



U.S. Department of Energy
Office of River Protection

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Richland, Washington 99352

FEB 01 2008

08-TED-007

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 – THE U.S. DEPARTMENT OF ENERGY, (DOE)
OFFICE OF RIVER PROTECTION (ORP) ASSESSMENT REPORT “ASSESSMENT OF
THE 242-A EVAPORATOR RECIRCULATION PUMP PB-1 INADVERTENT STARTUP,”
A-08-ASTM-TANKFARM-003

This letter transmits the results of ORP's, assessment of the 242-A Evaporator Recirculation Pump PB-1 Inadvertent Startup. The assessment was completed December 7, 2007.

The assessment resulted in one Concern, eight Findings and one Observation. The assessment team concluded that there are significant weaknesses in key aspects of the Conduct of Operations, electrical practices and procurement practices that directly lead to the inadvertent startup of the PB-1 pump.

Within 30 days of receipt of this letter you 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 the noncompliant conditions and the results achieved;
- The corrective actions that will be taken to identify the extent of condition, correct the causes, and prevent further findings; and
- The date when all corrective actions will be completed, verified, and compliance to applicable requirements achieved.

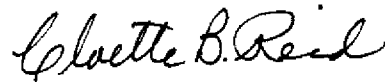
FEB 01 2008

Mr. John C. Fulton
08-TED-007

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If you have any questions, please contact me or your staff may contact Dennis H. Irby, Tank Farm Engineering Division, Assessment Team Lead, (509) 376-5652.

Sincerely,



Cloette B. Reid
Contracting Officer

TED:DHI

Attachment

cc w/attach:

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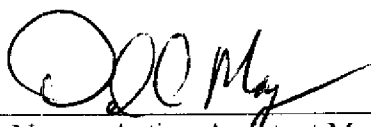
**U.S. Department of Energy
Office of River Protection**

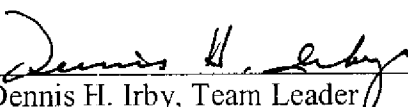
**Inadvertent Startup of the
242-A Evaporator Recirculation Pump PB-1 Assessment**

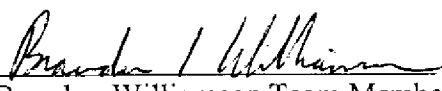
**Final Report
A-08-AMTF-TANKFARM-003**

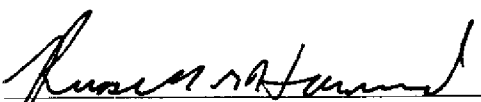
January 2008

Report Approval

Approved: 
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Tank Farm Project
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EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE), Office of River Protection conducted an assessment of the inadvertent startup of the 242-A Evaporator Recirculation Pump PB-1 from December 3 through December 7, 2007. The objectives of the assessment were to:

- Review Conduct of Work Controls, Maintenance, and Testing;
- Review Conduct of Electrical Practices; and
- Review Conduct of Procurement Practices.

Conclusion

The assessment team concluded that there are several weaknesses in key aspects of the Conduct of Operations, electrical practices and procurement practices related to the inadvertent startup of the PB-1 pump.

This assessment resulted in a Concern with four supporting Findings, four unrelated Findings and one Observation.

Concern

A-08-AMTF-TANKFARM-003-C01: The contractor's work planning and implementation process for hazard identification and mitigation did not provide adequate protection of workers and facility equipment prior to 242-A Evaporator Monitoring and Control System modifications.

Supporting Findings

A-08-AMTF-TANKFARM-003-F02: Tank Farm Contractor (TFC) procedures do not adequately implement the requirements of DOE Order 5480.19 Chapter 9, Lockouts and Tagouts, for protection of facility equipment.

A-08-AMTF-TANKFARM-003-F03: All sources of electricity to which employees were exposed were not de-energized in accordance with 29 Code of Federal Regulation 1910.333(a)(1) and National Fire Protection Association 70 E-2004 as required by the TFC Electrical Safety Standard TFC-ESHQ-S-STD-03.

A-08-AMTF-TANKFARM-003-F04: Contractor procedures do not ensure adequate compensatory measures are implemented when alarm or monitoring functions are disabled or secured.

A-08-AMTF-TANKFARM-003-F05: The discovery of damaged electrical items after receipt inspection did not result in any documented disposition action.

Findings

A-08-AMTF-TANKFARM-003-F06: The Job-Specific Safety Analysis did not specify the use of a hardhat as required Personal Protective Equipment in accordance with TFC procedures.

A-08-AMTF-TANKFARM-003-F07: The CH2M HILL Hanford Group, Inc. engineering organization's approval for the NovaTech subcontract was not found in the Passport System's electronic approvals as required by TFC-BSM-CP_CPR-C-05.

A-08-AMTF-TANKFARM-003-F08: Several of the Technical Evaluation forms for NovaTech proposals did not have the Quality Assurance signoff required by TFC-BSM-CP_CPR-C-05.

A-08-AMTF-TANKFARM-003-F09: An electrician did not have the minimum electrical safety training (First Aid).

Observation

A-08-AMTF-TANKFARM-003-O10: The Control and Use of Administrative Locks procedure (TFC-OPS-OPER-C-22) is inconsistent on expectations for which equipment should be in the program.

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1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Office of River Protection (ORP) conducted an assessment of the inadvertent startup of the 242-A Evaporator Recirculation Pump PB-1 from December 3 through December 7, 2007.

2.0 PURPOSE AND SCOPE

The objectives of the assessment were to:

- Review Conduct of Work Controls, Maintenance, and Testing;
- Review Conduct of Electrical Practices;
- Review Conduct of Procurement Practices.

3.0 APPROACH AND DELIVERABLES

The assessment team performed the review consistent with ORP M 220.1, "Integrated Assessment Program (DOE 2007)."

Major assessment activities consisted of:

- Preparation of the Assessment Checklists
- Selection of the Assessment Team;
- Pre-review activities;
- Entrance Meeting with the Tank Farm Contractor (TFC);
- Fieldwork activities;
- Development of the assessment results;
- Exit Meeting with the TFC; and
- Development of a final report, including a factual accuracy review by the TFC.

The ORP selected the assessment team based on technical expertise and experience. Appendix D provides the biographical summaries for each of the team members.

The assessment team conducted the entrance briefing on December 3, 2007. The assessment team performed fieldwork between December 3 through 7, 2007. Fieldwork consisted of TFC staff interviews and an inspection of the 242-A Evaporator Electrical cabinets and Motor Control Center (MCC)-3. Team members discussed assessment activities and results

periodically and communicated the issues to the TFC point-of-contact. Communication of program strengths, weaknesses, and TFC feedback related to requested information or resolution of issues occurred in real time. The assessment team held the exit briefing on January 3, 2008.

4.0 ASSESSMENT RESULTS

A summary of the results of the assessment, including observations, by assessment performance objective is provided below.

Concern

A-08-AMTF-TANKFARM-003-C01: The contractor's work planning and implementation process for hazard identification and mitigation did not provide adequate protection of workers and facility equipment prior to 242-A Evaporator Monitoring and Control System (MCS) modifications.

Supporting Finding Two

A-08-AMTF-TANKFARM-003-F02: TFC procedures do not adequately implement the requirements of DOE Order 5480.19 Chapter 9, Lockouts and Tagouts, for protection of facility equipment.

Requirements

DOE Order 5480.19, *Conduct of Operations*, Chapter 9, *Lockouts and Tagouts* states that, "The purpose of this chapter is to provide a method for equipment status control through component Tagging or Locking which should protect personnel from injury, **protect equipment from damage**, maintain operability of plant system, and maintain the integrity of the physical boundaries of plant systems."

Discussion

For the workscope of WFO-WO-07-1857, there was no clear procedural driver to consider hazards to plant equipment, and controls for protecting that equipment from damage.

Per the Conduct of Operations Implementation Plan, DOE Order 5480.19 is implemented by the following procedures:

TFC-OPS-OPER-C-05, *Lockout/Tagout Program (LOTO)* This procedure is a lifesaving measure for the control of the *unexpected release* of hazardous energy or materials. This procedure does not apply to administrative locks.

TFC-OPS-OPER-C-22, *Control and Use of Administrative Locks*, states that the purpose of administrative locks is to "...control facility configuration and prevent inadvertent equipment starts..."

The administrative lock program and the LOTO program are separate programs with different purposes. While the LOTO program controls configuration to prevent personnel injury, the administrative lock program controls configuration for other reasons. Administrative locks do not require a safe condition check, and locks from the administrative lock program shall not be used to meet any LOTO program requirements.

TFC-OPS-OPER-C-39, *Caution Tags*, states that "Caution tags are used only to prevent damage to or when directed by facility management for administrative reasons."

While either the *Control and Use of Administrative Locks* or *Caution Tags* procedures could have been applied in this case to open the MCC-3 main breaker prior to the work, neither were. These procedures are set up to dictate how a lock or tag should be applied and controlled once a need for one is identified, but they do not cover how the need to hang one is determined. The *LOTO* (i.e. hazardous energy control for worker safety) is specifically identified as a possible control in the Worksite Job Hazards Analysis (JHA) process, while the *Control and Use of Administrative Locks* or *Caution Tags* procedures are not.

The following procedures cover periodic inspection of procedure compliance, the notification of personnel for LOTO removal, and ensuring continuity through shift changes:

TFC-ESHQ-AP-C-01, "Management Assessment Program";
TFC-OPS-OPER-C-07, "Turnover of Shift Responsibility";
TFC-OPS-MAINT-C-01, "Tank Farm Contractor Work Control";
TFC-OPS-MAINT-C-02, "Pre-Job Brief"; and
ATS-310, Section 11.12, "Shift Turnover and Minimum Staffing Guideline for 222-S Laboratory Complex".

The Work Control Process laid out in **TFC-OPS-MAINT-C-01**, *Tank Farm Contractor Work Control*, calls for using the Worksite JHA process as the means of determining hazards of the job. This process includes numerous hazards to consider and points to possible controls for those hazards, however, the hazards are geared towards worker safety and do not directly consider potential hazards to the plant equipment. The contractor should evaluate the need for a higher level methodology that determines how specific types of tags are to be hung for specific jobs, keeping in mind the need to protect equipment as well as workers.

At the work performance level, there is a requirement for the Operations Engineer (OE) to fill out the Work release Checklist for OE's (A-6003-677), which includes a step to check, "Is configuration of equipment and systems properly identified for safe operation while work is

being performed,” but this broad statement is not geared towards protecting plant equipment from damage.

The issues discussed above are common to most work planning activities at the Tank Farms and are not considered to be specific to this particular work package.

Supporting Finding Three

A-08-AMTF-TANKFARM-003-F03: All sources of electricity to which employees were exposed were not de-energized in accordance with 29 Code of Federal Regulations (CFR) 1910.333(a)(1) and National Fire Protection Association (NFPA) 70 E-2004 as required by the TFC Electrical Safety Standard TFC-ESHQ-S-STD-03.

Requirements

Occupational Safety & Health Administration (OSHA) Standards for General Industry, 29 CFR 1910, Subpart S Electrical, Section 333, Selection and use of work practices.

1910.333(a)(1) De-energized Parts

Live parts to which an employee may be exposed shall be de-energized before the employee works on or near them, unless the employer can demonstrate that de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.

National Fire Protection Association (NFPA) Standard for Electrical Safety in the Workplace 70E, 2004 Edition, Articles 110.8(A)(1), 120.1 and 130.1.

Article 110.8(A)(1) Live Parts—Safe Work Condition

Live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them, unless work on energized components can be justified according to 130.1.

Article 130.1 Justification for Work.

Live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them, unless the employer can demonstrate that de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations. Energized parts that operate at less than 50 volts to ground shall not be required to be de-energized if there will be no increased exposure to electrical burns or to explosion due to electric arcs.

Article 120.1 Process of Achieving an Electrically Safe Work Condition.

An electrically safe work condition shall be achieved when performed in accordance with the procedures of 120.2 and verified by the following process:

- (1) Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.
- (2) After properly interrupting the load current, open the disconnecting device(s) for each source.
- (3) Wherever possible, visually verify that all blades of the disconnecting devices are fully open or that drawout type circuit breakers are withdrawn to the fully disconnected position.
- (4) Apply lockout/tagout devices in accordance with a documented and established policy.
- (5) Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the voltage detector is operating satisfactorily.
- (6) Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being de-energized could contact other exposed energized conductors or circuit parts, apply ground connecting devices rated for the available fault duty.

CH2M HILL Hanford Group, Inc. (CH2M HILL) Electrical Safety, TFC-ESHQ-S-STD-03, Revision B-8:

Live parts to which an employee may be exposed shall be put into an electrically safe work condition before an employee works on or near them (within the limited approach boundary), unless work on energized components can be justified in accordance with Article 130.1 of NFPA70E-2004 and 29 CFR 1910.303 and 333.

Discussion

The OSHA Standard (1910.333(a)(1)) allows for work on (energized) live parts based on one of two criteria:

- The introduction of hazards, additional or increased, or
- infeasibility due to equipment design or operational limitations.

According to the OSHA requirement, it is the responsibility of the employer to demonstrate either of the criteria have been met before the requirement to de-energize live parts is removed.

In this case, such a demonstration was not presented to the assessor for consideration. There were no design features or operational limitations presented to the assessor which prevented the de-energizing of the live parts, so that criterion was not met. The requirement to de-energize the live parts was still in force and was not negated by the practice of applying an electrically rated plastic shield in the panel. If the live parts had been de-energized by opening the breaker at MCC-3, it would have provided OSHA-compliant worker protection and it would have prevented the inadvertent startup of the PB-1 pump when the failed circuit board containing the failed relay was inserted.

NFPA70E, Article 110.8 requires live parts (50 volts or higher) to which an employee might be exposed shall be put into an electrically safe work condition before working on or near them. The electrically safe work condition exists when the conductor or circuit part to be worked on or near has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary.

Electricians performed a zero energy check prior to the installation of relay cards in the Multiplexer (MUX) Power Center Multiplexer (PCM 4) cabinet. Work was stopped when 120 Volts Alternating Current (VAC) was found on terminals 14 and 15 (marked PB-1) and two contractor safety personnel were called in to evaluate the situation. The decision by the contractor was to use voltage rated plastic to cover the terminals thus electrically isolating the electricians from the terminal boards including the PB-1 terminals that still had voltage present. Work was resumed after installation of the plastic and the relay boards were installed per the work plan.

The contractor did not follow the requirements of NFPA70E that requires live parts to be put into a safe work condition, i.e., de-energized whenever possible. NFPA70E, Article 130.1 allows work to be done on or near live circuits only when de-energizing the equipment introduces additional or increased hazards or is infeasible due to equipment design or operational limitations. No additional or increased hazards to personnel or facility could have occurred by isolating the power to the PB-1 terminals and isolating the PB-1 circuit would not have affected vital facility operations.

The contractor elected to use voltage rated plastic to isolate live parts instead of using the available drawing (H-2-99085) to trace out the circuit and isolate the circuit. Problem Evaluation Request (PER) CH2M-PER-2007-2034 shows safety personnel and management incorrectly concluded that the terminals were the only energized parts that workers needed protection from and that shielding the terminals using voltage rated plastic would adequately protect the workers. The workers who were changing out the Termination Panel (relay board) had the potential of being exposed to 120 VAC from the PB-1 circuit as the Molex connectors that connected the Termination Panel to the PB-1 circuit were not designed for connecting energized leads and the potential for shock existed. By regulation and the TFC's own procedure, deciding to work on or near live parts is the last resort after all other opportunities for establishing a safe work condition by de-energizing have been exhausted. The contractor's

decision to work on or near the live parts increased the workers chance for injury and electrocution, and significantly increased the risk of equipment damage.

Supporting Finding Four

A-08-AMTF-TANKFARM-003-F04: Contractor procedures do not ensure adequate compensatory measures are implemented when alarm or monitoring functions are disabled or secured.

Requirements

DOE Order 5480.19, Chapter 8 *Control of Equipment and System Status*, subsection 8 *Alarm Status* requires that “appropriate actions be taken to monitor equipment parameters for abnormal conditions that would be masked by deficient or non-reflashing alarms.”

Discussion

The 242-A MCS provides the operator with evaporator monitoring, control, and alarm capabilities. When this system is down, the alarms that would normally be displayed on the terminal screens and the alarm printer are disabled, as are the software interlocks built into the system. For instance, alarms would show on the MCS if either seal water flow is not within parameters or the evaporator vessel level is below the minimum level required to run the pump. These alarms are also interlocked to shutdown the PB-1 pump when proper conditions are not satisfied. Neither the interlock, nor the alarm were operable during the MCS outage.

While routine 242-A Evaporator Backside Rounds do contain a visual check of the pump room through the window, this check was not designed for, nor did it prove adequate, to provide timely indication that the PB-1 pump was running. The only temporary round established during the MCS outage was for temperature monitoring because the heating system was out of service (a separate and unrelated activity). No evidence was provided seemed to indicate that a careful consideration of alternate monitoring of the parameters whose alarms were masked by an MCS outage had been performed. Had a careful consideration of alternate alarm and status monitoring been performed (considering a time to damage of the pump seals given at 20-30 seconds without seal water), a prudent action would have been to open the power supply to the pump at MCC-3. Although the procedures identified in the Conduct of Operations Applicability Matrix (TFC-PLN-05) as the implementing procedures for DOE Order 5480.19 chapter 8 section c.8 cover logging of inhibited alarms, they do not address the need to perform alternate monitoring of masked alarms.

Supporting Finding Five

A-08-AMTF-TANKFARM-003-F05: The discovery of damaged electrical items after receipt inspection did not result in any documented disposition action.

Requirement

The TFC *Quality Assurance Program Description*, TFC-PLN-02, Chapter 15, Control of Nonconforming Items, states “Items that do not conform to specified requirements shall be controlled to prevent inadvertent installation or use of the item. Controls shall provide for identification, documentation, evaluation, segregation when practical, and disposition of nonconforming items, and for notification to relevant organizations.”

Documentation of a nonconformance is required when an item:

- Fails to meet required technical or quality requirements;
- Is of indeterminate quality;
- Is a suspect/counterfeit item.

Discussion

Hardware items purchased from NovaTech, the vendor of all services and hardware for the MCS Upgrade Project, under Subcontract 30358 passed receipt inspection on September 6, 2007. At that time, all items except some back ordered cables, were approved per the CH2M HILL Quality Assurance Inspection Plan for 242-A Evaporator MCS Upgrades. When the items arrived at the evaporator project site, some damage to part of the shipment was identified and photographs were taken. One of the electrical cabinets, which had power supplies mounted on the internal rack, had apparently been dropped and the tabs supporting the power supplies were bent. The drop had been severe enough to deform the tabs and tear through the bolt holes at the top of the tab. The relays intended for installation in the MCS upgrade were also part of this same shipment. Since a Nonconformance Report (NCR) documenting the shipment damage was not generated as required by the TFC Quality Assurance Program Description, use of any part of the damaged shipment constituted an unauthorized disposition of “use as is” and negated any investigation of potential damage to the relays in the MUX cabinet. If an NCR had been issued against the damaged shipment, it is possible that the relays may have been inspected again and not been placed into the MUX cabinet in the wrong (closed) position.

Findings Not Related to the Concern

A-08-AMTF-TANKFARM-003-F06: The Job-Specific Safety Analysis (JSA) did not specify the use of a hardhat as required Personal Protective Equipment (PPE) in accordance with TFC procedures.

Requirements

Job-Specific Safety Analysis (K-2 JSA) For RPP, Project WFO-WO-07-1857, dated September 4, 2007. The JSA shows electrical shock as a hazard.

CH2M HILL Personal Protective Equipment, TFC-ESHQ-S_IS-C-02, Rev. B-10, dated September 13, 2007, Section 3.1. Protection is required where there is a potential danger of head injury due to the hazards of falling or flying objects, electrical shock, or burns.

CH2M HILL Job Hazard Analysis, TFC-ESHQ-S_SAF-C-02, Rev. D-2, dated December 6, 2007, Section 4.1, Paragraph 2. Controls within the qualification or training of the worker but are seldom used, and are applicable to the entire work activity, should be placed in the precautions as a reminder that the hazard exists and the workers are expected to take the appropriate actions.

CH2M HILL Electrical Safety, TFC-ESHQ-S-STD-03, Rev. B-8, dated October 15, 2007, Section 3.10, Paragraph 1. A shock hazard analysis and an arc flash hazard analysis shall be completed and documented, in the work package, to identify hazards and determine appropriate safe work practices, protective clothing, and electrical PPE to be used before any person approaches exposed live parts within the limited approach boundary or the flash protection boundary.

CH2M HILL Electrical Safety, TFC-ESHQ-S-STD-03, Rev. B-8, dated October 15, 2007, Section 3.10, Paragraph 6. Work performed on energized electrical circuits, or near exposed live parts shall be performed by qualified personnel using appropriate PPE. Unqualified personnel can only approach when the conductor/equipment is in a safe to work condition.

Occupational Safety & Health Administration (OSHA) 29 CFR 1910.135(a)(2). The employer shall ensure that a protective helmet designed to reduce electrical shock hazard is worn by each such affected employee when near exposed electrical conductors which could contact the head.

National Fire Protection Association (NFPA) Standard for Electrical Safety in the Workplace 70E, 2004 Edition, Article 130.7(C)(3). Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with live parts or from flying objects resulting from electrical explosion. Employees shall wear nonconductive protective equipment for the face, neck, and chin whenever there is a danger of injury from exposure to electric arcs or flashes or from flying objects resulting from electrical explosion.

Discussion

The Finding discussed here is for tracking purposes and is considered closed and no further action is required.

The JSA did not specify the use of a hardhat as required PPE in accordance with TFC procedures. A pre-job briefing was performed on December 4, 2007 for the electricians performing Work Package WFO-WO-07-1857, Revision 1, to evaluate the relays in the MUX cabinet by voltage testing of energized parts. The fieldwork supervisor did not discuss the use of hardhats as required PPE and told the DOE assessor that hardhats are not used while working in the cabinets. The TFC industrial safety engineer and the project safety engineer were called to

the meeting and the project safety engineer added a pen and ink change to the JSA that required hardhats to be worn if work is to be performed on 240 VAC systems or less and the hot work is above the waist.

The JSA shows electrical shock to be the hazard present during the work and the JSA did not have any discussion on the use of head protection while working near exposed conductors. In developing the JSA, a review of the work package and a walk down would show that the electrician's head could come in close proximity to energized terminals (120 VAC). A shock hazard analysis as required by the TFC Electrical Safety Procedure should have also revealed the need for head protection. The TFC PPE procedure, OSHA and NFPA 70E requirements state a protective helmet designed to reduce electrical shock hazard shall be worn by employees when near exposed electrical conductors which could contact the head. The JHA Procedure states that controls within the qualification or training of the worker but are seldom used, and are applicable to the entire work activity, should be placed in the precautions as a reminder that the hazard exists and the workers are expected to take the appropriate actions. The electrician performing the work package was wearing the hardhat and his head at times was well within the cabinet while he was performing voltage tests on 120 VAC circuits.

The requirements of the TFC JHA Procedure were not followed in adding the hardhat PPE requirement that is seldom used but necessary for this work activity into the JSA. This was corrected as a result of discussions between the DOE assessor and TFC Project Safety Engineer by a pen and ink change to the JSA. By having the hardhat requirement in the JSA, the work crew is reminded of the additional risks involved with the energized circuits and allows the Field Work Supervisor to make a final determination to wear hardhats if there was a risk of an electrician's head coming into contact with an energized circuit.

A-08-AMTF-TANKFARM-003-F07: The CH2M HILL engineering organization's approval for the NovaTech subcontract was not found in the Passport System's electronic approvals as required by TFC-BSM-CP_CPR-C-05.

Requirement

The TFC procedure, *Procurement of Services*, TFC-BSM-CP_CPR-C-05, Rev G-2, Section 4.2.22, states "identify the required approvals on the Contract Requisition in accordance with Attachment C, and imbed the Determination of Required Approvals form in the PassPort Comm Log of the Contract Requisition."

Discussion

In the TFC procedure in effect at the time of the NovaTech subcontract execution, Rev G-2, Appendix C, step 3 states "*ALL contract requisitions and Contract Change Requests (CCRs) that involve Engineering Services must be approved by an Engineering Director or approved delegate.*" When the assessor reviewed the electronic approvals logged in the PassPort system, there were no approvals by engineering. TFC Procurement staff agreed that Engineering should

have been identified at the beginning of the process as one of the approvers in the PassPort system. They then produced a record of e-mail messages related to the succession of approvals of changes to the NovaTech subcontract. A review of the informal approval records, e-mails from Procurement to Engineering and e-mails from Engineering to Procurement, provided evidence that engineering had been involved in the review and approval of NovaTech proposals that resulted in subsequent contract changes.

A-08-AMTF-TANKFARM-003-F08: Several of the Technical Evaluation forms for NovaTech proposals did not have the Quality Assurance (QA) signoff required by TFC-BSM-CP_CPR-C-03.

Requirement

TFC procedure, Buyer's Technical Representative (BTR) Process, TFC-BSM-CP_CPR-C-03, section 4.3 Subcontract Preparation, directs the BTR to perform a technical evaluation of the proposal using one of the following three forms, as appropriate:

- Technical Evaluation (<\$550K),
Site Form A-6003-503
- Technical Evaluation (Competitive),
Site Form A-6003-504
- Technical Evaluation (Over \$550K),
Site Form A-6003-510

Discussion

Several examples of Technical Evaluation forms (A-6003-503) were reviewed that did not include a sign off from the QA Evaluator, even though the form identifies such a sign off is required for procurements of Quality Level 1-3. This procurement is Quality Level 3 and therefore all Technical Evaluations for this procurement require the QA Evaluator sign off.

A-08-AMTF-TANKFARM-003-F09: An electrician did not have the minimum electrical safety training (First Aid).

Requirement

CH2M HILL Electrical Safety, TFC-ESHQ-S-STD-03, Rev. B-8, dated October 15, 2007, Section 3.2, Paragraph 2. Electrical workers (electricians) shall attend First Aid training. This training shall be repeated at intervals not to exceed two years.

National Fire Protection Association (NFPA) Standard for Electrical Safety In the Workplace 70E, 2004 Edition, Article 110.6 (C). Employees working on or near exposed energized

electrical conductors or circuit parts shall be trained in methods of release of victims from contact with exposed energized conductors or circuit parts. Employees shall be regularly instructed in methods of first aid and emergency procedures, such as approved methods of resuscitation, if their duties warrant such training.

Discussion:

Work was being performed by an electrician without the required first aid training as required by the contractor's Electrical Safety Standard and NFPA70E. One of the assessment team members discovered looking at the electrician's Integrated Training Electronic Matrix that an electrician was performing work on the WFO-WO-07-1857 work package without having current first aid training. The contractor's Electrical Safety Standard and NFPA70E both require recurrent training in first aid and the TFC has established a 2-year retraining requirement. The contractor removed the electrician from the job and issued Problem Evaluation Request CH2M-PER-2007-2200. The PER recommended corrective actions were to verify first aid training for electricians, however, the required Hanford General Employee Training and worker lock and tag training should also be verified by the contractor for each electrician to meet the requirements of the Electrical Safety Standard Section 3.2.

Observation

A-08-AMTF-TANKFARM-003-O10: The Control and Use of Administrative Locks procedure (TFC-OPS-OPER-C-22) is inconsistent on expectations for which equipment should be in the program.

Discussion

Section 4.1 of the procedure directs the listing of all equipment in the administrative lock program, but in the same section directs removal of equipment from the list when the equipment is no longer required by the Authorization Basis (AB) to be controlled under this program. The inconsistency is that not all administrative locks are installed for AB reasons, yet the procedure would have them listed, then immediately removed, because they are not required by the AB.

5.0 CONCLUSIONS

The assessment team concluded that there are several significant weaknesses in key aspects of the Conduct of Operations, electrical practices and procurement practices that contributed to the inadvertent startup of the PB-1 pump. The contractor needs to evaluate the adequacy of procedures that implement the requirements of DOE Order 5480.19, Conduct of Operations, to protect equipment and facilities from damage, as well as protect the personal safety of workers. The procedures that establish the control of interfaces between operating facilities and modification or construction projects conducted in those operating facilities need to be re-evaluated as well. The training, understanding and implementing of the electrical safety

requirements of OSHA and NFPA need to be evaluated and enhanced. The understanding of the requirements for Nonconformance Reporting needs to be enhanced for facility and project staff.

6.0 REFERENCES

DOE 2006 - ORP M 220.1, *Integrated Assessment Program*, Revision 5, September 2007, U.S. Department of Energy, Office of River Protection, Richland, Washington.

Specific references and personnel contacted for each assessment performance objective are listed in Appendixes B and C.

APPENDIX A

242-A ASSESSMENT CHECKLISTS

WORK CONTROLS, MAINTENANCE, AND TESTING

Do the work request forms (work package) for facilities provide procedures and guidance for performing the work and allow documentation for:

- Description of symptom, problem, or work requested and the responsible person identifying them? YES NO NA
- Identification of crafts required? YES NO NA
- Dating of document package? YES NO NA
- Job priority? YES NO NA
- Personnel safety? YES NO NA

The workscope of MUX cabinet modifications was done under the TFC's Lockout/Tagout program as described in TFC-OPS-OPER-C-05.

- Identification of special process requirements (such as special work permits, special work instructions, special training, and personnel qualification requirements)? YES NO NA

See above

- Work instructions, hold-points to allow inspections, special requirements, use of special materials or tools, test instrument ranges, accuracy, and cleanup requirements? YES NO NA
- Required post maintenance testing, inspections, and acceptance criteria? YES NO NA
- Work supervisor or appropriate person in charge? YES NO NA
- Applicable operating and maintenance procedures? YES NO NA

The workscope was done under a work package (WFO-WO-07-1857).

- Description of work performed, as-found conditions, repairs made, cause-of-failure evaluations, identification of special tools and parts, calibration data, set points, adjustments made, and as-left conditions? YES NO NA

The workscope was done under a work package (WFO-WO-07-1857).

- Are the following items considered when assigning priorities: personnel safety; equipment repair urgency/limiting conditions of operations; operability of redundant equipment; critical path equipment; facility conditions required for equipment repair; repair or replacement parts status; and personnel availability? YES NO NA

See write-up for **A-08-AMTF-TANKFARM-003-F02**: TFC procedures do not adequately implement the requirements of DOE Order 5480.19 Chapter 9, Lockouts and Tagouts, for protection of facility equipment.

- Are preventive maintenance and surveillance priorities established commensurate with personnel and facility safety, environmental protection, programmatic consideration, and value? YES NO NA

See write-up for **A-08-AMTF-TANKFARM-003-F05**: Contractor procedures do not ensure adequate compensatory measures are implemented when alarm or monitoring functions are disabled or secured.

Maintenance procedures and other work-related documents (e.g., drawings and instructions) are used to provide appropriate work direction and to ensure that maintenance is performed safely and efficiently.

- Are compliance requirements for a given procedure clearly stated in the procedure or in other overall guidance and thoroughly communicated to each craftsman? (The normal two levels of compliance are: step-by-step compliance without deviation; or general intent compliance.) YES NO NA
- Are procedures and other work-related documents (such as vendor manuals, drawings, reference materials, and posted job performance aids) used in support of maintenance and are they technically accurate and up to date? YES NO NA
- Are maintenance procedures established and utilized as necessary for the conduct of maintenance activities commensurate with the activity's importance to safety and security? YES NO NA
- Are new and revised procedures reviewed or verified for technical accuracy prior to use and checked or validated to ensure usability and correctness prior to or during initial use? (Validation is done in a shop or training environment on a mockup or simulator or by the craftsperson and supervisor during the first use of the procedure.) YES NO NA
- Are procedures clear, concise, and do they contain adequate information for users to understand and perform their activities effectively? YES NO NA

See write-up for A-08-AMTF-TANKFARM-003-O10: The *Control and Use of Administrative Locks* procedure (TFC-OPS-OPER-C-22) is inconsistent on expectations for which equipment should be in the program.

- Are technical details such as setpoints, control logic, and equipment numbers consistent among procedures, drawings, and system descriptions? ___ YES ___ NO
___ x ___ NA
- Are cautions, warnings, and hold-points (such as quality checks) included in the procedures, as needed? ___ YES ___ NO ___ x ___ NA
- When there is the potential for equipment damage or injury during equipment operations, servicing, maintenance, or modification activities due to inadvertent activation of equipment, does the facility lockout/tagout program protect personnel from injury, protect equipment from damage, maintain the operability of plant systems, and maintain the integrity of the physical boundaries of plant systems? ___ YES ___ x ___ NO ___ NA

See write-up for **A-08-AMTF-TANKFARM-003-F02**: TFC procedures do not adequately implement the requirements of DOE Order 5480.19 Chapter 9, Lockouts and Tagouts, for protection of facility equipment.

- Does the independent verification program ensure correct facility operation and the correct position of components such as valves, switches, and circuit breakers?
___ YES ___ NO ___ x ___ NA
- Are temporary changes to procedures, if used, controlled through appropriate review and authorization prior to use and do they ensure user awareness of applicable temporary changes? ___ YES ___ NO ___ x ___ NA
- Do the maintenance procedures provide systematic guidance to craftsmen; are they technically correct, complete, and up to date; and are they presented utilizing sound human factors principles? ___ YES ___ NO ___ x ___ NA

An equipment repair history and vendor information program is established and maintained to provide historical information for maintenance planning and to support the maintenance and performance trending analysis of facility systems and components.

- Does the maintenance history program define what data are to be collected, how the data are to be recorded, and how the data are to be used? ___ YES ___ NO ___ x ___ NA

- Are maintenance history records maintained for systems, equipment, and components that affect safe and reliable facility operations or that could improve productivity and result in cost savings? ___ YES ___ NO NA
- Do equipment maintenance and repair history files contain items such as the following:
equipment and component identification,
maintenance records,
diagnostic monitoring data,
vendor information (or a reference to this information),
corrective and preventive maintenance or modification information, and
spare parts information? ___ YES ___ NO NA
- Is the maintenance record a chronological list of all maintenance repair work and materials expended on a piece of equipment or component? ___ YES ___ NO NA
- Is equipment repair history data used for such activities as failure analysis, conduct of maintenance assessments, preventive maintenance, outage planning, budget preparation, reviews of DOE-wide experience, and plant life extension? ___ YES ___ NO NA
- Is vendor information that is obtained from suppliers controlled and indexed for ready retrieval? ___ YES ___ NO NA
- Are personnel using vendor manuals provided with technically adequate documents that can be relied on to provide the best available information? ___ YES ___ NO NA
- Is there a controlled vendor manual or information issuance program consisting of a controlled master set and verified satellite copies available for checkout? ___ YES ___ NO NA

Supervisory positions have and use a turnover checklist in the turnover process that is designed to transfer vital information that may impact safety, system status, events, and the like.

- Do oncoming operators and supervisors review documents specified on their checklists and ask pertinent questions prior to assuming responsibility for their shift position? ___ YES ___ NO NA
- Do off-going supervisors or operators explain all items noted on the turnover checklist to oncoming operators? ___ YES ___ NO NA
- Is a crew briefing conducted by the operations supervisor as required after he/she has accepted responsibility for the shift, including a review of status, problems with

equipment, and evolutions in progress or planned during the shift? ___ YES ___ NO
___ x ___ NA

- Do reliefs occurring during the shift (e.g., exchange of control supervisory function) have a turnover to ensure that the oncoming person is at least as knowledgeable of the conditions as he/she would have been had a complete shift turnover process been conducted? ___ YES ___ NO ___ x ___ NA

- Do operators know the current status of the facility and systems? ___ YES ___ NO
___ x ___ NA

- Do operators understand the requirements for changing system and facility status?
___ YES ___ NO ___ x ___ NA

PROCUREMENT

The objective of this element is to evaluate the effectiveness of the contractor's procurement program. The assessor evaluates the preparation of procurement documents, qualification of bidders, receipt inspection of purchased equipment, and maintenance of vendor performance history. The assessor completes the following activities in performing this assessment:

- Review procurement documents that have been prepared and issued to vendors for bids, or to procure components or materials that may be used in safety related or important-to-safety applications.
- Review records associated with receipt inspection or acceptance testing conducted for materials that may be used in safety-related or important-to-safety applications.
- Review procurement documents and procedures that ensure that approved suppliers continue to provide acceptable items and services.
- Do purchased major electrical systems and equipment include provisions for isolation, to permit disconnection for maintainability? ___ X ___ YES ___ NO ___ NA

Procurement of Items (Materials), TFC-BSM-CP_CPR-C-06, Rev G-1, September 27, 2007

- Are all phases of receiving, inspecting, handling, storing, retrieving, and issuing of equipment, parts, and materials covered by effectively implemented policies and procedures from the time an item is received until it is installed at the facility?
___ X ___ YES ___ NO ___ NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

- Have policies and procedures been prepared to specifically describe the responsibilities and techniques for receiving, inspecting, handling, storing, retrieving, and issuing equipment, parts, and materials? YES NO NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007, Section 4.2.2 requires inspection and verification to ensure no apparent damage to material received. This was not done for this MCS Upgrade shipment.

- Are procedures/instructions available for items requiring special handling? YES NO NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

- Are maintenance materials stored, protected, and identified in a manner that provides ready availability for their intended use? YES NO NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

- Is a shelf-life control program provided for store items that are important to safe and reliable facility operation? YES NO NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

- Are safety-related and non-safety-related materials and equipment segregated from each other to prevent inadvertent use of the wrong category of item? YES NO NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

- Are periodic inspections of staging areas, stores, and warehouses performed? YES NO NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

- Is the quality of stored equipment, parts, and materials maintained in accordance with vendor information by appropriate means, such as environmental and shelf-life controls and preventive maintenance activities, where necessary? YES NO NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

- Are critical parts readily traceable from purchase to installation? YES NO NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

- Have procedures, including such items as weight, size, chemical reactivity, radioactivity, lifting instructions, and susceptibility to physical shock, damage, or electrostatic sensitivity, been prepared for items requiring special handling instructions? YES NO NA

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

ELECTRICAL PRACTICES

The objective of the electrical safety program is to ensure that electrical safety requirements necessary for safeguarding of personnel are being adequately implemented. Safe work procedures include training of qualified and unqualified personnel, analyzing the hazards and controlling the hazards (i.e. lockout/tagout of energy sources). Safety measures shall protect personnel against both direct and indirect exposure to energized components as required by NFPA70E, 29 CFR 1910 Subpart S, DOE Electrical Safety Handbook (DOE-HDBK-1092-2004) and CH2M HILL Electrical Safety Standard TFC-ESHQ-S-STD-03. In addition, only qualified persons who are capable of working safely on energized circuits and are familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding material, and insulated tools may work on energized equipment.

All equipment installed shall be approved by the TFC Authority Having Jurisdiction (AHJ) and determined to be safe by an OSHA recognized nationally recognized testing laboratory (NRTL) or found to be acceptable in accordance with the guidelines established by the AHJ. National Electrical Code (NEC) inspections are required for all new electrical installations and modifications to existing electrical installations covered by the most current edition of the NEC.

- Do the procedures include provisions to ensure that contractors are aware of their responsibilities in electrical safety? YES NO NA

The contractor's electrical safety procedure does not include OSHA requirements for PPE requirements for potential shock to the head.

- Does the contractor allow only qualified personnel to work on energized circuits?
 YES NO NA

One electrician did not have the required training in first aid.

- Does the training program cover the requirements of 10 CFR 1910 Subpart S?
 YES NO NA
- Are qualified and nonqualified personnel trained in areas that are not covered by 10 CFR 1910 Subpart S but that are necessary for their safety? YES NO NA
- Are qualified personnel trained to recognize exposed live parts; determine nominal voltage of exposed live parts; understand the requirements for clearance distances and the corresponding voltages to which a person may be exposed? YES NO NA
- Have all employees performing electrical work attend electrical safety training, commensurate to their exposure to electrical hazards as defined in CH2M HILL, Electrical Safety Standard, TFC-ESHQ-S-STD-03? YES NO NA

One electrician did not have the required training in first aid.

- Have all employees that work on de-energized electrical components being controlled by a lockout/tagout been trained as an authorized worker in accordance with the CH2M HILL, Lockout/Tagout Program, TFC-OPS-OPER-C-05? YES NO NA
- Have the first line managers, field work supervisors, and persons-in-charge (PICs) received the same level of electrical safety training as the workers for whom they supervise?
 YES NO NA
- Is the training appropriate for the level of responsibility of the individual?
 YES NO NA
- Does the contractor have a lockout/tagout program that includes electrical safety?
 YES NO NA
- Are live parts to which an employee might be exposed put into an electrically safe work condition before the employee works on or near them? YES NO NA

See Findings.

- Are lockout/tagout devices applied prior to working on or near exposed electrical conductors and circuit parts operating at 50 volts or more? ___ YES ___ X ___ NO ___ NA

See Findings.

- Are only qualified persons permitted to work on electrical conductors or circuit parts that have not been put into an electrically safe work condition? ___ YES ___ X ___ NO ___ NA

One electrician did not have the required training in first aid.

- Had a pre-job briefing been conducted in accordance with CH2M HILL, Pre-Job Briefing, TFC-OPS-MAINT-C-02 before starting the electrical work? ___ YES ___ X ___ NO ___ NA

Failed to discuss hardhat requirements.

- Has all of the electrical equipment installed or used by the TFC been approved by the AHJ and determined to be safe by an OSHA recognized NRTL or found to be acceptable in accordance with the guidelines established by the AHJ? ___ YES ___ NO ___ X ___ NA
- Has a NEC inspection been performed for all new electrical installations and modifications to existing electrical installations? ___ YES ___ NO ___ X ___ NA

APPENDIX B

RECORDS REVIEWED

RECORDS REVIEWED

242-A Evaporator Upgrades – Project Execution Plan, RPP-PLAN-33477, Rev 0.

242-A MCS PLC Upgrade Construction Test Procedure, RPP-PLAN-35052, Rev 0
Buyer's Technical Representative Process, TFC-BSM-CP_C-03, Rev C-1, February 19, 2006.

Caution Tags, TFC- OPS-OPER-C-39, Rev A, March 31, 2005.

Certificate of Registration, *NovaTech Process Solutions, LLC, ISO 9001:2000*, Underwriters Laboratories, Inc. May 8, 2003.

CH2M HILL Hanford Group Technical Evaluation, Contract Release 30358, August 30, 2006.

CH2M HILL Hanford Group Technical Evaluation, Contract Release 30358-0, December 4, 2006.

CH2M HILL Hanford Group Technical Evaluation, Contract Release 30358-6, March 14, 2007.

CH2M HILL Interoffice Memo, *Waste Feed Operations Electrical Distribution System Short Circuit Current Calculations Supporting Arc Flash Personal Protective Equipment Selection*, 7G120-03-TCO-002, dated August 7, 2003.

CH2M HILL Pre-Job Briefing, TFC-OPS-MAINT-C-02, Rev. C, dated October 27, 2006.

CH2M HILL Quality Assurance Inspection Plan, *242-A MCS Upgrade*, Subcontract 30358 Release 6, September 6, 2007.

Commissioning of Electrical Systems for Command, Control, Communications, Computer, Intelligence, Surveillance and Reconnaissance Facilities, Department of the Army, TM 5-694, dated February 2006.

Component Status Seals/Administrative Locks, WMP-242, Rev 2a, April 30, 2004.
Control and Use of Administrative Locks, TFC-OPS-OPER-C-22, Rev B-1, September 20, 2007.

Control of Inspections, TFC-ESHQ-Q_INSP-C-01, Rev B-2, May 23, 2007.

De-Energize and Re-Energize MCC-1, MCC-2, and MCC-3 at the 242-A Evaporator, TO-600-540, Rev G-3, December 31, 2003.

Digital Output Relay Testing on the CH2M HILL Hanford D/3 Evaporator System Upgrade, November 15, 2007, NovaTech.

DOE Electrical Safety Handbook, DOE-HDBK-1092-2004, Dated December 2004.

DOE Order 5480.19 *Conduct of Operations*, Chapter 8, Control of Equipment and Systems Status, Change 2, October 23, 2001.

Electrical Elementary Diagram, H-2-99085, Sheet 1 of 36, Rev 17, August 25, 2005.

Electrical Elementary Diagram, H-2-99085, Sheet 18 of 36, Rev 10, July 22, 2005.

Electrical One Line Diagram, H-2-100096, Sheet 1 of 3, Rev 15, September 26, 2007.

Electrical One Line Diagram, H-2-100096, Sheet 3 of, Rev 7, June 4, 2007.

Electrical Safety, TFC-ESHQ-S-STD-03, Rev B-8, October 15, 2007.

Electrician's Integrated Training Electronic Matrix (ITEM).

Engineering Change Notice, ECN 724480 Rev. 0.

Engineering Change Notice, ECN 724688 Rev. 0.

Engineering Change Notice, ECN 724824 Rev. 0.

Engineering Change Notice, ECN 724942 Rev. 0.

Equipment Temporary Modifications and Bypasses, TFC-OPS-OPER-C-11, Rev A-8, May 30, 2007.

Event Investigation Report: Fact Finding for 242-A PB-1 Pump Inadvertent Startup, report No. 2007-023, November 27, 2007.

General Provisions for Commercial Items, Rev 1, October 11, 2004, CH2M HILL Hanford Group, Inc.

Graded Quality Assurance, TFC-ESHQ-Q_ADM-C-01, Rev A-3, October 23, 2006.

Job-Specific Safety Analysis (K-2 JSA) For RPP, Project WFO-WO-07-1857, dated September 4, 2007.

Job-Specific Safety Analysis (K-2 JSA) For RPP, Project WFO-WO-07-1857, dated September 4, 2007.

Lockout/Tagout Program, TFC-OPS-OPER-C-05, Rev A-23, April 18, 2007.

Management Assessment Program, TFC-ESHQ-AP-C-01, Rev E-3, June 5, 2007.

Management of Central Warehouse Facilities and Stored Materials, HNF-PRO-375, Rev 9, June 25, 2007.

Material Receipt, Storage, Issuance, Return, and Excess Control, TFC-BSM-CP_CPR-C-18, Rev A-1, September 28, 2007.

MCS Logic Diagram, H-2-99949, Sheet 1 of 60, Rev 0, December 18, 1991.

MCS Logic Diagram, H-2-99949, Sheet 3 of 60, Rev 0, December 18, 1991.

MCS Logic Diagram, H-2-99949, Sheet 9 of 60, Rev 0, December 18, 1991.

Molex Product Specification, PS-99020-0087, dated March 19, 2003.

National Fire Protection Association (NFPA) National Electrical Code (NEC) 70, 2005 Edition.

National Fire Protection Association (NFPA) *Standard for Electrical Safety In the Workplace 70E*, 2004 Edition.

Nonconformance Report, CH-07-NCR-017, *Tyco Electronics relay model R10-E1P2-V700 shelf state is supposed to be in the "open" state*, November 15, 2007.

Nonconformance Report, CH-07-RPP-QSR-045, *242-A MCS Upgrades R10 Relay Activities*, December 19, 2007.

NovaTech FTP-8DOHC Field Termination Panel Drawing, Rev 0, dated November 27, 2007.

NovaTech Packing List 6001-210-PL1, *6001-210 CH2M HILL Hanford 242-A Evaporator Upgrade*, August 31, 2007.

NovaTech Relay Digital Output Test Data NT-8115-DO-DC, dated July, 19, 2007.

Occupational Safety & Health Administration (OSHA) 29 CFR 1910 Subpart S.

Occurrence report - EM-RP--CHG-TANKFARM-2007-0014, *242-A Evaporator Recirculation Pump P-B-1 Inadvertently Started And Operated Without Seal Water*.

Operating Specifications For the 242-A Evaporator, OSD-T-151-00012, Rev 1, October 2006.

Operational Configuration Control, TFC-OPS-OPER-C-38, Rev A-2, August 31, 2005.

OSHA Standards for General Industry, 29 CFR 1910, Subpart S Electrical.

Panelboard Schedule Drawing, H-2-85322, Revision 4.

Perform Scheduled Electrical Power Outage at 242-A Evaporator, TO-600-545, Rev A-10, October 26, 2007.

Pre-Job Brief, TFC-OPS-MAINT-C-02, Rev C, October 27, 2006.

Problem Evaluation Request (PER) CH2M-PER-2007-2026, *242-A Operator Discovered PB-1 Pump Operating When It Was Supposed To Be Shut Down*.

Problem Evaluation Request (PER) CH2M-PER-2007-2034, *Energized power was found during safe to work check in two MUX cabinets*.

Problem Evaluation Request (PER) CH2M-PER-2007-2047, *Tyco Electronics relay model R10-E1P2-V700 shelf state is supposed to be in the "open" state*.

Problem Evaluation Request, CH2M-PER-2007-2200.

Procurement of Items (Materials), TFC-BSM-CP_CPR-C-06, Rev G-1, September 27, 2007.

Procurement of Services, TFC-BSM-CP_CPR-C-05, Rev G-2, June 9, 2006.

Procurement of Services, TFC-BSM-CP_CPR-C-05, Rev H-1, November 20, 2007.

Quality Assurance Program Description, TFC-PLN-02, Rev D-1, October 4, 2007.

Quality Systems Manual, NovaTech Process Solutions, LLC.

Receiving, Storing, and Handling of Chemicals, TFC-ESHQ-S-STD-20, Rev A-2, March 30, 2007.

Relay Digital Output (8 Point), CH2M HHILL Hanford 242-A Evaporator, 6001-210, July 19, 2007.

Selection and Award, TFC-BSM-CP_CPR-P-03, Rev A-13, October 4, 2007.

Shift Turnover and Minimum Staffing Guideline for 222-S Laboratory Complex, ATS-310, Section 11.12, Rev 6, December 21, 2006.

Statement of Work, NovaTech Subcontract 30358, Revision 2, November 13, 2006, *242-A Evaporator Monitoring and Control System Upgrade, Maintenance, and Support Supplier Quality Assurance Program Evaluation*, TFC-ESHQ-Q_ADM-C-09, Rev A-2, June 26, 2006.

Supply Chain Process, TFC-BSM-CP_CPR-C-09, Rev B-12, September 27, 2007.

Tank Farm Contractor Standards/Requirements Identification Document, HNF-SD-MP-SRID-001, Rev 3, *Operations*.

Tank Farm Contractor Standards/Requirements Identification Document, HNF-SD-MP-SRID-001, Rev 3, *Configuration Management*.

Tank Farm Contractor Work Control, TFC-OPS-MAINT-C-01, Rev M-5, October 4, 2007.

Technical Basis for the 242-A Evaporator Operating Specifications, RPP-18465, Rev1, January 25, 2007.

Technical Requirement for Procurement, TFC-ENG-DESIGN-C-34, Rev A, May 25, 2007.

Total Quality Management Process, Quality Manual 102-1, Rev P, March 19, 2003 Tyco Electronics.

Turnover of Shift Responsibility, TFC-OPS-OPER-C-07, Rev A-7, November 12, 2004.

Tyco R10 Relay Data Sheet, Catalog 1308242.

Unreviewed Safety Question Determination, EV-07-1310-D, Rev. 1.

Work Order, WFO-WO-07-1857, latest release December 3, 2007.

APPENDIX C

INTERVIEWS CONDUCTED

Interviews/ Contacts

Chief Operating Officer
WFO Vice President, Acting
WFO Deputy Vice President/Acting Facilities Director
WFO 242-A Facility Manager
WFO Engineering Director
WFO Projects Director
Project Delivery Testing Manager
Safety Programs Manager
WFO Projects Administrator
WFO Electrical Shop Supervisor
WFO Shift Operations Manager
Information Resources Management Director
Procurement Specialist
Buyer/Procurement Specialist
Quality Assurance Engineer
WFO System Engineer
Construction Field Work Supervisor supporting WFO Projects
WFO Electrical Shop Supervisor
WFO System Engineer (CSE)
Craft: electricians
Construction Field Work Supervisor
Hanford NFPA Representative
NFPA Resident SME
Molex Corporation Engineer
Industrial Safety Specialist
Flour Hanford Safety Specialist

APPENDIX D

TEAM MEMBER BIOGRAPHIES

Team Member Qualification Summary

Team Member Name: Brandon I Williamson

Title and Organization: Facility Representative, Tank Farm Operations Division, ORP

Summary of Education and Technical Qualifications:

Bachelors of Science in Mechanical Engineering	Univ. of Washington
Masters of Science in Environmental Sciences and Engineering	Colorado School of Mines

Summary of Experience:

- ORP Facility Representative at the Hanford Tank Farms.
- Over 16 years of experience in the nuclear industry/
- At DOE-ORP, and RL prior to the creation of ORP, since June of 1998.
- Worked at DOE Rocky Flats Environmental Technology Site in Colorado as an assessor of both nuclear facility operations and environmental compliance.

Team Member Qualification Summary

Team Member Name: Russell G. Harwood, Assessment Team Member

Title and Organization: Electrical Oversight
Tank Farms Engineering Division
Office of the Assistant Manager for Tank Farms Project
Office of River Protection

Area Assigned: Electrical Practices

Summary of Education and Technical Qualifications and Experience:

- Twenty-one years in the electrical/electronics industry.
- Seventeen years experience in the nuclear and environmental restoration fields.
- Electrical Systems, DOE-RL Technical Qualification.
- BS in Electrical Engineering, University of Idaho.
- DOE Lead Auditor Qualified.
- Safety System Oversight Tank Farms Master Pump Shutdown System.
- Safety System Oversight Tank Farms Instrumentation and Control.

Summary of Experience:

- Program Manager of the ORP Tank Farm system upgrades.
- Program Manager of the DNFSB 2000-2 Recommendation closure (operability of vital safety systems).
- National Electrical Code (NEC) and OSHA inspector for ORP.
- Project manager for the contractor implementation of Basis for Interim Operation (BIO) compensatory measures, instrumentation upgrades, configuration management, emergency preparedness.
- Puget Sound Naval Shipyard electrical design engineer for communication and alarm systems.
- Formal Specialized Training:
 - NEC 2005, National Electrical Code
 - NFPA 70E, Electrical Safety in the Workplace
 - Low Voltage Circuit Breaker Maintenance
 - Instrumentation and Process Control
 - Variable Frequency Drives
 - Programmable Logic Controllers

Team Member Qualification Summary

Team Member Name: Dennis H. Irby, Assessment Team Leader

Title and Organization: Authorization Basis Engineer
Tank Farm Engineering Division
Office of Assistant Manager Tank Farms Project
Office of River Protection

Summary of Education and Technical Qualifications and Experience:

Bachelor of Science in Mining Engineering, South Dakota School of Mines & Technology
Master of Science in Mining Engineering, South Dakota School of Mines & Technology

Summary of Experience:

- Over 30 years of experience in the areas of: Nuclear safety authorization basis management, nuclear waste safety issue resolution, technology development, radioactive solid waste management, management of design of nuclear waste repository facilities, construction of high security facilities (including structures, utilities, and safety support systems), project management, manufacturing and marketing of remotely actuated machinery, and conducting field and laboratory research programs related to worker health and safety in mines with flammable gas and respirable dust issues.
- Experience and training in:
 - Conducting audits, assessments and surveillances related to the DOE Nuclear Safety and Waste Management Orders and the DOE Safety Management System Policy; and
 - Application of Management Oversight Risk Tree analysis techniques and DOE Accident Investigation techniques.
- Provided oversight of the resolution of the four priority one safety issues related to tank waste.
- Provided oversight of over 120 Authorization Basis actions, over 40 of which have been completed since the approval of the DSA.
- Has completed qualifications for Waste Management, Mechanical Systems, and Safety System Oversight Qualifications for Double-Shell Tank Primary Ventilation Systems and Double Contained Receiver Tank Purge Air Systems.