Independent Oversight Review of Management of Safety Systems at the Hanford Tank Farms

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Acronyms

ALARA	As Low As Reasonably Achievable
CAS	Contractor Assurance System
CFR	Code of Federal Regulations
CM	Corrective Maintenance
CRAD	Criteria, Review and Approach Document
CSE	Cognizant System Engineer
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
DST	Double Shell Tank
EIR	Event Investigation Report
FR	Facility Representative
FY	Fiscal Year
HRR	High Resolution Resistivity
HSS	Office of Health, Safety and Security
ISMS	Integrated Safety Management System
JCO	Justification for Continued Operation
LDM	Leak Detection and Monitoring
MOP	Management Observation Program
NCO	Nuclear Chemical Operator
NMMP	Nuclear Maintenance Management Program
OFI	Opportunity for Improvement
ORP	Office of River Protection
PdM	Predictive Maintenance
PER	Problem Evaluation Request
PM	Preventive Maintenance
QA	Quality Assurance
SAC	Specific Administrative Control
S/CI	Suspect/Counterfeit Items
SMP	Safety Management Program
SSC	Structures, Systems, and Components
SSO	Safety System Oversight
SST	Single Shell Tank
TOD	ORP Tank Farms Operations Division
TQP	Technical Qualification Program
TSR	Technical Safety Requirement
WRPS	Washington River Protection Solutions, LLC

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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 management of safety class or safety significant structures, systems and components (hereinafter referred to as safety systems) at the Hanford Site Tank Farms. The review was performed by the HSS Office of Safety and Emergency Management Evaluations and was carried out within the broader context of an ongoing program of targeted assessments of safety systems, with an emphasis on the implementation of management of safety systems across the DOE complex at sites that have hazard category 1, 2, and 3 facilities. The purpose of this Independent Oversight targeted assessment effort is to evaluate processes for monitoring, maintaining, and operating safety systems to ensure their continued reliable capability to perform the intended safety functions. This review also provides data for an ongoing HSS effectiveness review of the Department's implementation of Commitment #16 of the DOE implementation plan for Defense Nuclear Facilities Safety Board Recommendation 2004-1 regarding verification of Federal nuclear safety assurance capability. Independent Oversight accomplished this review by performing assessments that included activity-level observations.

This targeted review was performed at the Hanford Site during the period of January 28 - February 7, 2013. This report discusses the background, scope, methodology, results, and conclusions of the review, as well as opportunities for improvement (OFIs) and findings identified during the review.

2.0 BACKGROUND

The DOE Office of River Protection (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 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.

In a memorandum from the Chief Health, Safety and Security Officer to DOE senior line management dated November 6, 2012, HSS identified "Safety Class or Safety Significant Structures, Systems and Components (SSCs)" as an Independent Oversight targeted review area for 2013. The memo also stated that the areas would be further defined in supporting Independent Oversight Review Plans. In addition, the HSS memo stated that the performance of DOE line oversight would be evaluated during the targeted reviews to provide input to the overall evaluation of DOE Federal nuclear safety assurance capability.

3.0 SCOPE

For this review, Independent Oversight reviewed the documented ORP and WRPS processes for safety system oversight (SSO) and management of safety systems; observed work activities to verify the effectiveness of overall implementation, including technical safety requirement (TSR) and maintenance program implementation; performed tabletop walkdowns of operations procedures at the Tank Farms; observed relevant meetings; reviewed feedback and improvement program and performance documents; and interviewed key ORP and WRPS personnel. Where possible, Independent Oversight focused on portions of the safety significant Waste Transfer System involved with current retrieval activities to transfer the contents of C-101, a single shell tank (SST), to AN-101, a more reliable and newer double shell tank (DST). Where work observations were not available or the transfer activity did not provide the needed review samples, Independent Oversight broadened its scope as necessary to ensure that the criteria, review and approach documents (CRADs) were adequately addressed.

4.0 METHODOLOGY

The management of safety systems targeted review evaluated the effectiveness of processes for operating, maintaining, and overseeing the performance of the safety significant waste transfer and isolation SSCs at the Tank Farms. The review consisted of an evaluation of the procedures and processes used to demonstrate ongoing operability and reliability of these safety system(s). The review did not evaluate the adequacy of the documented safety analysis (DSA), but rather focused on the implementation of the facility's safety basis as it relates to the selected safety system. The review also evaluated the effectiveness of DOE SSO for the selected system.

The following sections of HSS CRAD 45-11, Rev. 3, *Safety Systems Inspection Criteria, Approach, and Lines of Inquiry*, were used to define the scope of this targeted review:

- Maintenance
- Surveillance and Testing
- Operations
- Cognizant System Engineer (CSE) and SSO
- Safety System Feedback and Improvement.

The review team also utilized elements of HSS CRAD 45-21, Rev. 1, *Feedback and Continuous Improvement Inspection Criteria and Approach – DOE Field Element*, to collect and analyze data on site office oversight activities associated with management of Tank Farms safety systems.

5.0 RESULTS

5.1 Maintenance

To evaluate WRPS safety system maintenance, Independent Oversight selected the safety significant mechanical systems associated with waste transfer at the Hanford C-Farm for review. The C-Farm is conducting retrieval activities to transfer waste from a SST (C-101) to a DST (AN-101) in the AN-Farm through a Portable 2-Way Splitter Box (POR 314) in the waste transport path. Safety significant SSCs associated with the tanks, interconnecting piping, valves, and temperature monitoring equipment for the

C- and AN-Farm waste transfer activities are identified on lists of safety significant components (Master Equipment List). Maintenance of safety significant SSCs is addressed in the Tank Farm DOE-approved nuclear maintenance management program (NMMP), *WRPS Nuclear Maintenance Management Program (TFC-PLN-29, REV C-3)*, in accordance with DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*. The plan is supported by the following implementing procedures:

- Tank Operations Contractor Work Control (TFC-OPS-MAINT-C-01) – This procedure identifies the processes, requirements, and expectations for work management at the Tank Farm. Work planning and execution is conducted using a graded approach with four levels of work planning rigor (Levels 1-4). According to the procedure, Level 1 work packages require detailed work instructions and are used for activities involving "safety SSCs, high/medium complexity, and/or involves implementing complex hazard controls."
- Work Planning and Work Instruction Development (TFC-OPS-MAINT-STD-02) – This is the standard used to implement TFC-OPS-MAINT-C-01.
- Preventive/Predictive Maintenance Administration (TFC-OPS-MAINT-C-12) – This procedure describes the WRPS preventive/predictive maintenance program administration. It outlines the process by which WRPS develops and manages preventive maintenance (PM) tasks and associated actions.
- Post Maintenance Testing (TFC-ENG-STD-08) – This standard applies to the post maintenance tests performed on all SSCs associated with the Tank Farms. The standard is required by the WRPS NMMP for safety SSCs and specifies that corrective maintenance (CM), PM, and troubleshooting work shall be reviewed for post maintenance testing applicability.
- Pre-job Briefings and Post-Job Reviews (TFC-OPS-MAINT-C-02) – This procedure provides general guidance for the performance of pre-job briefings and post-job reviews, and it affirms that pre-job briefings and post-job reviews are fundamental to the WRPS implementation of the integrated safety management system (ISMS).

Each of the implementing procedures was reviewed against the approved NMMP and found to be acceptable. A sample of completed work packages and ongoing work activities was compared to maintenance program procedures to evaluate adherence to the program, including work planning, pre-job briefings and post-job reviews, and post maintenance testing. The sample included CM and PM activities.

Except as noted below, maintenance activities were conducted in a manner that ensures system integrity, operability, and reliability. CM and PM processes for safety significant waste transfer activities at C- and AN-Farms are effectively implemented. Predictive maintenance (PdM) is not in place for the waste transfer systems associated with the C-Farm; WRPS concluded that there are no active safety features or equipment that would benefit from PdM activities. However, PdM activities have been implemented for other portions of the Tank Farms (e.g., certain DSTs under the DST integrity program).

DOE Order 433.1B recognizes maintenance as a safety management program (SMP) in accordance with 10 CFR 830.204. Chapter 17 of the DSA identifies the SMPs for the Tank Farm, but maintenance is not explicitly identified as one of those programs. Maintenance is, however, implicitly referenced in a few other locations as follows. One of the SMPs identified in Chapter 17 of the DSA (Section 17.4.5.13) is the "In-service Surveillance Program." The WRPS NMMP (TFC-PLN-29, REV C-3) is credited for accomplishing that SMP, but it is not clear whether the DSA invokes the entire NMMP, thereby making it also an SMP. TSR Section 5.6, "Safety Management Programs," states that all of the programs in Chapters 7-17 of the DSA are SMPs. Chapter 10, "Initial Testing, In-Service Surveillance, and Maintenance," includes requirements for the maintenance program. Together, these documents imply that maintenance is in fact an SMP, but the path to reaching this conclusion is convoluted. As a result,

required reviews and activities assigned to SMPs may not be consistently applied. (See Section 7, **OFI Maint-1**.)

A search of the WRPS Computerized History and Maintenance Planning Software (CHAMPS) database revealed that no safety-significant CM work packages had been generated within the last three years related to the systems selected for review (C-Farm and AN-Farm). A sample of five non-safety significant completed Level 1 (complex/high hazard work) CM work packages for these areas was reviewed to evaluate implementation of the program. The packages were in conformance with the WRPS maintenance and work control programs, with the exception of post-job feedback. The WRPS procedure for pre-job briefs and post-job reviews recognizes the importance of post job feedback to the ISM process. Section 1.0 of TFC-OPS-MAINT-C-02, Rev E-2 states, "The post job review process is a fundamental element of the ISMS core function of feedback and continuous improvement at the activity level." The procedure contains requirements for informal and formal post-job reviews. Four of the five packages reviewed contained post-job feedback. Although the procedure does not require these work packages to have a formal post-job review, it does require the supervisor to review and disposition the feedback included in the work document. However, WRPS produced no evidence to substantiate that the feedback was reviewed or addressed. (See Section 8, **Finding Maint-1**.)

Performance measures exist for CM and PM backlogs. The CM backlog for December 2012 for the Tank Farm was 363 open work packages that were more than 180 days old. Of the 363 backlog packages, 10 were associated with safety significant SSCs. The performance measure threshold for meeting the management expectations of this metric are a monthly value of 499 open work packages or less, and the "adverse" indicator threshold is 600 or more CM packages. Although the number of safety significant backlog packages for the month of December is a manageable number, the current CM backlog performance indicator thresholds do not sufficiently challenge the organization to reduce and keep the overall backlog as small as possible. (See **OFI Maint-2**.)

The number of delinquent PMs for the month of December 2012 was 91, none of them involving safety significant SSCs. (To qualify as a delinquent PM, the item has to have exceeded its defined grace period for performance.) The monthly numbers of late PMs have been around 100 for the last 9 months. The threshold values for this metric are 172 or less, 172-258, 258-344, and greater than 344 for Exceeds, Meets, Declining, and Adverse performance, respectively. As with the performance indicator for the CM maintenance backlog, these threshold values are not sufficiently challenging. (See **OFI Maint-2**.)

The waste transfer safety significant mechanical system SSCs are periodically inspected in accordance with maintenance requirements. System engineers accomplish this function by conducting routine and comprehensive walkdowns of assigned systems. The walkdowns are typically documented in the system notebooks, and Problem Evaluation Requests (PERs) are written to address identified problems. (See Section 5.4 for more information on system notebooks.)

A comparison of waste transfer mechanical system drawings to selected maintenance activities associated with waste transfer C- and AN-Tank Farms showed that work control, post-maintenance testing, material procurement and handling, and control and calibration of test equipment were formally controlled to ensure that changes were not inadvertently introduced, the system fulfills its requirements, and system performance was not compromised. Several pre-job briefings were observed during this targeted review. These briefings were thorough and addressed the work to be conducted, the hazards associated with the job, and the controls that would be used to control those hazards. Worker involvement and participation in the briefings were noted as a strength for the pre-job briefing process and a positive indication of employee/worker engagement at the Tank Farm. WRPS has also implemented a concept called "reverse pre-job," in which members of the management team may ask the workers attending a pre-job briefing to

repeat their understanding of the job in order to ensure thorough understanding of the work to be performed.

Requirements are established for procurement and verification of items and services**.** TFC-BSM-CP-CPR-C-06, *Procurement of Items (Materials)*, defines the process for procuring quality level materials or items utilizing a Bill of Material or a Material Requisition. WRPS uses this process for the procurement/ acquisition of engineered equipment, materials for construction activities, CM and PM materials, fabricated parts or components, permanent material installations, and direct materials (future field installations, tool crib supplies/stock, hand tools, shop stock, operations supplies, and maintenance supplies). TFC-BSM-CP-CPR-C-19, *Controlling Spare Parts Inventory*, provides the process for the identification, review and approval, procurement, and inventory management of spare parts and spare equipment. Interviews with WRPS management and craft supervision indicated that spare parts are established in inventory, as appropriate, to maintain continuity of facility operations and to reduce system and facility downtime through availability of the identified parts.

The WRPS process for ensuring that suspect/counterfeit items (S/CI) are not introduced into the Tank Farm credits the barriers in place within its procurement system, including receipt inspection, to screen out and prevent those items from entering the site. S/CI training is discussed in the site's S/CI procedure, but it is not consistently implemented. Section 4.9, Training, of TFC-ESHQ-Q-C-C-03, *Control of Suspect and Counterfeit Items*, states that a specific hands-on training class should be taken by 11 groups of WRPS managers, staff, and craft employees. Training records for two of the tank farm teams showed that only about half of the employees who should have taken the training had actually taken the course. Section 4.9 also says that, as a minimum, the identified groups of employees will review the S/CI procedure. However, WRPS produced no records showing that this required reading was completed. (See **Finding Maint-2**.)

Processes for ensuring supplier quality are identified in TFC-PLN-02, REV G-3, *WRPS Quality Assurance Program*, Section 2.7.2.2, "Supplier Evaluation and Selection," which includes requirements to ensure that approved suppliers continue to provide acceptable items and services. The program requires WRPS to evaluate the supplier's capability to provide items or services in accordance with the requirements of the procurement documents before awarding a contract.

Overall, the observed WRPS maintenance activities were properly planned, scheduled, and performed. The WRPS maintenance program and procedures are adequate to ensure the successful accomplishment of safety system maintenance and an acceptable level of safety system reliability. The PM program is effective, and backlogs of both CM and PM activities for safety significant SSCs are maintained at acceptably low levels. PdM is only in place for DSTs within the Tank Farms as part of the DST integrity program. Worker participation and engagement in the pre-job briefing activities was identified as a strength for WRPS and a positive indication of employee/worker engagement at the Tank Farm. However, certain required activities such as work package post-job feedback resolution and completion of required S/CI training are not adequately performed and/or documented, and certain performance metrics are not sufficiently challenging.

5.2 Surveillance and Testing

For the C-Farm mechanical systems selected for review, the TSRs identify only a few surveillances and tests. Independent Oversight reviewed the surveillance procedures and results used to meet the TSR specific administrative controls (SACs) for double valve isolation (TSR 5.8.6, 5.8.7, and 5.8.8); TSR In-Service Inspection/Tests for Isolation Valves for Double Isolation (TSR 6.3.1), and tests demonstrating selected isolation valves through-valve leakage was less than the limit of 0.1 gallons per minute (as described in the Tank Farms DSA 4.4.3 and TSR 6.3). Additionally, Independent Oversight reviewed

instrument calibration results for the temperature indicator in POR 314. From the perspective of meeting the TSR/DSA requirements, no technical deficiencies were observed in the procedures and/or checklists, the criteria matched the TSR/DSA requirements, and the results were documented and within specified criteria and frequencies.

In general, surveillance and testing activities for the selected portions of the Waste Transfer System were properly performed in accordance with TSR surveillance requirements and SACs. Surveillance and testing of the system demonstrate that the system is capable of accomplishing its safety functions and continues to meet applicable system requirements and performance criteria. However, Independent Oversight identified some concerns about the procedures used to verify double isolation from a human performance and operations perspective, as further described in the next section.

5.3 Operations

Operations are conducted in a manner that ensures the safety systems are available to perform the intended safety functions when required, except as noted below. Procedures related to the C-101 transfer operations, including related annunciator response procedures, are technically accurate to achieve required system performance for normal, abnormal, remote shutdown, and emergency conditions. Operations personnel are trained on procedure use, proper system response, failure modes, and required actions for credible accident scenarios in which the system is required to function. Training plans, manuals, on-the-job training and evaluation documents, and operator certification processes are technically accurate and complete, reflect current operations, and address recent system modifications or operational updates through formal continuing training courses. Record reviews and interviews with nuclear chemical operators (NCOs) involved with C-101 transfer operations indicated that Operations personnel are knowledgeable of system design and performance requirements in accordance with the facility safety basis. Formal processes have been established to ensure that proper operational configuration control is maintained in accordance with DOE Order 422.1, *Conduct of Operations*, through use of procedure lineups and verifications. Installed equipment and indications, such as components supporting techniques for valve position indication, are adequate to meet the requirements of the safety basis.

During the review, the waste transfer activity selected for examination was not in operation due to an outage at the receiving Tank Farm. Although the Independent Oversight team was not able to observe the actual operation, Independent Oversight walked through the system operating procedures and the system piping and instrumentation drawings with selected NCOs. The walkthroughs showed that adequate processes are in place to ensure the proper configuration and operation of the selected safety system components, with the following exceptions.

Procedure and operator aid controls for obtaining data from the High Resolution Resistivity (HRR) Leak Detection and Monitoring (LDM) system were not in accordance with established conduct of operations requirements. During observations of procedure walkdowns by NCOs in the control area for C-101 transfer and sluicing operations, the ORP Facility Representative (FR) accompanying the Independent Oversight reviewer noticed an unapproved procedure for checking the HRR data in the control area (an eight-page document titled “Procedure for Checking HRR Data for Tank Leak Detection” and dated October 10, 2011). The procedure had no distinguishing WRPS marks and was not a reviewed and approved document as required by TFC-OPS-OPER-C-13, *Technical Procedure Control and Use.* The NCO taking the HRR LDM data for the day was present and stated that he/she did not use this procedure. The NCO had used an approved data sheet for collecting data (no deficiencies were noted in the latest data sheet) and stated that although there is an operator aid to be used with the data sheet, he/she did not need it due to familiarity with the system. The operator aid was not present at the work station normally used to collect the data and could not be located within the control area, contrary to TFC-OPS-OPER-C-

41, *Operator Aids*, step 4.4.2.c, which states, "Operator aids are sturdy and firmly attached close to where they would be expected to be used, or securely fastened to the equipment to which they refer." Because the deficient condition was identified by ORP and the HRR LDM system is not a safety system per the DSA, ORP will continue the follow up on this issue.

Certain Tank Farm operations procedures are not sufficiently designed to ensure that safety-significant isolation valves are properly positioned in accordance with SACs identified in the DSA. As demonstrated by the following, weaknesses in the human factors aspects of the procedures increase the likelihood of errors in valve positioning. (see **Finding Ops-1** and **OFI Ops-1**):

- The Tank Farms DSA, Section 4.5.9.2, "SAC Description," states that "Each safety-significant isolation valve is positioned in accordance with a continuous use operating procedure developed for each waste transfer that includes the correct method to position each isolation valve from TO-020-610." (TO-020-610, Operate Tank Farms Waste Transfer System Valves, Rev. F-5, is the continuous use procedure addressing the eight different methods of positioning for isolation valves in the Tank Farms.) The continuous use procedure developed specifically for the waste transfer from Tank C-101 to Tank AN-101 (TO-220-123, Over-Ground Transfer from 241-C-101 to 241-AN-101 and Sluicing of Tank 241-C-101, Revision A-3) contains the valve alignment checklist showing the isolation valves and their required positions, but does not contain the correct method for positioning each isolation valve, as required by the DSA section cited above. WRPS personnel indicated that they believe they meet the intent of the DSA statement by including a general requirement in TO-220-123 to follow TO-020-610 for all valve-positioning actions. Independent Oversight, however, determined that WRPS is non-conservatively interpreting the statement in the DSA and that the approach used in TO-220-123 does not conform to the literal meaning of Section 4.5.9.2 of the DSA.
- Independent Oversight performed tabletop walkdowns of a valve alignment in POR 314 that is frequently required during active retrieval and sluicing operations (more than once a week during operations, according to operator interviews). Independent Oversight performed a total of six of these walkdowns, with three qualified NCOs, an NCO designated as an operations subject matter expert, a knowledgeable system engineer, and a knowledgeable training instructor. Although TO-020-610 is a continuous use procedure, none of these six individuals went to the specific section of TO-020-610 directing them to use Table 1, which lists the correct method for valve manipulation. Five of the six skipped the decision steps and went directly to Table 1, which is the correct table. However, one of the six skipped the decision section and also skipped Table 1; this individual went to the wrong method for the valves specified in the TO-220-123 valve alignment checklist, which would have resulted in erroneously opening closed isolation valves in the process of verifying their position.
- Although TO-020-610 does not contain overt technical errors, it is extremely misleading and has some characteristics that are likely to cause human error. The section containing the logic steps directing the operator to the table of positioning methods is titled, "5.1 Transfer Valve Tamper Seals." All of the personnel performing the tabletop walkdowns stated that they skipped this section because they were aware that tamper seals are not used in C-Farm. They were not aware that Section 5.1 also contains the logic steps directing them to Table 1. Additionally, Table 1 lists the specific valves by component number, the type of valve, and the specific method (one of seven methods), but does not list the specific section in the body of the procedure to be used for the specific valve. Because the same type of valve may use two different methods, the procedure user has to determine the correct section by matching type of valve and method to the section titles, introducing unnecessary decision points for the user and increasing the probability of errors. The ambiguity in the procedure, in combination with interviews and tabletop exercises confirming that the procedure steps are not well understood by operators, increases the potential for errors in positioning safety significant isolation valves.
- The current implementation of TO-020-610 and TO-220-123, as well as the human factors deficiencies within TO-020-610, does not meet the human factors standards for procedures

established in TFC-OPS-OPER-STD-01, *Technical Procedure Format and Preparations Standard*, which states, "Procedures must be developed with emphasis on the human-factors aspect of their intended use." The procedures also do not meet the intent of TFC-OPS-OPER-C-13, *Technical Procedure Control and Use*, which states, "Technical procedures will incorporate Human Performance Improvement concepts and philosophies to increase error prevention."

In summary, operations are conducted in a manner that ensures the safety systems are available to perform the intended safety functions when required. Procedures are technically accurate and complete, and operator training is comprehensive. NCOs are current in their training and demonstrate a high level of competency in their knowledge of the safety systems. Adequate systems are in place to maintain safety system equipment and system status. Operation of the safety significant Waste Transfer System is rigorous and meets the assumptions of the safety basis for safe operation. However, management attention is needed to ensure that optimal human performance aspects are considered in the procedures and methods used for safety system valve manipulations.

5.4 WRPS Cognizant System Engineer Program

WRPS has established a system engineer program as defined in DOE Order 420.1B, *Facility Safety*, to ensure continued operational readiness of identified systems to meet their safety functional requirements and performance criteria. (Although DOE Order 420.1C is the latest revision, it has not yet been incorporated into the WRPS contract.) The WRPS system engineer program has recently undergone notable change. The changes were initiated in October 2012 and have been implemented in all areas except for the C-Farm Retrieval and Closure organization. The program is transitioning from a system engineer who focuses primarily on day-to-day system operation/maintenance/testing to an approach where CSEs are delegated the authority from the WRPS Chief Engineer as the Design Authority for assigned areas of the Tank Farm. Field support engineers assist the CSEs by following smaller groups of individual systems, and they evaluate day-to-day performance and work under the technical direction of the CSE. This concept allows the CSE to focus on overall system performance trends and safety basis issues.

For C-Farm Retrieval and Closure, system engineers are presently assigned for day-to-day system monitoring, and a CSE has recently been identified for C-Farm. WRPS intends to fully implement the CSE concept described above for C-Farm Retrieval and Closure once the CSE has achieved full qualification. The C-Farm CSE reports to the Retrieval and Closure organization but receives system engineering oversight and program direction from the CSE Manager, who reports through the Base Operations Engineering organization. Two other CSEs report to other Tank Farm organizations and also receive the same CSE oversight and program direction from the CSE Manager. The remaining eight Tank Farm CSEs report directly to the CSE Manager.

The cognizant system engineers prepare periodic system health reports, which are presented to senior WRPS management. The health reports are prepared for each safety system, as well as other systems that are important to mission success, and are sufficiently detailed. Risks, concerns and other issues affecting reliability are included in the report and the reports contain a scoring process for determining overall system health based on: Operations/ Availability, Maintenance, and Configuration Management. These factors are integrated into an overall rating for the system. However, the ratings do not include other factors that influence system health (e.g., system degradation, lack of critical spares, and other risks/concerns being tracked by the system engineer). Degraded system performance represents risk to operations and mission success. (See **OFI CSE-1**.)

Independent Oversight considers the current routine system health presentations to senior management to be a positive step in informing management of the status of important systems. During the presentations,

Level 1 managers representing Operations, Engineering, and Projects are in attendance, primarily to represent their organizations and to gain understanding of current system performance. Because these meetings lack formality, the information is not effectively leveraged to ensure that system risk is minimized and reliability is maximized. (See **OFI CSE-2**.)

The system notebook for the Waste Transfer System engineer was reviewed against the WRPS procedure for system notebook preparation (TFC-ENG-FACUP-D-01.2). The notebook contained acceptable detail and met the expectations of the procedure. Three PERs written since 2009 (WRPS-PER-2009-0136, WRPS-PER-2012-0487, and WRPS-PER-2012-0486) identified minor issues in the consistent implementation of system notebooks maintained by system engineers or their backups. No implementation issues were found in the notebook implementation associated with the Waste Transfer System. However, the system notebook for Retrieval and Closure mechanical systems has not been updated since the fourth quarter of calendar year 2011. WRPS-PER-2012-0486 was generated on April 4, 2012, to address this issue. The PER corrective action was to update the notebook by April 2, 2013. Despite the fact that the problem had been identified in April 2012, no action was taken to ensure that routine notebook entries would be made as required by procedure until the entire notebook could be updated in April 2013. This allowed the notebook to be increasingly non-compliant and out of date. Problems with the management of system notebook issues are further discussed in Section 5.5. (See **Finding CSE-1**.)

The WRPS system engineers are assigned a qualification card, and are evaluated via oral examination after completing the qualification card. WRPS management sets expectations that the qualification be completed within one year of beginning the qualification process. The qualification card addresses all of the key areas of CSE responsibility, but there is no formal document to identify the training and qualification process for WRPS system engineers and no training plan or standard to ensure consistency in the qualification process. DOE Order 420.1B, Section 3.d. (3) states that "Qualification requirements for CSEs must be consistent with those defined for technical positions described in DOE O 5480.20A, Chapter IV, paragraph 2f, 'Technical Staff for Non-Reactor Nuclear Facilities'." DOE Order 5480.20A, Chapter I, General Requirements, Section 5.a states, "Operating organizations shall define qualification requirements for personnel in each functional level based on the criteria contained in this Order." Contrary to this requirement, WRPS has not defined qualification requirements for the system engineer position. This issue was identified as part of the 2012 Engineering Independent Assessment and is being addressed by PER WRPS-PER-2012-0491.

For the systems included in this review, system engineers were appropriately qualified and experienced. System engineer qualification cards include knowledge of facility and system safety basis, applicable codes and standards for design and maintenance, failure modes and effects analysis, root cause analysis, performing periodic system walkdown and reviews, and preparing system health reports. System engineer functions, responsibilities, and authorities are clearly defined in the Conduct of System Engineering procedure (TFC-ENG-FACSUP-P-01). System engineers are familiar with systems engineering documents (e.g., drawings, calculations, system design descriptions), maintenance and procurement activities, surveillance tests, and existing system condition and performance.

Some attention is needed to address the issues discussed above with system notebooks, documentation of the CSE training and qualification program, and level of detail in system health reports. However, the WRPS system engineers provide adequate technical support for operations and maintenance through the activities described in DOE Order 420.1B, including reviewing design changes, ensuring effective configuration management, identifying trends in key system parameters from operations and surveillances, determining operability, performing analysis of problems, and initiating corrective actions. System assessments are conducted by system engineers and include reviews of system operability, reliability, and material condition. Detailed and comprehensive safety system assessments are performed

and periodically scheduled. System engineers are assisted by other qualified experts as needed in performing system assessments.

The CSE program is established and is undergoing improvements that are expected to have a positive effect on system performance and reliability. The system engineers who were interviewed are appropriately experienced and qualified. However, a formal training and qualification plan/program for CSEs is not currently in place, as previously identified by WRPS and documented in an open PER. The system notebook for mechanical systems in C-Farm Retrieval and Closure has not been updated for over a year, and actions to correct this problem have been ineffective. Differences in reporting relationships for the Retrieval and Closure CSE/system engineers may present challenges to the CSE program in this area of the Tank Farms. Although the current set of system attributes do not promote a fully comprehensive assessment of system health and the process is not formalized sufficiently to fully promote leveraging the information to reduce system risk and improve reliability, system health feedback to senior management is occurring on a regular basis and performance monitoring for safety significant systems has improved.

5.5 WRPS Safety System Feedback and Improvement

Independent Oversight evaluated the establishment and implementation of feedback and improvement programs and processes that affect nuclear safety significant systems at the Tank Farms. Independent Oversight reviewed program and process documents, interviewed responsible managers and staff, and evaluated samples of process outputs, such as assessment and trend reports, performance indicator reports, lessons-learned publications, event analysis reports, and PERs. With some exceptions (identified in this section of the report), WRPS has established adequately defined feedback and improvement programs and implementing documents supporting the effective management of Tank Farm safety systems. Processes are detailed in several program descriptions, including quality assurance (QA) and contractor assurance system (CAS) programs and the WRPS ISMS. WRPS has issued implementing program plans (e.g., CAS, assessment, Engineering management, and subcontractor oversight) and numerous implementing procedures, desk instructions, and guides (e.g., performance analysis and identification of recurring events, QA surveillances, issues management, management and specialty assessments, safety basis implementation checklist, trend and root cause analysis, lessons learned, management observations, and performance indicators). In addition, various guidance and links to outside information sources are available on the program owner home pages of the Tank Farm intranet.

Assessment Program. With some exceptions, WRPS has established and implemented an adequate program to assess programs, processes, and performance related to the management of Tank Farm safety systems. The assessment program includes a spectrum of formal, documented assessment types (e.g., independent, management, management observations, and QA surveillances). The formal assessment program is implemented through a structured integrated planning process and maintained in a schedule that integrates ORP assessment activities. In addition to company-level assessment procedures, organizations such as Engineering have issued guidance documents for the conduct of assessments. Periodic assessments that are mandated by DOE directives or regulations, such as SMP reviews, are designated as “specialty assessments” and are identified, monitored, and included in the integrated assessment schedule. The integrated assessment schedules for 2010 through 2013 examined by Independent Oversight reflected an appropriate variety of nuclear safety related reviews by the various responsible organizations. Postponing or cancelling scheduled assessments must be justified in writing by the team lead and approved by the Project Operations Manager. The completed postponement or cancellation forms for 2012 showed appropriate bases for schedule changes. Team leaders are required to complete a web-based training course on assessment techniques and a qualification card, unless they are otherwise qualified as Nuclear Quality Assurance (NQA)-1 Lead Assessors. Line managers review and approve management assessments. Independent Oversight reviewed the reports for approximately 20 formal management, independent, and specialty assessments conducted by WRPS in 2011 and 2012, as

well as a sample of quality surveillance reports and management observation reports. Formal assessment reports are documented in consistent formats with CRADs attached and summarized in the body of the report. In many cases, specific checklists of criteria and compliance results were used and were attached to the report.

Most of the formal reports reviewed were well-documented, value-added evaluations of programs and/or performance. For example, an independent assessment of engineering design control, system engineering, and the Engineering organization and a subsequent management assessment of the Engineering SMP, conducted in 2012, were comprehensive and thorough reviews. These assessments identified many issues for correction and continuous improvement of engineering processes and performance. A 2011 management assessment of TSRs conducted by the Operations organization and a 2012 independent assessment of procurement document control were also thorough reviews of safety processes. In 2012, senior management directed formation of a team of managers and subject matter experts to conduct an extensive effort of observation of fieldwork execution to improve conduct of operations performance by Operations and Maintenance personnel and promote behaviors that support safety and reliable operations. This assessment was performed over a six-month period by 35 observers identifying issues for correction and providing real-time coaching and mentoring to communicate management expectations and impart the observers' knowledge and experience to first line supervisors, operators, and craftsmen. Team member observations were recorded on field observation checklists that have been incorporated into the ongoing management observation program (MOP). The review generated 237 completed checklists and 45 PERs. The collected results of the observations were analyzed, and the team provided eight recommendations and a corrective action plan for process and performance improvement to the Conduct of Operations Council. Implementation of the corrective action plan is being tracked through a PER.

Notwithstanding these rigorous, value-added assessments, the program could be strengthened by management attention to the following implementation weaknesses (See **OFI F&I-1**):

- More emphasis on program and process implementation and on the quality of outputs, rather than simple compliance with requirements. In many cases, the focus of assessment activities is on verifying the adequacy of requirement flowdown into process documents rather than watching work and reviewing process outputs. Independent Oversight noted that several reports stated the purpose or scope as "evaluating implementation" or concluded that processes or programs were "effectively implemented" when the scope of the assessment as reported was limited primarily or exclusively to process descriptions reflecting flowdown of upper level requirements. For some reports, the criteria lacked qualitative elements (e.g., "investigations are performed" rather than "adequate or rigorous investigations were performed" or "investigations effectively evaluated and documented the events and identified causes to promote development of recurrence controls").
- More rigor by team members, team leaders, and management reviewers and approvers in ensuring the accuracy and completeness of assessment reports. Areas where weaknesses were noted include: accuracy and consistency of scope and purpose statements; accuracy in wording of conclusion statements (i.e., "implemented" does not just mean that requirements have been flowed down into procedures); fully supported bases in the text for issues, results, and conclusions; sufficient descriptions of what was reviewed or watched or who was interviewed, linked to and supportive of the results and conclusions; and formal identification of areas found deficient or needing improvement as issues documented on PERs.

WRPS managers conduct frequent, documented field observations that provide direct interaction between managers and workers performing various field activities, affording opportunities for mentoring; communicating management expectations; and improving understanding of field conditions and issues related to work documents, worker knowledge and behaviors, and overall work planning and control performance. The requirements and process for implementing the MOP are detailed in an administrative

procedure and implemented by the top three levels of management in organizations that perform field activities. Currently, WRPS managers perform between 250 and 300 documented worksite visits monthly. Observation details are documented in an online database and observed problems are addressed on the spot and/or through the PER process as appropriate. Data on management participation in the work site visit and observation program is monitored by Contractor Assurance and reported as indicators on the monthly Tank Farm Performance Dashboard (described below under Performance Indicators).

Between 100 and 150 QA surveillances are performed annually to evaluate the quality of work activities at the Tank Farms. These surveillances are planned and scheduled annually and primarily address verification of proper fabrication and testing and work conducted by subcontractors and suppliers, including follow-up on corrective actions to address previously identified issues. Independent Oversight reviewed a sample of ten QA surveillance reports generated in 2011 and 2012 and concluded that the surveillance activities were well documented and provide valuable assurance of quality and feedback for improvement of safety systems.

A member of the Contractor Assurance organization reviews and evaluates completed assessment reports for compliance with assessment procedure requirements and expectations. These reviews are not required by or described in any procedure, but the results are documented on a formal checklist that scores performance for various elements of assessment planning, preparation, performance, and reporting. The results are provided as feedback to the assessment's team leader. While this informal feedback mechanism is a beneficial continuous improvement activity, additional benefits could be achieved by broadening the qualitative elements of the checklist criteria and better using the results. WRPS has previously identified that improvements in this process can be made and will address this in the resolution of PER 2012-1728. (See **OFI WRPS-F&I-1**.)

Event Reporting and Analysis. WRPS has established generally adequate procedures for identifying, notification and reporting, investigating, and periodically analyzing performance trends for occurrences as required by DOE Order 232.2, *Occurrence Reporting and Processing of Operations Information*, and other DOE directives and associated guidance. Independent Oversight reviewed a sample of event investigation reports (EIRs) for six 2011 and 2012 occurrences and the fourth quarter fiscal year (FY) 2012 occurrence reporting performance analysis report to evaluate these processes and their implementation.

The WRPS occurrence reporting procedure specifies that the Shift Manager or 222-S Operations Manager, as appropriate, ensures that a PER is submitted to document and disposition the event or condition and determines whether an investigation of the occurrence is appropriate with reference to TFC-OPS-OPER-C-14, *Initial Event Investigation Process*. This procedure describes prompt investigative actions to be taken to support occurrence reporting and subsequent categorization, evaluation, and disposition of the issue(s) in the processing of the PER. However, the purpose, scope, and use of the results of this process and the interfaces with the Occurrence Reporting and PER procedures (TFC-OPS-OPER-C-24 and TFC-ESHQ-C-C-01, respectively) are insufficiently defined. In addition, WRPS is not implementing this procedure as written, as further described below. (See **OFI WRPS-F&I-2** and **Finding WRPS-F&I-1**.)

The Initial Investigation procedure includes a listing of some of the responsibilities of personnel and the responsible manager that duplicates those included in the Occurrence Reporting procedure. The Initial Investigation procedure requires the responsible manager to determine the level of formality for the initial investigation (i.e., low, mid, or high level). However, there is inconsistent guidance and criteria for making these graded approach determinations. The procedure only provides a limited purpose (to understand the precursors leading to the event), a brief description of the typical process (individual or small group interviews), and a statement that the injury investigation reporting process "meets the

requirements" (undefined) for a low level investigation. The criteria for a mid level investigation describe the typical process as a large group meeting with the intent of identifying precursors and evaluating compensatory measures taken, potential causes, and extent of condition. The criteria specified for a high level investigation add the identification of failed barriers to the list of mid level investigation objectives and state that the high level investigation provides recommendations and lessons learned. Each of these sections includes statements that the "cause analysis team" (undefined) will continue the event investigation process in accordance with the PER procedure, including cause determinations and lessons learned. The Occurrence Reporting procedure and the PER procedure do not refer to or address how the information, lessons learned, and recommendations in the initial investigation reports are to be used. The apparent primary benefit of the initial event investigation process is the conduct of fact-finding meetings, which are not discussed in other WRPS procedures. The sections of the procedure on the conduct of each level of investigation provide little direction about actual investigative activities beyond the initial gathering of related documentation, witness statements, and photographs and the conduct of fact-finding meeting(s). (See **OFI WRPS-F&I-2** and **Finding WRPS-F&I-1**.)

Implementation issues were identified in each of the EIRs reviewed by Independent Oversight. The EIR for an occurrence documented on the one PER in 2012 that was categorized as "significant" did not indicate any level designation. However, the report did not address all the elements cited in Procedure OPS-OPER-C-14, including lessons learned and failed barriers. A bulleted list of potential causes is provided, but without any discussion or bases. The four other EIRs that were reviewed appeared to be improperly categorized as low level investigations, because they met the criteria or examples for categorization as mid level investigations identified in the procedure. For example, a low level investigation was conducted in 2012 for a valve misalignment event during a transfer evolution, which was a significance level 3 reportable occurrence; valve misalignments and reportable events are both cited as examples where a mid level investigation is to be conducted. In addition, this report provided an inaccurate and incomplete extent-of-condition review that inadequately discussed the similarities of a cited previous misaligned valve incident (2011) and failed to identify at least two other similar events documented on PERs in 2011. The EIR for another event in 2011, involving incorrect positioning of two valves and issues related to interpretations of defense-in-depth actions and failure to identify a potential water hammer inducing jumper configuration, was also conducted as a low level investigation. The investigation of an August 2011 reportable event related to the failure to properly record and verify the acceptability of tank temperature readings in support of DSA administrative control requirements was also conducted as a low level investigation. (See **OFI WRPS-F&I-2** and **Finding WRPS-F&I-1**.)

A mid level investigation EIR for an incident inadequately addressed the scope of the deficiencies and the potential extent of condition. In this incident, a substitute contractor weld inspector, without the required radiological training to conduct a weld inspection per procedure, performed a remote inspection based on cell phone photographs. The incident was observed and reported as a finding by an ORP FR, and the event investigation was not conducted until eight days after the event. The subsequent investigation of the issue, as documented in the EIR and PER 2012-1338, focused on the failure to document and pre-approve a remote inspection methodology. There was no discussion of why the field work supervisor allowed the work to proceed without a properly radiologically trained inspector, why this issue was not identified during the pre-job briefing, and why the work crew and supervision lacked a questioning attitude. (See **OFI F&I-2** and **Finding F&I-1**.)

In July 2012, an ORP FR identified additional issues with inadequate implementation of the initial event investigation procedure, including untimely initiation of PERs and delays in the conduct of investigations. These issues, documented as a single Priority Level 2 finding, are addressed by a WRPS corrective action plan being managed through PER 2012-1270. However, the specified actions do not address the process and performance weaknesses identified by this Independent Oversight review. (See **OFI WRPS-F&I-2** and **Finding WRPS-F&I-1**.)

The WRPS analysis and conclusions in the quarterly performance report reviewed by Independent Oversight address the appropriate scope of operational and non-operational events and issues and sufficiently evaluated the data sets for adverse trends.

Performance Indicators. With exceptions noted in Section 5.1 of this report, WRPS has established and maintains a suite of appropriate performance indicators and associated analysis to assist management in monitoring performance levels in key areas affecting nuclear safety and prompting further evaluation or corrective actions when warranted and as a tool for driving continuous improvement. At the company level, approximately 45 indicators are reported monthly in a "Performance Dashboard," addressing safety and health, conduct of operations, environmental management, engineering, radiological control, emergency preparedness, problem identification and resolution, performance assessment, and management focus areas. Each indicator is identified as a leading or lagging indicator; reflects performance over the past year; identifies the objective, measure, goals, and performance thresholds (i.e., red, yellow, green, and blue rating levels); and analysis and action statements.

The Performance Indicator procedure specifies that Level 1 and 2 managers are to analyze the indicators for which they are the assigned "owners" for adverse trends each month, but the only reference to methodology is "based on statistical calculations" and the direction to submit a PER for any adverse trend. There is no linkage to any trend analysis procedure, nor are any criteria or definition of an adverse trend provided. WRPS has issued Procedure TFC-ESHQ-Q-C-C-06, *Trend Analysis Process*, but analysis responsibilities are limited to the company's Contractor Assurance Manager and staff. In addition, neither the Performance Indicator procedure nor the monthly Performance Dashboard sheets indicate how specified actions are to be managed or by whom. (See **OFI WRPS-F&I-3**.)

Engineering has established and maintains organization-level performance indicators addressing such areas as product quality, safety performance, configuration management, productivity, continuous improvement, and training and qualification. Each indicator report has a red/yellow/green/blue rating; includes a definition, measures, goals, analysis, and action descriptions; and addresses monthly performance over a 12-month period. Similar to the company-level performance indicators, when actions are identified on the Performance Dashboard sheet there is no designation of an action owner or the method of managing the specified action(s).

Issues Management. WRPS has established an adequate issues management program and processes to document, evaluate, and correct deficiencies and promote continuous improvement using a graded approach. The PER system encourages formal identification, evaluation, and management for all levels of process and performance problems and opportunities for improvement. Procedures and guidance documents define the requirements and processes for conducting apparent and root cause analysis. A safety review board of top-level company managers meets quarterly to review, discuss, and approve top-level feedback and improvement plans and reports, ongoing significant safety issues and trends, and reports on the health of SMPs. Longstanding and regularly maintained program improvement plans are in place for the Engineering and Conduct of Operations organizations' programs. A collective significance review process brings company QA and CAS management and staff, organization assurance staff, and bargaining personnel together regularly to review and discuss feedback and performance data sets for common themes and areas needing further review or action, with recommendations reported to senior management.

Independent Oversight reviewed more than 20 completed and in-process PER documents, including many of the PERs generated during the March 2012 independent assessment of the Engineering program and PERs associated with the event reports discussed in the previous section. Although WRPS has documented, evaluated, and effectively resolved many issues using the PER process, the program's

effectiveness is limited by implementation weaknesses. Independent Oversight identified many examples where the documentation, evaluation, and disposition of PERs were not sufficiently rigorous or comprehensive to provide a full understanding of the issue or fully effective actions or recurrence controls. Identified weaknesses in documentation and disposition included the following (see **OFI WRPS-F&I-4** and **Finding WRPS-F&I-2**):

- The stated extent-of-condition and/or causal analyses were inappropriate to fully scope the issue for effective resolution and recurrence control. In several cases, the PER did not explain the scope and method of the extent-of-condition analysis as required by the PER procedure (e.g., "the problem is limited to the instance identified in the PER"). The extent-of-condition statement in PER 2012-0470 simply described the issue (inconsistencies between documents regarding configuration control of engineering change notices, as-built drawings, and facility drawings and failure to get ORP approval for a contract deliverable), rather than determining whether the condition could exist elsewhere. The method and scope of the analysis are not documented on the PER. The cause statement was that when the contractor changed, the program was assigned to the wrong organization (Construction, not Engineering). The PER does not discuss why this program was wrongly assigned or why it took years to identify the lack of an accurate as-built program plan or implementing procedures. In addition, although the specified corrective action was to "revise the As-Built Program Plan and develop implementing procedures for as-built drawings and field verification," the need for interim or compensatory actions was not addressed in the PER. This PER remains in process, with the action due date of September 20, 2013, 19 months after the issue was identified.

  A similar problem is evident in PER 2011-1669, which addresses a reportable event where over-limit tank temperature readings that are subject to actions in a TSR administrative control were taken on a temporary round sheet that lacked the required acceptance criteria, and the out-of-specification reading was not identified during the supervisor's round sheet review. The extent-of-condition review was limited to a review of other DST temperature records for over-limit temperatures (with no time period specified), rather than addressing the possibility that other round sheets or temporary data sheets for TSR-related data had been used without acceptance criteria. The cause identified was that the shift manager and operating engineer failed to recognize the over-limit reading, but no actions addressed this cause. The analysis and actions did not address why a temporary round sheet was authorized and approved without the DSA-required acceptance criteria, or who authorized it.

  Other examples where the documentation, evaluation, and disposition of PERs were not sufficiently rigorous or comprehensive included PERs 2012-0475, 2012-0474, 2012-0471, and 2012-1338.

- The description of actions to be taken lacked sufficient specificity. PER 2012-0494 notes that the Engineering Change Notice procedure does not provide clear roles and responsibilities for design document adequacy, completeness, and approval. The only action was to "confirm the revised engineering improvement plan contains the plans that will address this PER." The improvement plan is not a formal issue tracking system, and the specified actions are not managed at the level of PER actions. Similarly, PER 2012-0491 identifies weak requirements flowdown and implementation of DOE Order 420.1B (facility safety) and DOE-STD-1073 (configuration management). The extent of condition states that the issue is considered to "exist through many of the documents, procedures and guides in WRPS system engineer program." The action is to "Evaluate and revise WRPS Engineering Program documents, policies, plans, procedures and guides as necessary to address the issues identified in this PER."
- Action or closure statements do not always fully address the stated issue or specified actions. For example, an action specified in PER 2011-1138 was to develop and distribute a lessons-learned document and an associated set of management expectations to a target audience, "at minimum, line management." The action was closed without issuance of lessons learned, and there is evidence of a presentation of management expectations to a group of operators in only one organization.

Another example that exhibited several of these weaknesses was PER 2012-0486, which documented an assessment observation that two system engineer notebooks were not being maintained or updated. Although this observation should have been designated as a finding for non-compliance with the requirements of the Conduct of System Engineering procedure and thus should have been assigned a higher significance level, no extent-of-condition review was required because this PER was designated a significance level of "track until fixed." However, the responsible owner filled in the extent-of-condition block with "confined to this incident," and corrective actions were limited to having summer interns update the two cited notebooks; no recurrence controls were specified (not required by procedure for a "track until fixed" PER). Nevertheless, Independent Oversight identified that the same issue had been previously documented in 2010 (PER 2010-3408) and 2009 (PER 2009-0136). Neither this PER nor the related PER 2012-0487 addresses the system engineers' apparent failure to identify these inadequate notebooks during the annual review of notebooks to ensure that they are "accurate, complete and consistent with other notebooks," as required by the Conduct of System Engineering procedure. Section 5.4 and Finding CSE-1 of this report provide further discussion of problems with outdated system engineer notebooks. (See **OFI WRPS-F&I-4** and **Finding WRPS-F&I-2**.)

Collectively, these documentation and analysis weaknesses indicate insufficiently rigorous management of issues by responsible managers and oversight by Contractor Assurance personnel. (See **OFI WRPS-F&I-4** and **Finding WRPS-F&I-2**.)

Lessons Learned. WRPS has established and implemented an operating experience/lessons learned program that identifies, evaluates, and provides for appropriate application of lessons learned generated from external operating experience and internal activities, conditions, and events. The program includes a content-rich and user-friendly intranet site and a designated company coordinator who maintains formal documentation and manages screening activities, subject matter expert evaluations, and application actions. The lessons-learned intranet website contains hotlinks to WRPS internally generated lessons-learned documents, the DOE Headquarters lessons learned website and database, and the Hanford Site contractor's collaborative lessons-learned database (administered by DOE Richland contractor Mission Support Alliance). When prompt notification of a safety issue is warranted, the company coordinator periodically issues "Just-In-Time" bulletins pending issue of a formal lessons-learned report.

The full-time, designated company coordinator maintains the site procedure, interfaces with the Hanford contractor's lessons-learned administrator and inputs lessons to that database. The coordinator maintains a spreadsheet of the externally generated lessons that are screened, the assignment and status of subject matter expert review, the evaluation results (including actions to be taken and when taken) and PERs that are written, when appropriate. The Hanford contractor's lessons-learned system includes a non-mandatory feedback mechanism for reporting lesson quality or usefulness and whether or how viewers applied the lesson. The company coordinator monitors feedback from WRPS users as it pertains to WRPS-generated lessons learned.

The Engineering intranet site includes a listing of engineering best practices and lessons learned in 18 topical areas (e.g., configuration management, mechanical systems, nuclear safety, design process, and transfer systems and pumping systems). However, this intranet site has not been maintained; no lessons have been posted since 2005. Engineering should review the intent and content of this information and establish a path forward for its use and maintenance. (See **OFI WRPS-F&I-5**.)

Activity-Level Feedback and Improvement. As discussed in Section 5.1, post-job reviews were not always performed and dispositioned correctly. Independent Oversight's review of a sample of five Level 1 completed CM work packages identified that for the four packages that contained worker feedback, WRPS management could produce no evidence that the work supervisor properly addressed the feedback. Proper handling of worker feedback during the performance of work is an essential element of ISMS

feedback and improvement. (See **Finding Maint-1**.)

In summary, WRPS has established and implemented the elements of an appropriate assurance system supporting Tank Farm management of safety systems. Managers and subject matter experts are capable, proactive, and focused on effective performance and continuous improvement. However, attention to detail as applied in planning, performing, and documenting assessment activities has not been sufficient and issues management processes have not always been accurately and rigorously implemented to ensure that problems are effectively addressed, especially with regard to extent of condition and recurrence controls.

5.6 ORP Safety System Oversight Program

Two engineers in the ORP Tank Farms Operations Division (TOD) are assigned as SSO engineers: one assigned to the Tank Farms ventilation safety systems, and the other assigned to the Tank Farms mechanical safety systems. They were re-assigned to the TOD during a reorganization of ORP at the start of FY 2013. The TOD, composed of SSO personnel and FRs, reports to the Tank Farms Project Assistant Manager, who is a direct report to the ORP Manager.

The current SSO program is defined and/or referenced in the following ORP management and plan documents. Program Plan 07-TED-020 provides the most detail on the SSO program but was intentionally created as a bridge document, to be cancelled upon the approval of a permanent ORP management document. Although no implementing procedure has been developed, the program plan incorporates the SSO program core requirements from DOE Order 426.1B, Appendix D, such as roles and responsibilities for managers, supervisors, and SSO personnel. As an example, the program plan requires SSO responsibilities to be clearly defined in the individual SSO personnel performance plans. ORP's Federal Technical Capability Panel Agent intends to finalize MGT-QT-IP-XX, *ORP Safety Oversight Engineering Qualification Process*, in the next few months and cancel 07-TED-020. Independent Oversight notes that an assessment of the ORP technical qualification program (TQP) in 2011 identified the need to complete this document by March 2012. The approved documents listed below adequately flow down and define the SSO requirements from DOE Order 426.1, Appendix D, to site-level documents:

- Program Plan 07-TED-020, *Safety Oversight Program Plan, Rev 3*
- Program Plan MGT-QT-PL-01 R3 7-17-12, *Technical Qualification Program Plan,*
- Desk Instruction MGT-QT-DI-01 R2, *Technical Qualification Program: Federal Technical Capability Panel Agent Duties*
- Plan MGT-PM-PL-02, *Safety Management Functions, Responsibilities, and Authorities*
- Individual Performance Plan for the Tank Farm Ventilation Safety Systems SSO
- Individual Performance Plan for the Tank Farms Mechanical System SSO.

One requirement from DOE Order 426.1 Appendix D, included in 07-TED-020 is for the supervisor with responsibilities for SSO personnel to periodically evaluate the SSO program's effectiveness. The TQP self-assessment (11-ENS-025, November 2011) and the Engineering Services Division management self-assessment (11-ESD-019, September 2011) evaluated parts of the SSO program, such as SSO personnel qualification status, support from ORP management, and the status of revising program documents. However, no assessment of SSO program effectiveness has been completed since the program was established in 2005. (See **OFI ORP-1**.)

The assignments of the ventilation safety system SSO engineer have changed over the last several years. When the SSO program was first established, the DST ventilation safety system was designated as safety significant. A few years later, this system was downgraded to general service. At present, a major Tank

Farm DSA change and implementation is in process concerning the safety systems at Tank Farms, and the Tank Farm ventilations safety systems are scheduled in the near term to change from general service back to safety significant. Independent Oversight noted that when the DST ventilation safety system was designated as safety significant, the SSO plan at that time (07-TED-020) cited a need for an instrumentation and control SSO engineer in its staffing analysis. That staffing analysis has not been conducted/revised to address the latest change in designation of the ventilation safety systems to safety significant classification. (See **OFI ORP-2**.)

The two Tank Farm SSO engineers have completed an adequate qualification process and have been assigned to their respective safety systems for several years. Both were found to be fully aware of their roles and responsibilities as defined in DOE Order 426.1, Appendix D, especially as further documented in their individual performance plans. They have dedicated most of their time and resources to implementing those responsibilities. As required by site policies, they have routinely and clearly documented their activities in the ORP operational awareness database. Both have strong engineering backgrounds and are highly experienced and thoroughly knowledgeable of their systems. Further, they have good communication and routine interface with their ORP Division Director, other ORP managers and staff, and WRPS cognizant and system engineers and Engineering management.

The Tank Farm SSO engineers conduct adequate oversight in such areas as configuration management, maintenance, and surveillance and testing. This oversight is performed as part of various oversight activities, including planned surveillances, field walkdowns, active engagement in design reviews and other meetings, and safety system document reviews. Surveillances are jointly performed with the Tank Farm FRs. The SSO engineers also routinely provide detailed subject matter expert reviews of DSA changes and of safety system compliance with design requirements and codes.

Additionally, ORP has adequately completed several efforts directly related to improving performance in some important SSO functional areas. For example, in July 2010, ORP conducted a surveillance of the WRPS's Tank Farm configuration management program (10-ESD-22) and identified issues concerning such items as the need for the approval of a configuration management plan/program using DOE-STD-1073, the need to resolve open PERs related to WRPS configuration management deficiencies, the adequacy of Drawing Reconstitution Plan implementation (further described below), and the need to maintain configuration management when work packages are not fully completed (i.e., the Engineering Change Notice is terminated when work is only partly complete). In May 2011, the Tank Farm mechanical systems SSO engineer conducted a follow-up surveillance on the open issues from the initial configuration management surveillance. The follow-up surveillance supported the conclusions that WRPS had made significant progress in implementing an effective configuration management program, but continues to struggle with the backlog from work orders that are partially completed and the associated Engineering Change Notices that were never updated to reflect partial work completion. As part of this surveillance, the status of the Drawing Reconstitution Plan completion was evaluated. With American Recovery and Reinvestment Act Drawing Reconstitution Plan funding, WRPS updated 3000 important and/or safety significant system drawings that were greatly in need of correction. The results of the surveillance show that this two-year project was carefully overseen for quality and independent verification by the ORP Tank Farm Project Assistant Manager and staff.

In another example of the active and effective involvement of the ORP Tank Farm SSO engineers in overseeing WRPS, in March 2012 the Tank Farm mechanical systems SSO engineer actively participated in a WRPS assessment of the WRPS Engineering organizations (FY2012-WRPS-I-0006) in the areas of design control process application, design control requirements management, system engineering, and engineering organization management. Several findings were identified in the areas of engineering change control, inadequate engineering calculations, procedures supporting the Engineering Change Notice and Field Change Notice process flow, engineers' qualifications, an adverse trend concerning

insufficient technical rigor in the WRPS Engineering organization, treatment of adverse trends in the corrective management process, and failure to apply the corrective action management process within the Engineering organization. The Tank Farm mechanical system SSO engineer is conducting a follow-up surveillance on the progress of implementing corrective actions to the WRPS 2012 independent assessment of Engineering, concurrently with this Independent Oversight review.

The Tank Farm SSO engineers' surveillance schedules for FY 2013 show three surveillances for each of them, and their schedules are in the current ORP integrated assessment plan. The first scheduled surveillance for the Tank Farm mechanical system SSO engineer was to review the WRPS Freeze/Water Hammer DSA amendment in November 2012. This surveillance was not initiated until after the onset of freezing weather, so it represents a missed opportunity to be proactive in fully validating the implementation of freeze protection requirements before winter. (This shortcoming is somewhat mitigated because an FR performed a review of the implementation of freeze protection requirements that overlapped the SSO surveillance.) The rest of the scheduled but uncompleted surveillances for the SSO engineers for FY 2013 are in topical areas that cover areas of high importance for their assigned systems.

Independent Oversight reviewed operational awareness database entries to further evaluate the performance of the Tank Farm SSO engineers in accomplishing their assigned responsibilities; these engineers use the operational awareness database extensively to document their activities. Independent Oversight concluded that both Tank Farm SSO engineers are actively engaged in pursuing and completing their assignments as dictated by the current demands of their assigned systems. For example, the Tank Farm mechanical system SSO engineer (the SSO engineer responsible for the waste transfer system) conducted the following oversight activities over the last couple of years:

- Provided oversight and ASME B31.1 owner approval of initial service leak checks for various mechanical connections/joints at the Tank Farms 242-A evaporator.
- Attended and provided oversight comments/questions at several Tank Farm Control Decision meetings, Plant Review Committee meetings, Commercial Grade Dedication meetings concerning various Tank Farm mechanical engineering concerns/problems, and Waste Transfer Confinement Review Board (WTCRB) meetings. (The WTCRB is an independent board that looks at waste transfer activities to see whether they could result in waste getting past SSCs designed to contain the waste.)
- Provided oversight comments for the water hammer and freezing justification for continued operation (JCO) at various stages in its approval and highlighted concerns about the soil depth required for underground transfer lines.
- Provided oversight comments during various reviews of draft Tank Farm safety basis amendments (e.g., the 241-C-112 Extended Reach Sluicer System Hydraulic System Pressure Relieving Device and draft amendments that close the freezing and water hammer JCOs TF-11-01 and TF-11-02).
- Provided direct field surveillance/oversight of the pneumatic test rig to be used for testing waste transfer piping encasement.

ORP has established and implemented an effective SSO program to ensure that safety systems can reliably perform as intended. SSO engineers are appropriately trained and qualified in accordance with an established training program and are active in oversight of contractor actions to maintain safety systems and proactive in supporting positive changes to enhance safety system performance. Although two areas related to staffing analysis and self-assessment warrant improvement, the overall SSO program is designed and functioning in an efficient and effective manner.

5.7 ORP Safety System Feedback and Improvement

In addition to the focused review of the ORP SSO program, Independent Oversight performed a broader evaluation of the establishment and implementation of ORP programs and processes for conducting

oversight of WRPS management and operation of nuclear safety systems and ORP internal feedback and improvement systems and performance. Independent Oversight reviewed program and process documents, interviewed responsible managers and staff, and evaluated samples of process outputs (e.g., assessment schedules, surveillance and operational awareness reports, issues management data, contract performance-based incentive criteria, evaluations, and ORP self-assessments). With some exceptions identified in previous sections of this report, ORP has established and implemented adequately defined contractor oversight and feedback and improvement programs. ORP has established formal contractor oversight and self-assessment programs and implementing procedures that provide for a comprehensive, risk-based prioritized assessment of nuclear safety programs and performance and effective management of identified issues. A formal process has been established and implemented for identifying, planning, scheduling, performing, and monitoring surveillance activities, which are integrated into the WRPS assessment schedule. Formal processes have been established for evaluating the contractor's quarterly event analysis report, safety basis management, startup/restart of nuclear facilities, issue reporting and resolution, and staff technical qualification.

ORP SSO engineers, nuclear safety subject matter experts, and FRs conduct formal surveillances of specific functional or topical areas, documented routine operational awareness activities and follow-up on corrective actions to identified issues related to nuclear safety. ORP surveillances are planned and scheduled on an annual basis and have been integrated into the contractor's integrated assessment schedule. Schedules are changed or supplemented as appropriate and maintained throughout the year. Approximately 80 formal ORP oversight activities were incorporated into the WRPS integrated assessment schedule for FY 2013. In addition, hundreds of less-formal oversight activities, such as field observations, meeting attendance, and document reviews, are documented annually in a searchable ORP operational awareness database. ORP monthly reports communicate oversight assessment and operational awareness activities and the resulting findings and observations to the contractor, with expectations for corrective actions and formal responses for issues of higher significance.

ORP employs a variety of appropriate performance-based incentives to prioritize and monitor contractor performance in ensuring or improving nuclear safety. Areas with defined incentives, objectives, and criteria/measures for FY 2013 include safety culture, feedback and improvement (criteria for trending, performance indicators, conduct of operations, and the MOP), event investigation, radiological control performance, activity-level work planning and execution (procedure compliance and work package quality), and engineering program effectiveness for performing work within controls (Engineering Change Notice backlog and the Operations Document Recovery Plan).

In summary, ORP has established and implemented effective programs and processes for conducting oversight of WRPS management and operation of nuclear safety systems. ORP staff appropriately implement oversight programs and processes, and internal feedback and improvement systems are effective. ORP has also established appropriate and measurable performance-based incentives related to nuclear safety.

6.0 CONCLUSIONS

Overall, WRPS and ORP have effectively implemented the programs and processes necessary for effective management of safety systems at the Hanford Tank Farms. The WRPS maintenance program and procedures are adequate, and the WRPS maintenance activities that were observed were properly planned, scheduled, and performed. Worker participation and engagement in the pre-job briefing activities was identified as a strength for WRPS and a positive indication of employee/worker engagement at the Tank Farm. Surveillance and testing activities for the selected portions of the Waste Transfer System were properly performed in accordance with TSR surveillance requirements and SACs.

Operations procedures are technically accurate and complete, operator training is comprehensive, and systems are in place to maintain safety system equipment and system status. Although management attention is needed to ensure that optimal human performance aspects are considered in the procedures and methods used for safety system valve manipulations, WRPS meets the assumptions of the safety basis for operation of the safety systems. The WRPS CSE program is established and is undergoing improvements that are expected to have a positive effect on system performance and reliability. Although further improvements are needed in such areas as a formal training and qualification plan/program for CSEs, improved accuracy in the maintenance of system notebooks, and greater rigor in performance monitoring of safety systems, the overall CSE program is performing adequately. WRPS has established and implemented the elements of an appropriate assurance system supporting Tank Farm management of safety systems. Managers and subject matter experts are capable, proactive, and focused on effective performance and continuous improvement. However, management action is needed to ensure that sufficient attention to detail is applied in planning, performing, and documenting assessment activities and in accurately and rigorously implementing issues management processes.

ORP has established and implemented an effective SSO program to ensure that safety systems can reliably perform as intended. SSO personnel are appropriately trained and qualified in accordance with an established training program. Although two areas related to staffing analysis and self-assessment were identified for potential improvement, the overall SSO program is designed and functioning in an efficient and effective manner. On a broader perspective, ORP has established and implemented effective ORP programs and processes for conducting oversight of WRPS management and operation of nuclear safety systems. ORP internal feedback and improvement systems are effective, and ORP has established appropriate and measurable performance-based incentives related to nuclear safety.

7.0 OPPORTUNITIES FOR IMPROVEMENT

This Independent Oversight review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management organizations and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

Office of River Protection

OFI ORP-1: Conduct an assessment of the implementation of the ORP Tank Farm SSO program.

OFI ORP-2: Review the Tank Farm SSO staffing to determine the need for a dedicated instrumentation and control Tank Farm SSO engineer to support the pending change in the Tank Farm ventilation safety system designation, or whether other compensatory actions are needed.

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OFI Maint-1: Because the maintenance program is not clearly delineated as an SMP for the Tank Farm, the next DSA revision should explicitly identify the maintenance program as an SMP to ensure that all required reviews and activities assigned to SMPs are consistently applied.

OFI Maint-2: Lower the thresholds for the current CM and PM backlog performance indicators in order to challenge the organization to reduce and keep the backlogs as small as possible.

OFI OPS-1: 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. Ensure that the primary objective from an operations perspective is to simplify and streamline the evolutions consistent with the human factors principles established in WRPS plans and procedures addressing human factors and technical procedure development.

OFI CSE-1: Develop additional attributes (e.g., system degradation, lack of critical spares, and other risks/concerns being tracked by the system engineer) to address all areas affecting system health.

OFI CSE-2: Consider implementing more formality in the system health reporting process. Adding more detail to the system ratings and adopting more formality in the system health process will improve the management of the reliability of important systems. For example, establishing a formal Plant Health Committee at a senior manager level would not only improve senior leadership's understanding of current risks but would also provide a forum for Operations, Engineering, and Projects Level 1 managers to work collectively to leverage the system health report process to ensure that system risk is optimally managed and addressed in a timely manner.

OFI WRPS-F&I-1: Strengthen the WRPS assessment program to provide greater assurance that safety-related topical areas are rigorously and effectively assessed and accurately reported. Specific actions to consider include:

- Establish more formal review and feedback processes for completed reports that engage the organization assurance manager in ensuring the quality of assessments and reporting. Consider adding organization managers as reviewers on management assessment reports. Consider incorporating mentoring and peer review of a selected sample of assessment reports in ongoing assurance manager counterpart meetings.
- Collect, analyze, and report rating data and provide results and trending information collectively and by organization to WRPS management.

OFI WRPS-F&I-2: Strengthen event investigation processes and performance. Specific actions to consider include:

- Revise the initial event investigation procedure, TFC-OPS-OPER-C-14, to limit its scope to prompt gathering of information details directly related to the incident, the scene, and associated activities and the conduct of fact-finding meetings. Clarify how the results of these early activities interface with the formal investigation activities conducted in accordance with the PER process, which already includes extent-of-condition reviews, causal analyses, and corrective action responsibilities.
- Expand the guidance and direction for the conduct of fact-finding activities and consider gathering witness statements, even if on a voluntary basis. Ensure that a designated note taker is assigned in addition to the facilitator, and record more detail in EIRs during the fact-finding discussions.
- Review and revise as appropriate TFC-OPS-OPER-C-14, TFC-OPS-OPER-C-24, and TFC-ESHQ-C-C-01 to ensure that they include appropriate linkages and unambiguously defined roles, responsibilities, and authorities for event investigation, analysis, and reporting. Include discussion of the role of the PER process in the completion and updating of information transmitted to the DOE ORPS database.

OFI WRPS-F&I-3: Review and revise as appropriate procedure TFC-PRJ-PC-C-11, *Performance Indicator Program*, to include more detail on the determination and management of required actions that will be reflected on individual Performance Dashboard sheets (e.g., guidance on when actions should be identified and the requirements for assigning personnel responsible for actions, due dates, and closure).

OFI WRPS-F&I-4: Strengthen the implementation of the PER process to ensure that process and performance issues are accurately documented and rigorously evaluated and that they result in effective recurrence controls. Specific actions to consider include:

- Establish a corrective action review board of organization assurance managers and other selected managers and staff to review a sample of PERs for accuracy and quality, including proper categorization, extent-of-condition and causal analyses, corrective actions, and recurrence controls. Provide formal feedback to responsible managers, maintain data on identified problems, and periodically communicate the collected results and trends to senior management.
- Establish an interim expectation that organization assurance managers will review all PERs managed in their organization for quality, both in process and at closure, until performance routinely meets requirements and management expectations.
- Develop a required reading bulletin or live presentation related to known PER performance weaknesses, and issue it to all line managers who could have responsibility for PER management. Provide examples of improperly performed or documented PER process elements, along with explanations of what should have been performed or documented.
- Emphasize to line managers that the ultimate purpose of the issues management process is not only to correct the specific problem at hand, but also to prevent the same or similar conditions, events, or poor performance from happening again. This objective can be achieved at all issue significance levels within the framework of a graded approach.

OFI WRPS-F&I-5: The Engineering organization should review and clarify the intent and content of its best practices and lessons-learned intranet site and take actions to either delete or update and maintain this website.

8.0 FINDINGS

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Finding Maint-1: WRPS produced no evidence to substantiate that the supervisor properly reviewed and addressed the post-job feedback included in four of the five CM work packages that were reviewed.

Finding Maint-2: Compliance with the S/CI procedure training required by TFC-ESHQ-Q_C-C-03, *Control of Suspect and Counterfeit Items,* Section 4.9, "Training," could not be demonstrated.

Finding Ops-1: The current implementation of procedures for aligning and verifying valves during waste transfer operations, as well as the human factors deficiencies in the valve positioning procedure, does not meet the human factors standards for development and use of procedures established by WRPS, thereby increasing the likelihood of errors in valve positioning.

Finding CSE-1: Contrary to WRPS procedure TFC-ENG-FACSUP-D-01.2, *System Notebook Preparation,* the Retrieval and Closure mechanical systems notebook has not been kept up to date, and previous WRPS system notebook corrective actions including corrective actions for the most recent PER on this topic (WRPS-PER-2012-0486) have not been effective in maintaining the notebook.

Finding WRPS-F&I-1: WRPS is not effectively implementing the initial event investigation process as specified in procedure OPS-OPER-C-14, *Initial Event Investigation Process,* and Section 2.5 of TFC- PLN-02, *Quality Assurance Program Description*.

Finding WRPS-F&I-2: The implementation of issues management processes by WRPS has not been fully effective in ensuring that the extent and causes of problems are fully and accurately investigated and that these processes result in appropriate, effective corrective actions and recurrence controls as required by DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*; 10 CFR 830, Subpart A, *Quality Assurance Requirements*; WRPS TFC-ESHQ-Q-C-C-01, *Problem Evaluation Request*; and WRPS TFC-PLN-02, *Quality Assurance Program Description.*

Appendix A
Supplemental Information

Dates of Review

Planning Visit:	January 7-11, 2013
Onsite Review:	January 28 – February 8, 2013

Office of Health, Safety and Security Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
William A. Eckroade, Principal Deputy Chief for Mission Support Operations
John S. Boulden III, Director, Office of Enforcement and Oversight
Thomas R. Staker, Deputy Director for Oversight
William E. Miller, Deputy Director, Office of Safety and Emergency Management Evaluations

Quality Review Board

William Eckroade
John Boulden
Thomas Staker
William Miller
Michael Kilpatrick
George Armstrong
Robert Nelson

Independent Oversight Site Lead

William Miller

Independent Oversight Reviewers

William Miller – Lead
Robert Compton
Glenn Morris
Ed Stafford