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Assessment of Work Planning and Control at the Savannah River National Laboratory

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Acronyms

AAP	Annual Assessment Plan
ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
AMNMS	Assistant Manager for Nuclear Material Stabilization
APAP	Annual Performance Assurance Plan
CAS	Contractor Assurance System
CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
CY	Calendar Year
DOE	U.S. Department of Energy
DOE-SR	Savannah River Operations Office
DPO	Differing Professional Opinion
e-HAP	Electronic Hazard Analysis Process
EA	Office of Enterprise Assessments
ECP	Employee Concerns Program
EM	Office of Environmental Management
FR	Facility Representative
FRC	Facility Representative Council
FY	Fiscal Year
IH	Industrial Hygiene
IPAM	Integrated Performance Assurance Manual
ISMS	Integrated Safety Management System
JHA	Job Hazard Analysis
OFI	Opportunity for Improvement
OPEX	Operating Experience
ORPS	Occurrence Reporting and Processing System
OSQA	Office of Safety and Quality Assurance
PI	Principal Investigator
PSAL	Process Science Analytical Laboratory
QRA	Qualitative Risk Assessment
R&D	Research and Development
SME	Subject Matter Expert
SRIP	Savannah River Implementing Procedure
SRM	Savannah River Manual
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
STAR	Site Tracking, Analysis and Reporting
TEE	Training, Education, and Experience
TLV	Threshold Limit Value
TQP	Technical Qualification Program
WCD	Work Control Document
WP&C	Work Planning and Control

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EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Office of Worker Safety and Health Assessments, within the independent Office of Enterprise Assessments (EA), conducted an independent assessment of work planning and control (WP&C) and selected elements of feedback and improvement at the Savannah River National Laboratory (SRNL). EA also examined the DOE Savannah River Operations Office (DOE-SR) oversight activities at SRNL. Savannah River Nuclear Solutions, LLC operates SRNL, and DOE-SR provides Federal oversight. EA conducted this assessment July 10-13 and 24-27, 2017. This assessment focused on the effectiveness of the SRNL WP&C program within the research and development (R&D) areas at the following directorates: Environmental Stewardship, Science & Technology, Clean Energy, and National Security.

SRNL Work Planning and Control

Since 1998, research activities at SRNL have been governed by a WP&C process that is focused on the SRNL research community. SRNL management recognizes the importance of continual improvement in the WP&C process and is currently upgrading the longstanding WP&C process to address concerns expressed by SRNL management and the research staff, and to bring the WP&C process more in line with the DOE-HDBK-1211-2014, *DOE Handbook on Activity-Level Work Planning and Control Implementation*. During this assessment, EA reviewed numerous SRNL WP&C procedures, hazard analyses, and work control documents and observed nine SRNL research experiments conducted within the R&D areas of four SRNL directorates.

EA identified a number of positive attributes in the design and implementation of the SRNL WP&C process for research experiments, including the extensive use of R&D directions and procedures, an electronic hazard analysis process to aid work planners, and the wide-spread use of practical factors. The SRNL WP&C process has been effective in implementing the core functions of integrated safety management at the work-activity level. EA identified one WP&C best practice [practical factors (Prac Facs)] that has been integrated into research activities which demonstrates and validates the knowledge and skills required to perform a research task.

Despite these positive attributes and strengths, EA also identified some vulnerabilities regarding the design of the WP&C process and its implementation in the SRNL research laboratories. The WP&C procedures do not adequately describe "skill-of-the-researcher" work activities, mechanisms for linking and documenting training requirements, work planner training, and guidance for performing industrial hygiene qualitative risk assessments. EA identified vulnerabilities in WP&C implementation related to broad work scopes that inhibited the linkage of hazards and controls to specific work tasks, and in four of the nine experiments, hazards that should have been identified by SRNL personnel were missed.

SRNL Feedback and Improvement

SRNL staff members are engaged in the WP&C feedback and improvement process and provided good examples of internal feedback and lessons learned. The laboratory has also initiated a knowledge transfer process to transfer critical knowledge from experienced scientists to post-doctoral researchers.

However, SRNL has not established a formal process for capturing internal feedback and improvements discovered during R&D activities. SRNL is transitioning the electronic hazard assessment process tool

into a new database that will provide a framework with the capability to establish an institutional feedback and improvement process to retain internal (local) feedback and lessons learned and allow easy retrieval.

The SRNL self-assessment program includes 20-30 formal self-assessments on WP&C each year. The SRNL performance assurance/contractor assurance system organization does not schedule independent assessments to review activity-level R&D WP&C activities, but is planning future independent assessments of SRNL Integrated Safety Management System processes, including activity-level R&D WP&C.

DOE-SR Oversight

DOE-SR has a comprehensive integrated process for Federal line oversight, including assessment planning and performance, operational awareness activities, issues management, and performance assurance analysis. DOE-SR and its Nuclear Materials Stabilization organization have generally adequate processes to evaluate SRNL safety performance and the effectiveness of WP&C and the contractor assurance system. The staff is well-qualified and technically competent. DOE-SR has demonstrated a strong commitment to improving WP&C, including assigning a WP&C lead to provide focus and continued emphasis. However, oversight staff is limited in reviewing R&D WP&C activities. Also, DOE-SR has an ineffective operational experience program for developing, sharing, and implementing lessons learned.

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1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Worker Safety and Health Assessments, within the Office of Enterprise Assessments (EA), conducted an independent assessment of the work planning and control (WP&C) process, selected elements of the feedback and improvement programs, and DOE Savannah River Operations Office (DOE-SR) oversight activities at the Savannah River National Laboratory (SRNL). The onsite portions of this assessment were conducted July 10-13 and 24-27, 2017.

EA performed this independent assessment at SRNL in consideration of the Deputy Secretary's response to the Defense Nuclear Facilities Safety Board's letter and technical report DNFSB/Tech-37, which included a commitment to enhance Federal oversight of activity-level WP&C. Additionally, the WP&C program assessment is within the broader context of EA's targeted assessments of programs at DOE sites that have high-consequence activities or whose performance may present significant risks in accordance with DOE Order 227.1A, *Independent Oversight Program*.

2.0 SCOPE

EA conducted this assessment in accordance with the *Plan for the Office of Enterprise Assessments Assessment of Work Planning and Control Program at the Savannah River National Laboratory*, July 2017. This assessment evaluates the implementation of the WP&C program at SRNL, within the research and development (R&D) areas of the following directorates: Environmental Stewardship, Science & Technology, Clean Energy, and National Security. This assessment also includes evaluation of elements of the feedback and improvement program, as well as the DOE-SR processes for oversight pertaining to WP&C activities.

3.0 BACKGROUND

The Savannah River Site (SRS) is located in south-central South Carolina and occupies an area of about 310 square miles in Aiken, Barnwell, and Allendale counties. The management and operating contract for SRS is held by Savannah River Nuclear Solutions, LLC (SRNS). SRNL is one of several business elements at SRS that is operated by SRNS, which is a partnership of Fluor Corporation, Newport News Nuclear, Inc. and Honeywell International. SRNL became an independent business unit on October 1, 2016, but some functions still rely on SRNS site manuals, procedures, processes and requirements. DOE-SR provides Federal oversight of SRNS.

SRNL is the only national laboratory for the DOE's Office of Environmental Management (EM) and is organized into five research directorates for National Security, Environmental Stewardship, Science & Technology, Clean Energy, and Nuclear Material Programs. Over 1,000 SRNL research scientists, engineers, technicians, and staff members conduct more than 600 ongoing research experiments through a research-focused WP&C process described in Section 5.0.

In 2006, the EA predecessor office, the Office of Independent Oversight, within the Office of Security and Safety Performance Assurance conducted an independent assessment "Inspection of Environment, Safety, and Health (ES&H) programs" at the SRS, which included WP&C.

4.0 METHODOLOGY

EA implements the independent oversight program through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. Organizations and programs within DOE use various terms to document specific assessment results. In this report, EA uses the terms "deficiencies, findings, and opportunities for improvement (OFIs)" as defined in DOE Order 227.1A. DOE line management and/or contractor organizations must develop and implement corrective action plans for deficiencies identified as findings. Other important inadequacies not meeting the criteria for a finding are also highlighted in this report and are summarized as deficiencies in Appendix C. These deficiencies should be addressed consistent with site-specific issues management procedures.

As identified in the assessment plan, this assessment considered requirements related to the SRNL WP&C process. The criteria guiding this assessment were based on specific objectives, criteria, and lines of inquiry associated with activity-level WP&C contained in DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*, Appendix D, *Activity-Level Work Planning and Control Criterion Review and Approach Documents with Lines of Inquiry*.

In addition, EA collected and analyzed data on DOE-SR oversight and SRNL feedback and improvement activities related to the WP&C process, and used elements of criteria and review approach document (CRAD) 45-21, *Feedback and Continuous Improvement Inspection Criteria and Approach - DOE Field Element*, and specific criteria and lines of inquiry associated with activity-level WP&C contained in DOE Guide 226.1-2A.

EA examined key documents, such as work packages, procedures, manuals, analyses, policies, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs and observed research and programmatic work activities, along with routine meetings, such as plan of the day and briefings. The individual members of the EA assessment team, the Quality Review Board, and EA management responsible for this assessment are listed in Appendix A. The documents reviewed, personnel interviewed, and observations made during this assessment that are relevant to the findings and conclusions of this report are listed in Appendix B.

5.0 WORK PLANNING AND CONTROL PROGRAM

Objective:

The Organization has developed and approved WP&C processes to enable safe performance of work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-1) (Criteria #3 and 6)

The Organization has established a management and organizational framework for (1) initiating, analyzing, planning, and approving activity-level work and (2) authorizing, releasing, and safely performing activity-level work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-4) (Criterion #5)

Since 1998, research activities at SRNL have been governed by a WP&C process that is focused on the research community within SRS at SRNL. The SRNL research WP&C program is described through a series of 13 WP&C implementation procedures in Section 7 of the SRNL Procedure Manual L1 and the SRNL Manual on *Conduct of Research & Development (Integrated Safety Management for the R&D Environment)*, which serves as the framework of the SRNL WP&C process. Of these 13 Manual L1 procedures, Procedure 7.02, *Conduct of Research and Development (R&D) - Hazard Analysis*, and Procedure 7.23, *Conduct of Research and Development (R&D) - Work Planning and Control*, provide the primary implementation requirements for the current R&D WP&C processes.

SRNL management recognizes the importance of continual improvement in the R&D work control process. The Conduct of Research and Development Manual was substantially revised in 2008 when the R&D Hazard Analysis Process moved to an electronic database system – the electronic hazard analysis process (e-HAP) – which is the cornerstone of the R&D hazard analysis process. Although the e-HAP WP&C process is well established and has been in effect for more than ten years, SRNL is re-designing and revising the written and electronic WP&C process to reflect current trends in WP&C in the DOE community as reflected in DOE HDBK-1211-2014, *DOE Handbook on Activity-Level Work Planning and Control Implementation*, as well as feedback from the SRNL research staff obtained through recent e-HAP surveys. According to SRNL, the intent of the new SRNL WP&C process, which has a projected completion date of January 2018, is to transition the existing Lotus Notes-based e-HAP process to a more user-friendly and flexible software platform in order to streamline and centralize the current multi-faceted hazard analysis process.

The SRNL Conduct of R&D Board, whose members represent a cross-section of the Laboratory, provides direction for and oversight of the SRNL WP&C process. This Board meets monthly (more frequently during recent months), serves as the review committee for changes to the WP&C procedures in the L1 Manual, reports to the SRNL Operations Council (the senior SRNL Council), and provides the direction for the ongoing redesign of the SRNL WP&C process. EA observed a Board meeting and found the process to be an effective mechanism for oversight of the current WP&C process.

SRNL has established an effective management and organizational framework for (1) initiating, analyzing, planning, and approving activity-level work; and, (2) authorizing, releasing, and safely performing activity-level work, as shown by SRNL's safety record (i.e., 1.5 million hours worked in Calendar Year (CY) 2016 without a recordable injury or illness).

However, EA identified the following problem areas in the design of the SRNL WP&C processes:

- The lack of a well-defined and consistent work planning and scoping approach for defining low-hazard work activities and associated hazards and hazard controls routinely performed by the research staff, such as glass cleaning and using hand-powered tools.

- The lack of a formalized work planner training program that has resulted in inconsistent e-HAPs and work control documents (WCDs).

- The lack of an SRNL procedure for implementing the SRNL industrial hygiene (IH) qualitative risk assessment (QRA) process as required by two SRNL procedures.

- The lack of a WP&C mechanism to identify training requirements for hazards in research experiments and to document those training requirements in e-HAPs and WCDs.

SRNL does not have a consistent WP&C process that defines the work scope, hazards, and controls for low-hazard laboratory work tasks that are routinely performed by trained, knowledgeable, and experienced research staff (i.e., "skill of the researcher"). These routine, low-hazard work tasks are sometimes addressed in an e-HAP by some SRNL groups (e.g., Engineering Development Laboratory), but more often are not addressed at all. In one experiment, glassware cleaning is a routinely performed low-hazard work activity performed by the research staff. Step #16 of the R&D directions for "Simulant Formulation and Pitting Corrosion Testing Using Bullets" requires researchers to "clean all the glassware" at the completion of the experiment but provides no work scope, hazards, or controls associated with glassware cleaning. A common practice for glassware cleaning in chemistry labs involves the use of aqua regia (a mixture of hydrochloric acid and nitric acid). Cleaning glassware with

aqua regia requires specific hazard controls (goggles, gloves and a chemical fume hood). The hazards of glass cleaning and the hazard controls are generally well known to those that perform this activity, but the hazards and controls for such routine work activities are not documented, and the SRNL R&D WP&C Committee has not defined how such work activities are to be addressed. In other experiments, the research staff used hand-held power tools; however, the work scope, hazards, and controls associated with using hand-held power tools were not documented. For example, power tools were involved in sample polishing and overhead stirring of the electro-polishing solution during a corrosion testing experiment performed in the Energy Materials Research Laboratory. The work scope and hazards and controls for using power tools were not addressed in either the e-HAP for this experiment under "physical hazards" or in the associated R&D instructions or job hazard analysis (JHA). Although one of the research staff members performing this task had a waiver of a documented hazard analysis for using handheld power tools based on previous training, education, and experience (TEE form), the TEE form does not document hazards and/or controls associated with a work task. Section 3 of the SRNL Conduct of Research and Development Manual requires that "all hands-on work shall be evaluated as described in this procedure," but does not define how to evaluate routine, low-hazard tasks, and the hazards and controls of such tasks are not documented. However, a number of routinely performed low-hazard research-related tasks are not evaluated. **(Deficiency)** (See **OFI-SRNL-WPC-01**)

The lack of a formalized work planner training program has resulted in inconsistent e-HAPs and WCDs (e.g., there were different control sets for the same hazards in two similar corrosion testing experiments). Over 600 WCDs, such as e-HAPs, JHAs, procedures, and R&D instructions, are currently used for research activities at SRNL. SRNL procedures assign the responsibility for the preparation of WCDs or work planning (i.e., defining work scope, analyzing hazards, and assigning controls) to a work planner who is typically the research Group Manager, the Principal Investigator (PI), or the SRNL staff member assigned to perform and/or supervise the research activity. The SRNL WP&C process also provides many options for Group Managers and PIs when preparing WCDs. SRNL Procedure 7.02 provides both the definition and responsibilities for a work planner and establishes "the criteria for the work to be performed." However, minimal instruction, training, or guidance is available for those who prepare e-HAPs and other WCDs. The May 2017 e-HAP survey identified similar concerns that reached a similar conclusion. The survey also identified "the need for a 'super user' resource for individuals to turn to when they have a question on how to complete the (e-HAP) form." There are widely diverging WCDs for experiments with similar work scope and hazards and sometimes hazards and controls are missed or cannot be linked to specific experimental work activities, as discussed later in this assessment report. (See **OFI-SRNL-WPC-02**)

For all of the SRNL research activities observed, many IH hazards were identified in the e-HAP (hazardous chemicals, noise, heat stress, etc.) that require an IH exposure assessment to determine the significance of the hazard in order to determine the appropriate hazard controls (personal protective equipment, specialized training, etc.). The SRNL WP&C mechanism used by SRNL industrial hygienists to initially assess the potential worker risk to exposure to carcinogens, highly acutely toxic chemicals, and nanomaterial and beryllium hazards is a QRA. SRNL procedures for beryllium and nanomaterials specifically require a QRA to be performed if these chemicals are involved in the experiment. However, SRNL and the SRNS IH group have not developed a procedure or written guidance for conducting a QRA. Thresholds have not been defined for performing a QRA, and the QRA process for interfacing with the SRNL WP&C process has not been described, resulting in a QRA process that is expert-based. Of the nine experiments observed by EA, seven experiments meet the SRNL industrial hygienist's expectation for performing one or more QRAs. To date, a total of six QRAs have been performed for the nine experiments observed. However, four of these QRAs are associated with only one experiment (corrosion testing), and the other two QRAs are associated with hydrofluoric acid use in two experiments. IH has not performed a QRA for the remaining IH hazards identified in the observed experiments requiring a QRA based on the industrial hygienist's expectations, such as the potential for exposure to

toxic metals when cleaning the sputtering chamber (as discussed later in this report). For the sputtering chamber cleaning work activity, IH did not identify the chemical exposure hazards and controls of this work activity in the e-HAP or WCDs, and did not perform an exposure assessment (QRA) to verify that potential worker exposures were within acceptable limits. Section 5.1 of the SRNS Procedure 4Q/104, *Exposure Assessment Program*, states that "exposure assessment is performed in accordance with guidance outlined in the American Industrial Hygiene Association (AIHA) document *A Strategy for Assessing and Managing Occupational Exposures*." **(Deficiency)** (See **OFI-SRNL-WPC-03**)

Some SRNL and SRNS training requirements were associated with hazards in each of the nine research experiments observed by EA (e.g., lasers, highly toxic chemicals, nanomaterials). However, the SRNL WP&C process does not provide a mechanism for identifying training requirements for a particular research experiment and then linking those training requirements to hazards identified in e-HAPs and WCDs and documenting the training requirements in e-HAPs and WCDs. Based on interviews with SRNL Group Leaders, the identification and linkage of some training requirements is a challenge, and in one case resulted in missed training requirements. Section 5.5 of Procedure 7.02 requires worker training, qualification, and fitness for duty to be confirmed before beginning work and the Group Manager/Leader to ensure that the applicable training requirements are identified and implemented. However, SRNL does not identify training requirements in WCDs, nor does the e-HAP system identify and document training requirements. As a result, required training has been missed. In the experiment related to removing deuterium from water, the research staff relies on research equipment with an embedded Class 3B laser system (Class 1), which, according to the Manual 4Q procedure on *Training and Documentation*, requires completion of the initial computer-based site laser safety training. The e-HAP and other WCDs do not identify this required training, and the research staff authorized to perform this work has not completed this training. **(Deficiency)** (See **OFI-SRNL-WPC-04**)

The positive attributes and issues associated with implementing the SRNL WP&C process as observed during the performance of nine research experiments are addressed for each integrated safety management core function in the next section of this report.

6.0 WORK PLANNING AND CONTROL IMPLEMENTATION

Objective:

The scope of work is described in sufficient detail to allow the work planning process to identify hazards associated with the work and to develop necessary schedules, priorities, and work instructions. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-1)(Criteria #2 and 3)

Work activities are initiated in SRNL through a number of means ranging from phone calls to formal work requests. The SRNL Conduct of Research and Development Manual and SRNL Procedure 7.23 adequately describe the SRNL process of initiating, scoping, and planning research work at SRNL. For the nine research experiments observed by EA, SRNL defined research work steps through a combination of R&D directions and/or procedures. In some cases, this was adequate. For example, the work steps for sample prep analyses for glass, sludge, slurry, and residues in the Process Science Analytical Laboratory (PSAL) are well documented through a series of procedures. Similarly, in another experiment, work steps for the sample prep and analysis of actinides in environmental samples in the Nuclear Measurements Laboratories are well documented in the R&D directions.

A particularly positive observation was an improved level of communication of work scopes in the interface between SRNL Operations in the Shield Cells (Building 773A) and SRNL research activities since the last review by the EA predecessor organization. A Finding in that review stated, "In some

cases, the lack of interface between SRNL R&D activities and SRNL Operations activities has resulted in the potential for hazards not being sufficiently identified and analyzed." During this 2017 assessment, the analysis and processing of radioactive sludge samples in the 773A Shield Cells has demonstrated a collaborative, effective process for communicating work scope, roles, and responsibilities to the SRNL Research Operations Department (Shield Cell Operations) and SRNL research staff. The use of R&D and Operations pre-job briefs, identification of R&D work scope responsibilities in the e-HAP, and use of an Integrated Safety Management System (ISMS) Form as part of the Shielded Cells Work Request process has enhanced hazard identification and communication of hazards and controls between the two groups. SRNL has effectively addressed this previous assessment finding.

Regarding implementation of the SRNL WP&C process, the work scopes as defined in the e-HAP and Hazards and Controls Summary in four of the nine e-HAPS were so broad that there was no direct linkage of some hazards and controls to work activities for individual research experiments being performed under the e-HAP. (**Deficiency**) One example is the e-HAP for the Ball Mill and Sieving experiment, which in addition to the operation of the Ball Mill, encompasses 18 additional work activities (see next Section on Hazard Controls for details). Interviews with the SRNL research staff confirmed this concern, but some of the staff indicated the necessity of broad scope e-HAPs due to the lengthy and tedious process of preparing and approving an e-HAP. This concern was expressed by SRNL at the Conduct of R&D Board meeting attended by EA and was also identified in the recent May 2017 e-HAP survey. The May 2017 e-Hap survey identified a number of concerns with the e-HAP process, including frustrations with long delays for SME approvals, a time-consuming Management of Safety Basis/Unreviewed Safety Question process, and requirements to complete sections of the e-HAP that may not be applicable to the experiment.

Objective:

All hazards that could adversely impact workers, the public, the environment, and the facility and its equipment are documented and analyzed for severity/significance. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-2)(Criteria #2, 4, 5, 7, and 8)

For SRNL research activities, the work planner and responsible manager are responsible for executing the hazard analysis process described in SRNL Procedure 7.02. This procedure requires that the PI and responsible manager prepare an e-HAP for all hands-on research activities, including a completed R&D Hazards Screening Checklist, a summary of the hazard control actions that is automatically generated by the e-HAP system, and any associated documentation. For each of the nine research experiments, an e-HAP was prepared in accordance with SRNL requirements, although a few hazards were missed as explained in the following paragraphs.

For the observed research experiments, most hazards were identified through the R&D Hazards Screening Checklist process. For example, compressed gases or cryogens were associated with several of the research experiments. For each of these experiments, the potential for an oxygen deficient atmosphere was identified in the R&D Hazards Screening Checklist, and a detailed calculation of the potential asphyxiant hazard (e.g., argon and nitrogen hazards in the Sputtering Chamber research experiment and argon hazards in the operations conducted in the PSAL) was included as an attachment to the e-HAP.

However, the following potential hazards in four of the observed experiments were not identified in the R&D Hazards Screening Checklist process: **(Deficiency)**

- The potential combustible dust hazard associated with operating the Ball Mill and Sieve in the Engineering Development Laboratory Building 786-A, although recognized by the PI, was not addressed in either the e-HAP or JHA for this activity.

- Although a JHA referenced in the e-HAP for an Actinides experiment being performed in the Analytical Development Section listed an "ergonomics issue" for two activity/job steps, ergonomic hazards associated with certain research laboratory tasks (e.g., repetitive motions and excessive force from pipetting, awkward postures, hand-arm vibration from vortexing) were not identified in the e-HAP Hazard Screening Checklist for the PSAL experiment and the Analytical Development Section Actinides experiment.

- The potential chemical exposure hazards associated with cleaning hazardous materials (toxic metals) from the interior surfaces of the sputtering chambers after using the sputtering chambers were not identified in the R&D Hazards Screening Checklist and JHAs associated with this research experiment.

Although the screening checklist includes a question under the category "Chemicals/Hazardous Materials" concerning the use of flammable or combustible materials, it is not apparent that this would include combustible dusts, particularly because the supporting detail for this question addresses only "Handling Class 1 flammable materials."

Similarly, although a question on ergonomic hazards is included in the screening checklist under the category of "Worksite Environmental Conditions," the question focuses solely on lifting hazards involving manual lifts greater than 50 pounds or repetitive lifts for weights greater than 31 pounds, excluding such ergonomic hazards as repetitive motions from pipetting and hand-arm vibration hazards from using vortex machines. These hazards are routinely experienced in a research environment and have regulatory limits. The American Conference of Governmental Industrial Hygienists (ACGIH) has established threshold limit values (TLVs) for lifting, hand-activity level, and hand-arm vibration, which are invoked by 10 CFR 851, *Worker Safety and Health Program*. Additionally, the single question regarding manual lifting does not fully incorporate all of the lifting conditions that are used in the ACGIH Lifting TLV, (the e-HAP lifting question does not address lifting zones, distance of weight away from the body, and body postures, all of which would lower the maximum recommended weight limit for a single lift to a weight less than 50 pounds). Another contributing factor to missing the ergonomic hazards is due in part to an absence of ergonomic training for SRNL staff and work planners. The SRNL training manager stated that SRNL does not currently offer any ergonomic training to aid in identifying ergonomic hazards and controls.

Concerning the missed hazard from cleaning out the sputtering chambers, the work scope for this activity focused only on operating the sputtering chamber and not its eventual cleanout through either wet wiping the interior of the chamber or by using a portable bead blaster. In either cleaning scenario, a worker could be exposed to hazardous and toxic chemicals (e.g., lead, cadmium, and chromium). The sputtering experiment e-HAP identified chemical hazards with respect to generating environmental waste, but the e-HAP and WCDs did not mention potential worker exposures (inhalation or dermal). Section 5.3.1 of Procedure 7.23 states that "all hazards that could adversely impact workers, the public, the environment, the facility or the equipment are documented and analyzed for severity/significance." In addition, 10 CFR 851.21(a)(5) also requires that contractors "evaluate operations, procedures and facilities to identify workplace hazards."

Objective:

Controls are identified and implemented that effectively protect against identified hazards and approved activity-level work control documents can be performed as written. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-3)(Criteria #2, 3, 4, 5, 6, 7, and 8)

SRNL management expects appropriate controls, as defined in SRNL Procedure 7.02, to be identified for all hazards associated with the work activity and to be effectively implemented to protect against the identified hazards. For the nine research activities observed by EA, most hazard controls were identified in research e-HAPs and WCDs and were being implemented in accordance with the applicable e-HAP and WCDs.

Within the research environment, ensuring that the research staff is adequately trained and qualified on the laboratory equipment and applicable research methods is critical for the overall success of the hazard identification and control program, and such requirements are well defined in SRNS *Training and Qualification Manual 4B*. All of the observed SRNL research groups relied on system practical factors (or Prac-Facs) to demonstrate the knowledge and skills required to perform a research task that is evaluated by a qualified watchstander, instructor, or evaluator. Two of the SRNL group leaders that EA interviewed have used the SRNS "Prac-Facs Program" to validate the adequacy of his or her staff members' proficiency in performing specific research tasks. To date, several hundred Prac-Facs have been documented and implemented in the SRNL directorates. For example, the SRNL Nuclear Measurement Group relies on a series of well-documented Prac-Facs to ensure that the research staff members within the Analytical Development Section are knowledgeable of the means and methods of such research activities as performing solvent extractions. If expanded to document activity-level hazards and controls, the Prac-Fac process could also be used to address the lack of a "skill-of-the-researcher" WP&C mechanism for those tasks for which there are Prac-Facs. **(Best Practice)**

In four of the nine experiments observed, a number of the hazard controls could not be linked to either a specific experiment being conducted or a specific hazard for which the control was intended. In each of these experiments the work scope was too broad to identify and link the number of controls to a specific work task, as discussed earlier in this section. For the research experiment involving the use of a Ball Mill and Sieving operation in Building 786-A, the same e-HAP also addresses a wide range of nineteen additional activities such as soldering activities, use of calibration gases, adhesive use, use of flammable liquids, pump transfers of caustic materials, and other activities. For this e-HAP, the hazards and controls for the Ball Mill and Sieving operation are adequately identified in a JHA which supplements the e-HAP. However, JHAs are not identified for most of the remaining nineteen activities, and there is no direct correlation of hazards and controls in the e-HAP to specific work activities. For example, one of the twenty work activities identified in the e-HAP is soldering activities. There is no JHA or procedure that describes the work scope, hazards or controls for soldering activities and the "Physical Hazards" Section of the e-HAP adds additional confusion in stating that the "activity" does not involve soldering. While this e-HAP identifies eight procedures associated with the twenty work activities identified in the e-HAP, there is no direct correlation between a number of the procedures and the twenty work tasks identified in the Description of the R&D activity. Furthermore, the referenced procedures do not adequately identify hazard controls, or, as in one case (Planetary Monomill or Ball Mill procedure), the procedure identifies hazard controls that conflict with those controls in the e-HAP. In this case, Section 4 of the Ball Mill procedure states, "wear hearing protection when operating the Ball Mill to prevent a loss of hearing as noise levels may exceed 85 dBA," but the e-HAP does not identify any noise hazards. Section 5.3.1 of Procedure 7.23 requires that "all hazards that could adversely impact workers, the public, the environment, the facility or the equipment are documented and analyzed for severity/significance". **(Deficiency)**

Objective:

Work is conducted diligently in accordance with approved work instructions and within established controls. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-4)(Criteria #2, 3, and 5)

Section 5.5 of Procedure 7.23 provides detailed requirements for confirming work readiness and executing work. In addition, the e-HAP provides WP&C mechanisms to ensure that the applicable SMEs have reviewed and approved hazards and controls pertinent to their technical disciplines (e.g., IH, fire protection, and environmental). The completion of such reviews are recorded through the signature of the SMEs and are visually displayed to the PI within the online e-HAP through SME review indicators which change color from red (unapproved) to yellow and finally green (approved) when the SME approves the e-HAP. The e-HAP Hazards and Controls Summary indicates who approved the e-HAP by name and title and provides a list of approved workers. Each of the nine experiments used this effective, robust approval process.

SRNS provides guidance for two variations of pre-job briefings (formal and informal) in the Guidelines for Conducting Pre-Job Briefings. SRNL has embraced these guidelines, and the SRNL Group Leaders that were interviewed are aware of SRNS's expectations. The formal pre-job briefings observed in preparation for Radioactive Sludge Analysis and Processing in the Building 773-A Shield Cells by both Shield Cell Operations and SRNL research staff members were consistent with these expectations.

For the work observed, work activities were performed in accordance with approved work instructions and within established controls.

7.0 FEEDBACK AND IMPROVEMENT AND OVERSIGHT

7.1 SRNL Feedback and Improvement

Objectives:

The Organization has a feedback and improvement process that fosters learning from both internal and external operating experience (OPEX) and continuous improvement for activity-level work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-5) (Criteria #1 and 5; feedback and lessons learned)

The WP&C processes are routinely evaluated by the organization's contractor assurance system (CAS) and feedback and improvement processes, and lessons learned are adequately captured and incorporated into the planning and performance of ongoing and future work activities. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-5)(Criteria #1-4; feedback and lessons learned)

During nine activity-level work observations and meetings with researchers and technicians, SRNL staff members were engaged in verbally communicating feedback and internal lessons learned and giving examples of local process improvements. For example:

- During the tank 38 sample transfer pre-job briefing, an experienced technician reminded everyone to be careful of the possible "long tail" (informal lesson learned) on the sample bag.

- Researchers in the PSAL displayed vendor-calibrated electronic pipettes (process improvement) that were found and purchased in response to a quality non-conformance report.

- A researcher in the Hydrogen Technology Research Laboratory provided a feedback/process improvement example involving the replacement of silver-coated gaskets with stainless steel gaskets in order to prevent discoloration and deterioration in the tritium/deuterium separation process equipment.

External lessons learned (distributed by the DOE OPEX Program) and those developed as part of Category 1, 2, or 3 occurrence reports occurring on SRS are readily available through the SRNL OPEX coordinator. The SRNL OPEX coordinator provided EA with ten sample lessons learned. EA's review of the lessons learned samples indicated that they were promptly distributed throughout the laboratory.

SRNL has taken steps to begin analyzing critical knowledge transfer needs within the laboratory. The SRNL workforce manager stated that SRNL is developing a knowledge transfer process with a set of initial metrics used to identify those directorates most vulnerable to loss of critical knowledge through staff retirements. The process involves pairing experienced researchers with post-doctoral researchers to establish mentoring and knowledge/lessons learned transfer relationships.

SRNL does not have an established institutional process for capturing internal (local) feedback obtained during R&D work activities (e.g., from workers during work processes or during post-job reviews), tracking disposition of the feedback, ensuring it is evaluated for lessons learned, and retaining it in a manner that allows it to be easily queried and retrieved by work planners when new work or modifications to existing work are being developed. **(Deficiency)** This vulnerability was noted in a previous assessment of Environment, Safety, and Health programs at SRS by the EA predecessor organization, and was also identified as a finding (OP.5 F-1) in the SRNS Conduct of Operations assessment conducted by EM-42 and DOE-SR in October 2015. SRNL has not developed corrective actions to address establishing an institutional process for capturing internal feedback and lessons learned obtained during R&D work activities.

EA reviewed five formal post-job reviews (recorded as self-assessments), which contained excellent examples of feedback in the form of OFIs. One OFI in the assessment results for Assessment No. 2017-SA-003570 was not entered into the SRNS Site Tracking, Analysis and Reporting (STAR) system. Responsible managers have the discretionary authority to choose which OFIs are tracked in STAR. However, there is no local SRNL repository (i.e., database for housing all the local SRNL R&D feedback and lessons learned) including all the good feedback (OFIs) from the formal SRNL post-job reviews. Such a repository could provide readily retrievable feedback/lessons learned for work planners when new work processes are being developed.

EA observed examples of applicable feedback being implemented during work evolutions; however these examples of feedback/lessons learned were not captured and retrievable by work planners for use as lessons learned during future work process development. (See **OFI-SRNL-FI-01**)

SRNL is revising the project management system and transitioning the e-HAP tool to a new database software program. This effort provides a new framework that could help establish an institutional feedback and improvement process to capture, track, and retain internal feedback and lessons learned and provide for easy retrieval. (See **OFI-SRNL-FI-02**)

The WP&C program does not adequately assign responsibility for collection/retrieval and review of applicable lessons learned for use in developing or modifying WCDs. SRNL Procedure 7.23 does not indicate who (i.e., which role) is responsible for collecting and reviewing applicable external and internal (local) lessons learned for implementation during the development of WCDs. PIs and researchers indicated that they believe they have a role in identifying lessons learned, but there is confusion about how/where to obtain applicable internal (local) lessons learned and who is ultimately responsible for determining which lessons learned will be incorporated into a WCD.

Objectives:

The Organization has a feedback and improvement process (including lessons learned) that fosters learning from both internal and external OPEX and continuous improvement for activity-level work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-5) (Criteria #2-4; CAS/ITS)

The WP&C processes are routinely evaluated by the organization's CAS and feedback and improvement processes, and lessons learned are adequately captured and incorporated into the planning and performance of ongoing and future work activities. (DOE Guide 226.1-2A, Appendix D, Objective WP&C2-5)(Criteria 1-6; CAS)

Although SRNL became an independent business unit on October 1, 2016, some functions still rely on SRNS site manuals, procedures, processes, and requirements. The SRNL CAS process is one of those functions. SRNS has a mature and robust CAS process, and SRNL provided extensive evidence of external and internal assessments to EA. EA reviewed assessments related to WP&C and Conduct of Operations, including an external 2015 DOE EM-42/ DOE-SR assessment of Conduct of Operations, a May 2017 Independent Evaluation Board Review of Conduct of Operations, a sample of ten formal SRNL self-assessments of R&D activities, a sample of ten SRNL Management Field observations, and three category 3 Occurrence Reporting and Processing System (ORPS) reports with associated extent of condition reviews, effectiveness reviews, and Corrective Action Review Board reviews. SRNL performs approximately 20 to 30 formal self-assessments related to WP&C each year; for example, 30 were performed in 2014 and 21 in 2015. Every month, designated managers conduct management field observations. Formal assessments were found to be generally well documented with appropriate management reviews.

The STAR system is a mature, comprehensive issue tracking system which enables tracking and trending of events, corrective actions, and issue recurrence and provides up-to-date metrics and reports for distribution throughout the site. SRNS publishes an extensive CAS/performance analysis report on a quarterly basis that provides site status (including SRNL) for programs, including continuous improvement, WP&C, CAS metrics, OPEX/lessons learned, ORPS event analysis, and trend analysis.

The CAS/performance analysis report for the second quarter of Fiscal Year (FY) 2017 contains a discussion of WP&C program health, specifying that one of the areas needing improvement is the "applicability of WP&C to all aspects of activity-level work" and "WP&C not only applies to maintenance, but also to operations, construction, start-up, R&D, and deactivation/demolition. This has led the majority of WP&C assessments to be performed in the area of Maintenance work control." EA found this observation to be valid, particularly in the case of site-level independent reviews of the SRNL WP&C program. For example, the May 2017 Independent Evaluation Board evaluation of integrated safety management did not include assessment of SRNL R&D activities. The SRNL Performance Assurance/Contractor Assurance Organization has not developed an assessment plan that includes review of ISMS processes and activity-level WP&C during independent assessments of its CAS program. The Performance Assurance Organization is aware of this gap in its assessment planning with respect to independent assessments of the SRNL CAS program and is planning to include activity-level WP&C in the scope of the ISMS portion of the assessments. (See **OFI-SRNL-FI-03**)

Formal SRNL self-assessments do not include activity-level review of implementation of lessons learned during initial preparation or modification of WCDs. EA reviewed ten recent self-assessments of WP&C, including work observations, pre-job briefings, and post-job reviews, but there is no evidence of formal review of lessons learned (external and internal) collected and implemented during initial development or modification of WCDs.

SRNL has not developed key performance goals, objectives, and metrics for tracking and trending WP&C program effectiveness. SRNL is developing new metrics across the laboratory to address its recent Maturity Assessment, which was conducted as part of the Separate and Independent Business Unit Implementation (March 2017), but has not included WP&C metrics as part of this effort. (See **OFI-SRNL-FI-04**)

Objective:

The Organization has developed and approved WP&C processes to enable safe performance of work. (DOE Guide 226.1-2A, Appendix D, Objective WP&C1-1) (Criteria #4 and 9 - worker involvement)

SRNL Procedure Manual L1, Procedures 7.23 and 7.02, contain appropriate guidance on including workers and SMEs in hazard analysis, WCD development, and R&D procedure walk downs. During the nine work observations conducted at SRNL, researchers and technicians uniformly stated that they are actively involved in the development, review, and walk down of work control processes during the development or modification of WCDs. For example, researchers conducting experiments involving deuterium and/or tritium removal from water in the Hydrogen Technology Research Laboratory and researchers operating the Sputter chambers in the Energy Materials Research Laboratory stated that the PIs routinely involved them in the development, review, and walk down of WCDs used in their laboratories.

7.2 Savannah River Operations Office Oversight

Objective:

DOE field element line management has established and implemented effective oversight processes that evaluate the adequacy and effectiveness of CAS and DOE oversight processes. (DOE Order 226.1B)

Processes are in place for Federal line oversight as described in Savannah River Manual (SRM) 400.1.1G, *Integrated Safety Management System Description Manual*. The ISMS description adequately outlines the interconnecting processes used to evaluate SRNL safety performance, maintain operational awareness, formally evaluate safety performance, provide avenues for communication and evaluation of concerns, and utilize feedback information to promote improvement in safety performance.

SRM 226.1.1F, *Integrated Performance Assurance Manual* (IPAM), combines the descriptions for the oversight and quality assurance plans into a single management description document, and provides processes to: (1) plan, conduct, and document assessment activities; (2) transmit assessment results to contractor management; (3) document and track DOE and contractor corrective actions; and, (4) conduct and track DOE-SR senior management field observations. The IPAM also describes the STAR system that provides the automated infrastructure for documenting the results of the oversight processes. The IPAM and the supporting STAR system meet the requirements of DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*, and DOE Order 414.1D, *Quality Assurance*. The processes provide a solid basis for consistent planning, conducting, documenting, and tracking oversight activities between programmatic oversight conducted by the Office of Safety and Quality Assurance (OSQA) and various line oversight organizations, such as the Assistant Manager for Nuclear Material Stabilization (AMNMS), that oversee SRNL.

DOE-SR has demonstrated a strong commitment to improving WP&C and CAS, including assigning a well-qualified WP&C programmatic lead to provide focus and continuing emphasis; conducting CAS and WP&C programmatic assessments using review criteria from DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*; and requiring line assessment of

WP&C and CAS in annual performance assurance plan (APAP) direction from the DOE-SR manager. The line assessments of CAS and WP&C were conducted and the reports met requirements of the IPAM; however, of the six WP&C-related assessments at SRNL reviewed, none included observation of R&D work activities. DOE-SR also used external resources to conduct assessments such as those from EM-42 to perform a conduct of operations assessment at SRNL in 2015. An ISMS review declaration conducted in FY16 included a self-assessment by the SRNL contractor, as well as an independent review of contractor performance by DOE-SR. This ISMS review declaration provided self-critical and actionable information to make improvements.

DOE-SR appropriately uses its oversight results to provide feedback to SRNL regarding safety performance, as identified in the AMNMS monthly performance feedback to SRNL, the FY17 Performance Evaluation and Measurement Plan for SRNL, and AMNMS assessment reports (e.g., 2016-SA-004732, *Validation Review for PBI SRNS2016 SRNL-4.02 (Environmental Waste Management)* and the *DOE-SR Award Fee Determination Scorecard against the FY16 SRNL Performance and Evaluation Management Plan*).

A July 2011 DOE accident investigation report noted the need for increased SME presence in the field. DOE-SR was initially not able to provide this increased oversight due to SME resources committed to required programmatic reviews. In the last two years, DOE-SR management supported OSQA with additional SME resources, including four safety engineer positions, to increase field oversight and support (such as IH and occupational safety expertise) to line organizations. The OSQA Director stated that the safety engineers are qualified to enter assigned field facilities unescorted and plans to establish office space in the field to further increase the effectiveness of SME field oversight and support to DOE-SR line oversight organizations. EA found some evidence of increased SME field presence at SRNL, including STAR entries and AMNMS personnel acknowledgement of a willingness to seek SMEs out for additional technical support when needed. However, based on the number of issues related to IH and occupational safety hazard identification in Section 6.0 of this report, DOE-SR SME oversight of SRNL R&D WP&C is not yet fully effective.

Communicating oversight results and emergent issues up the line management chain from the facility representative (FR) to the DOE-SR manager is timely and effective. The daily operation reports provided the facility operations status and meaningful emergent and ongoing issues that may need further management attention. Processes for communicating oversight results to contractors in a timely manner are generally effective. AMNMS typically transmitted assessment reports to SRNL within the month after completion of the assessment.

Objective:

The DOE field element line oversight program includes written plans and schedules for planned assessments, focus areas for operational oversight, and reviews of the contractor's self-assessment of processes and systems. (DOE Order 226.1B 4b(2))

The IPAM provides a comprehensive approach for scheduling and planning assessments for each CY. OSQA works with line oversight organizations, identifies oversight trends through STAR trending analyses requiring additional oversight focus, and identifies assessment-related requirements to publish an APAP. The CY17 APAP issued in December 2016 to line oversight organizations for developing their organization-specific annual assessment plan (AAP) provided direction on assessments in the areas of WP&C, IH, management field observation, CAS, trend analysis, and such focus areas as effectiveness of corrective actions, recurring events, and hazardous energy control. As line oversight organizations populate their AAP into the STAR system, the IPAM appropriately requires OSQA to roll up the AAPs into an integrated assessment plan and provide tracking of the schedule in the STAR system. The

AMNMS CY2017 AAP effectively implemented the CY17 APAP for its facilities, including SRNL, and found that DOE-SR line management was actively tracking schedule completion.

Objectives:

The DOE field element has implemented an effective FR program. (DOE Order 422.1)
Maintain sufficient technical capability and knowledge of site and contractor activities to make informed decisions about hazards, risks, and resource allocation; provide direction to contractors; and evaluate contractor performance. (DOE Order 226.1B)

DOE-SR has well-qualified and technically-competent staff and management and has implemented an effective FR program. Savannah River Implementing Procedure (SRIP) 400, Chapter 430.1, *Facility Representative Program*, is generally consistent with DOE-STD-1063-2011, *Facility Representatives*, and adequately describes their duties, responsibilities, and authorities. The DOE-SR manager has chartered a Facility Representative Council (FRC) made up of all site FRs to strengthen DOE technical oversight of contractor activities. The FRC is a sounding board to ensure consistent approaches to oversight between organizations, (e.g., consistent application of occurrences reporting criteria and FR qualification requirements). The FRC also is responsible for developing the quarterly DOE-SR Facility Representative Program Performance Indicators report and conducting the triennial FR program self-assessment. The FR program is a proven source for filling current management positions. For example, the current directors of the Nuclear Material Operations Division, AMNMS, and OSQA organizations were previously DOE-SR FRs.

Staffing plans require two FRs for full coverage at SRNL. One qualified FR recently retired, and the new FR became fully qualified in June 2017. In 2016, the AMNMS started the process for filling the anticipated SRNL FR opening due to retirement.

EA observed the SRNL FR perform routine duties and found that the FR was familiar with the facilities, the Documented Safety Analysis, and the contractor management and staff. The FR was observant and followed up on important issues affecting safety (e.g., corrective actions to repair a leaking fire suppression system). However, operational awareness of R&D activities was limited. DOE Order 226.1B, Section 4.b(1), and DOE-STD-1063-2011, Section 4.1.1, states that operational awareness activities shall be conducted in facilities based on the hazards and FRs shall be aware of work in progress and in planning. Almost all the FR's oversight attention was on research operations support (facilities maintenance), and the FR had observed R&D WP&C activities only once in the last four months partly because of the FR's view of risk at SRNL and the lack of available SRNL work planning and scheduling information for R&D work activities. (**Deficiency**) The FR stated he is now periodically working with SRNL research management to identify opportunities for WP&C observations.

The DOE-SR technical qualification program (TQP) is sufficiently described in SRM 300.1.1B, Chapter 6, Section 6.1, *Human Capital Management Systems Manual, Technical Qualifications Program.* The program is administered by the EM Human Resources Advisory Office with advice and input from the highly experienced DOE-SR Federal Technical Capability Program Agent and the Chief Engineer. EA reviewed a sample of five TQP records for FRs and Safety System Oversight engineers and found them to be complete. OSQA SMEs providing programmatic oversight were currently qualified to perform their functional areas of responsibilities based on TQP records. TQP records also indicate that technical oversight personnel are supervised or managed by Senior Technical Safety Manager qualified individuals as required. The TQP was last self-assessed in 2010; however, the SRM has been reviewed and updated within the last year by the DOE-SR employee concerns program (ECP) manager. The TQP managers are aware of the need to conduct a self-assessment and stated that they are planning an assessment of the TQP later in 2017.

Criteria:

An effective differing professional opinion (DPO) process or program has been established and implemented. (DOE Order 442.2)

The differing professional opinion (DPO) process is adequately documented in SRIP 400, Chapter 442.2, *Resolution of Differing Professional Opinions for Technical Issues Involving Environment, Safety and Health.* This procedure provides a choice for contractor and DOE-SR employees of going through the local DOE-SR DPO process or using the DOE Order 442.2 process. Email records show employees are provided information on use of the DPO. The DPO coordinator indicated it is rare that employees utilize the DPO process, with no DPO cases submitted in the last two years. DPO is included in the General Employee Training received by employees.

Criteria:

An effective employee concerns program (ECP) has been established and implemented. (DOE Order 442.1A, CRAD 45-21)

The ECP is adequately described in SRIP 400, Chapter 442.1, *DOE-SR Employee Concerns Program*, and it was effectively implemented. The designated ECP manager has received training and has over five years of experience with the ECP program and the Equal Employment Opportunity specialist is being cross trained as designated backup to the ECP manager. The ECP posters for DOE-SR are displayed on bulletin boards in Building 730B and at SRNL to inform employees of their right to submit concerns for investigation. Employee training on the ECP is included in conjunction with General Employee Training. In 2013, EA's predecessor organization conducted a review of the ECP that identified one finding (Finding 1) and six OFIs. DOE-SR has addressed these issues except for completion of annual self-assessments (OFI-5), and EA discussed several observations with the ECP Manager regarding the ECP SRIP and ECP web page. An independent OSQA assessment of the ECP was planned for August 2017. No employee concerns were submitted about SRNL in the last two years. EA reviewed two recent employee concern cases and found them to have been thoroughly investigated and processed per the ECP SRIP.

Criteria:

An OPEX program has been developed and implemented, and an OPEX Program Coordinator has been designated. (DOE Order 210.2A 4a)

The OPEX program is described in SRIP 200, Chapter 210.2, *DOE-SR Operating Experience and Lessons Learned Program*, April 2011. Revisions to DOE Order 210.2A, *DOE Corporate Operating Experience Program*, in April 2011included significant changes to the DOE OPEX program and how DOE corporate OPEX documents are developed and applied across the DOE complex; however, the DOE-SR OPEX procedure has not implemented these substantive changes in the last six years. The OPEX coordinator has many years of experience in OPEX, but numerous other performance assurance duties significantly detract from her OPEX duties. In addition, the lessons learned database that had supported the OPEX program no longer functions, and no resources have been provided to support the development of another database. DOE-SR could not provide any documentation regarding lessons learned being developed by DOE-SR personnel, and there was no evidence that the OPEX coordinator was ensuring DOE lessons learned or corporate OPEX documents were being tracked to ensure the affected organizations have reviewed and taken necessary actions. To provide FRs a source of OPEX information, the FRC made sure that each FR would at least receive lessons learned directly through the

DOE OPEX distribution. DOE-SR is not adequately developing, sharing, and implementing lessons learned through the OPEX program as required by DOE Order 210.2A or SRIP 200, Chapter 210.2. (**Finding F-SR-1**)

8.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for EA appraisal findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 227.1A to manage these corrective action plans and track them to completion. In addition to the findings, deficiencies that did not meet the criteria for a finding are listed in Appendix C, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

SRNL

None.

DOE-SR

Finding F-SR-1: DOE-SR OPEX is not adequately developing, sharing, and implementing lessons learned through the OPEX program as required by DOE Order 210.2A or SRIP 200, Chapter 210.2.

9.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified some OFIs to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in appraisal reports, they may also address other conditions observed during the appraisal process. EA offers these OFIs only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

SRNL

OFI-SRNL-WPC-01: As a model for skill-of-the-researcher tasks, such as soldering, glass cleaning, and using handheld power tools, consider using the pre-authorized task process recently developed at the Lawrence Livermore National Laboratory for well-bounded, commonly performed tasks, for which institutionally consistent controls can be specified. A pre-authorized task, having already received reviews and approvals by the appropriate SMEs, could be used by work planners across SRNL in the generation of new WCDs without further review and approval. In general, the use of general hazard analyses and pre-authorized tasks streamlines the hazard analysis process by excluding commonly understood general hazards and controls from the WCDs, allows the worker to focus on less familiar hazards, and enables consistency of hazards and controls for the same work task when applied across the organization.

OFI-SRNL-WPC-02: Consider implementing a work planner trainer and qualification program, such as the *Managing the Work Planner Qualification Program* which was recently implemented at Lawrence Livermore National Laboratory. In this type of program, work planners that lead the WCD preparation team must be trained and qualified. The formal work planner training and qualification program includes required reading, training, briefings by SMEs, and mentored on-the-job training, addressing the fundamental elements essential to successful work planning.

OFI-SRNL-WPC-03: When performing an IH QRA, consider incorporating into the QRA process the recent guidance established by the AIHA Exposure Assessment Committee and documented in Chapter 26, *Rules and Guidelines to Facilitate Professional Judgement*, of the AIHA publication *A Strategy for Assessing and Managing Occupational Exposures* (4th Edition).

OFI-SRNL-WPC-04: Consider linking the e-HAP system and SRNS training database to facilitate the automatic identification and documentation of training requirements in e-HAPs and other hazard analysis tools (e.g., JHAs). As a model, consider using the Laboratory Training Records and Information Network (LTRAIN) training database computer-based interface with the WP&C tool used for research activities at the Argonne National Laboratory.

OFI-SRNL-FI-01: Consider benchmarking the institutional process in place at Lawrence Livermore National Laboratory for capturing, tracking disposition, and retrieving feedback/lessons learned for use in WCD development or modification.

OFI-SRNL-FI-02: Consider taking advantage of the current SRNL effort to transition the e-HAP tool to a new database system architecture to address establishing an institutional feedback and improvement process to capture, track, and retain feedback and lessons learned for easy retrieval by work planners.

OFI-SRNL-FI-03: Consider inviting WP&C experts from other DOE national laboratories to participate as assessors during independent assessments of SRNL's WP&C program.

OFI-SRNL-FI-04: Consider developing key performance goals, objectives, and metrics for the WP&C program to enable tracking and trending of program effectiveness.

DOE-SR

None.

Appendix A
Supplemental Information

Dates of Assessment

Onsite Assessment: July 10-13 and 24-27, 2017

Office of Enterprise Assessments (EA) Management

William A. Eckroade, Acting Director, Office of Enterprise Assessments
Thomas R. Staker, Director, Office of Environment, Safety and Health Assessments
William E. Miller, Deputy Director, Office of Environment, Safety and Health Assessments
C.E. (Gene) Carpenter, Jr., Director, Office of Nuclear Safety and Environmental Assessments
Kevin G. Kilp, Acting Director, Office of Worker Safety and Health Assessments
Gerald M. McAteer, Director, Office of Emergency Management Assessments

Quality Review Board

Steven C. Simonson
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Kevin E. Horace, Team Leader
James R. Lockridge
Roby D. Enge
Terry E. Krietz

Observer

Robin M. Keeler, AU-11

Appendix B
Key Documents Reviewed, Interviews, and Observations

Documents Reviewed

SRNL

Operating Experience Program Procedure, Manual 1 B, Procedure 4.14, 09/07/11
Contractor Assurance Quarterly Q2-FY2017 Performance Analysis Report, 05/04/2017
Contractor Assurance System Manual 22Q, Procedure CAS-1, Rev. 1, 04/12/17
Contractor Assurance System Manual 22Q, Procedure MM-1, Rev. 1, 02/02/17
SRNL ORPS Reports listings for 2014, 2015, 2016 and 2017
Self-assessments (Post Job Reviews): 2017-SA-003543, 003570, 003622, 003707 and 003809
Operating Charter: SRNL Conduct of R&D Board, undated
SRNL Review Board Charter (Corrective Action Review Board and Management Review Team), Rev. 1, 11/28/16
SRNL Conduct of Research and Development, SRNL-IM-2008-00025, Rev. 0, November 2008
SRNS Conduct of Operations, EM-42/SR Operations Office Assessment Report, Oct. 19-23, 2015
SRNL Procedure Manual L1, SRNL Chemical Hygiene Plan, Procedure 3.13, Rev. 14, 4/18/17
SRNL Procedure Manual L1, Control and Handling of Highly Toxic Materials, Procedure 3.14, Rev. 5, 5/10/16
SRNL Procedure Manual L1, SRNL Metallic Lead Management Program, Procedure 3.19, Rev. 4, 4/2/13
SRNL Procedure Manual L1, Handling Hydrofluoric Acid Solutions, Procedure 3.20, Rev. 4, 5/11/16
SRNL Procedure Manual L1, Requirements for Working with Unbound Engineered Nanoparticles, Procedure 3.26, Rev. 3, 6/3/13
SRNL Procedure Manual L1, Conduct of R&D-Hazard Analysis, Procedure 7.02, Rev. 10, 9/3/14
SRNL Procedure Manual L1, SRNL Job Hazard Analysis Program, Procedure 7.17, Rev. 3, 5/12/09
SRNL Procedure Manual L1, Conduct of R&D-Work Planning and Control, Procedure 7.23, Rev. 8, 8/19/2014
SRNL Procedure Manual L1, SRNL Performance Assurance System Implementation and Clarification, Procedure 8.03, Rev. 0, 4/11/17
Quality Assurance Manual, 1Q, Work Planning and Control, Procedure 9-4, Rev. 13, 12/17/08
SRNL Procedure Manual L1, First Line Manager Performance of Hands-on Work, Procedure 7.22, Rev. 1, 5/17/16
SRNL Procedure Manual L1, Conduct of R&D-Interim R&D Work Directives, Procedure 7.29, Rev. 1, 1/22/15
SRNL Procedure Document System Manual PS, Administration of SRNL R&D Work Control Documents, Procedure PL-AP-4006, Rev. 1, 12/15/16
SRNL 2S Compliance Summary, Document SRNL-L1000-2013-00012, Rev. 4, 08/17/16
Contractor Assurance Manual 22Q, Procedure CAP-1, Corrective Action Program, Rev. 3, 5/11/17
Occurrence Report EM-SR-SRNS-ALABS-2017-0002
Occurrence Report EM-SR-SRNS-SRNL-2014-0002
Occurrence Report EM-SR-SRNS-SRNL-2013-0001
Occurrence Report EM-SR-SRNS-SRNL-2014-0003 and associated EOC, Effectiveness Review and LL
Occurrence Report EM-SR-SRNS-SRNL-2016-0004 and associated EOC, Effectiveness Review and LL
Occurrence Report EM-SR-SRNS-SRNL-2015-0001 and associated EOC, Effectiveness Review and LL
A sample of 10 Management Field Observations conducted in 2015, 2016 and 2017
A sample of 10 Self-assessments conducted in 2014, 2015 and 2016
A sample of 10 Lessons Learned distributed throughout SRNL from the SRS LL system
Final Report of the SRNL Separate and Independent Business Unit Implementation (30 March 2017)
Independent Evaluation Board (IEB) SRNL ISM Evaluation Final Report 2017-SUR-34-0008, May 15-May 25, 2017

Manual 4Q, Industrial Hygiene Manual, Procedure 103, Roles of Industrial Hygiene in the Assessment Process, Rev. 5, 5/5/14
Manual 4Q, Industrial Hygiene Manual, Procedure 104, Exposure Assessment Program, Rev. 8, 12/21/16
Manual 4Q, Industrial Hygiene Manual, Procedure 108, Industrial Hygiene Competent Person Program, Rev. 9, 5/22/14
Manual 4Q, Industrial Hygiene Manual, Procedure 208, Lead Compliance Program, Rev. 7, 9/16/09
Manual 4Q, Industrial Hygiene Manual, Procedure 210, Nanomaterials Program, Rev. 1, 11/30/12
Manual 4Q, Industrial Hygiene Manual, Procedure 302, Handling Materials That Pose a Potential Occupational Carcinogenic Hazard, Rev. 8, 4/12/17
Manual 4Q, Industrial Hygiene Manual, Procedure 308, Occupational Exposure to Hazardous Chemicals in Laboratories, Rev. 4, 12/7/11
Manual 4Q, Industrial Hygiene Manual, Procedure 401, Exhaust Hoods Used for Control of Hazards, Rev. 10
Manual 4Q, Industrial Hygiene Manual, Procedure 1001, Training and Documentation, Rev. 13, 1/1/13
Manual 4Q1.1, Industrial Hygiene Survey Procedures, Procedure 103A, Exposure Monitoring Strategy, Rev. 5, 6/23/16
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SRNL
SRNL Safety and Assurance Program Manager
2017 Integration Council Chair
Director ESH&QA
Performance Assurance/Contractor Assurance Manager
Group Managers
Facility Managers
Workforce Manager
Training Manager
Program Manager (WP&C)
Section Director
Operating Experience Coordinator
Principal Investigators/Work Planners
Laboratory Researchers
Quality Manager
Safety Engineer
Industrial Hygienist
e-HAP IT Developer

DOE-SR
Office of Safety and Quality Assurance Office Director
Performance Assurance Division Director
WS&H Program SME
Infrastructure and Environmental Engineering (FTC Agent for DOE-SR)
EM Human Resources Advisor
Facility Representative Council Chair
ECP Specialist
DPO/OEP/LL Coordinator
Nuclear Materials Operations Division Director
Nuclear Materials Programs Division Engineer
Facility Representative (SRNL)
Safety System Oversight (SRNL)

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DOE-SR
Facility Representative Activity at SRNL

Appendix C
Deficiencies

Deficiencies that do not meet the criteria for a finding are listed below, with the expectation from DOE Order 227.1A that site managers will apply their local issues management processes for resolution.

SRNL Work Planning and Control

- SRNL does not have a WP&C process that consistently defines the work scope, hazards, and controls for low-hazard laboratory work tasks that are routinely performed by trained, knowledgeable, and experienced research staff (i.e., "skill of the researcher"). Section 3 of the SRNL Conduct of Research and Development Manual requires that "all hands-on work shall be evaluated."

- SRNL has not developed either a procedure or written guidance for the performance of QRAs for assessing SRNL worker exposures to hazardous chemicals. The assessment of workplace exposures is required by 10 CFR 851.21, *Hazard Identification and Assessment*, and SRNL procedures for beryllium and nanoparticles require a QRA to be performed.

- The SRNL WP&C process does not have an adequate mechanism to ensure that all worker training requirements are identified and met before performing work. Section 5.5 of Procedure 7.23 requires that worker training, qualification, and fitness for duty are confirmed prior to beginning work.

- In four of the nine experiments observed, work scopes prepared in e-HAPs and WCDs by work planners were too broad, resulting in hazard controls that could not be linked to either a specific experiment being conducted or a specific hazard for which the control was intended. Section 5.4 of Procedure 7.23 requires that "hazards and controls are clearly identified in the work control documentation."

- The e-HAP process did not identify all potential hazards in four of the nine observed experiments in the R&D Hazards Screening Checklist process, and subsequently these hazards were not analyzed for severity or significance. 10 CFR 851.21, *Hazard Identification and Assessment*, requires the identification of existing and potential hazards; 10 CFR 851.23, *Safety and Health Standards*, requires compliance with ACGIH TLVs; and Section 5.3.1 of Procedure 7.23 states that "all hazards that could adversely impact workers, the public, the environment, the facility or the equipment are documented and analyzed for severity/significance."

SRNL Feedback and Improvement

- SRNL has not established an institutional process for capturing feedback and lessons learned obtained during R&D work activities. The SRS Quality Assurance Manual, 1Q 9-4, Rev. 13, Attachment B, Item 22, specifies that WP&C procedures are to include a process for lessons learned/feedback during the execution of planning, as well as an expectation that lessons learned will be incorporated into active and in-development documents. DEAR Clause [48 CFR 970.5223-1(c) (5)] states that documentation of the safety management system shall describe how the contractor will provide feedback about the adequacy of controls and continue to improve safety management.

DOE-SR Oversight

- DOE-SR is providing limited operational awareness oversight of research and development WP&C and work activities at SRNL. DOE Order 226.1B, Section 4.b(1), and DOE-STD-1063-2011, Section 4.1.1, state that operational awareness activities shall be conducted in facilities based on the hazards and facility representatives shall be aware of work in progress and in planning.