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

NOV 6 2007

07-TOD-107

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, OFFICE OF RIVER PROTECTION (ORP) TANK FARM PROJECT ASSESSMENT OF CH2M HILL S-102 SPILL EVENT RECOVERY ACTIVITIES, A-07-TOD-TANKFARM-004

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 July 27, 2007 to October 3, 2007, 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 5 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. The response should include:

- The causes of the 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; and
- The date when all corrective actions will be completed, verified, and compliance to applicable requirements will be achieved.

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. 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 orally, 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. M. Fetto, ORP
CH2M Correspondence Control

U.S. Department of Energy
Office of River Protection

Assessment of
CH2M HILL S-102 Spill Event Recovery Activities
Conducted July 27, 2007 through October 3, 2007

Office of River Protection

Team Members:

M. C. Brown
R. L. Frink
C. E. Hampton
M. R. Moreno
J. L. Polehn
W. L. Smoot
J. Shuen
G. D. Trenchard
B. I. Williamson
D. L. Wright
R. M. Yasek

October 2007

U.S. Department of Energy
Office of River Protection
Assessment Report

Division: Tank Farm Operations Division (TOD)

Assessors: M. C. Brown, R. J. Ciola, R. L. Frink, C. E. Hampton, M. R. Moreno, J. L. Polehn, J. Shuen, W. L. Smoot, B. I. Williamson, D. L. Wright, R. M. Yasek

Assessment Number: A-07-TOD-TANKFARM-004

Date Completed: October 26, 2007

Contractor: CH2M HILL Hanford Group, Inc. (CH2M HILL)

Facility: Tank Farms

Title: Review of CH2M HILL Recovery Actions from the S-102 Spill Event (July 27, 2007 – October 3, 2007).

Guide: *U.S. DOE Office of River Protection, S-102 Recovery Oversight Plan* dated August 10, 2007.

Assessment Purpose and Scope:

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 has 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 is plugging of the pump suction area while the pump was ran in reverse (the pumps suction becomes the pumps discharge during reverse rotation operations) causing sufficient pressurization of the dilution line to overcome the hydraulic resistance to the top of the tank resulting in a rupture of the dilution hose.

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 July 27, 2007 to October 3, 2007. October 3, 2007, was selected as the cut-off date for this assessment to coincide with the work completed prior to the removal of the dilution hose; dilution hose removal began on October 4, 2007. 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.

Five Findings and 4 Observations have been identified. These are described in detail in the "Assessments Results" section of this report.

Additional assessments will be performed; these will be reported as the S-102 recovery progresses. The next assessment will include, at a minimum, DOE oversight results of the dilution hose removal.

Assessment Summary

Interviews:

- Vice President Safety, Health and Quality Assurance;
- Closure Radiological Control Director and supporting staff;
- Surveillance and Maintenance Director;
- S-Farm Project Director;
- Safety and Health Director;
- Radiological Control Program Director;
- C-Farm Work Management Director;
- Retrieval/Closure Engineering Director;
- Surveillance and Maintenance Work Control Manager (Senior Supervisory Watch) and supporting staff;
- S-102 Project Manager;
- Closure Facility Radiological Control Support Lead;
- Closure Operations Engineering Support Manager;
- C-Farm Project Engineering Manager;
- S-102 Spill Event Investigation Fact-Finding Lead;
- S-102 Spill Response Investigation Fact-Finding Lead; and
- Occupational Safety Lead for Heat Stress and Respirators.

Documents Reviewed:

- DOE O 5480.19, *DOE Conduct of Operations Requirements for DOE Facilities.*
- HNF 5183, Rev. 1, *Tank Farms Radiological Control Manual.*

- HNF-SD-WM-TSR-006, *Tank Farm Technical Safety Requirements.*
- RPP-13033, *Tank Farm Documented Safety Analysis.*
- TFC-ESHQ-RP_RWP-C-03, *ALARA Work Planning.*
- DOE-RL-92-36, *Hoisting and Rigging Manual.*
- TFC-OPS-MAINT-C-01, *Tank Farm Contractor Work Control.*
- Work package CLO-WO-07-1267, *S-102 Dilution Hose Removal* (including review of the As Low As Reasonably Achievable (ALARA) Management Worksheet, Industrial Hygiene (IH) Monitoring Plan, Waste Planning Checklist, Worksite Hazard Analysis, Radiological Work Permits (RWPs), and Safety Plan).
- RWP COJ-112.
- RWP CO-408.
- Standing Order CO-07-003, Rev. 7, *S-102 Spill Compensatory Measures.*
- Standing Order CO-07-004, Rev. 0, *Releasing Work Involving Potential Release of Radioactive Fluids.*
- Standing Order CO-07-007, Rev. 0, *Industrial Hygiene Sampling When Implementing TF-AOP-006, TF-AOP-011, and TF-AOP-015.*
- Closure Ops Lockout/Tagout CO-2007-039.
- TFC-ESHQ-RP_ADM-C-11, Rev. D, *Joint Review Group.*
- TFC-OPS-OPER-C-31, Rev. A-3, *Communication Guidelines.*
- Tank Farm Conduct of Operations Manual, Chapter 4, *Communications.*
- AOP-006, *Response to High Radiation.*
- AOP-011, *Response to Radiological/Hazardous Material Leaks, Spills and/or Personnel Contamination.*
- AOP-015, *Response to Reported Odors or Unexpected Changes to Vapor Conditions.*
- TFC-OPS-MAINT-C-02, *Pre-Job Briefing.*
- HNF-IP-1266, *Tank Farm Operations Administrative Controls.*
- EM--RP—CHG-TANKFARM-2007-0009, *Tank 241-S-102 Waste Spill (Type A Investigation).*
- EM--RP—CHG-TANKFARM-2007-00010, *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.*
- *TFC-OPS-OPER-C-05, Lockout/Tagout Program.*
- RPP-17965, *Safety Evaluation of the Single-Shell Tanks Modified Sluicing Waste Transfer System.*
- RPP-15188, *Hazard Evaluation Database Report.*
- TFC-ENG-SB-C-03, *Unreviewed Safety Question.*
- PISA Evaluation Worksheet – Postulated Waste Leak Accident Scenario Resulting from Pressurizing/Channeling Within Waste Tank Solids.
- ORP TED Engineering Review – 2005 ISMS Review Findings vs. S-102 Spill.
- CH2M HILL letter 7L000-TAE-07-001, *Team Charter for Event Response Review for the S-102 Equipment and Soil Contamination Event of July 27, 2007 (PER-2007-1327 and 1329).*

- RPP-RPT-34831, *Root Cause Analysis – CH2M-HILL-PER-2007-1327, Radioactive Waste Spill at 241-S-102 on July 27, 2007.*
- TE-07-009, *Technical Evaluation for the C-109 and AN-106 Transfer Pumps.*
- 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).*
- RV-S102-7, *Readiness Verification Checklist, Tank 241-S-102 Spill Recovery Field Work – Dilution Hose Removal (Work Order CLO-WO-07-1267).*

Field Recovery Oversight

Field Recovery Oversight began on the day of the event, July 27, 2007, and has continued since. Field Oversight activities included:

- Emergency Response;
- Event Notifications;
- Occurrence Reporting;
- Event Investigations (including fact-finding meetings);
- S-Farm radiological control methodologies (including S-102);
- S-102 radiological perimeter surveys;
- S-102 High Radiation Area (HRA)/High Contamination Area (HCA) radiological surveys;
- Fixative application;
- In-field Mockups (preparation for dilution hose removal);
- Training;
- Joint Review Group (JRG) meetings;
- Post-Job As Low As Reasonably Achievable (ALARA) Reviews;
- Team Planning Meetings (TPM);
- CH2M HILL employee briefings;
- Management readiness meetings; and
- Pre-Job Briefings.

Radiological Controls

Significant improvement in Radiological Control practices has been observed since oversight focus has been applied to the S-102 spill recovery. Some areas in which improvement has been noted are:

- Passage of items over different radiological control zones in a controlled manner;
- Facial contamination spread mitigation (i.e., touching of face with fingers, 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);
- Dust control;
- Proper frisking speed;

- Standardization for dressing and undressing of Personnel Protective Equipment (PPE);
- Periodic checking of pencil or electronic dosimetry;
- Control of radiological zones in change trailers and within the vicinity of S-102 spill area;
- Use of buddy system to assist team members in dressing and undressing of PPE; and
- Care in ensuring PPE do not contact sharp objects that might result in tears.

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 HRA/HCA, observation of entries into the S-102 HRA/HCA, practice mock-ups, and evaluated mock-ups). Numerous meetings were observed that included: TPMs, JRG meetings, Post-Job ALARA Review meetings, Fact-Finding meetings, Pre-Job Briefings, and management readiness meetings.

CH2M HILL is appropriately taking a conservative approach by exercising a high degree of rigor in the work control planning and approval process. The team planning meetings have been very productive; good feedback from employees resulted in the proper selection of tools and PPE that would be used in the dilution hose removal. Employee feedback has been a key factor in establishing the work sequence for high radiological risk work; this has resulted in a reduction in exposure to work place hazards. Employee feedback resulted in the optimal dress/undress sequence of PPE when entering and exiting the S-102 HRA/HCA. Employee feedback played a key role in establishing the frequency of entries into the S-102 HCA/HRA; this was not only a benefit to reducing radiological exposure, it was also a benefit by reducing the exposure of employees to work place hazards. Teamwork while dressing and undressing in the change trailers has shown a marked improvement. Some employees have taken it upon themselves to assist in coaching other employees in the proper application of anti-contamination clothing, plastic suits, respirators, IH monitoring equipment, etc.

Other areas that have been of benefit to reducing exposure to work place hazards have been:

- Heat stress monitoring of personnel during periods of high temperature;
- Prudent selection of work periods to minimize work during periods of high temperature;
- Application of pest control in the S-Farm complex; and
- Application of fixative to contain the waste spill.

One area in which additional work is needed involves 3-way communication. This has been categorized as an Observation (A-07-TOD-TANKFARM-004-O09) and is presented in the "Assessment Results" section of this report.

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.

Engineering/SB Oversight

ORP Tank Farm SB Staff performed the following reviews and completed the following reports:

- Review of *DOE ORP, S-102 Recovery Oversight Plan* dated August 10, 2007.
- Review of the historical revisions to RPP-17965, *Safety Evaluation of Single-Shell Tanks (SSTs) Modified Sluicing Waste Retrieval System* to assess if a reverse flow hazardous condition was identified.
- Review of RPP-15188, *Hazard Evaluation Database Report*, to assess whether the waste transfer leak hazardous condition has been previously identified.
- Report: Perspective of the Unreviewed Safety Question Determination (USQD) process related to the S-102 spill incident.
- Report: Evaluation of 2005 Integrated Safety Management System Report against S-102 hazard analysis, SST retrieval SB amendments, and Unreviewed Safety Question evaluation history.
- Report: SB Perspectives on the S-102 Spill Event.
- Developed chronology of the CH2M HILL Nuclear Safety & Licensing (NS&L) decisions leading up to the spill: draft Review Comment Record (RCR) (dated October 16, 2002), for the Seepex pump design review, SB Clarification (Log No. 2004-4177), and review of the transfer piping system identified the need to establish the physical disconnection of the piping.
- Review of adequacy of the initial Potential Inadequacy in the Safety Analysis (PISA) evaluation worksheet for the S-102 dilution system design. (Note: It was later determined that the 241-S-102 Seepex pump dilution water line was considered physically connected to the waste transfer line. The PISA was changed to a TSR violation.)
- Review of adequacy of the initial PISA evaluation worksheet - *Postulated Waste Leak Accident Scenario Resulting from Pressurizing/Channeling within Waste Tank Solids.*

- Review of 241-S-102, *Process Control Plan* PCP (RPP-17043) to assess if potential negative consequences from operational deviations from the strategy were assessed.

- Review of the following Problem Evaluation Requests (PERs): CH2M-PER-2007-1327, *S-102 Transfer Pump Leak Results in Waste Spill near S-102 Pump Pit*; CH2M-PER-2007-1370, *S-102 TSR Violation for Dilution System Design;* CH2M-PER-2007-1506, *Postulated waste leak accident scenario resulting from pressurizing/channeling PISA.*

- Review of the following Technical Evaluations: TE-07-009, *Technical Evaluation for the C-109 and AN-106 Transfer Pumps*, and 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).*

- Review of numerous USQDs, for example: EV-07-1277D, *Backflow of Waste into the Seal Water System from the 242-A Evaporator Slurry Pump (P-B-2),* and TF-07-0231D, *Release of RPP-17965, Rev. 6, "Safety Evaluation of the Single-Shell Tanks Modified Sluicing Waste Retrieval System.*

Investigation Oversight

Investigation oversight included a review or observation of the following:

- Event Fact-Finding Meeting (July 30, 2007).
- Event Response Fact-Finding Meeting (July 31, 2007).
- S-102 Lock and Tag Fact-Finding Meeting (July 17, 2007).
- Health Effects investigation meetings.

The review evaluated the adequacy of CH2M HILL's investigations and included the adequacy of response actions, occurrence reporting, DOE notifications, PER resolution and causal analyses, corrective actions and timeliness of due dates.

The initial fact-finding meetings following the S-102 spill event and response were less than adequate. This information was relayed to CH2M HILL senior management immediately upon completion of the fact-finding meetings. The investigation teams compensated for this inadequacy through detailed personal interviews and group interviews. This "compensation" was determined to be sufficient to provide the investigation teams with enough detailed information to provide a thorough evaluation of the spill and response scenarios. ORP reviewed the Root Cause analysis for the S-102 spill event, and determined that the investigation was very thorough, and the causal analyses were methodical and detailed.

The spill event response investigation report was also reviewed for adequacy. The report was also thorough and identified appropriate areas for recommended improvement.

The Health Effects Investigation was less effective and efficient. CH2M HILL was slow to identify all potentially affected workers and to adequately "bound" the number of workers that were in the vicinity of the spill or the TF prior to soil and spill stabilization; the soil and spill stabilization occurred initially late in the day on July 27, 2007. This noted deficiency was compounded by the Hanford Site emergency response organization, specifically the Event Coordination Team (ECT), since the ECT did not focus any effort on personnel accountability. This was discussed several times with CH2M HILL management; corrective actions were implemented and eventually the numbers of potentially affected workers was refined to a final number. The aforementioned deficiencies were adequately identified in the Type A Accident Investigation Report for the S-102 Spill, and are not repeated in this report.

Assessment Results

FINDING A-07-TOD-TANKFARM-004-F01:

During the mock-up training and entry into the S-102 HRA/HCA to perform radiological surveys, the assessors observed examples of poor work planning and contamination control practices. (Hampton, July 31, 2007.)

Requirement:

HNF-5183, *Tank Farms Radiological Control Manual:*

- Radiological work activities are to be conducted as specified by the controlling technical work document and RWP (Article 341).
- Plan access to and exit from the work area (Appendix 3A, Checklist for Reducing Occupational Radiation Exposure).
- Hoses and cables entering the work area should be secured to prevent the spread of contamination or safety hazards (Article 342).

Discussion:

There were no radiological controls written into the work instructions or RWP that provided direction or authorized the donning and doffing of Self-Contained Breathing Air (SCBA) equipment in the Contamination Area (CA). The TF Radiological Control Manual identifies specific controls that allow personnel to drink water in CAs. Similar controls for donning and doffing the SCBAs in the CA would be appropriate to minimize spread of contamination.

Contrary to the above requirements, initially the contamination corridor used to egress and ingress the HRA/HCA was too narrow. People leaving the HRA/HCA rubbed up

against personnel helping to remove rubber overshoes increasing the likelihood of the spread of contamination.

Hoses and cables installed prior to the installation of the HRA/HCA fencing were not secured to prevent the hoses and cables from being pulled from the HCA into the CA. This was discussed with the Closure Projects Radiological Control Director.

Several people placed their feet on steel piping supports. The piping supports had sharp corners that could damage contamination clothing and rubber boots. One operator wearing water resistant clothing for contamination control sat on a water pipe in a manner which could have damaged his clothing by the piping supports. This was discussed with the Closure Projects Radiological Control Director and the Senior Supervisory Watch.

The PCM-1B used in the SX change trailer had a light that was not working. The light is supposed to flash to let the user know that the unit is counting. One operator indicated that it had not worked for a long time. The assessors observed someone had drawn a question mark around the light. No one questioned whether or not the PCM-1B was operable and continued to use it. The light was subsequently repaired after the assessors pointed out the deficiency to the Closure Projects Radiological Controls Director.

CH2M HILL management has been informed of these issues. For those issues not yet resolved, resolution is in progress.

FINDING A-07-TOD-TANKFARM-004-F02:
The pre-job discussion for the mock-up training conducted in S-Farm did not include a discussion of abnormal events as required by TFC-OPS-MAINT-C-02, *Pre-Job Briefing*. (Hampton/Smoot, August 14, 2007.)

Requirement:
TFC-OPS-MAINT-C-02, Section 4.2.2 specifies, "Conduct a detailed pre-job briefing using the Pre-Job Briefing checklist (A-6002-893), addressing only those details pertinent and important to the task at hand."

Discussion:
The abnormal events section of the pre-job checklist provides for a discussion of:

- Emergency Response;
- Alarm Response;
- Location of nearest:
  - Spill Kit;
  - Operable Safety Shower;
  - Operable Decontamination facility;
  - Event response equipment, supplies, personnel;
- Roles and Responsibilities for Injury, Spills, etc.; and
- Lessons learned.

These items were not discussed during the pre-job.

The above weaknesses were discussed with the Closure Radiological Control Director, who agreed with the issues and wrote two PERs (2007-1660 and 2007-1661) to address and correct these issues.

FINDING A-07-TOD-TANKFARM-004-F03:
The C-Farm Work Management Director did not review the work package, CLO-WO-07-1267, *241-S-102 Dilution Hose Removal,* before it was submitted for review and approval by the JRG as required by CH2M HILL requirements. (Hampton, September 24, 2007.)

Requirement:

TFC-OPS-MAINT-C-01, Section 4.4.3, *Complex Work Process,* states:

The Work Control Manager is responsible for:

- Approve the work when confident that it is properly planned.
- Determine if it needs to go to the JRG for approval. If JRG approval is required, return to the planner to schedule JRG review.

Discussion:

Contrary to the above requirements, the C-Farm Work Management Director did not review the completed work package to ensure the work was properly planned prior to submitting the work package to the JRG for review and approval as required by the CH2M HILL work control procedure.

CH2M HILL management has been informed of this issue; resolution is in progress.

FINDING A-07-TOD-TANKFARM-004-F04:
Work Package, CLO-WO-07-1267, *241-S-102 Dilution Hose Removal,* preparation and review process did not ensure all hazards were properly identified and mitigated as required. (Hampton/Smoot, September 24, 2007.)

Requirement:

TFC-OPS-MAINT-C-01, Section 4.4.3, *Complex Work Process,* states:

"Perform a walk down using the Worksite Hazard Analysis to determine the tasks and hazards associated with the work."

Discussion:

During the JRG meeting for review and approval of the dilution hose removal work instructions, multiple issues were discussed that had not been identified during the planning process. The JRG conditionally approved the work package with 15 issues requiring resolution prior to final approval. The 15 issues included such items as:

- Modify the work instructions to retain all the equipment: stairs, jersey barriers, and chair.
- Critical lift plans have to be verified.
- Determine the need for heat trace to keep the waste from gelling.
- Evaluate criteria for resumption of work.
- HP (HOLD POINT) change to state that all criteria of Attachment A were met.

In addition to the issues identified by the JRG, other CH2M HILL personnel observing the meeting raised questions/issues regarding the engineering controls to be employed to control contamination. Additionally, ORP raised questions regarding radiological work and other hazard controls. Several of these questions identified inadequacies in the work planning process that resulted in changes to the work instructions for resolution. Specific questions/issues raised by ORP after the work package had been approved by the JRG include:

- Dose rate calculations had not been evaluated for the changing radiological conditions caused by draining the hose into the drum, and for placing the length of the hose into a wooden box.

- Controls for donning respiratory equipment in a contamination area were not adequately documented. Expectations for contamination surveys of personnel and the respiratory equipment were discussed in detail at the pre-job briefings conducted prior to field work.

- Specific contingencies were built into the work package that authorized the Shift Operations Manager to resume work after an abnormal radiological event provided that the RWP Safe Condition or Void levels were not exceeded. Notification of the Radiological Control Director for his approval to resume work was not required by the work procedure, nor is it a management expectation. The Radiological Control Director was present in the field during the recovery work and would have been involved in the decision making process to resume work.

- The de-energizing of the heat trace did not require a zero energy check of the heat trace after it is tagged out prior to cutting. Consideration from a lesson learned from a similar issue was not incorporated into the work instructions.

- The work process required the installation of a glove bag to be used as a spray shield on each end of the hose to be disconnected for removal. There was only

one HP signature block for the two glove bag inspections that are required. Expectations for what constitutes an acceptable inspection were not provided.

- The work instructions discussed support for the cam lock fitting during disconnection of the hose, but did not provide sufficient detail to explain how the hose and fitting would be supported. This was a concern because there could have been a maximum of one gallon of liquid held by the spray shield, and if not properly supported, a spill might occur.

- The work directions specify taking a contamination swipe survey on caps installed on the riser extension box side, but did not discuss the reason for taking the swipe or if work should be paused until the contamination levels of the swipes were known. Normally contamination found in process contamination surveys should be evaluated prior to continuing with work to ensure contamination controls are effective. The swipe surveys on the caps were for future work planning. The potential ramifications of taking them had not been considered in light of the fact that time constraints were present due to the use of SCBA while working in the HCA. As the procedure was written, if the contamination levels exceed predetermined levels the FWS had to either take action to reduce the levels or stop work. Taking the time to decontaminate or having to stop work because the predetermined contamination levels had been reached would unnecessarily adversely impact the task.

- The JRG did not address the Judgment of Needs from the Type A investigation or from the CH2M HILL accident investigations. The JRG approved the Work Planning document, AMW, and RWP contingent on addressing open issues from the JRG. Resolution of issues from these two investigations could significantly impact the recovery activity.

- The Judgment of Needs from the Type A investigation or from the CH2M HILL accident investigations were not discussed in the planning meetings and consequently were not evaluated for lessons learned during the planning process that could impact this work.

The C-Farm Work Management Director has been informed of these issues; resolution is in progress. Resolution is being coordinated with the WFO Work Control Manager to ensure consistency.

FINDING A-07-TOD-TANKFARM-004-F05:
Contingency actions for unusual radiological situations were built into work documents that allow the Shift Operations Manager to authorize resumption of work prior to conducting a critique to determine the cause of the unusual situation and without obtaining the concurrence of the line manager responsible for the work and the Radiological Control Director as required by HNF-5183, "*Tank Farm Radiological Controls Manual.*" (Hampton/Smoot, September 24, 2007.)

Requirement:

- HNF-5183, *Tank Farms Radiological Controls Manual,* Article 127 states: "It is the Department's desire and expectation, based on concern for the safety and well-being of workers and the general public, that radiological work practices be continually scrutinized and questioned so that opportunities for improvement can be identified, assessed and applied.

  A formal critique process should be established to obtain pertinent facts following an unusual radiological situation. This process complements the Occurrence Reporting and Processing System (ORPS) of DOE O 232.1, Occurrence Reporting and Processing of Operations Information. The process, as described in Article 351, is used to quickly establish facts in chronological order so that the underlying reasons or causes for the success or failure are well understood."

- HNF-5183, "*Tank Farm Radiological Controls Manual,*" Article 345 states:

  1. "Radiological Control Technicians and their supervisors, and any worker through their supervisor has the authority and responsibility to stop radiological work activities for any of the following reasons:

     - Inadequate radiological controls;
     - Radiological controls not being implemented; or
     - Radiological Control HP not being satisfied.

  2. Once radiological work has been stopped it shall not be resumed until proper radiological control has been established.

  3. Resumption of radiological work requires the approval of the line manager responsible for the work and the Radiological Control Manager".

The contingency actions in work package CLO-WO-07-1267 for *241-S-102, Dilution Hose Removal,* include two abnormal events that indicate the need to re-evaluate the radiological controls of the work activity for adequacy. These events are personnel contacting tank waste and a spill of potentially radiological liquid on the ground.

For both of these events the work package states:

- Pause work Conditions will be evaluated and work will resume upon the following:

  - FWS and HPT verify radiological levels are within safe conditions limits.
  - Notify shift manager and obtain concurrence for resuming work.

Discussion:

The contingency actions do not address entering the appropriate abnormal operating procedures or specify that the approval of the Radiological Controls Manager and the appropriate line manager would be required to resume work.

One Shift Operations Manager was questioned and stated that based on the contingencies in the work package he would not contact the Radiological Controls Manager for concurrence to resume work. The Shift Operations Manager's position was supported by Closure Operations management in a separate discussion. Proceeding with a work evolution in which an individual is contaminated with radiological liquid and/or tank waste or inadequate radiological controls results in a spill of radiological liquid without a critique to determine facts, causes, and then establishment of corrective actions is not consistent with the TFRCM.

ORP notes that the abnormal operating procedure for a spill or personnel contamination requires that a fact-finding meeting be held, but does not require obtaining the Radiological Control Manager/Director's concurrence to resume a work activity. A cursory review of a recent contamination event was conducted and found that the required fact-finding meeting was held; PER-2007-0911 discussed a recent personnel contamination event in SX farm and the associated fact-finding meeting. PER-2007-0911 was closed; however, it did not mention obtaining the Radiological Control Director's permission to resume work. Internal Office Memorandum, 7X300-NJM-07-009 R1, FINAL FACT FINDING REPORT EIR-2007-008, "S FARM CONTAMINATION EVENT" does not address obtaining the Radiological Control Manager/Director's concurrence to resume work. The fact that TFs abnormal operating procedures did not require the concurrence of the Radiological Controls Manager/Direct to resume work after a spill or personnel contamination, indicated that this is a TFs-wide issue not isolated to Closure Projects.

Discussions with Closure radiological and line personal noted that the use of "stop work" discussed in the TFRCM would be reserved for a more programmatic loss of radiological controls. This is not consistent with DOE expectations to understand the cause of the inadequate radiological controls and for line and Radiological Control Manager responsible for the activity to approve corrective actions prior to resumption of the work activity.

CH2M HILL management has been informed of these issues; resolution is in progress.

OBSERVATION A-07-TOD-TANKFARM-004-O06:
ORP oversight personnel observed a lack of senior management oversight during mock-up training for removing the dilution hose. (Hampton, August 29, 2007)

Discussion:

The TFC conducted the mock-up in the S-Farm complex near the spill scene to allow personnel the opportunity to look at the actual spill scene through the chain link fence, if necessary, to clarify some aspects of the hose disconnect and removal work instructions. The oversight provided by the TFC for the first mock-up was not commensurate with the significance of the S-102 spill. Senior (Vice President or Director-level) personnel from Operations, Radiological Controls, or Environmental Safety & Health did not provide managerial oversight of the initial mock-up training. Additionally, the person responsible for the S-102 cleanup did not observe the mock-up. The C-Farm Operations manager was on-hand to observe, but did not enter the TF, limiting his ability to observe the mock-up training. Since senior management did not have first-hand knowledge of crew performance and adequacy of the work instructions, it is not clear how senior management could conclude that recovery preparations were in line with their expectations.

Lack of senior management oversight was discussed with the Chief Operating Officer. Senior Management oversight was present during the second mock-up training. The S-Farm Project Director, the Closure Project Radiological Controls Director, and C-Farm Operations Manager provided oversight.

ORP TOD Closure Required: **YES [ ]** **NO [X]**

OBSERVATION A-07-TOD-TANKFARM-004-O07:
The Radiological Control organizational structure did not provide the independence necessary to allow Radiological Control personnel the ability to make decisions and take actions without being influenced by Operations. (Hampton, September 17, 2007.)

Discussion:

RPP-13033, *Tank Farm Documented Safety Analysis, Chapter 7.0 Radiation Protection* states: "TFC Safety, Health, and Quality Assurance organization has the overall authority and responsibility for development, implementation, and maintenance of the radiological control program. This authority and responsibility is delegated to the radiological control organization, which is responsible for providing program direction and technical support to the TFC and line management organizations." The Documented Safety Analysis further states: "To ensure independence in making correct radiological control decisions, Radiological Control Program personnel are accountable through a reporting chain that is independent of line management." HNF-5183, TFs Radiological Control Manual, stresses the need to "ensure independence in making correct radiological decisions."

During interviews with the Radiological Control Programs Manager and the Closure Project Radiological Control Director, it became evident that the Radiological Control Programs Manager did not have the responsibility or the authority to ensure correct radiological decisions were being made with regard to the spill clean up. There was

limited oversight of the mock-up training and work planning by the Radiological Control Program Organization.

The assessors noted that the Closure Operations Project Radiological Control Director had not demonstrated that line management had influenced his decisions regarding radiological controls, however, independence in making correct radiological control decisions is not assured by the organizational structure. The cleanup was being managed by Closure Operations. The radiological support for planning, cleanup performance, and oversight was the responsibility of the Closure Operations Project Radiological Control Director. The Closure Operations Project Radiological Control Director was not a part of, or matrixed to, the TFC Safety, Health, and Quality Assurance Organization, and reported instead to Closure Operations Project line management.

While the Closure Operations Project Radiological Control Director has demonstrated he exercises independent judgment with regard to radiological decisions, lack of independence is not consistent with Radiological Control Manual expectations and lack of involvement by the Radiological Control Program Organization is a missed opportunity that could add significant value to the spill cleanup.

CH2M HILL management has been informed of this issue.

ORP TOD Closure Required:

OBSERVATION A-07-TOD-TANKFARM-004-O08:
The mock-up team did not ensure time keeping in support of radiological concerns, was exercised. (Smoot, September 14, 2007.)

Discussion:

During a pre-job briefing, the FWS stated that it was acceptable for personnel wearing plastic PPE to wear them for a maximum of 30 minutes. Implied in the FWS's statement was that this was also the method for controlling radiological exposure time. This concept of exposure control did not ensure that a task is performed within time constraints to keep dose ALARA. Of particular concern is the fact that the mock-up report stated observers could acquire an accumulated one Rem of exposure watching from outside the work area and observers should be moved to a location where they could watch via video. The draft ALARA Management Worksheet listed total observer dose as 137 mrem whole body. If dose rates in the general area are high enough to acquire one Rem of accumulated dose, then additional time keeping to complete tasks within a 30 minute period or less should have been considered. Additionally, the ALARA work sheet estimate of 137 mrem whole body dose for observers is not consistent with the statement that observers could acquire an accumulated one Rem of exposure.

CH2M HILL management has been informed of these issues; resolution is in progress.

ORP TOD Closure Required: **YES [ ]** **NO [X]**

OBSERVATION A-07-TOD-TANKFARM-004-O09:
Three Way Communications Improvement is marginal despite emphasis by CH2M HILL Management and ORP FRs. (Frink, October 22, 2007.)

Discussion:

During a review of the oversight documentation generated in support of the S-102 spill recovery, it was noted that 3-way communications has marginally improved despite repeated emphasis by ORP oversight and direct intervention by CH2M HILL management. In most cases, improvement is noted only when CH2M HILL management is directly involved in the enforcement of the use of 3-way communications. Additionally, during the CH2M HILL Safety Pause on July 19, 2007, several employees clearly did not have an appreciation for the importance of ensuring that accurate information is conveyed and how 3-way communications can promote conveyance of accurate information. It was also clear in the Safety Pause that several employees did not understand when it was most appropriate to use 3-way communication. Chapter 4 of the TFs Conduct of Operations Manual clearly specifies when the use of 3-way communication is appropriate. Chapter 4 states: "Three-way communication is expected for conveying plant status, configuration, changes, conducting operations and providing direction such as:

- Communicating emergency directions;
- Communicating operating instructions such as start-up and shutdown of equipment; and
- Reporting process parameters such as temperature, level, flow, and material balance discrepancy."

CH2M HILL management has been informed of this issue; resolution is in progress.

ORP TOD Closure Required: **YES [ ]** **NO [X]**

Conclusion:

During review of documents, field observations, meeting attendance, and discussions with CH2M HILL staff, the ORP staff found that CH2M HILL's conduct of operations, work planning, and radiological control practices have shown areas in which improvement has been achieved. There are, however, areas in which improvement is still warranted. CH2M HILL has been informed of the identified weaknesses and is evaluating the appropriate action to take.

No deficiencies were noted with respect to recovery actions associated with Engineering/SB and Event Investigation.

Despite the 5 Findings and 4 Observations, the assessment team concluded that CH2M HILL's recovery has been adequate.