



U.S. Department of Energy
Office of River Protection

P.O. Box 450, MSIN H6-60
Richland, Washington 99352

08-TOD-036

APR 17 2008

0800886

Mr. John C. Fulton, President
and Chief Executive Officer
CH2M HILL Hanford Group, Inc.
2440 Stevens Center Place
Richland, Washington 99354

Dear Mr. Fulton:

CONTRACT NO. DE-AC27-99RL14047 – U.S. DEPARTMENT OF ENERGY (DOE), OFFICE OF RIVER PROTECTION (ORP) TANK FARM PROJECT ASSESSMENT OF CH2M HILL HANFORD GROUP, INC. (CH2M HILL) S-102 SPILL EVENT RECOVERY ACTIVITIES, A-08-AMTF-TANKFARM-011

The ORP Tank Farm Project Facility Representatives (FR) and Technical Staff conducted an assessment of the recovery actions in response to the spill from S-102 on July 27, 2007. This assessment encompasses those activities from October 4, 2007 to January 15, 2008, and includes those areas specified in the *U.S. DOE Office of River Protection, S-102 Recovery Oversight Plan* dated August 10, 2007, namely, Field Recovery Oversight, Engineering/Safety Basis Oversight, and Investigation Oversight. This assessment resulted in the identification of 2 Findings, 2 Non-Cited Findings and 4 Observations. Additional assessments will be performed; these will be reported as the S-102 recovery progresses. Despite the findings, the assessment team concluded that CH2M HILL's recovery has been adequate.

Within 30 days of receipt of this letter, CH2M HILL should respond to the assessment findings and non-cited findings. The response should include:

- The causes of the findings or non-cited findings;
- The corrective actions that have been taken to control or remove any adverse impact from noncompliant conditions (remedial actions) and the results achieved;
- The corrective actions that will be taken to identify the extent of condition, correct the cause, and prevent further findings or non-cited findings; and
- The date when all corrective actions will be completed, verified, and compliance to applicable requirements will be achieved.

Findings, non-cited findings, and supporting issues of findings that are designated as "CLOSED" are exempt from the aforementioned response criteria.

Mr. John C. Fulton
08-TOD-036

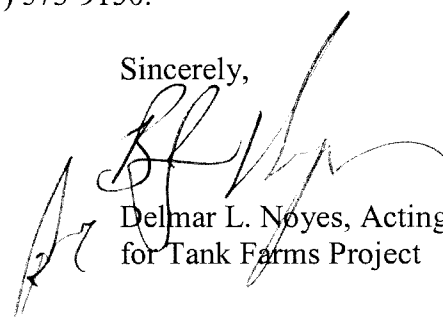
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The Assessment Observations do not identify deficiencies, but represent experience-based observations of the team members that CH2M HILL should consider as a source of information for improving its program. A formal response to the Observations is not required.

This letter is not considered to constitute a change to the contract. In the event the Contractor disagrees with this interpretation, it must immediately notify the Contracting Officer verbally, and otherwise comply with the requirements of the Contract clause entitled 52.243-7, Notification of Changes.

If you have any questions, please contact me, or you may contact Mark C. Brown, Director, Tank Farm Operations Division, (509) 373-9150.

Sincerely,



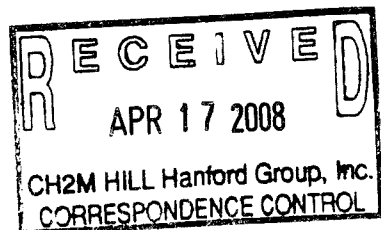
Delmar L. Noyes, Acting Assistant Manager
for Tank Farms Project

TOD: MCB

Attachment

cc w/attach:

- E. J. Adams, CH2M HILL
- C. E. Anderson, CH2M HILL
- T. E. Bratvold, CH2M HILL
- R. A. Dodd, CH2M HILL
- G. N. Hanson, CH2M HILL
- M. D. Hasty, CH2M HILL
- T. L. Hissong, CH2M HILL
- J. W. Long, CH2M HILL
- J. A. McDonald, Jr., CH2M HILL
- W. E. Ross, CH2M HILL
- R. G. Quirk, DNFSB
- C. E. Hampton, PAC
- W. L. Smoot, PAC
- R. C. Jansons, PAC
- CH2M Correspondence Control



**U.S. Department of Energy
Office of River Protection**

**Tank Farm Contractor
CH2M HILL Hanford Group, Inc. S-102 Spill Event Recovery
Activities Assessment**

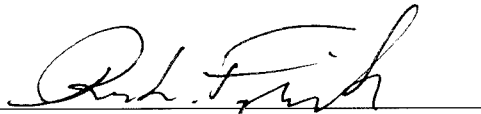
A-08-AMTF-TANKFARM-011

March 2008


Report Approval

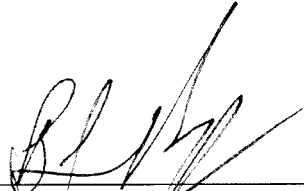


Mark Brown, Team Leader
Office of River Protection



Ronald Frink, Team Member
Office of River Protection

Approved: 


Delmar L. Noyes, Acting Assistant Manager
Tank Farms Project
Office of River Protection

Date: 4-17-08

ACRONYMS

ALARA	As Low As Reasonably Achievable
AMW	ALARA Management Worksheet
CA	Contamination Area
CH2M HILL	CH2M HILL Hanford Group, Inc.
CHAMPS	Computerized History and Maintenance Planning Software
DAC	Derived Air Contamination
DBVS	Demonstration Bulk Vitrification System
DOE	Department of Energy
DSA	Documented Safety Analysis
DST	Double-Shell Tank
FR	Facility Representative
FWS	Field Work Supervisor
HAZOP	Hazard and Operability
HCA	High Contamination Area
HIHTL	Hose in Hose Transfer Line
HRA	High Radiation Area
HVAC	Heating Ventilation and Conditioning
JON	Judgment of Need
JRG	Joint Review Group
MRT	Mobile Retrieval Tool
ORP	Office of River Protection
PISA	Potential Inadequacy in the Safety Analysis
PPE	Personnel Protective Equipment
RWDD	Raw Water Distribution Device
RWP	Radiological Work Permit
SAC	Specific Administrative Control
SB	Safety Basis
SCA	Soil Contamination Area
SCBA	Self-Contained Breathing Apparatus
SMP	Safety Management Program
SS	Safety Significant
SSW	Senior Supervisory Watches
SSW	Senior Supervisory Watches
TFC	Tank Farm Contractor
TFRM	Tank Farm Radiological Control Manual
TPM	Team Planning Meetings
TSR	Technical Safety Requirements
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
WTCRB	Waste Transfer Confinement Review Board JRG - Joint Review Group

EXECUTIVE SUMMARY

The purpose of this assessment was to document the U.S. Department of Energy (DOE) Office of River Protection (ORP) Facility Representative (FR) and Technical Staff oversight of CH2M HILL recovery actions in response to the spill from S-102 on July 27, 2007. This assessment encompasses those activities from October 4, 2007 to January 15, 2008. January 15, 2008 was selected as the cut-off date for this assessment to roughly coincide with the work completed prior to the removal of the contaminated soil. This assessment evaluates those areas specified in the DOE ORP, S-102 Recovery Oversight Plan dated August 10, 2007, namely, Field Recovery Oversight, Engineering/Safety Basis (SB) Oversight, and Investigation Oversight. This is the second oversight report on this subject area. The first report covered the time period of July 27, 2007 to October 3, 2007. Significant improvement in Radiological Control practices has been observed since oversight focus has been applied to the S-102 spill recovery. Several areas were noted to be deficient with respect to Conduct of Operations and Work Control. 2 Findings, 2 Non-Cited Findings and 4 Observations have been identified. These are described in detail in the "Assessments Results" section of this report.

Conclusion

Through the review of documents, field observations, meeting attendance, and discussions with CH2M HILL staff, the assessment team concluded that CH2M HILL's conduct of operations and radiological control practices have shown areas in which improvement has been achieved. There are, however, areas in which improvement is still warranted. Additionally, improvements are warranted with respect to incorporation of existing requirements into supporting work documents. CH2M HILL has been informed of the identified weaknesses, has completed corrective actions, or is evaluating the appropriate action to take.

The efforts taken by the Senior Supervisory Watches, Field Work Supervisors, Field Crew, and the Work Planner have been evaluated throughout the recovery process. These efforts have consistently been evaluated as excellent.

Findings

A-08-AMTF-TANKFARM-011-F01: Work orders and supporting documentation were found to be deficient. Several of the supporting issues have been resolved, but they demonstrate a need for overall improvement in work planning and hazard mitigation. (Cliff Hampton, Rick Jansons, January 15, 2008)

A-08-AMTF-TANKFARM-011-F02: USQ Evaluation failed to consider all applicable previously analyzed accident scenarios during preparation of USQ determinations. (Jian-Shun Shuen, January 15, 2008)

Non-Cited Findings

A-08-AMTF-TANKFARM-011-N03: Work steps performed out of sequence during an S-102 equipment removal evolution. (Derek Wright, October 22, 2007)

A-07-AMTF-TANKFARM-011-N04: Attending to restroom breaks and cell phone calls requires employees to be absent from a pre-job briefing and, therefore, prevents them from fulfilling their responsibilities as defined in TFC-OPS-MAINT-C-02. (Ron Frink, October 23, 2007)

Observations

A-07-AMTF-TANKFARM-011-O05: Poor contamination control was observed when an operator tossed a bag of material over the HCA/HRA boundary. (Cliff Hampton, November 20, 2007)

A-07-AMTF-TANKFARM-011-O06: During the process of removing the outer layer of anti-contamination clothing from an individual, the personnel undressing the individual became confused about the sequence of undressing. (Cliff Hampton, November 1, 2007)

A-07-AMTF-TANKFARM-011-O07: Contractor oversight, during the removal of contaminated equipment, was not commensurate with the significance of the work. (Cliff Hampton, November 20, 2007)

A-07-TOD-TANKFARM-011-O08: Personnel working to support S-102 contaminated equipment removal were observed to have their hair hanging outside of their anti-contamination clothing. (Cliff Hampton, November 20, 2007)

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1.0 INTRODUCTION	1
2.0 PURPOSE AND SCOPE.....	1
3.0 APPROACH	1
3.1 Field Oversight Activities.....	1
3.2 Results Overview by Area	2
3.3 Engineering/SB Oversight	4
3.4 Investigation Oversight.....	6
4.0 ASSESSMENT RESULTS.....	7
5.0 CONCLUSIONS.....	18
APPENDIX A - List of Interviewed Personnel and Reviewed Documentation.....	A-1
APPENDIX B - Team Member Biographies.....	B-1

1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Office of River Protection (ORP), performed an assessment of the Tank Farm Contractor (TFC) implementation of the CH2M HILL Hanford Group, Inc. (CH2M HILL) S-102 Spill Event Recovery Activities from October 4, 2007 through January 15, 2008. On July 27, 2007, during reverse rotation of the positive displacement (progressive cavity) pump installed in Tank 241-S-102 (S-102), a release of waste occurred outside of the designed transfer system confinement boundary. Visual observation of the leak site, elevated dose rates near the dilution hose and confirmation that the dilution hose contained waste have demonstrated that the release was from the dilution hose. The dilution line ultimately leads from the pump suction to an above-ground structure and then to a rubber dilution hose. The failure mechanism has been determined to be plugging of the pump suction area while the pump was operated in the reverse direction (the pump's suction becomes the pump's discharge during reverse rotation operations) causing sufficient pressurization of the dilution hose to overcome the hydraulic resistance to the top of the tank resulting in a rupture of the dilution hose.

2.0 PURPOSE AND SCOPE

The purpose of this assessment was to document the ORP Facility Representative (FR) and Technical Staff oversight of CH2M HILL recovery actions in response to the spill from S-102 on July 27, 2007. This assessment encompasses those activities from October 4, 2007 to January 15, 2008. January 15, 2008, was selected as the cut-off date for this assessment to roughly coincide with the work completed prior to the removal of the contaminated soil. This is the second oversight report on this subject area. The first report covered the time period of July 27, 2007 to October 3, 2007.

3.0 APPROACH

The assessment team performed the review consistent with *DOE ORP, S-102 Recovery Oversight Plan* dated August 10, 2007, namely, Field Recovery Oversight, Engineering/Safety Basis (SB) Oversight, and Investigation Oversight. Appendix A provides a list of personnel interviewed and documentation reviewed.

3.1 Field Oversight Activities

Field Oversight activities that were completed from October 4, 2007 to January 15, 2008 included:

- C-109 Hazard and Operability Study (HAZOP) meeting for MRT Waste Retrieval System (Fold Track)
- HAZOP meeting for the C-104 Ventilation system
- Waste Transfer Confinement Review Board JRG – Joint Review Group (WTCRB) Initial Review C-109 Transfer & Channeling Technical Evaluations – (Draft) Technical

Evaluation for the C-109 and AN-106 transfer Pumps (TE-07-009)- (Draft) Technical Evaluation for C-109 and AN-106 Waste Channeling (TE-07-012)

- CH2M HILL employee briefings
- Contaminated soil excavation/removal methodologies using Toro Dingo and other options
- Control Decision Meeting for control options and application to waste transfer systems
- Fact-Findings
- Field activities associated with CLO-07-1545 - *S-102 Remove and Dispose of Equipment Outside of HRA*
- Field activities associated with CLO-WO-07-1340, *S-102 Remove Contaminated Equipment from Inside HRA*
- Field activities associated with CLO-WO-07-1614, *Operations Standing Minor Work Order*
- Field activities associated with CLO-WO-07-1627, *S-102 Ready Waste Drum for Shipment*
- In-field Mockups (removal of equipment inside the HCA/HRA, contaminated soil removal adjacent to the riser extension box at Riser 7)
- Joint Review Group (JRG) meetings
- Management readiness meetings
- Post-Job ALARA Reviews
- Pre-Job Briefings
- S-102 High Contamination Area (HCA) / High Radiation Area (HRA) radiological surveys
- S-102 radiological perimeter surveys
- S-102 Table Top Drill
- S-Farm radiological control methodologies (including S-102)
- Team Planning Meetings (TPM)
- Training

3.2 Results Overview by Area

Radiological Controls

Significant improvement in Radiological Control practices has been observed since oversight focus has been applied to the S-102 spill recovery. For example, significant improvement was noted on November 20, 2007, when the undressing crew practiced exceptionally good contamination control practices and communication practices. The undressing process was well thought-out and the undressers' actions were deliberate, consistent, and coordinated. The undressers clearly communicated utilizing good 3-way communications with the individuals they undressed and with each other. It is noteworthy that one of the dayshift undressers took the initiative to monitor the undressers during the swing shift and provide suggestions to ensure that good contamination control practices continued.

Other areas in which improvement has been noted are:

- Radiological zone awareness
- Facial contamination spread mitigation (i.e., not touching of face with fingers, not wiping the face with cloth to remove sweat, checking for contamination prior to attaching a respirator to a face mask and prior to donning the face mask)
- Periodic checking of pencil or electronic dosimetry
- Control of radiological zones in change trailers and within the vicinity of S-102 spill area

Conduct of Operations/Work Control

ORP staff performed reviews of Conduct of Operations and Work Control throughout the recovery process. These reviews involved field work (i.e., entries outside of the S-102 High Contamination Area (HCA)/High-Radiation Area (HRA), observation of entries into the S-102 HCA/HRA, and practice mock-ups). Numerous meetings were observed that included: The Technical Program Managers (TPMs), JRG meetings, Post-Job As Low As Reasonably Achievable (ALARA) Review meetings, Engineering/Safety Basis (SB) meetings, fact-finding meetings, pre-job briefings, and management readiness meetings.

Employee feedback continues to be a key factor in successfully establishing the work sequence for high radiological risk work; this has effectively been used and has resulted in a reduction in exposure to work place hazards.

Improved use of 3-way communication was noted during undressing of personnel upon exiting the S-102 HCA/HRA. This was previously discussed in the Radiological Controls section of this report.

The support provided by the C-Farm Operations Manager was especially noteworthy on November 22, 2007. This individual voluntarily provided management support of the S-102 cleanup. Because he was not the Senior Supervisory Watch (SSW), did not have any specific role in the activity, and the fact that it was well past normal working hours, ORP oversight questioned why he was in the farm. He explained that he wanted to be available to provide any assistance he could to support the S-102 cleanup efforts. He had not been tasked by management to be on-hand. His dedication is noteworthy; this is the type of management support that should be commended. This was discussed with the C-Farm Project Director.

Additionally, good ALARA work practices and preparation by the Field Work Supervisor (FWS) during the removal of contaminated equipment from S-102 were observed. Work package sequencing issues had to be resolved to accomplish the work in the manner that the FWS wanted. The FWS's plan minimized the time workers were in the HCA/HRA. The work package was changed to allow the sequencing planned by the FWS.

The FWS was also noted on several occasions reminding field personnel to minimize their exposure to radiation. He was also observed reading the dose from an electronic dosimeter of a

worker in the HCA/HRA. The FWS clearly demonstrated that he was acutely aware of the work status, location of employees and their proximity to, and time within, elevated dose rate areas.

During the same work evolution, a problem with the work instructions was noted in the field. The FWS identified the problem and was able to expeditiously obtain authorization, after numerous telephone conversations, to “pen and ink” the work instructions to add the missing step with minimal disruption of the work.

Several areas were noted to be deficient with respect to Conduct of Operations and Work Control. These are discussed in detail in the “Assessment Results” section of this report. These include:

- Failure of a Unreviewed Safety Question (USQ) evaluation to consider all applicable previously analyzed accident scenarios;
- Technical basis for air sampler locations and instructions not provided;
- Design and use of approved beta shielding was not specified;
- Procedural requirements for controlling radiological conditions were not implemented in work instructions;
- Radiological Work Permit (RWP) CO-439 did not specify radiation protection measures commensurate with the existing and potential hazards;
- Work Order CLO-WO-07-1341 allowed mechanical excavation within two feet of a transfer line contrary to TFC procedural requirements;
- Inadequate implementation of a respiratory staging area adjacent to the S-102 spill area;
- Specified actions for cut/damaged wires not consistent with TFC procedural requirements;
- Work steps performed out of sequence during an equipment removal evolution; and
- Inadequate participation in a pre-job briefing.

Deficiencies that have been noted during field work and during meetings have been communicated to CH2M HILL management in a timely manner to provide the contractor with real-time feedback. The responsiveness of CH2M HILL in responding to the deficiencies has played a large role in the improvements that have been noted.

3.3 Engineering/SB Oversight

ORP Tank Farm SB staff completed the following reports or completed the following actions:

- Attended a control decision meeting in response to Type A investigation JON ENG-4, *The safety basis needs to be changed by CH2M HILL/ORP to require that new primary pressure boundaries for S-102 be classified as Safety Significant (SS)*. The control options for designation of the waste transfer system primary confinement boundary as SS and applications to waste transfer systems were discussed. A path forward for a SB amendment was agreed to by ORP and CH2M HILL.

- Attended control decision meeting to select options to address potential waste leak paths not covered by TSR controls (e.g., waste transfer instrumentation systems, pump connections, etc.). A path forward for a SB amendment was agreed to by ORP and CH2M HILL.
- SB oversight on implementation of Type A Investigation JON ENG-2, *CH2M HILL needs to revise its design review processes, procedures and implementation to ensure approved designs are technically correct and satisfy the requirements of the Documented Safety Analysis (DSA)*, CHG-ENG-2.2, *Implement Enhanced HAZOP* and EM-1, *CH2M HILL needs to analyze events of higher probability but lower consequence in the tank farms emergency planning hazards assessment*: SB Staff monitored the following enhanced HAZOPs: C-104 new portable ventilation for removal of old equipment, AN/AW Exhausters (W-314), 242-A Evaporator Heating Ventilation and Air Conditioning (HVAC) Upgrade, C-109 retrieval including fold track, and Demonstration Bulk Vitrification System (DBVS).
- Reviewed the adequacy of the initial Potential Inadequacy in the Safety Analysis (PISA) evaluation worksheet - *Uncontrolled Release of Waste Aerosol to the Atmosphere Due to Air Blowdown of a Waste Transfer Line*. This issue was identified through the C-109 enhanced HAZOP.
- Reviewed the following Unreviewed Safety Question Determinations (USQDs): TF-07-0685-D, *Airblow C-108 Hose-in-Hose Transfer Line (HIHTL) per Work Package CLO-WO-06-02171*; TF-06-0962, *Perform Airblow of C-103 Transfer Lines per Work Package CLO-WO-001249*; TF-07-1898-D Revision 0 and Revision 1, *Per Work Order CLO-WO-07-1341 (Draft) S-102 Remove Contaminated Soil*; TF-07-1957-D, *Evaluation of Waste Leak Paths for Transfer Related Activities Associated with Double-Shell Tanks (DSTs) 241-AP-101, 241-AP-105, and 241-AW-102*.
- Reviewed Technical Evaluation: TE-07-027, *Technical Evaluation of Waste Leak Paths and Waste Leaks Due To Waste Channeling for Transfer Related Activities Associated with Tanks 241-AP-101, 241-AP-105, and 241-AW-102*.
- Reviewed corrective actions for EM-RP-CHG-TANKFARM-2007-0011, *Postulated Waste Leak Accident Scenario Resulting from Pressurizing/Channeling is Not Considered in the Safety Basis*.
- Reviewed SB focus corrective actions for EM-RP-CHG-TANKFARM-2007-0010, *Tank 241-S-102 Dilution System Design Represents a Technical Safety Requirements (TSR) Violation*.
- Reviewed SB Amendment to exclude condensate generated in the inactive 241-SX ventilation system from the TSR definition of waste;
- Completed ORP Specific Administrative Control (SAC) assessment which included Type A investigation JON WC-2, *CH2M HILL management needs to clarify TSRs with regard to radiological measurements as indicators of waste transfer leaks*;

- Reviewed USQD TF-07-1898-D, Rev. 0 and Rev. 1, Work Order CLO-WO-070-1341 (Draft), *S-102 Remove Contaminated Soil*.
- Reviewed waiver 07-1341-R2, *Additional Controls for Using Machine Excavation for S-102 Soil Removal*.
- Reviewed USQ Process Bulletin #273.

ORP issued a letter to CH2M HILL (07-ESQ-234, dated December 20, 2007) that communicated a finding that was observed during a December 12, 2007, surveillance performed by ORP engineering staff. This finding is titled: *Unreviewed Safety Question Determination (USQD) TF-07-1898-D for Work Order CLO-WO-07-1341(Draft) "S-102 Remove Contaminated Soil" did not follow the USQD process because it did not evaluate the proposed change against all applicable accident scenarios, which have been evaluated in the previously approved safety analysis. Secondly, the USQD was performed on a draft document.*

This finding is being addressed in CH2M-PER-2007-2264 and is included in this document for reference only.

ORP subsequently performed a surveillance on the revised USQD (TF-07-1898-D Revision 1) and found that the evaluation again failed to address an applicable accident scenario (i.e., the load drop scenario). This resulted in another finding and is discussed in the "Assessment Results" section of this report as A-08-AMTF-TANKFARM-011-F02. CH2M HILL is addressing this finding through CH2M-PER-2008-0052.

3.4 Investigation Oversight

CH2M HILL has completed the investigation of three distinct areas of interest in the S-102 waste spill event. These areas involve the events leading up to and including the spill, emergency response to the spill, and health effects.

CH2M HILL has issued documents reflecting the completion of the three investigations. These are:

- RPP-RPT-34831, *Root Cause Analysis Report CH2M-PER-2007-1327, Radioactive Waste Spill at Tank 241-S-102 on July 27, 2007*, dated September 17, 2007.
- Interoffice Memorandum 7L000-TAE-07-001, *Team Charter for Event Response Review for the S-102 Equipment and Soil Contamination Event of July 27, 2007 (PER-CH2M-2007-1327 and 1329)*, dated August 27, 2007.
- RPP-RPT-34902, *Health Effects Report for 241-S-102 Spill Event*, dated October 2007.

Each report was reviewed and was found to be adequate. Investigation oversight will not be addressed in subsequent S-102 recovery assessment reports since this is now complete.

4.0 ASSESSMENT RESULTS

Findings:

A-08-AMTF-TANKFARM-011-F01: Work orders and supporting documentation were found to be deficient. Several of the supporting issues have been resolved, but they demonstrate a need for overall improvement in work planning and hazard mitigation. (Cliff Hampton, Rick Jansons, January 15, 2008)

Supporting Issue 1:

The technical basis for air sampler locations and instructions to locate air samplers on the job were not provided for 241-S-102 spill cleanup. (Rick Jansons, December 27, 2007)

Requirement:

Tank Farms Radiological Control Manual (TFRCM) Article 555.2:

- “2. Monitoring of airborne radioactivity shall [835.403(a)] be performed:
- a. Where an individual is likely to receive an exposure of 40 or more Derived Air Contamination (DAC)-hours in a year; or [RPP # 91]
 - b. As necessary to characterize the airborne radioactivity hazard where respiratory protective devices for protection against airborne radionuclide have been prescribed. [RPP # 92]”.

Discussion:

RPP-36058, *241-S-102 Spill Area Excavation Workplace Air Sampling Evaluation*, dated December 20, 2007, was reviewed. This document was written as a supplement to RPP-31894, *Closure Operations Work Place Air Sampling Analysis* to provide specific implementation of TFC-0504-FCDMP-0018 for the 241-S-102 spill site. The method for evaluating the need for workplace air sampling was also based, in part, on NUREG-1400 guidance.

The TFC appropriately concluded workplace air sampling was required. However, neither the technical basis for air sampler locations nor instructions to locate air samplers on-the-job were documented in the workplace air sampling evaluation or provided in the technical work documents.

This issue was identified by ORP during review of JRG-approved documents. This issue was communicated to the TFC and corrected. ORP has reviewed the actions and documentation to support resolution of this issue; this issue is considered closed.

Supporting Issue 2:

RWP CO-439, *Excavating and Removal of Contaminated Soil inside the HCA/HRA Spill Area*, did not specify radiation protection measures commensurate with the existing and potential hazards. (Rick Jansons, 12/27/2007)

Requirement:

TFRCM Article 321:

“321 Radiological Work Permits; written authorizations shall [835.501(d)] be required to control entry into and perform work within radiological areas. [RPP # 109] These authorizations shall [835.501(d)] specify radiation protection measures commensurate with the existing and potential hazards. [RPP # 110].”

Discussion:

- 1) Radiological Work Permit (RWP) direction was inadequate for Personal Protection Equipment (PPE) requirements for undressers. The RWP stated, “Personnel performing undress duties shall wear the appropriate PPE for their work area as per RadCon direction and as a minimum of only one level below the personnel they are undressing.” Neither the RWP nor the work instructions provided clear directions regarding PPE for the undressers. It was not clear whether workers should be dressed for Contamination Area (CA) conditions, or HCA conditions. It was not clear what type, if any, of respiratory protection is required.

This issue was identified by ORP during review of Joint Review Group (JRG)-approved documents (CLO-WO-07-1341) and communicated to CH2M HILL. Another RWP was issued which stated, “Undressers in the HCA shall wear two pair of PPE and no respirator.” The RWP contained no HCA Action Levels. The HCA Safe Condition Levels were ≥ 320 mrad/hr/100 cm² beta-gamma or $\geq 20,000$ dpm/100 cm² alpha. Respiratory protection for undressers would be required at those contamination levels.

This issue was also identified by ORP during review of JRG-approved documents. This issue was again communicated to the TFC and corrected prior to commencing work.

- 2) The Work Instruction CLO-WO-07-1341 step 2.2.5 stated, “If soil contamination exceeds 50 rad/hr (open window reading uncorrected): excavation activities will be stopped...etc.” The work instruction allowed work activities to continue after management approval was obtained. However, the RWP contained this requirement as a Safe Condition Level. The RWP directed the work be suspended until management approval was obtained to restart work. This was not consistent with the contractor procedural requirements that specify specific actions to be performed when a Safe Condition Level was reached. No pre-approved contingency plans to mitigate the hazard were provided. No new, higher Soil Contamination

Area (SCA) level, or void limit was provided. Additional work planning and a new RWP, at a minimum, would be required to allow work to continue above 50 rad/hr (open window reading uncorrected).

This issue was identified by ORP during review of JRG-approved documents and corrected prior to commencing work.

Supporting Issue 3:

Work order CLO-WO-07-1341, *S-102 Remove Contaminated Soil*, for removing contaminated soil allowed mechanical excavation within two feet of a transfer line contrary to the requirements of TFC-ESHQ-S_IS-C-03, *Excavating, Trenching, and Shoring*. (Cliff Hampton, December 27, 2007)

Requirement:

TFC-ESHQ-S_IS-C-03, *Excavating, Trenching, and Shoring*, states to “excavate by hand when within five feet of a known or suspected transfer line.”

Discussion:

TFC-ESHQ-S_IS-C-03, *Excavating, Trenching, and Shoring*, allows the facility vice president to waive the prohibition against using machine excavators in tank farms but does not provide for waiving the prohibition for using machine excavators within five feet of a transfer line. Waiver 07-1341-R1 titled “Additional Controls for Using Machine Excavation for S-102 Soil Removal,” signed by the Closure Operations Vice President, waived the prohibition on machine excavation as allowed and effectively waived the prohibition on using machine excavators within five feet of a transfer line by the following statement: “The Dingo is not to be used for excavation within approximately 2 feet of the HIHTL once the HIHTL shield plates have been removed.”

During a meeting with CH2M HILL management, the contractor agreed with this Supporting Issue #3 and explained that Waiver 07-1341-R1 was being revised to reflect that the Dingo hydraulic breaker (jackhammer) was disabled and the contractor no longer considered the use of the Dingo to be machine excavation but equivalent to hand excavation. There is no prohibition regarding hand excavation in the vicinity of a transfer line. After the meeting, waiver 07-1341-R2 “Additional Controls for Using Machine Excavation for S-102 Soil Removal,” was issued and work order CLO-WO-07-134, *S-102 Remove Contaminated Soil* was approved.

Supporting Issue 4:

The survey plan used by the contractor to control the area being used to stage respiratory equipment and specify contamination surveys of personnel donning equipment in a contamination area did not provide specific controls for personnel contamination surveys conducted before the respiratory equipment was donned. The procedure, described below, used

to provide guidance for developing survey plans states that personnel contamination surveys are outside the scope of the procedure. (Cliff Hampton, December 27, 2007)

Requirement:

TFC-ESHQ-RP_MON-C-23, *Release Surveys for Material and Equipment*, states:
“The following items are outside the scope of this procedure; personnel contamination surveys.”

Discussion:

CLO-WO-07-1341, *S-102 Remove Contaminated Soil*, work instruction step 2.6 discussed an area inside the CA/RA for PPE to be staged. 2007-CO-005, *Survey Plan for Use of a Lay-down Area Inside of a Contamination Area*, was provided by CH2M HILL to document the method by which the lay down area would be controlled.

The survey plan stated, “HPT to ensure that personnel who are donning respiratory equipment inside the CA, have received a survey of their hands and face, as well as performing a large area wipe of the equipment to be worn.” No criteria was provided to specify the contamination levels or actions to be taken if some level of contamination was found on the person being surveyed. It is possible that a person’s gloves could be contaminated to some level acceptable for working in the CA but unacceptable for using their hands to don a respirator.

This issue was identified by ORP during review of JRG-approved documents. This issue was communicated to CH2M HILL and corrected prior to commencing work. PER-CH2M-2007-1661 was generated for this issue. ORP has reviewed the actions and documentation to support resolution of this issue; this issue is considered closed.

Supporting Issue 5:

CLO-WO-07-1341, *S-102 Remove Contaminated Soil*, specifies actions for cut/damaged wires that are not consistent with the actions specified in TFC-ESHQ-S-IS-C-03 “Excavating, Trenching, and Shoring.” (Cliff Hampton, December 27, 2007)

Requirement:

TFC-ESHQ-S_IS-C-03, *Excavating, Trenching, and Shoring*, Section 4.1 states:
“At a minimum follow the electrical safety guidelines of Table 1.” Table 1 states that if a direct buried cable needs to be moved for any reason, have an electrician handle the cable. If the insulation is found to be compromised (worn or damaged) during this handling process, take corrective actions to protect the workers and notify the shift manager. To resume work the following actions are required. Actions will include verifying extent of damage, verifying safe condition using qualified electricians, and establishing a corrective action plan.

Discussion:

CLO-WO-07-1341, *S-102 Remove Contaminated Soil*, specifies the following actions:

- “If wire has been cut/damaged, or is interfering with excavation - ensure wire is de-energized, remove wire and safe-off, *OR* Safe-off wire in place.”

TFC-ESHQ-S-IS-C-03, Section 4.1 states: At a minimum follow the electrical safety guidelines of Table 1:

- “If the insulation is found to be compromised (worn or damaged) during this handling process, take corrective actions to protect the workers and notify the shift manager.”
- “To resume work the following actions are required. Actions will include verifying extent of damage, verifying safe condition using qualified electricians, and establishing a corrective action plan.”

Failure to follow the requirements of TFC-ESHQ-S-IS-C-03 is also a non-compliance with the excavation permit DAN 3250.

This issue was identified by ORP during review of JRG-approved documents. This issue was communicated to the CH2M HILL and corrected.

Supporting Issue 6:

Work instructions were not adequate to ensure unanticipated radiological conditions would be evaluated if RWP limits were not exceeded. (Cliff Hampton, November 29, 2007)

Discussion:

The JRG approved a change to the work instructions of work order CLO-WO-07-1340 that allowed disconnecting the hoses believed to contain water that was not contaminated with radioactive material. The work was allowed to be conducted within the limits of the RWP that does not require action until contamination levels $\geq 50,000$ dpm/100cm² beta-gamma or ≥ 70 dpm/100cm² alpha are reached. ORP pointed out that since the water is believed to not be contaminated, activity levels above background would be an indication that additional evaluation of radiological conditions would be in order. The JRG agreed and the work order was adequately amended.

ORP has reviewed the actions and documentation to support resolution of this issue; this issue is considered closed.

Supporting Issue 7:

Work Order radiological controls were inadequate to safely drain the Raw Water Distribution Device (RWDD) hose if internal contamination had been detected. (Cliff Hampton, December 5, 2007)

Discussion: Work Order CLO-WO-07-1340, *S-102 Remove Contaminated Equipment Around R-7* is a high-risk work package approved by the JRG. Section 4.15 of the work instructions directed the draining of the RWDD hose. If the contamination surveys found levels of contamination greater than 50,000 dpm/100cm² beta-gamma or 70 dpm/100cm² alpha, the work package required that the hose be capped and further evaluated. If the levels of contamination were less than 50,000 dpm/100cm² beta-gamma or 70 dpm/100cm² alpha, the work instructions specified draining the hose into a drape.

Detectable levels of contamination below 50,000 dpm/100cm² beta-gamma or 70 dpm/100cm² alpha would have been an indication that radioactive material was present in the hose, or possibly the contamination survey was invalid due to cross-contamination. There were no work instructions or information provided to direct further investigation if contamination levels were less than 50,000 dpm/100cm² beta-gamma or 70 dpm/100cm² alpha. It is highly unlikely that the RWDD hose was internally contaminated.

If the hose ends were contaminated at levels below 50,000 dpm/100cm² beta-gamma or 70 dpm/100cm² alpha enough information would not be available from the contamination surveys taken to determine the extent of the contamination over the length of the hose (approximately 60 feet) or the radiation and contamination levels that would be present in the drape after draining the hose.

Work package steps required the hose to be clamped before being disconnected and the hose end internals surveyed. The clamps limited the amount of water drained from the hose until the ends of the hose were surveyed. After obtaining the surveys of the hose ends directions were provided to decontaminate the glove bags to <50,000 dpm/100cm² beta-gamma before opening the glove bags and making them drapes. After the glove bags were made into drapes, the clamps were to be loosened and the hose drained into the drapes. No specific directions or actions were provided in the work instructions to address potentially higher levels of contamination in the hose from draining the hose into the drapes in the event contamination had been detected. Consequently, the contamination and radiation levels could exceed the limits of the RWP.

During the performance of the work order the hose ends were disconnected in certified glove bags and the required surveys of the interior of the RWDD hose ends and exposed surfaces in the glove bags were performed. No contamination was found and the hoses were drained safely into the drapes. Observation of the inadequacy of the radiological controls was discussed with the Senior Supervisory Watches (SSW) and Radiological Controls Oversight personnel. One

SSW said he would direct the Field Work Supervisor to provide written feedback to the work planning organization.

ORP has reviewed the actions and documentation to support resolution of this issue; this issue is considered closed.

Supporting Issue 8:

Work Order (CLO-WO-07-1341) for the design and use of approved beta shielding was not specified for 241-S-102 soil excavation activities. (Rick Jansons, December 27, 2007)

Requirement:

TFC-ESHQ-RP_RWP-C-03, REV J-5, ALARA Work Planning, section 4.3.1, step 4.d:

- “Specify use of temporary shielding and/or in-process shielding or shipping containers.
- Document the basis for shielding design and application in the work instructions. If these requirements have been met by another procedure or document (technical basis document, engineering data transmittal, etc.), reference it.
- Prepare a technical basis document for temporary shielding designs that are used repetitively for specific applications.
- Other single-use designs may be included in the work document using simple calculations to determine design effectiveness, with a simple drawing of the design attached.”

Discussion:

Work Instruction for CLO-WO-07-1341 Steps 4.3 and 4.4 specified use of “approved beta shielding” for dose reduction. The RWP specified using approved beta shielding (rubber mat) but no criteria or technical basis were provided to determine what constituted “approved” beta shielding.

This issue was identified by ORP during review of JRG-approved documents. This issue was communicated to CH2M HILL and corrected prior to commencing work.

ORP has reviewed the actions and documentation to support resolution of this issue; this issue is considered closed.

Supporting Issue 9:

In Work Instructions CLO-WO-07-1341 procedural requirements for controlling radiological conditions were not implemented. (Rick Jansons, December 27, 2007)

Requirement:

TFC-ESHQ-RP-RWP-C-03, REVISION J-5, ALARA Work Planning, section 4.3, note 1:

“For medium and high-risk work activities, meter or needle deflection should be used for controlling radiological conditions unless extenuating circumstances preclude its use.”

Discussion:

This provision was not included in the RWP, ALARA Management Worksheet (AMW), or Work Instructions. The work package did not contain any discussion of extenuating circumstances that would preclude use of meter deflection in this case.

This issue was identified by ORP during review of JRG-approved documents. This issue was communicated to CH2M HILL and corrected prior to commencing work.

ORP has reviewed the actions and documentation to support resolution of this issue; this issue is considered closed.

A-08-AMTF-TANKFARM-011-F02: USQ Evaluation failed to consider all applicable previously analyzed accident scenarios during preparation of USQ determinations. (Jian-Shun Shuen, January 15, 2008)

Requirement:

TFC-ENG-SB-C-03, Revision D-3, *Unreviewed Safety Question Process*, requires that the following question be answered as YES or NO:

A.1.1. Could the proposed change increase the probability of an accident previously evaluated in the facility's existing safety analyses?

The procedure provides the preparer guidance in answering Question A.1.1; the guidance states: “In answering this question, the first step is to determine the accident scenarios, which have been evaluated in the previously approved safety analysis that may be affected by the proposed change. By focusing on the initiators of the previously evaluated accident scenarios, it can be determined whether there is an increased likelihood that a given accident would occur.”

Discussion:

ORP performed an oversight review of USQ Evaluation TF-07-1898-D, Rev. 0, *Work Order CLO-WO-070-1341 (Draft), S-102 Remove Contaminated Soil*, on December 11, 2007. The review identified that the USQD failed to consider an applicable accident (i.e., Unplanned Excavation/Drilling) that was previously analyzed and documented in the Tank Farms DSA.

This ORP - identified error was addressed by the contractor in the RPP Lessons Learned No. 07-042, reminding the USQ evaluators to “Ensure USQ evaluation includes thorough review of potentially applicable accidents (e.g., Section 3.3.2.3.1, ‘Accident Selection,’ in RPP-13033, and accidents described under Section 3.3.2.4, ‘Hazard Evaluation Results for Representative Accidents’).” USQ evaluators were required to read the lessons learned bulletin and document the action.

When Revision 1 of the USQ evaluation, TF-07-1898-D, was issued on January 4, 2008, the ORP reviewer again identified that the USQ evaluation failed to address an applicable accident scenario (i.e., the load drop scenario) in the USQ determination. The load drop accident scenario is germane to the S-102 soil removal activity as the load-in and load-out of steel shielding plates and soil drums will be handled by a crane. The hoisting and rigging safety management program (SMP) was selected in the Documented Safety Analysis (DSA) for controlling the hazards. This deficiency in the preparation of a USQ determination was documented in PER-2008-0052. CH2M HILL has subsequently issued the USQ Process Bulletin #273 to provide guidance to USQ evaluators with respect to PER-2008-0052 to ensure that all relevant accidents are considered and appropriately documented by USQ evaluators during preparation of USQ determinations.

To prevent recurrence of the type of failure described above, CH2M HILL has updated the USQD form to include a list of all applicable accidents that USQ evaluators should consider when completing USQ determinations. USQ evaluators are required to indicate on the USQ determination form each accident that is applicable to the proposed changes being evaluated.

ORP has reviewed the actions and documentation to support resolution of this issue; this issue is considered closed.

Non-Cited Findings

A-08-AMTF-TANKFARM-011-N03: Work steps performed out of sequence during an S-102 equipment removal evolution. (Derek Wright, October 22, 2007)

Requirement:

TFC-OPS-MAINT-C-01, *Tank Farms Contractor Work Control*, Section 4.7.1 step 11 states that “Using Attachment D as a guide, perform work in accordance with the work instructions and document results on the Computerized History and Maintenance Planning Software (CHAMPS) work record”. Appendix D continues to say “Perform work instruction steps in the order that they are written unless the work order specifies that sequencing is negotiable.”

Discussion:

On October 22, 2007, during an evolution to disconnect and remove the High Pressure Mixer tubing from the area outside of the S-102 HCA/HRA (CLO-WO-07-1545, *S-102 Remove and*

Dispose of Equipment Outside of the HRA) the FR noticed that one of the steps had been completed out of sequence from the work instructions. The step that was performed out of sequence was a minor step and had no safety impact to the worker, environment, facility, or process. This issue was immediately discussed with the SSW who then notified the FWS. The FWS conducted a safety pause and notified the Shift Manager. The FWS was told to make an entry into the work record and the Shift Manager allowed work to continue. A fact-finding was subsequently held.

CH2M HILL management has been informed of this issue; CH2M-PER-2007-1846 has been generated to resolve this issue. ORP has reviewed the actions and documentation to support resolution of this issue; this issue is considered closed.

A-07-AMTF-TANKFARM-011-N04: Attending to restroom breaks and cell phone calls requires employees to be absent from a pre-job briefing and, therefore, prevents them from fulfilling their responsibilities as defined in TFC-OPS-MAINT-C-02. (Ron Frink, October 23, 2007)

Requirement:

TFC-OPS-MAINT-C-02, Section 4.2, *Pre-Job Briefing* states that during a pre-job briefing, the employee's responsibilities are:

"Participate in pre-job briefing. Understand the following:

- Scope of work
- What is expected during the performance of the work
- Who is in charge of the task
- Controls that have been established for the work to be performed.

Ask all questions pertinent to scope of work, hazards controls, and requirements."

Discussion:

On October 23, 2007, during the Pre-Job briefing for CLO-WO-07-1627, *241-S-102, Ready Drum for Shipping* several personnel attending the pre-job briefing took the liberty to take restroom breaks and respond to cell phone calls. This is contrary to the requirements of TFC-OPS-MAINT-C-02.

In light of the fact that employees were not present during portions of the pre-job, the FR interrupted the pre-job briefing and recommended that the pre-job continue after everyone was present. The FWS agreed and repeated those portions of the briefing that were missed (i.e., Worksite Hazards Analysis and RWP).

Attending to rest room breaks and cell phone calls requires an employee to be absent from a pre-job briefing and therefore prevents them from fulfilling their responsibilities as defined in TFC-OPS-MAINT-C-02. This behavior represents a non-compliance to TFC-OPS-MAINT-C-02.

CH2M-PER-2007-1899 was generated to address this issue. ORP has reviewed the actions and documentation to support resolution of this issue; this issue is considered closed.

OBSERVATIONS

A-07-AMTF-TANKFARM-011-O05: Poor contamination control was observed when an operator tossed a bag of material over the HCA/HRA boundary. (Cliff Hampton, November 1, 2007)

Discussion:

Poor contamination control was observed when an operator tossed a bag of material over the HCA/HRA area boundary to an operator inside that was wearing a Self-Contained Breathing Apparatus (SCBA). The operator was not able to catch it and it fell on to the contaminated ground. Subsequently the bag was dragged to where it was to be used without regard to disturbing the contaminated soil.

This observation was discussed with the SSW, Radiological Controls Director and the Director of Closure Operations.

A-07-AMTF-TANKFARM-011-O06: During the process of removing the outer layer of anti-contamination clothing from an individual, the personnel undressing the individual became confused about the sequence of undressing. (Cliff Hampton, November 1, 2007)

Discussion:

On November 1, 2007, during the process of removing the outer layer of anti-contamination clothing from an individual, the personnel undressing the individual became confused about the sequence of undressing and disconnecting the bottle rack from the SCBA mask. Although the guidance was posted and had been previously used by the personnel undressing the individual, they did not refer to the posted guidance to determine when to disconnect the bottle rack from the mask. The individuals determined a course of action that was inconsistent with the posted guidance and did not consult the radiological controls supervisor, radiological controls personnel, or the FWS.

This observation was discussed with the SSW, Radiological Controls Manager and the Director of Closure Operations.

A-07-AMTF-TANKFARM-011-O07: Contractor oversight, during the removal of contaminated equipment, was not commensurate with the significance of the work. (Cliff Hampton, November 20, 2007)

Discussion:

Contaminated equipment removal work in the S-102 HCA/HRA area was expected to begin on Friday, November 16, 2007, and progress through Sunday, November 18, 2007. The oversight provided by the contractor on Friday and Sunday (Saturday was cancelled) was not commensurate with the significance of the spill; there were no Senior (Vice President or Director-level) personnel from Operations, Radiological Controls, or Environmental, Safety & Health providing oversight. This issue was previously raised and then adequately addressed during dilution hose removal mock-up training and during the dilution hose removal. Given the significant potential for radiological contamination spread, removal of contaminated equipment and soil should receive the same level of contractor oversight as the dilution hose removal.

A-07-TOD-TANKFARM-011-O08: Personnel working to support S-102 contaminated equipment removal were observed to have their hair hanging outside of their anti-contamination clothing. (Cliff Hampton, November 20, 2007)

Discussion:

On November 20, 2007, four people (two on dayshift and two on swing shift) were observed to with their hair hanging down over their anti-contamination clothing. In one case, one person's hooded sweat shirt also had the hood hanging over the back of the anti-contamination clothing. This poor work practice was addressed by contractor management.

5.0 CONCLUSIONS

During reviews of documents, field observations, meeting attendance, and discussions with CH2M HILL staff, ORP staff found that CH2M HILL's conduct of operations and radiological control practices have shown areas in which improvement has been achieved. There are, however, areas in which improvement is still warranted. Additionally, improvements are warranted with respect to incorporation of existing requirements into supporting work documents. CH2M HILL has been informed of the identified weaknesses, has completed corrective actions, or is evaluating the appropriate action to take.

The efforts taken by the SSW, FWS, Field Crew and the Work Planner have been evaluated throughout the recovery process. These efforts have consistently been evaluated as Excellent.

APPENDIX A

LIST OF INTERVIEWED PERSONNEL AND REVIEWED DOCUMENTATION

Personnel Interviewed:

Assessment and Corrective Actions Director
C-Farm Project Engineering Manager
C-Farm Work Management Director and supporting staff
Closure Industrial Hygiene Manager
Closure Maintenance Director
Closure Operations Engineering Support Manager
Closure Operations Manager
Closure Operations Vice President
Closure Radiological Control Director and supporting staff
Nuclear Safety and Licensing Director and supporting staff
Radiological Control Program Director
Retrieval/Closure Engineering Director
S-102 Project Manager
Safety and Health Director
Safety, Health and Quality Assurance Vice President
S-Farm Operations Director
S-Farm Project Director
Surveillance and Maintenance Director
Surveillance and Maintenance Work Control Manager (Senior Supervisory Watch) and supporting staff
Training and Procedures Director

Documents Reviewed:

- CH2M HILL letter 7L000-TAE-07-001 dated August 27, 2007, *Team Charter for Event Response Review for the S-102 Equipment and Soil Contamination Event of July 27, 2007 (PER-2007-1327 and 1329)*
- CH2M-PER-2007-1370, *S-102 TSR Violation for Dilution System Design*
- CLO-WO-07-1340, *S-102 Remove Contaminated Equipment Inside HRA*
- CLO-WO-07-1341, *S-102 Remove and Dispose of Contaminated Soil at Riser 7*
- CLO-WO-07-1545, *S-102 Dispose of Equipment Outside the HRA*
- CLO-WO-07-1595, *Install Jumpers to Drain Lines at S-102*
- CLO-WO-07-1627, *S-102 Ready Waste Drum for Shipment*
- DOE O 5480.19, *DOE Conduct of Operations Requirements for DOE Facilities*
- DOE-RL-92-36, *Hoisting and Rigging Manual*
- EM--RP—CHG-TANKFARM-2007-0009, *Tank 241-S-102 Waste Spill*
- EM--RP—CHG-TANKFARM-2007-0010, *Tank 241-S-102 Dilution System Design Represents a Technical Safety Requirements Violation*
- EM--RP—CHG-TANKFARM-2007-0011, *Postulated Waste Leak Accident Scenario Resulting from Pressurizing/Channeling is Not Considered in the Safety Basis*
- HNF 5183, Revision 2, *Tank Farms Radiological Control Manual*

- HNF-IP-1266, *Tank Farm Operations Administrative Controls*
- HNF-SD-WM-TSR-006, *Tank Farm Technical Safety Requirements*
- Interoffice Memorandum 7L000-TAE-07-001, *Team Charter for Event Response Review for the S-102 Equipment and Soil Contamination Event of July 27, 2007 (PER-CH2M-2007-1327 and 1329)*, dated August 27, 2007
- Root Cause Analysis for PER-2007-1370, *Backflow Prevention System Violation*
- RPP-13033, *Tank Farm Documented Safety Analysis*
- RPP-13750, *Waste Transfer Leaks Technical Basis Document*
- RPP-35412, *End Point Criteria for Clean-Up of Contaminated Soil Resulting from 241-S-102 Waste Spill of July 27, 2007*
- RPP-36058, *241-S-102 Spill Area Excavation Workplace Air Sampling Evaluation*
- RPP-RPT-34831, *Root Cause Analysis Report – CH2M-PER-2007-1327, Radioactive Waste Spill at 241-S-102 on July 27, 2007*
- RPP-RPT-34902, *Health Effects Report for 241-S-102 Spill Event* dated October 2007
- RPP-RPT-35910, *241-C-104 Ventilation System Process Hazard Analysis*
- Standing Order CO-07-003, Revision 7, *S-102 Spill Compensatory Measures*
- Standing Order CO-07-008 Revision 0, *Chain of Command During Retrieval Operations*
- Standing Order CO-07-009, Revision 0, *Industrial Hygiene Dose Reconstruction Sampling for Waste Transfer and Retrievals*
- Tank Farm Conduct of Operations Manual, Chapter 4, *Communications*
- TE-07-009, *Technical Evaluation for the C-109 and AN-106 Transfer Pumps*
- TE-07-012, *C-109 Retrieval System Technical Evaluation for Pressurizing / Channeling within Waste Tank Solids*
- TE-07-017, *Technical Evaluation for Pressurizing/Channeling within Waste Tank Solids by Operation of Weight Factor Dip Tubes in 244-S Double-Contained Receiver Tank (DCRT)*
- TE-07-027, *Technical Evaluation of Waste Leak Paths and Waste Leaks Due To Waste Channeling for Transfer Related Activities Associated with Tanks 241-AP-101, 241-AP-105 and 241-AW-102*
- TF-AOP-011, *Response to Chemical and/or Radiological Events*
- TF-AOP-015, *Response to Reported Odors or Unexpected Changes to Vapor Conditions*
- TFC-ENG-SB-C-03, *Unreviewed Safety Question Process*
- TFC-ESHQ-RP_ADM-C-11, Revision D, *Joint Review Group*
- TFC-ESHQ-RP_MON-C-11, *High Radiation Areas Physical Access Controls*
- TFC-ESHQ-RP_RWP-C-03, *ALARA Work Planning*
- TFC-ESHQ-S_IS-C-03, *Excavating, Trenching, and Shoring*
- TFC-OPS-MAINT-C-01, *Tank Farm Contractor Work Control*
- TFC-OPS-MAINT-C-02, *Pre-Job Briefing*
- TFC-OPS-OPER-C-05, *Lockout/Tagout Program*
- TFC-OPS-OPER-C-31, Revision A-3, *Communication Guidelines*
- USQ Process Bulletin #273

- USQD TF-06-0962, *Perform Airblow of C-103 Transfer Lines per Work Package CLO-WO-001249*
- USQD TF-07-0685-D, *Airblow C-108 HIHTL per Work Package CLO-WO-06-02171*
- USQD TF-07-1898-D, *Per Work Order CLO-WO-07-1341 (Draft) S-102 Remove Contaminated Soil*
- USQD TF-07-1957-D, *Evaluation of Waste Leak Paths for Transfer Related Activities Associated with DSTs 241-AP-101, 241-AP-105, and 241-AW-102; and Waiver 07-1341-R2, Additional Controls for Using Machine Excavation for S-102 Soil Removal*

APPENDIX B

TEAM MEMBER BIOGRAPHIES

(BIOGRAPHIES ARE ON FILE)