground Transfer Line (OGT)

Twenty-one action items were identified in meeting minutes on March 11, 1999. Closure of 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 overground transfer line and encasement have been designed for use, removal, and disposal after use. Design using a hose and hose transfer line provides temporary application with a maximum useful life determined by the hose material. Specification HNF-4407 calls out for a minimum 1 year life of the hose. The SEL HNF-4531 also requires a 1 year life. The hose test report HNF-4892, Appendix C, documents the storage life of the hose as 7 years. This item is closed.

3.3.4 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. Closure of the remaining open action items is 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."

  The transfer line utilizing hose for both the primary line and the encasement has been designed and tested to hose manufacturing standards. The application of burst pressure testing requirements provides an equivalent approach to the acceptance requirements of ASME Section III as documented in the hose ATP, RPP-4892. This item is closed.

- **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. The heat trace system has been design as self-limiting ensuring that the operating temperature of the hose material is not exceeded. This item is closed.

- **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]."

  The current line routing with a low point in the transfer configuration has been accepted for the initial transfer of waste. Monitoring during this transfer will be used to provide a basis for drainage design for subsequent transfers from the system. The monitoring will include radiation surveys during line operation, flushing, and removal. Design for subsequent transfers should include adequate slope to allow the transfer line and secondary containment to self drain or provide another specific methodology for the timely removal of waste consistent with WAC 173-303-640(4)(c)(iv). This item is closed for the initial transfer operation, but requires further action prior to subsequent transfers. This item shall be added to the second transfer prestart punch list.

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

  All local and remote alarms have been incorporated on the P&IDs H-14-103656 and H-14-103657. This item is closed.

- **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). Applicable configuration control has been established in HNF-4972 (Set Point Calculations), and RPP-5051 (MEL) for design details, instrument set points, and accuracy requirements. The system design is acceptable, item closed.

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

  HNF-3885 has been revised to incorporate all appropriate operational limits for the systems and components. This item is closed.

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

  All applicable technical details and comments have been incorporated in the drawings. The item is closed.

- **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 baseline load analysis for the 252-S substation has been documented in HNF-4947, and the utilities have been upgraded by addition of separate transformer feeds for one of the two hot water heater banks. Specific load analysis for the SY-101 RAPID Mitigation System modifications to electrical loads has been performed and the additional loads are acceptable. This item is closed.

- **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. This has been shown to be acceptable to the AB by approval of the "super" USQ TF-99-0692.

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

  All corrections and as-built detail have been incorporated into the electrical and instrumentation drawings. This item is closed.

- **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."

A high point has been added in the transfer line outside the PPP, ensuring that the flow meter will operate full. The item is closed.

- **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."

  As stated for RCR 36 above, a high point is located in the transfer line outside the PPP, ensuring that the flow meter will operate full. This item is closed.

- **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, at the current 149 inches from the bottom of the tank. 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). This drawing has been deleted from the published drawing set. The system design is acceptable.

- **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. The basis for the flow value, is given in RPP-5517, Design Acceptance Summary for the New Generation Transfer Pump, Appendix A, page 5-57. It notes that 10 gpm flow in achieved with a supply pressure of 40 psig. This is within the envelope of the requirement of 10 gpm at 90 psig supply pressure given in WHC-S-0238, section 3.2.6. These values were found to be acceptable as verified by approval of RPP-5517.

- **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. An orifice was incorporated into the design to reduce flow, but not below 6 ft/sec, which is a specification in the Functions and Requirements document. The comment is closed

- **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."

  The flow totalizer function has been added. This item is closed.

3.3.5 Design Review Checklist

In addition to the remaining open items from the system design review, several open items were identified from the Design Review Checklist. Closure of these open items is summarized below:

- Calculation completion - There are several engineering calculations that need to be completed and documented.

  The critical analyses are complete for the initial transfer and back delute; however, because of the time constraints required to complete the first waste transfer,

construction proceeded at risk. This item is in the second category (see Section 1.4). The system design is acceptable. Further calculations may be required for subsequent transfers.

- 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 was verified in the HNF-4359 (Engineering Design Calc. ...) document.

- 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 conform to the design basis as part of design implementation. The documents that make up the contractor prudent controls have been completed, HNF-3737 and –1266. These controls allow the initial pumping and the first back dilute. In addition, the Process Control Plan HNF-4264 has been completed for the above first transfers. Prior to subsequent transfers, HNF-3737 and HNF-4264 must be reviewed and modified based on changed process conditions if necessary. Based on the review, Contractor Prudent Controls in HNF-IP-1266 may require modification.

- 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. The documents that make up the contractor prudent controls have been completed, HNF-3737 and HNF-IP–1266. These controls allow the initial pumping and the first back dilute. Prior to subsequent transfers, HNF-3737 and HNF-4264 must be reviewed and modified based on changed process conditions if necessary. Based on the review, Contractor Prudent Controls in HNF-IP-1266 may require modification.

- 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 have been specified and are documented in the Commercial Grade Item dedication, No. 00755, finalized October 19, 1999.

- A compliance matrix to identify requirements, the design attributes that satisfy the requirements, 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. Compliance with requirements is necessary as part of design implementation. The compliance matrix(s) are completed and documented in RPP-4992 and RPP–4993, Design Requirements Document Compliance Matrix and 6430.1a Compliance Matrix respectively.

- 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 load analysis has been completed. It is documented in HNF-4947, (Load Flow Analysis for 252-S Substation).

- 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 was completed as part of design implementation for the first transfer. See also system Design Review RCR 6 above and Appendix B.

- 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 are established as part of design implementation and are documented in the HNF-3737, HNF-1266, and HNF–4531 (SEL).

Appendix A

RAPID Mitigation Document List

SY-101 RAPID TRANSFER PROJECT

Date: November 15, 1999

Document Number	*REFERENCE LIST Title*
HNF-3645	HAZARDS EVALUATION FOR TANK 241-SY-101 WASTE SURFACE LEVEL GROWTH
HNF-3705	TANK 241-SY-101 SURFACE LEVEL RISE REMEDIATION OPTIONS & EVALUATION*
HNF-3737	TANK 241-SY-101 SAFETY BASIS FOR REMEDIATION ACTIVITIES & OPERATIONS BEFORE CLOSURE OF THE USQ ON WASTE SURFACE CHANGE*
HNF-3824	TANK 241-SY-101 SURFACE LEVEL RISE REMEDIATION PROJECT PLAN*
HNF-3825	SPEC FOR TANK FARM TRANSFER PUMPS WITH SUBMERSIBLE MOTORS*
HNF-3832	ALTERNATIVES GENERATION ANALYSIS FOR 241-SY-101 EXPEDITED WASTE TRANSFER TO 241-SY-102*
HNF-3885	FUNCTIONAL REQUIREMENTS & TECHNICAL CRITERIA FOR THE 241-SY-101 RAPID MITIGATION SYS
HNF-3914	SY-101 LEVEL GROWTH PROJECT VALUE ENGINEERING SECESSION REPORT
HNF-3966	HAZARD EVALUATION FOR TRANSFER OF WASTE FROM TANK 241-SY-101 TO TANK 241-SY-102*
HNF-4043	SPEC FOR SY-101 RAPID MITIGATION MOBILE WATER SUPPORT SKID
HNF-4044	ENGINEERING TASK PLAN FOR WASTE TRANSFER FROM TANK 241-SY-101 TO 241-SY-102*
HNF-4089	ENGINEERING TASK PLAN FOR NEAR TERM MECHANICAL MITIGATION OF TANK 241-SY-101 LEVEL GROWTH
HNF-4169	SPEC FOR 241-SY-101 RAPID MITIGATION PREFABRICATED PUMP PIT
HNF-4170	TECHNICAL SPEC FOR 241-SY-101 RAPID MITIGATION TRANSFER PUMP PIPING
HNF-4185	SPEC FOR VARIABLE FREQUENCY DRIVE*
HNF-4186	SPEC FOR NEW GENERATION TRANSFER PUMP TEST
HNF-4216	TECHNICAL SPEC FOR SY-101 RAPID MITIGATION SYS ANTISYPHONING SLURRY DISTR ASSEMBLY
HNF-4235	TECHNICAL SPEC FOR SY-101 RAPID MITIGATION TRANSFER PUMP I&C ENCLOSURES
HNF-4252	STRUCTURAL DESIGN CRITERIA FOR THE SY-01 RAPID MITIGATION SYS
HNF-4264	PROCESS CONTROL PLAN FOR TANK 241-SY-101 SURFACE LEVEL RISE REMEDIATION
HNF-4359	ENGINEERING DESIGN CALCULATIONS FOR THE SY-101 RAPID MITIGATION PROJECT
HNF-4360	241-SY-101 SYS TEST REPORTS
HNF-4403	ACCEPTANCE TEST PROCEDURE FOR THE TANK 241-SY-101 MECHANICAL MITIGATION ARM (MMA)
HNF-4407	SPEC FOR SY-101 RAPID MITIGATION SYS HOSE & HOSE ASSEMBLY
HNF-4416	PROJECT SPECIFIC 90 DAY STORAGE AREA DANGEROUS WASTE TRAINING PLAN*
HNF-4469	241-SY-101 RAPID MITIGATION AUTHORIZATION BASIS & ENVIRONMENTAL COMPLIANCE MATRIX

HNF-4512	TEST REPORT FOR THE 241-SY-101 TRANSFER PUMP
HNF-4519	DESIGN REVIEW REPORT FOR THE SY-101 RAPID MITIGATION SYS
HNF-4531	SAFETY EQUIPMENT LIST FOR THE 241-SY-101 RAPID MITIGATION PROJECT
HNF-4559	SYS DESIGN DESCRIPTION FOR THE 241-SY-101 RAPID MITIGATION TRANSFER SYS*
HNF-4858	RESPOND & PUMP IN DAYS (RAPID) PROJECT SPARE PARTS LIST
HNF-4891	HAZARD EVALUATION FOR BACK DILUTION OF TANK 241-SY-101 WASTE*
HNF-4947	LOAD FLOW ANALYSIS FOR 252S SUBSTATION
HNF-4971	MASTER INSTRUMENT LIST FOR RAPID PROJECT*
HNF-4972	SET POINT CALCULATIONS FOR RAPID PROJECT
HNF-5278	ENG. EVAL. FOR ACCEPTABLE OP. OF YOKOGAWA FLOW METER AND CALIBRATOR
RPP-4892	ACCEPTANCE TEST REPORT FOR THE SY-101 HOSE & HOSE ASSEMBLY (HAHA)
RPP-4992	DESIGN REQUIREMENTS DOCUMENT COMPLIANCE MATRIX FOR 241-SY-101 SURFACE LEVEL RISE REMEDIATION PROJECT
RPP-4993	6430.1A COMPLIANCE MATRIX FOR 241-SY-101 SURFACE LEVEL RISE REMEDIATION PROJECT
RPP-5051	MASTER EQUIPMENT LIST FOR RAPID PROJECT*
RPP-5117	DESIGN ACCEPTANCE SUMMARY REPORT FOR THE NEW GENERATION TRANSFER PUMP (NGTP)*
RPP-5249	241-SY-101 RAPID MITIGATION SYS ACCEPTANCE FOR BENEFICIAL USE
RPP-5261	OPERATIONAL TEST REPORT
RPP-5344	MAXIMUM FIRST TRANSFER AND DILUTION VOLUMES FOR 241-SY-101*
RPP-5354	DESIGN REVIEW CLOSURE REPORT FOR THE SY-101 RAPID TRANSFER SYSTEM
TWR-4176	RAPID SY-101 SURFACE LEVEL RISE MITIGATION PROJECT RADIOLOGICAL DESIGN ENGINEERING
TWR-4177	RAPID SY-101 SURFACE LEVEL RISE MITIGATION PROJECT DOSE RATE CALCULATIONS
WHC-S-0238	SPECIFICATION FOR PROTOTYPE TANK FARM TRANSFER PUMPS WITH SUBMERSIBLE MOTOR*

note:
*Not a Design Baseline Document,
Index of Baseline Documents does not include Blueprints and ECNs, see H-14-103558 (Index)

Appendix B

Important Communications Concerning the Project

Important Communications Concerning the Project

1. R. S. Popielarczyk to R. E. Raymond, "241-SY-101 RAPID Mitigation System Design for Wind Missile," dated October 11, 1999.

2. CC-mail from D. L. Dyekman to W. J. Powell, "SY-101 Transfer Line Leak Detection," dated September 27, 1999.

3. R. S. Popielarczyk to R. E. Raymond, "Slope of Hose in Hose Transfer Line for the SY-101 to SY-102 Waste Transfer," dated July 2, 1999

4. R. S. Popielarczyk to R. E. Raymond, "Design Review Prior to Irreversible Installation," dated August 27, 1999.

RPP-5354
Revision 0

INTEROFFICE MEMO

LOCKHEED MARTIN

From: Technical Operations & Engineering
Phone: 373-5751 R2-58
Date: July 2, 1999
Subject: SLOPE OF HOSE IN HOSE TRANSFER LINE FOR THE SY-101 to SY-102 WASTE TRANSFER

To:	R. E. Raymond	G1-54
cc:	D. I. Allen	R2-50
	H. R. Hopkins	R2-58
	R. E. Larson	T4-07
	M. A. Payne	R2-58
	R. W. Powell	R3-75
	R. W. Reed	T4-07
	W. E. Ross	R2-50
	R. L. Schlosser	R1-56
	RSP File	

Attached are concerns, brought to my attention by the design authority, regarding the current design for the 101-SY to 102-SY transfer line. During the development of the design for the 101-SY transfer line the design evolved from a hose in pipe configuration sloped towards 102-SY to a hose in hose configuration which is not self-draining. Two concerns with the current design are discussed in the attachment: The hold-up of waste, which would occur in the dead leg should a leak develop and the plugging potential if solids were to settle out during the transfer.

The design authority and I discussed these concerns and agreed that given the urgent need to make the initial transfers of waste that the risks identified with the current design are manageable.

It is likely that one larger transfer will be made, or several smaller transfers in a short period. I ask that you have the design evaluated after the first set of transfers for the concerns raised, utilizing the information gained during the transfers on waste hold up, flushing performance, radiation levels, system performance operating parameters and anticipated future transfers to be made with the system.

R. S. Popielarczyk
Chief Engineer

ncw

Position Paper: SY-101 RAPID Transfer Line Slope Date: 6/17/99

Position: Transferring part of the contents of SY-101 to SY-102 through a hose in hose laying on the ground, with a large low point, is acceptable in an emergency. If it is not an emergency, then the hose in hose should be designed with sloped drainage to a low point.

Scope: There is no disagreement with making a emergency transfer using the hose on the ground. The rest of the discussion will be limited to designing, installing and operating the hose in hose to drain to a low point, if there is not a declared emergency.

Background: A part of Tank SY-101 contents need to be transferred to Tank SY-102 to provide space for the crust to expand without rising over the secondary confinement. Without level remediation the crust was expected to reach the secondary confinement boundary (458 inches, single tank wall) about September of 1999.

The first transfer is expected to be about 100,000 gallons of liquid. It is then expected (projected) that diluting with water after the first transfer, and later two more small transfers, with their associated water dilutions, will be required to reduce the crust growth concern to a manageable one. It is not know when the other transfers might occur or what line they will use to do the transfer. The hose in hose line is designed to have a one year life. The 4 inch encasement hose can not be easily pressure tested after installation. The 2 inch primary hose can tested by flow, but not by pressure test. In addition, there are no design provisions for flushing the 4 inch encasement hose should a primary hose leak occur. This is the first instance of hose in hose waste transfers being performed at Hanford.

Discussion: In general, all transfer lines at the Hanford site are designed to drain to a low point with a leak detector. The leak detector is required to detect leaks as they occur, and operator or automatic response is required within 30 minutes of the alarm.

The hose on the ground is not self-draining. The 137 ft. low point allows about 22 gallons of waste to settle in the primary 2 inch hose.

Leaks: If a leak occurs, the encasement fills up with liquid and overflows to the SY-102 riser extension, which has a leak detector. If the encasement also has a hole in it then the leak goes into the ground or forms a pool. If undetected, either pool or ground soak could cause unacceptable onsite or offsite consequences.

If a leak occurs in the primary pipe and the encasement does not leak - then clean up of a 4 inch hose encasement filled with about 54 gallons of waste is required. If the encasement was sloped and 1/4 inch of waste was assumed to remain in the entire line - then 3.5 gallons of waste would be left in the line.

If 54 gallons of SY-101 waste were to leak out of the line, it is less than that required for unacceptable onsite or offsite consequences. The concern would be ALARA. Dose rates from the waste could be an order of magnitude more if the encasement were full. To clean up a leak into the encasement the plan is to unbolt the 147 ft. encasement from SY-101 and raise it in the air with a crane to allow it to drain to SY-102.

ALARA concerns are the major result of the leak into the encasement, when the encasement does not leak. Operator detection (visual) is relied on to detect the encasement breach and unacceptable pool leak. It would be very difficult for the operator to detect a small leak coming from a hose sitting on the ground covered with lead blankets. The leak detectors would not alarm because the leak from the primary and encasement are equal. The HAZOP may wish to revisit this accident.

Since there are no design provisions for flushing the encasement hose should a primary leak occur, the 54 gallons of waste contained in the undrained portion of the line would require emergency recovery action. Operators would be required to drain waste from the encasement by disconnecting and lifting the hose. If flushing provisions were incorporated, the source term would be reduced, however, personnel exposure during flushing and some increased exposure during line drainage could be anticipated. Without sloping the line for drainage, these conditions are unavoidable.

Plugging Concern: If an unanticipated shutdown were to occur, then the 2 inch primary line would tend to plug from undiluted 25% solid slurry. This could occur should the water skid break a hose. This would result in pure slurry being pumped for a limited time. This slurry would settle in the bends of the primary hose and tend to plug at the bends. At a 25% solids concentration it takes more than 4 times the vertical height of the pipeline diameter to plug the pipeline. The 1 and 2 ft. elevation drops from SY-102 and SY-101 respectively could plug the 2 inch hose, if given time to settle.

An interlock is in place to prevent pumping undiluted waste should dilution water be lost. The bends in the hose are gradual (10 inch radius) so this will help keep lines clear. The slurry is susceptible to dissolution of solids by dilution, so it is probable that if enough time and effort were taken the hose could eventually be freed of solids. This would require working in a high radiation area. The lines would have to be removed and replaced if repeated pressure and dilution attempts were not successful in clearing them. Although flushing provisions are in place for primary line flushing after a loss of power, flush provisions for both normal and loss of power conditions require an intact water supply hose.

Passive Design: A sloped line would drain whenever pumping stopped. This passive design feature would reduce the dose rate from radioactive material in the line. It would remove contaminated material from potential personnel areas and the environment without further action. Passive design features are preferred over active design features (flushing) or administrative controls (High Radiation Areas).

Time and Cost: It is estimated that somewhere between 1 and 5 days of critical path time would be lost if the hose lines were sloped. It is further estimated that it would cost between 60,000 and 140,000 $ to implement the change.

Summary: Accident scenarios indicate that the probability of a pool leak accident occurring is increased with hose in hose design, and it is make worse by putting the line on the ground, in that a leak is harder to detect. ALARA considerations indicate that in the accident conditions outlined it would be significantly better to have a sloped line to avoid the major accident than have to react to either plugging or unacceptable leak accidents. The passive design features of a sloped line are preferred over active design features or administrative controls.

Good engineering practice dictates that a sloped line design is better than a design with a large dead leg. The large inherit risk incurred on this project leads us to remove risk whenever possible. The sloping of the line will reduce risk to the project and the site.

References:

Aude, T. C., Cowper, N. T., Thompson, T. L., and Wasp, E. J., "Slurry Piping Systems: Trends, Design Methods, Guidelines", Chem. Eng. 74, June 28, 1971.

Powell, W. J., "Design of Slurry Pipeline Systems", unpublished, Jan. 1976.

INTEROFFICE MEMO

LOCKHEED MARTIN

From:	Technical Operations and Engrg		79000-99-060
Phone:	373-5751	R2-58	
Date:	October 11, 1999		
Subject:	241-SY-101 RAPID MITIGATION SYSTEM DESIGN FOR WIND MISSILE		

To:	R. E. Raymond	S7-70
cc:	R. L. Schlosser	R1-56
	J. M. Grigsby	R1-44
	C. E. Hanson	S7-70
	W. J. Powell	S7-70
	R. W. Reed	T4-07
	S. H. Rifaey	R1-56
	A. R. Tedeschi	R1-56

Reference: Letter, A. R. Tedeschi, LMHC, to M. C. Skriba, FDH, "Contract Number DE-AC06-99RL14047; DOE Order 6430.1A Design Criteria Application For Safety Class Structures, Systems, and Components," LMHC-9852008, dated March 18, 1999.

BACKGROUND

The 241-SY-101 RAPID Mitigation System has been designed to mitigate waste level growth by providing a transfer route to pump waste to Tank 241-SY-102. Safety Class components supporting execution of the transfer has been located in temporary outdoor instrument panels. These instrument panels are designed to withstand the high wind condition; however, the panels have not been designed to withstand a wind missile impact.

The DOE Orders require design of Safety Class structures, systems, and components (SSCs) to appropriate natural phenomena criteria including high winds and wind missiles. For the Hanford site, the criteria require consideration of 80 mile per hour wind with a wood 2x4 weighing 15 pounds and traveling at 50 miles per hour for Safety Class SSCs. This design requirement is procedurally implemented in LMH-PRO-097, *Engineering Design and Evaluation,* reflecting guidance provided in various DOE documents.

ASSESSMENT

If high wind conditions were sufficient to preclude manned operation of the panel, the operability requirement for the safety functions provided by the panel would not be satisfied. Under this condition, the transfer would be terminated based on current control requirements (Standing Order TWO-99-19 requires cessation of normal transfer operations if sustained winds are greater than 50 mph). Before restart of the transfer, physical inspection for missile damage and possibly a circuit test would provide assurance of operability. Appropriate procedurally defined restart criteria would be required to show design consideration of the wind missile.

Powell, William J (Bill)

From: Dyekman, Dale L
Sent: Monday, September 27, 1999 12:51 PM
To: Buchanan, Joseph R
Cc: Hanson, Carl E; Powell, William J (Bill); Miller, Phillip C (Phil)
Subject: FW: SY-101 Transfer Line Leak Detection

Joe,

The attached e-mail is the only hard record I could find (as of this morning) documenting the meeting between LMHC/DOE and the Washington State Department of Ecology discussing the conceptual design of the SY-101 overground transfer line. Following is a brief synopsis:

DATE of MEETING: 4/28/99

LOCATION: Washington State Dept. Ecology Kennewick Office;

Attendees: Richard Heggen, Robert Wilson, WA. DEPT. ECOLOGY;
Mark Ramsay, DOE/RL;
Steve Shaw, SY-101 Engineering Team;
Dale Dyekman, Phil Miller, LMHC/Environmental

PURPOSE: To discuss the SY-101 overground transfer line Hose and Hose Assembly design, and WAC 173-303-640 requirements for leak detection within 24 hours.

If you have any questions just give me a call.

- Dale

P.S. - Ecology did not respond to my request for an e-mail receipt confirmation.

-----Original Message-----
From: Dyekman, Dale L
Sent: Thursday, April 29, 1999 1:26 PM
To: Heggen, Richard V; Wilson, Robert W (Bob)
Cc: Miller, Phillip C (Phil); Ramsay, Mark L; Szendre, Stephen A; Wilk, Jerome L (Jerry); Shaw, Steven W (Steve); Dyekman, Dale L
Subject: SY-101 Transfer Line Leak Detection

Dick,

You previously asked a question regarding the leak detector readouts from the current design of the proposed SY-101 above ground transfer line.

The transfer system as designed, has two leak detectors: one placed in the above ground pre-fabricated pump pit installed on the 101-SY riser; one placed inside the 102-SY riser extension. Both leak detectors have local alarms (local strobe lights); both leak detectors alarm at a local instrument panel which is planned to be located in the tank farm (generally near the 101-SY pre-fabricated pump pit); and both leak detectors will also alarm inside the SY Tank Farm DACS trailer. An operator will be stationed inside the DACS trailer during SY waste transfers.

Please confirm your receipt of this message with a reply message, to ensure compatibility between e-mail programs.

Thank you very much.

- Dale Dyekman
Environmental Engineer
Lockheed Martin Hanford Co.
372-2234

INTEROFFICE MEMO

LOCKHEED MARTIN

From: RS Popielarczyk R2-58
Phone: 373-5751
Date: August 27,1999
Subject: DESIGN REVIEW PRIOR TO IRREVERSIBLE INSTALLATION

To: RE Raymond

cc:	HR Hopkins	R2-58
	PF Kison	T4-07
	RE Larson	T4-07
	WJ Powell	S7-70
	RW Reed	T4-07
	Project Files	S7-70

HNF-PRO-1819, Rev. 3, "PMHC Engineering Requirements," Sections 2.9.1.1 and 2.9.1.2, require that "...design verification be completed prior to irreversible installation..." of equipment.

I have reviewed the design and installation of the SY-101 Surface Level Rise Remediation RAPID Transfer system. I have concluded that the LMHC interpretation of the HNF-PRO requirement for design verification has been completed sufficient to approve installation (but not operation of the transfer), since all installations are reversible.

This memo provides direction to cognizant engineers and design authorities for LMHC to approve installation pending further completion of design verification.

RS Popielarczyk
Chief Engineer

RER/rmn

2.8.5 Engineering Change

2.8.5.1 With the exception of vendor information and classified drawings, all design baseline documents retained by Hanford Site document control shall be revised with an ECN. See HNF-PRO-440, "Engineering Document Change Control Requirements," for further requirements and the applicable form(s).

2.8.5.2 An ECN shall not be field worked until the ECN has been approved by the affected Design Authority(ies) and meets the other approval requirements listed in this procedure for a design baseline document.

2.8.5.3 Essential drawings shall have ECNs incorporated within 30 calendar days from the date the ECN is signed as work-completed.

2.8.5.4 Other design baseline drawings depicting safety class or safety significant structures, systems, or components shall have all work-completed ECNs incorporated within 90 calendar days from the date the sixth work-completed ECN is signed as work completed, or when clarification of the drawing is required before the accumulation of six ECNs. If a design baseline drawing does not depict safety class or safety significant structure, system, or component, then it shall be revised when clarification of the depicted information is required by the Design Authority. For a structure, system, or component in deactivation, the 30- or 90-day incorporation period can be extended on a case-by-case basis. The chief engineer shall approve and document the new incorporation period.

2.8.5.5 For procured engineering services, the process for changing architect-engineer (A-E) documents/drawings (including documentation) shall be in accordance with the performer's quality assurance program. This requirement applies to documents generated by and under the control of the A-E. As-built A-E drawings are entered in the Hanford retrieval system. (See Section 2.10, "Turnover of Design Documentation").

2.9 Verification of Solution

2.9.1 General

2.9.1.1 When technically feasible, verifications for the adequacy of a design shall be completed and documented before relying on the structure, system, or component to perform its function and before installation becomes irreversible. (10 CFR 830.120 Implementation Guide, Section 4.6.5, paragraph 3)

2.9.1.2 When it is not technically feasible to verify a design (or part of a design), then the unverified portion of the design shall be identified, documented, and controlled as an open design issue until the verification is complete. If a part cannot be verified, then the Design Authority shall use engineering judgement to determine if the part can still be used, and shall document that justification. (10 CFR 830.120 Implementation Guide, Section 4.6.5, paragraph 3)

2.9.1.3 Design verification shall be required for a new application of a design and when any of the design criteria or features to the original design have been changed for the same application.

2.9.1.4 Design adequacy shall be verified by qualified persons other than those who designed the structure, system, or component. (Section 6, 3.3.3, HNF-MP-599, *Project Hanford Quality Assurance Program Description*, and DOE Order 6430.1A, Division 1, Section 0140 (07 and 08))

2.9.1.5 Verifications of design outputs shall be performed by one or more of the following methods: reviews, alternate calculations, and/or qualification testing. A review occurs when a qualified individual or group of individuals evaluates the documentation to verify that it meets the design criteria. Alternate calculations involve the use of one or more different methods of analysis to ensure the correctness and applicability of pertinent design calculations, using both hand and computer calculations. Qualification testing is a physical evaluation during which a piece of equipment is operated. In all cases, the Design Authority shall determine what verification documents shall be part of the design basis.

2.9.1.6 After verification has been completed, designs and their associated design baseline shall be reviewed and approved by the Design Authority to ensure adequacy of the design (both final design and subsequent changes/revisions) for the intended applications.

2.9.1.7 Changes to final designs, field changes, modifications to operating facilities, and nonconforming items dispositioned use-as-is or repair shall be justified and subject to design control measures commensurate with those applied to the original design. These measures shall include assurance that the design analyses for the structure, system, or component are still valid. For a structure, system, or component in deactivation, design control measures shall be consistent with either the original design or the deactivation plan.

2.9.2 Testing and Inspections

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	DSTE	Date 11-29-99
Project Title/Work Order		EDT No. 628302
RPP-5354, Rev. 0, Design Review Closure Report for the SY-101 RAPID Transfer System		ECN No. NA

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
D. G. Baide	R1-56	X			
P. L. Bartley	T4-07	X			
M. H. Brown	T4-07	X			
W. E. Bryan	S5-05	X			
J. R. Buchanan	S7-70	X			
D. L. Dyekman	R1-51	X			
M. F. Erhart	R1-56	X			
J. M. Grigsby	R1-44	X			
C. E. Hanson	S7-70	X			
C. D. Jackson	S7-34	X			
N. W. Kirch	R2-11	X			
L. J. Kripps	R1-44	X			
R. E. Larson	T4-07	X			
T. C. Oten	R1-56	X			
W. J. Powell	S7-70	X			
R. E. Raymond	S7-70	X			
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R. L. Schlosser	R1-56	X			
LMSI Central Files	B1-07	X			
Office of River Protection - DOE Reading Rm	H2-53	X			
Project Files	S7-70	X			
Working Files (3)	S7-70	X			