

**Independent Oversight Review of the  
Hanford Tank Farms  
Safety Management Program Implementation  
Electrical Safety in the 222-S Laboratory**



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**Office of Safety and Emergency Management Evaluations  
Office of Enforcement and Oversight  
Office of Health, Safety and Security  
U.S. Department of Energy**

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## Acronyms

DOE	U.S. Department of Energy
FOM	Facility Operations Manager
FR	Facility Representative
FWS	Field Work Supervisor
HSESP	Hanford Site Electrical Safety Program
HSS	Office of Health, Safety and Security
ISM	Integrated Safety Management
LAB	Limited Approach Boundary
LO/TO	Lockout/Tagout
OFI	Opportunity for Improvement
OM	Operations Manager
ORP	Office of River Protection
PPE	Personal Protective Equipment
RPT	Relocatable Power Tap
SME	Subject Matter Expert
SMP	Safety Management Program
WRPS	Washington River Protection Solutions, LLC

# **Independent Oversight Review of the Hanford Tank Farms Safety Management Program Implementation Electrical Safety in the 222-S Laboratory**

## **1.0 PURPOSE**

The U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), conducted an independent review of the implementation of the electrical safety management program (SMP) at the Hanford Site Tank Farms' 222-S Laboratory. The HSS Office of Safety and Emergency Management Evaluations performed the review to assess the effectiveness of management programs that ensure the safety of workers, the public, and the environment. Independent Oversight's review was performed concurrently with the review conducted by the Office of River Protection (ORP). This Independent Oversight review was conducted within the broader context of ongoing reviews of SMPs at DOE sites with Hazard Category 1, 2, and 3 nuclear facilities. The focus of this review involved evaluating implementation and effectiveness of the SMPs at the Hanford Tank Farms to ensure continued safe work performance in accordance with the principles of Integrated Safety Management (ISM) described in DOE Policy 450.4A, *Integrated Safety Management Policy*, which enables the Department's mission to be accomplished efficiently while ensuring safe operations at all Departmental facilities and activities.

## **2.0 BACKGROUND**

The DOE ORP was established in 1998 to manage the 56 million gallons of liquid or semi-solid radioactive and chemical waste stored in 177 underground tanks at the Hanford Site. ORP serves as DOE line management for two functions: the Tank Farms, which maintain the 177 underground storage tanks; and the Waste Treatment and Immobilization Plant, which is under construction and will be used for retrieval, treatment, and disposal of the waste stored in the underground tanks. The Tank Farms are managed and operated by Washington River Protection Solutions, LLC (WRPS) under contract to ORP. The ORP Tank Operations Division provides Tank Farm oversight. The 222-S Laboratory performs chemical and radiological tests to support Tank Farm operations.

The Independent Oversight program is designed to enhance DOE safety and security programs by providing DOE and contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements, and the effectiveness of DOE and contractor line management performance in safety and security and other critical functions as directed by the Secretary. The Independent Oversight program is described in and governed by DOE Order 227.1, *Independent Oversight Program*, and a comprehensive set of internal protocols, operating practices, inspectors' guides, and process guides. The program is implemented by two subordinate offices: the Office of Security and Cyber Evaluations and the Office of Safety and Emergency Management Evaluations.

The Office of Safety and Emergency Management Evaluations evaluates safety policies and programs throughout DOE with a particular emphasis on evaluating worker and public protection from nuclear hazards that exist at many DOE sites. This office accomplishes its mission through two primary mechanisms: (1) a network of staff site leads who are assigned to monitor the activities at DOE sites with nuclear facilities or activities, and to coordinate office appraisal activities at those sites; and (2) a program of targeted reviews that evaluate selected functional or topical areas at multiple sites across the DOE complex. Appraisal activities are selected, prioritized, and planned based on such factors as risk to workers and the public, facility operational status, and performance history.

Electrical safety is required for worker protection, as well as for continued proper functioning of electrically powered equipment.

### **3.0 SCOPE**

This SMP review evaluated the effectiveness of implementation of electrical safety at the Hanford 222-S Laboratory, including implementation of the core functions of ISM, processes for work control, identification and control of hazards including isolation of energy sources, uses of personal protective equipment (PPE), and post-job evaluation and feedback of lessons learned. The review also evaluated the effectiveness of ORP oversight related to electrical safety implementation at 222-S Laboratory, including a review of the concurrent ORP *Assessment of Washington River Protection Solutions LLC Electrical Safety Program*, ORP Assessment Number S-13-SHD-TANKFARM-014. The ORP assessment included the Hanford 222-S Laboratory and the Tank Farms. The electrical safety program at the 222-S Laboratory and the Tank Farms is a Hanford wide program covering all contractors of both the Office of River Protection and the Richland Office. This program is DOE-0359, Revision 2, *Hanford Site Electrical Safety Program*.

### **4.0 METHODOLOGY**

The SMP review evaluated the implementation effectiveness of the Hanford Site Electrical Safety Program (HSESP) at the 222-S Laboratory. The review consisted of an evaluation of the procedures used to perform observed electrical work; evaluation of the job hazards analyses supporting the work, including the electrical hazard evaluation; observation of the pre-job briefings for observed work; interviews of craft workers and supervisors; and walkdowns of electrical equipment areas with the ORP facility representative (FR) assigned to the 222-S Laboratory. The ORP electrical safety subject matter expert (SME) was also observed walking down a Tank Farm to assess the adequacy of electrical cable physical protection. ORP oversight of electrical safety was also evaluated.

Selected objectives and criteria from HSS Criteria, Review and Approach Document 64- 10, Rev. 2, *Performance Based Inspection of Worker Safety and Health Utilizing the Integrated Safety Management (ISM) Core Functions*, were used to define the scope of this targeted review; the five core ISM functions, when followed, require tasks to be clearly defined and examined for hazards to workers. The core functions further require that, prior to work commencing, controls be provided to protect workers from hazards resulting from the work. When the work is performed, the scope is required to stay within the limits defined when planning the work, and the identified controls must be used for worker protection. Finally, after the work is completed, the ISM core functions require a feedback and improvement step to identify what went well and what did not go well during the performance of the work. This after-the-fact review also seeks any lessons learned by the workers and their supervision on how to do this type of work better in the future. The five core ISM functions are:

- I. Define the scope of work
- II. Analyze the hazards
- III. Develop and implement controls
- IV. Perform the work within controls
- V. Feedback and improvement.

Independent Oversight toured the 222-S Laboratory spaces with the ORP FR, observing the general condition of electrical equipment and paying particular attention to informational labeling of electrical equipment. The ORP FR and Independent Oversight observed the electricians who were performing the

bi-monthly and annual surveillance of the cathodic protection system of underground transfer lines and tanks at the 222-S Laboratory. The cathodic protection system is quite extensive, and the surveillance required repeated connection of meters to energized electrical connections. Independent Oversight and the ORP FR also observed the lockout/tagout (LO/TO) and inspection of ventilation exhaust fans at the 222-S Laboratory. At the C Tank Farm, Independent Oversight accompanied the ORP electrical safety SME inspecting the protection of electrical cables at the Tank Farms. Due to the configuration of the Tank Farms and frequent reconfiguration of equipment, many electrical cables, both power and signal, are routed across the ground where people and equipment travel. The area above and adjacent to underground tanks can be congested with equipment and cables.

Independent Oversight coordinated its review with previously scheduled ORP oversight activities detailed on the ORP Integrated Assessment Plan. Information about the Independent Oversight review team and schedule is provided in Appendix A. A list of key documents reviewed is provided in Appendix B.

The findings and Opportunities for Improvement (OFIs) from the ORP review are repeated verbatim in Appendix C.

## **5.0 RESULTS**

The results are presented in accordance with the five core functions of safety management.

### **5.1 Define the Scope of Work**

The work orders for the observed tasks (surveillance testing of the cathodic protection system, inspection of the cathodic protection system rectifiers, and inspection of ventilation exhaust fans) utilized existing maintenance procedures. The scope of work for each activity was previously defined in the applicable maintenance procedure as these were recurring maintenance tasks. The scope of work definition for observed tasks was satisfactory.

### **5.2 Analyze the Hazards**

The annual cathodic protection system testing and bi-monthly inspection of the cathodic protection system rectifiers at the 222-S Laboratory was performed using WRPS Procedure 2S22045 *Cathodic Protection System Testing* and rectifier inspections were done using WRPS Procedure 2S22036, *Inspect 222-S and 219-S Cathodic Protection Rectifiers*. The field work supervisor (FWS) covered, in detail, the hazards and as discussed later, the PPE requirements. The activity was bounded by the General Hazard Analysis and a Hanford Site Electrical Hazard Evaluation to address the shock and arc flash hazards. The analysis of hazards was satisfactory. Electrical hazards and normal industrial hazards were adequately identified. Independent Oversight and the ORP FR noted that natural hazards including heat, insects, snakes, and rodents were also identified. The cathodic protection connections accessed during this test are located in shallow underground pits. The senior electrician performing the test noted that all of the types of animals identified in the hazard analysis were encountered during one or more previous test performances. The hazard analysis for the exhaust fan inspection was similarly thorough especially with respect to isolation of energy sources through LO/TO.

Overall, the hazard analyses for the observed tasks were satisfactory.

### 5.3 Develop and Implement Controls

The controls developed and implemented to protect workers from identified hazards were appropriate and effective for the work observed. Aside from normal electrical shock and arc flash hazards, the exhaust fan evaluation emphasized LO/TO to prevent contact with moving fan belts. Limited Approach Boundaries were specified based on the electrical hazards present.

The controls specified for the work activities observed were satisfactory.

### 5.4 Perform the Work Within Controls

During the cathodic protection rectifier inspection and system testing, the workers were monitored for heat related stress by their FWS. Additionally, the cautions prescribed to prevent contact with creatures residing within the cathodic protection access pits were practiced effectively by the workers. No wildlife was encountered during the test observed, but the electricians noted that such encounters were not unusual. Ladder safety was also implemented correctly. Additional discussions of the observed activities is provided below.

#### Cathodic Protection Rectifier Inspection and Testing

During the rectifier inspection and testing, an electrician wore his identification badge and dosimeter on a lanyard around his neck. The badge, dosimeter, and lanyard contained metal and could have posed a potential electrical contact hazard. The ORP FR identified that the *Hanford Site Electrical Safety Program*, DOE-0359, Section 5.8, Item 8 states, “Conductive articles of jewelry and clothing (e.g., watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn where they present an electrical contact hazard with exposed energized conductors or circuit parts.” During rectifier inspections performed the next day, the electrician ensured that no metal articles were near the exposed conductors. The procedure was performed satisfactorily. Attention to this requirement for personnel protection was identified in the ORP Electrical Safety Assessment as **OFI S-13-SHD-TANKFARM-014-002**.

During the pre-job briefing for the cathodic protection testing and inspection, one of the electricians questioned the acceptability of the reservoir oil level for rectifier EN-RECT-5745. The oil level has been significantly lower than the “Oil Level” mark on the inside of the reservoir. The electrician and the FWS recalled that the system engineer might have evaluated the condition and determined the oil level to be acceptable. During the rectifier inspection, the EN-RECT-5745 reservoir oil level was well below the “Oil Level” mark. Procedure 2S22045, *Cathodic Protection System Testing*, being performed at the same time by the same crew contained a note that states, “EN-RECT-5745 has oil level below the tap changer. This oil level has been approved by the rectifier manufacturer with supporting documentation with the vendor file for this equipment.” Procedure 2S22036 did not contain a similar note providing the additional information about acceptability of oil levels. The FWS committed to following up with the system engineer to ensure that the oil level was acceptable. (See **OFI-1**.)

In addition to the problem of the acceptable oil level not matching the oil level mark on the installed equipment in Rectifier EN-RECT-5745 and the acceptable oil level being identified as different from the mark in one procedure but not in the other, the electricians found Procedures 2S22045, *Cathodic Protection System Testing*, and 2S22036, *Inspect 222-S and 219-S Cathodic Protection Rectifiers*, very difficult to use. The procedures were technically correct and were performable. However, the procedures were confusing and convoluted, requiring jumping back and forth among steps to complete the required actions. Issues noted during the activity included: (See **OFI-1**.)

- Wire labels for Terminals 2 and 3 were reversed for test station EN-STA-5745-A.
- An unclear label was used on the reference electrode on Terminal 7 for test station EN-STA-5745-E.

- Steps were skipped, but later repeated during testing of station EN-STA-5745-E.

One of the electricians performing the procedures was a long-time electrician at the 222-S Laboratory and was very familiar with the procedure, but he still found the procedure confusing. The FWS indicated that the electricians made him aware of the problems and that he was drafting changes to the procedure to address their concerns. (See **OFI-1**).

In the April 2013 Independent Oversight review of Safety System Management at the Hanford Tank Farms, Independent Oversight identified an issue (listed as OFI-OPS-1) with technically correct but confusing procedures in the WRPS system. The 222-S Laboratory is part of the Hanford Tank Farms and the above listed procedures found to be confusing were produced in the same procedures system as those cited earlier this year. That OFI recommended: *Perform a human factors review of the procedural approach used to position safety significant isolation valves within the Tank Farms, and revise the applicable technical procedures as necessary to minimize the potential for human error.* Based on the results of this Independent Oversight review and the concurrent ORP review, problems with confusing technical procedures are not isolated and are recurring, indicating that past corrective actions have not been fully effective. (See **OFI-1**.)

#### Exhaust Fan Inspection

Independent Oversight and the ORP FR attended the Exhaust Fan Inspection pre-job briefing and found it to be satisfactory. Normal industrial hazards were identified. LO/TO requirements, noise hazards, and required hearing protection were emphasized.

No problems were noted with the ventilation exhaust fan inspection procedure during performance of this inspection.

Independent Oversight and the ORP FR performed a walkdown of the 222-S Laboratory duct level and manipulator repair shop for compliance with the *Hanford Site Electrical Safety Program*. They concurrently inspected extension cord use, electrical panel access, labeling, and general housekeeping. Housekeeping was generally satisfactory, and there were no issues observed with extension cords. Three issues were noted and investigated further by the ORP FR: 1) use of a receptacle outlet splitter, 2) a damaged receptacle, and 3) use of the Incident Energy Labels (orange warning labels).

#### Receptacle Outlet Splitter

A receptacle labeled “LP-UPS-1” in the 222-S Laboratory duct level, north wall, had an orange splitter or adapter plugged into it. Three power supplies were plugged into this splitter. The other receptacle had a single load plugged into it. The ORP FR followed up with the 222-S Laboratory electrical engineer, and the engineer stated that the configuration was acceptable since the plug was an Underwriters Laboratories, Inc. listed current tap. The engineer provided a photograph that showed an Underwriters Laboratories, Inc. listing label on the current tap. He also provided a document that described the use of this type of device, which is known formally as a Relocatable Power Tap (RPT). The RPT is allowed for low voltage equipment, and, in this case, low voltage power supplies were plugged into it. The ORP FR and ORP electrical safety SME concluded that the RPT was acceptable.

#### Damaged Receptacle

Receptacle GE-4, located on the north wall of the duct level, had a “Service Required” tag attached to it that contained the statement “Do Not Use.” The ORP FR investigated the repair status of the receptacle and whether it was isolated with a LO/TO. The damaged receptacle was logged on the “Service Required Tag Log Sheet” (reference tag number 1434) on October 19, 2011.



The status of the repairs for the receptacle was discussed with a maintenance FWS. The FWS determined that the face plate was actually separated from the receptacle box and that the receptacle was already under LO/TO 222-S-13-037. The LO/TO was installed in April 2013 in response to a stop work order issued over concerns with defective circuits and electrical devices. The receptacle was repaired in mid-July 2013, and the applicable LO/TO tags were cleared.

The ORP FR discussed with the operations manager (OM) the issue of using a Service Required Tag when a potential hazard may have existed. The OM interviewed the facility operations managers (FOMs), and the OM determined that the FOMs had evaluated the receptacle's condition and established that a hazard was not present when the condition was first discovered in 2011. However, including the statement "Do Not Use" on the tag may have implied a hazard. The issue has been resolved by the repair of the receptacle. The OM discussed his expectation with the FOMs that damaged or defective equipment or systems should be evaluated for potential hazards.

#### Incident Energy Labels

The preheat and reheat control electrical panels for the air handling units were labeled with the Incident Energy Labels identified in Appendix E of the *Hanford Site Electrical Safety Program*, DOE-0359. Other panels did not have the Appendix E label, but had an older version of the warning label. The requirement to use warning labels is described in DOE-0359, Section 5.8.3.c, which states in part, "If an incident energy analysis has been performed, and an arc flash hazard exists, the equipment to be worked on shall be field marked with a label containing the available incident energy prior to work being performed."

Independent Oversight and the ORP FR interviewed the WRPS 222-S Laboratory electrical engineer who oversees electrical work at the laboratory. The engineer explained that load studies are being performed on circuits above 125 kilovolt amperes (kVA) where electronic Digitrip control devices are being added to some of the circuit breakers. The load studies could change the incident energy and require that a new Incident Energy Label be attached to the panel. The engineer explained that electrical panels are being opened, but that the labels are not being placed on the panels until the calculations are complete. The HSESP requires equipment to be field marked with a label containing the available incident energy prior to work being performed. The WRPS 222-S Laboratory electrical engineer was contacted and explained that other panels have had an energy analysis performed, but that a formalized plan had not been implemented for installing warning labels. This issue was documented as **Finding S-13-SHD-TANKFARM-014-F01** in the ORP electrical safety assessment.

WRPS began implementation of the revised HSESP on January 1, 2013; however, an implementation plan was never issued. The need to prepare an implementation plan for the HSESP revision was documented as **OFI S-13-SHD-TANKFARM-014-001** in the ORP electrical safety assessment.

Independent Oversight accompanied the ORP electrical safety SME and FRs touring the C Tank Farm. The electrical safety SME conducted an inspection of the electrical cable protectors commonly known as yellow jackets. The lines of inquiry the SME used for the yellow jacket followed the requirements of WRPS Tank Farms Procedure TFC-OPS-OPER-C-10, *Vehicle and Dome Load Control in Tank Farm Facilities*. These requirements include:

- Inspect for physical damage (e.g., cracks or broken pieces).
- Inspect cover hinge for damage.
- Inspect that the cables installed fit correctly and have not been damaged by forcing them between channel dividers.
- Inspect cable protector to ensure it is installed on a nearly flat surface.

- Ensure cable protectors are not overcrowded or pinched (the lid can pinch the cable insulation, present a tripping hazard, or both).
- Ensure female slots mesh properly with male tabs of the cable protector. (Two different types will not mesh but they should be butted together.)

The ORP and Independent Oversight reviewers identified multiple instances of yellow jacket that were not in compliance with the Tank Farm procedure. Problem Evaluation Report WRPS-PER-2013-0602 addressed a stop work on April 8, 2013, for issues on the yellow jacket and included recommended actions to follow the cable protection procedures. The yellow jacket problems identified in this walkdown of C Tank Farm were documented in the ORP electrical safety assessment as **Finding S-13-SHD-TANKFARM-014-F02**.

#### Limited Approach Boundaries

Limited approach boundaries (LABs) were identified in the Hanford Site Electrical Hazard Evaluation to address the shock and arc flash hazards associated with the job. However, during the pre-job briefing there was no discussion of the electricians' or observers' roles with respect to the approach boundaries. Observers, not wearing full electrical shock protection equipment must observe the LABs. The ORP FR discussed this omission with the FWS, specifically that highlighting approach boundaries and the required controls (e.g., escorting requirements, distances, prohibitions) for future electrical work would increase worker awareness, especially for unqualified workers who might have to enter an approach boundary. This suggestion was documented in the ORP Electrical Safety SME's assessment as **OFI S-13-SHD-TANKFARM-014-003**.

Although LABs were not discussed in the pre-job briefing, the exposed conductors were always attended by a qualified electrician and workers and observers conformed with LAB requirements (identified as 3 feet, 6 inches, in compliance with HSESP requirements) during the Independent Oversight and the ORP FR observations of the testing inspection of the cathodic protection system rectifiers at the 222-S Laboratory.

### **5.5 Feedback and Improvement**

As noted above, the electricians were forthcoming regarding feedback on problems encountered when using the approved procedures. Electricians appropriately explained to the FWS that the procedures worked, but that usability problems made the procedures confusing and the FWS appropriately initiated actions to correct the procedures. During work observations and morning meetings observed, 222-S Laboratory supervision routinely and repeatedly requested feedback and suggestions for improving/facilitating work necessary for Laboratory operations. The OFI identified was not due to unresponsiveness to worker feedback by supervision, but rather due to a repeat problem with the usability of technical procedures produced by the same procedure system. Although feedback and Improvement functions observed at the 222-S Laboratory during this review were satisfactory, continued management attention is warranted to ensure procedure human factors and usability are improved

### **5.6 ORP Oversight of Electrical Safety**

Independent Oversight accompanied the ORP FR who was touring the 222-S Laboratory spaces and observing electrical work and LO/TOs at the 222-S Laboratory. The FR was quite familiar with the HSESP and electrical safety in general. The FR performed an assessment of electrical safety program implementation at the 222-S Laboratory as part of a wider electrical safety assessment led by the ORP electrical safety SME. The FR used the electrical safety SME as a consultant when questions arose regarding observed conditions. The ORP FR was knowledgeable of facility conditions and identified

electrical safety implementation problems to both facility management and the ORP electrical safety SME.

Independent Oversight also accompanied the ORP electrical safety SME and assigned FRs on tours of the C Tank Farm. The SME examined electrical cable protection and identified several examples of deficient cable protection. Discussions with ORP personnel indicated that cable protection has improved but does not yet meet ORP expectations. The ORP FRs, interviewed by Independent Oversight, were aware of requirements for and were assessing implementation of electrical cable protection on their tours of the Tank Farm areas.

ORP activities assessing electrical safety program implementation at the Hanford Tank Farms and the 222-S Laboratory observed by Independent Oversight included routine FR building tours and conduct of ORP Assessment S-13-SHD-TANKFARM-014, *Washington River Protection Solutions LLC Electrical Safety Program*. The FRs observed touring 222-S Laboratory and Tank Farm facilities were knowledgeable and questioning. The ORP electrical safety subject matter expert was repeatedly observed checking electrical equipment installations in the Laboratory and Tank Farm facilities. Independent Oversight agreed with the issues identified and categorized in the ORP assessment report.

## **6.0 CONCLUSIONS**

WRPS is working to implement new or revised electrical safety requirements in the HSESP. Although WRPS implementation of the HSESP is a work in progress, WRPS personnel demonstrated attention to safety in work that was observed by ORP and Independent Oversight.

ORP oversight identified multiple instances of cable protectors not properly being used and noted that the installation of warning labels needs to be standardized and followed in accordance with the HSEP. ORP oversight assessors also consider the ORP electrical safety program and work practices to be very good with areas to improve including field supervisor and electrician monitoring of the work environment during the performance of work.

ORP identified two findings and three OFIs during the assessment of electrical safety implementation. Independent Oversight concurs with the ORP findings and OFIs. The OFI regarding the need for an implementation plan to facilitate implementation of the HSESP revision is a particularly appropriate broad-based action with the potential to prevent additional electrical safety implementation problems.

In addition to the issues identified by ORP, Independent Oversight identified an OFI in the WRPS procedures program. The problems with the cathodic protection inspection and test procedures noted during work observations were noted by ORP, but were viewed by ORP as an isolated incident that the FWS was addressing with a procedure revision that was in process. Independent Oversight previously encountered a similar problem with WRPS technical procedures that were technically correct, but difficult to perform and not user friendly. Thus, Independent Oversight identified an OFI that focuses on improving the procedure system by systematically reviewing technical procedures for ease of use and making appropriate revisions.

## **7.0 OPPORTUNITIES FOR IMPROVEMENT**

Independent Oversight identified the following OFI, which complements the OFIs identified by ORP in the concurrent review. These OFIs are not intended to be mandatory. Rather, they are to be reviewed and evaluated by the responsible line management organization and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

**OFI-1: Review and revise technical procedures to make directions to workers clear and specific with work steps flowing continuously forward from start to finish of each procedure.**

## **Appendix A Supplemental Information**

### **Dates of Review**

Onsite Review: July 8-11, 2013

### **Office of Health, Safety and Security Management**

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### **Independent Oversight Reviewers**

Robert E. Farrell

## **Appendix B Documents Reviewed**

- DOE-0359, Revision 2, *Hanford Site Electrical Safety Program*
- 222-S Laboratory Maintenance Procedure 2S22045, Rev/Mod D-1, *Cathodic Protection System Testing*, February 26, 2013
- 222-S Laboratory Maintenance Procedure 2S22036, Rev/Mod H-2, *Inspect 222-S and 219-S Cathodic Protection Rectifiers*, November 22, 2010
  - 222-S Laboratory Maintenance Procedure 2S23032, Rev/Mod F-1, *222-S Primary Exhaust Fans Inspection*
- Data Sheets from Work Order LAB-WO-13-0023, *Insp. 222S Cathodic Protection*, February 21, 2013
- Hanford Site Electrical Hazard Evaluation, 2S-00594 7 2S-00852, *Inspect 222-S Cathodic Protection Bi-Monthly and Annual*, July 8, 2013
- Hanford Site Electrical Hazard Evaluation, 2S-00513, *Inspect Primary Exhaust Fans EF-1, EF-2, EF-3*, April 11, 2013
- Washington River Protection Solutions (WRPS) Job Hazard Analysis Checklist for Work Package 2S-00513, *Inspect Primary Exhaust Fans 1, 2 & 3*, October 10, 2012
- WRPS Daily Report 222-S, July 8, 2013
- 222-S Planned Work Activities, July 8, 2013
- 222-S Laboratory Daily Operating Instructions (DOI) July 8, 2013
- WRPS Daily Report 222-S, July 9, 2013
- 222-S Planned Work Activities, July 9, 2013
- 222-S Laboratory Daily Operating Instructions (DOI) July 9, 2013
- WRPS Daily Report 222-S, July 10, 2013
- 222-S Planned Work Activities, July 10, 2013
- 222-S Laboratory Daily Operating Instructions (DOI) July 10, 2013
- WRPS Daily Report 222-S, July 11, 2013
- 222-S Planned Work Activities, July 11, 2013
- 222-S Laboratory Daily Operating Instructions (DOI) July 11, 2013
- 222-S Laboratory Plan of the Week for Week of July 8, 2013
- ORP Tank Operations Division Meeting Agenda, July 10, 2013
- ORP Tank Farms Report 19606, Planned Level 2 Assessment: *222-S Electrical Safety*, August 15, 2013
- ORP Assessment Report S-13-SHD-TANKFARM-014, *Washington River Protection Solutions LLC Electrical Safety Program*

**Appendix C**  
**Findings and Opportunities for Improvement**  
(extracted verbatim from the ORP report)

**FINDINGS**

During the review, ORP identified two findings documented in ORP assessment report S-13-SHD-TANKFARM-014:

**Finding S-13-SHD-TANKFARM-014-F01** Electrical panels at the 222-S Laboratory were not being field marked with a label showing the available incident energy or the required level of PPE prior to work being performed.

**Finding S-13-SHD-TANKFARM-014-F02:** Multiple instances of the flexible cords not protected from damage in C Farm.

**OPPORTUNITIES FOR IMPROVEMENT**

During the ORP review of electrical safety at the 222-S Laboratory and C Tank Farm, the following OFIs were identified by ORP:

**OFI S-13-SHD-TANKFARM-014-001:** WRPS had not issued an implementation plan for DOE-0359, *Hanford Site Electrical Safety Program*.

**OFI S-13-SHD-TANKFARM-014-002:** An electrician was wearing a conductive item that could have posed an electrical shock hazard.

**OFI S-13-SHD-TANKFARM-014-003:** Workers did not notify an observer at the work site of the limited approach boundary or the hazards.