Savannah River Remediation, LLC
Liquid Waste Contract
Savannah River Site

Report from the Department of Energy
Voluntary Protection Program
Onsite Review
November 4-13, 2014

U.S. Department of Energy
Office of Environment, Health, Safety and Security
Office of Health and Safety
Office of Worker Safety and Health Assistance
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Foreword

The Department of Energy (DOE) recognizes that true excellence can be encouraged and guided but not standardized. For this reason, on January 26, 1994, the Department initiated the DOE Voluntary Protection Program (VPP) to encourage and recognize excellence in occupational safety and health protection. This program closely parallels the Occupational Safety and Health Administration (OSHA) VPP. Since its creation by OSHA in 1982 and DOE in 1994, VPP has demonstrated that cooperative action among Government, industry, and labor can achieve excellence in worker safety and health. The Office of Environment, Health, Safety and Security (AU) is responsible for managing DOE-VPP. AU intends to expand contractor participation complex-wide and coordinate DOE-VPP efforts with other Department functions and initiatives, especially Integrated Safety Management (ISM).

DOE-VPP focuses on areas where DOE contractors and subcontractors, using ISM, can surpass compliance with DOE orders and OSHA standards. The program encourages a *stretch for excellence* through systematic approaches, which emphasize creative solutions through cooperative efforts by managers, employees, and DOE.

Requirements for DOE-VPP participation are based on comprehensive management systems with employees actively involved in assessing, preventing, and controlling the potential health and safety hazards at their sites. DOE-VPP is designed to apply to all contractors in the DOE complex, including production facilities, laboratories, subcontractors, and support organizations.

DOE contractors are not required to participate in DOE-VPP. In keeping with OSHA and DOE-VPP philosophy, *participation is strictly voluntary*. Additionally, participants may withdraw from the program at any time. DOE-VPP consists of three programs with designations and functions similar to those in OSHA's VPP: Star, Merit, and Demonstration. The Star program is the core of DOE-VPP. This program is aimed at truly outstanding protectors of employee safety and health. The Merit program is a steppingstone for participants that have good safety and health programs, but need time and DOE guidance to achieve true Star status. The Demonstration program, used rarely by the Department, allows DOE to obtain additional information to recognize achievements in unusual situations about which DOE needs to learn more before determining approval requirements for the Merit or Star program.

By approving an applicant to participate in DOE-VPP, DOE recognizes that the applicant exceeds the basic requirements for systematic protection of employees at the site. As the symbols of such recognition, DOE provides certificates of approval and the right to use DOE-VPP flags for the program in which the site is participating. The participants may also choose to use the DOE-VPP logo on its letterheads and/or on award items for employee incentive programs.

This report summarizes the results from the evaluation of Savannah River Remediation, LLC (SRR), at the Savannah River Site in South Carolina during the period of November 4-13, 2014, and provides the Associate Under Secretary for AU with the necessary information to make the final decision regarding SRR's continued participation in DOE-VPP.

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ABBREVIATIONS AND ACRONYMS

AHA	Assisted Hazard Analysis
ASA	Auditable Safety Analysis
AU	Office of Environment, Health, Safety and Security
BBS	Behavior-Based Safety
BLS	Bureau of Labor Statistics
CFR	Code of Federal Regulations
CM	Corrective Maintenance
CSTF	Concentration, Storage, and Transfer Facilities
DART	Days Away, Restricted or Transferred
DMM	Di-Methyl Mercury
DNFSB	Defense Nuclear Facilities Safety Board
DSA	Documented Safety Analysis
DWPF	Defense Waste Processing Facility
DOE	Department of Energy
EET	Employee Environment Team
EISM-EA	Enterprise Integrated Safety Management-Exposure Assessment
EJTA	Employee Job Task Analysis
EP	Emergency Preparedness
ESQB	Executive Safety Quality Board
ETF	Effluent Treatment Facility
EPHA	Emergency Planning and Hazard Analysis
ETP	Effluent Treatment Project
FTF	F-Area Tank Farm
HSS	Office of Health, Safety and Security
HTF	H-Area Tank Farm
IH	Industrial Hygiene
IIE	Integrated Independent Evaluation
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
LSIT	Local Safety Improvement Team
LWGS	Lead Work Group Supervisor
NAICS	North American Industry Classification System
OSHA	Occupational Safety and Health Administration
PIC	Person in Charge
PM	Preventive Maintenance
PPE	Personal Protective Equipment
RCT	Radiological Control Technician
RWP	Radiological Work Permit
SDS	Safety Data Sheet
SME	Subject Matter Expert
SR	Savannah River Operations Office
SRNS	Savannah River Nuclear Solutions, LLC
SRR	Savannah River Remediation, LLC
SRS	Savannah River Site
STAR	Site Tracking, Analysis, and Reporting
STR	Subcontractor Technical Representative

STS	Safety-Trained Supervisor
SWRG	Safe Work Rules and Guidelines
Team	Office of Environment, Health, Safety and Security DOE-VPP Team
TRAIN	Training Record Automated Information Network
TRC	Total Recordable Case
USF	University of South Florida
VPP	Voluntary Protection Program
WIPP	Waste Isolation Pilot Plant
WSRC	Washington Savannah River Company
WSI	Wackenhut Security, Inc.

EXECUTIVE SUMMARY

The Department of Energy's (DOE) Savannah River Site (SRS) is a Nuclear Materials Processing Center in the State of South Carolina, located on land in Aiken, Allendale, and Barnwell counties adjacent to the Savannah River, 25 miles southeast of Augusta, Georgia. In September 2000, SRS, managed by the Washington Savannah River Company (WSRC), was certified as a DOE Voluntary Protection Program (VPP) Star site and subsequently recertified in November 2003 and June 2006. On July 1, 2009, the liquid waste scope of work transitioned from WSRC to Savannah River Remediation, LLC (SRR). SRR is responsible for operation of the Liquid Waste Facilities in F-Area Tank Farm, H-Area Tank Farm, Effluent Treatment Project, Saltstone Processing/Disposal Facility, and the Defense Waste Processing Facility. The workforce at SRR consists of approximately 1,900 people, including skilled crafts, building trades, engineers, support staff, managers, and safety and health professionals. The Augusta Building and Construction Trades Council collectively represents construction personnel and has strongly endorsed SRR's participation in DOE-VPP. SRR received its initial Star certification in May 2011.

Per DOE-VPP requirements, the 3-year recertification review was due in 2014. This report contains the results of that assessment conducted by the Office of Environment, Health, Safety and Security DOE-VPP Team (Team) and provides the necessary information for the Associate Under Secretary for Environment, Health, Safety and Security to make the final determination regarding SRR's continued participation in DOE-VPP.

SRR injury and illness rates are declining with no recordable subcontractor injuries or illnesses in the past 3 years. As of this report, SRR has experienced six recordable injuries during calendar year 2014 while working 3.7 million hours, showing a continuing reduction and a rate that is significantly lower than the comparison industry rates.

SRR managers continue to demonstrate a high level of management commitment to safety and health excellence as a prerequisite for mission performance. Managers remain visible, approachable, and credible to the workforce. Although resources to perform the mission remain tightly constrained, managers are appropriately prioritizing the work, supporting efforts to increase efficiency and remove barriers, and empower workers to pause or stop work.

SRR continues to provide many opportunities for workers to be actively involved. Team interviews indicated that SRR employee involvement and participation continue to be effective. Worker input is used extensively to identify and correct safety issues, improve work processes and mission execution, select controls, conduct prejob and postjob briefings, and perform work safely. Depending on the work location, workers help with control selection such that hazard controls do not impede work processes or introduce new hazards. SRR and Savannah River Nuclear Solutions, LLC (SRNS) continue to work together as a combined core team for VPP participation by sharing ideas and initiatives.

SRR continues to share programmatic processes for worksite analysis with SRNS. SRR augments these processes with facility-specific direction to address unique facility hazards. SRR uses an auditable safety analysis to capture the identification and analysis of hazards in a radiological facility. Although DOE no longer requires this method, SRR continues this approach because it effectively documents the hazards analysis. SRR can continue to improve its hazard analysis by validating that existing strategies effectively control exposures. SRR

should also continue to seek ways to identify and use leading indicators to monitor safety campaigns' effectiveness.

SRR continues to apply elimination of hazards as the preferred levels of control, such as substitution or engineered controls, to the hazards that are inherent in SRR operations and facilities. Other controls, such as administrative or personal protective equipment, reduce potential exposures and remain effective. SRR continues to improve the site-wide heat stress program. SRR is working with SRNS and DOE Savannah River Operations Office (SR) to address needed improvements to make exercise scenarios challenging and decrease the overlap between drill and exercise scenarios.

SRR has a well-established training and qualification program that trains employees to recognize hazards and to protect themselves and coworkers. SRR training programs equip managers, supervisors, and employees with knowledge to understand the established safety and health policies, rules, and procedures in order to promote safe work practices and minimize exposure to hazards. SRR should consider working with SRNS to implement guidance on effective use of the Training Records Automated Information Network system to eliminate repetitive actions when updating training information and creating status reports.

SRR continues to support a strong safety program that includes demonstrated management commitment and active employee involvement. Members of the Local Safety Improvement Teams and the VPP Core Team are dedicated to improving safety and helping every worker return home safely. SRR's improvements to the hazard analysis processes effectively document the basis for hazard control decisions. Procedures, postings, work packages, and training ensure workers know the appropriate controls. Workers are confident in their knowledge, skills, and abilities to perform work safely and have no problem pausing or stopping work when questions or issues arise. In a few cases observed by the Team, this confidence may lead to complacency on the part of workers who may accept deviations from established procedures and processes. SRR needs to find ways to continually combat the normal human tendency to normalize small deviations that might eventually lead to an accident or injury. The extent of this condition does not currently amount to a significant programmatic deviation, and the SRR culture that embraces self-assessment and observation ensures SRR can continue to improve. SRR restored programmatic controls for keys to locked areas in the tank farms by corrective actions after the assessment, and was verified by DOE-SR personnel. The Team recommends SRR continue in DOE-VPP at the Star level.

TABLE 1
OPPORTUNITIES FOR IMPROVEMENT

Opportunity for Improvement	Page
SRR should carefully review decisions to close corrective actions based on plans and ensure it does not put unnecessary pressure on managers to close corrective actions prematurely.	5
SRR should evaluate worker involvement in planning and executing maintenance work to determine if the current process is effectively using the knowledge and skills of the workforce.	8
SRR should continue seeking methods to ensure worker confidence does not lead to worker complacency.	9
SRR should review the use of shop chemicals and ensure eyewash stations are readily available when SDS first-aid recommendations include a 15-minute flush for accidental exposure.	12
SRR should validate its assumptions regarding DMM exposure with a sampling that assures it adequately analyzes the dermal exposure hazard.	13
SRR should ensure it trains workers and safety personnel to continually question abnormal or unexpected conditions and ensure hazard analyses prove conditions are safe.	14
SRR should continue to search for opportunities to use leading indicators for tracking and trending.	14
SRR should request and implement guidance from SRNS on effective use of the TRAIN system to facilitate updating training and remove redundant actions for each member of a work organization.	22
SRR should explore ways to encourage greater participation in STS certification as a means to prepare workers for future supervisory positions and improving safety culture.	22

I. INTRODUCTION

The Department of Energy's (DOE) Savannah River Site (SRS) is a Nuclear Materials Processing Center in the State of South Carolina, located on land in Aiken, Allendale, and Barnwell counties adjacent to the Savannah River, 25 miles southeast of Augusta, Georgia. SRS is approximately 310 square miles in size. Initially built during the 1950s to refine nuclear materials for deployment in nuclear weapons, the site has evolved to a multifaceted mission, including nuclear materials storage and management, nuclear stockpile management and support, environmental remediation, decontamination and decommissioning, liquid waste management, and nuclear fuel manufacturing.

In September 2000, SRS, managed by the Washington Savannah River Company (WSRC), was certified as a DOE Voluntary Protection Program (VPP) Star site and subsequently recertified in November 2003 and June 2006. In August 2008, operations work at SRS separated into two contracts, one for the management and operations of SRS and one for the liquid waste operation of the site. The liquid waste contract scope remained with WSRC. On July 1, 2009, the liquid waste scope of work transitioned from WSRC to Savannah River Remediation, LLC (SRR). The SRR team consists of URS, Bechtel, CH2M HILL, and Babcock and Wilcox. DOE awarded SRR its DOE-VPP Star as a standalone company in May 2011.

SRR is responsible for operation of the Liquid Waste Facilities in F-Area Tank Farm (FTF), H-Area Tank Farm (HTF), Effluent Treatment Project (ETP), Saltstone Processing/Disposal Facility, and the Defense Waste Processing Facility (DWPF). SRR administrative operations are centrally located between these facilities in building 766-H. The liquid waste contract awarded to SRR focuses on emptying and closing the site's underground high-level waste tanks. These tanks contain approximately 36 million gallons of waste consisting mostly of salt material and a smaller amount of high-activity sludge waste. Initially, SRR was expected to close 15 of the single-shell waste tanks by the end of the contract's 6-year base period, and to close an additional seven tanks by the end of the 2-year contract option period. Because of funding limitations, SRR's contract now provides for mission performance of the following scopes of work:

- Storage of high level nuclear waste in H and F Area Tank Farms;
- Receipt of high level nuclear waste from H Canyon (H Canyon is operated by Savannah River Nuclear Solutions, LLC (SRNS));
- Treatment of waste to remove radionuclides in the Actinide Removal Process and the Modular Caustic Side Solvent Extraction Unit;
- Disposition of nuclear waste in either the DWPF for high level waste or the Saltstone Production Facility for low activity waste; and
- Emptying, cleaning, and closure of waste tanks.

The high-level waste tanks at SRS constitute one of the largest, if not the largest, environmental risks in South Carolina. Movement of waste within the tank farms, evaporation of water to reduce volume, chemical treatment to inhibit corrosion, decomposition of organic materials, radiolysis of water to produce hydrogen, movement of sludge from the tank farms to DWPF, and transportation and storage of vitrified and solidified wastes all present risks to the workforce. In addition to radiological hazards, these facilities also share the same types of industrial and

chemical hazards experienced by general industry. Hazards in the workplace are associated with operating pressurized process equipment and ergonomic-related activities resulting in back/muscle injury and repetitive motion injuries. Explosion hazard potential also exists in facilities from chemical reactions, over-pressurization of equipment, or equipment failure. Other types of hazards involve hazardous energy and material handling operations with forklifts, elevators, cranes, hoists, and earthmoving equipment.

Contractually, SRR uses site procedures and programs developed and maintained by SRNS. Both SRR and SRNS continue to maintain a single VPP Core Team. While both contractors understand that DOE must certify them separately under the VPP process to attain Star certification, both contractors are using a single-site, integrated approach to implement the five elements of VPP.

The workforce at SRR consists of approximately 1,900 people, including skilled crafts, building trades, engineers, support staff, managers, and safety and health professionals. The Augusta Building and Construction Trades Council collectively represents construction personnel and has strongly endorsed SRR's participation in DOE-VPP.

Per DOE-VPP requirements, the 3-year recertification review was due in 2014. The Office of Environment, Health, Safety and Security DOE-VPP Team (Team) conducted observations and interviews as necessary to ensure all the tenets of VPP were adequately reviewed. This report contains the results of that assessment and provides the necessary information for the Associate Under Secretary for Environment, Health, Safety and Security to make the final determination regarding SRR's continued participation in DOE-VPP. The Team recommends that SRR continue in DOE-VPP at the Star level.

II. INJURY INCIDENCE/LOST WORKDAYS CASE RATE

Injury Incidence/Lost Workdays Case Rate (SRR Operations and Construction)					
Calendar Year	Hours Worked	Total Recordable Cases (TRC)	TRC Incidence Rate	DART* Cases	DART* Case Rate
2011	5,503,015	13	0.47	2	0.07
2012	4,731,343	6	0.25	2	0.08
2013	4,260,769	9	0.42	1	0.05
3-Year Total	14,495,127	28	0.39	5	0.07
Bureau of Labor Statistics (BLS-2012) average for NAICS** #562 Waste Management and Remediation Services			5.3		3.4
Injury Incidence/Lost Workdays Case Rate (Subcontractors)					
Calendar Year	Hours Worked	TRC	TRC Incidence Rate	DART* Cases	DART* Case Rate
2011	235,856	0	0.00	0	0.00
2012	231,240	0	0.00	0	0.00
2013	179,046	0	0.00	0	0.00
3-Year Total	646,142	0	0.00	0	0.00
Bureau of Labor Statistics (BLS-2012) average for NAICS** #236 Construction of Buildings			3.4		1.8

* Days Away, Restricted or Transferred
** North American Industry Classification System

TRC Incidence Rate, including subcontractors: 0.37
DART Case Rate, including construction and subcontractors: 0.07

SRR operations and construction injury and illness rates are declining with no recordable subcontractor injuries or illnesses in the past 3 years. Approximately 80 percent of SRR hours relate to waste management and remediation services with the balance related to construction activities. Most subcontractor hours fall under the construction NAICS. The Team reviewed nine first aid and two injury/illness cases and found a consistent application of title 29, Code of Federal Regulations, part 1904, *Recording and Reporting Occupational Injuries and Illnesses* (29 CFR 1904). As of this report, SRR has experienced six recordable injuries during calendar year 2014 while working 3.7 million hours, showing a continuing reduction, and a rate that is significantly lower than the comparison industry rates. SRR fully meets the expectations for continued participation in DOE-VPP.

III. MANAGEMENT LEADERSHIP

Management leadership is a key element of obtaining and sustaining an effective safety culture and implementing the guiding principles of Integrated Safety Management System (ISMS). The contractor must demonstrate senior-level management commitment to ISMS and occupational safety and health, in general, and to meeting the expectations of DOE-VPP. Management systems for comprehensive planning must address health and safety requirements and initiatives. As with any other management system, authority and responsibility for employee health and safety must be integrated with the management system of the organization and must involve employees at all levels of the organization. Elements of that management system must include: (1) clearly communicated policies and goals; (2) clear definition and appropriate assignment of responsibility and authority; (3) adequate resources; (4) accountability for both managers and workers; and (5) managers must be visible, accessible, and credible to employees.

In 2011, the Team concluded that the SRR management team was fully engaged and supportive of continuing excellence in safety and health and recognized this excellence as an essential element of completing its mission. Managers integrated across functional lines and recognized the importance of providing effective, efficient processes to help workers perform safely every day. Managers were clearly visible, available, and responsive to the workforce.

In accordance with its contract, SRR uses the SRS-wide system of procedures for environment, health, and safety. SRNS, the site infrastructure contractor, maintains the procedures in cooperation with SRR. In cases where the unique nature of SRR work requires significantly different procedures, SRR establishes a separate procedure. The overall SRS safety policy is established by DOE-SR in SRSPM 250.1.1D, *Savannah River Site Policy Manual*, Chapter IV. This policy applies to all SRS contractors and establishes a consistent site-wide approach to worker protection. That policy establishes that *the hallmark and highest priority of work activities shall be the protection of all workers and the integrity of the safeguards and security systems in place at SRS.*

The SRR senior management team has a wealth of experience at SRS. Most senior managers worked at SRS before SRR won the liquid waste contract. Their experience is not, however, limited to SRS. Managers bring experience from the commercial nuclear industry, the Sellafield site in the United Kingdom, the Waste Isolation Pilot Plant (WIPP) in New Mexico, the West Valley Demonstration Project in New York, the Los Alamos National Laboratory in New Mexico, and the Separations Process Research Unit cleanup project in New York. Managers use that experience to help SRR implement cost effective and safe approaches to accomplish its mission.

SRR managers are very visible to workers. From the company president down, managers make intentional efforts to visit workspaces, communicate with workers, and respond to worker comments and feedback. Because SRR has a small footprint for areas of responsibility, SRR locates managers' offices (other than the company president and direct staff) in the facilities they support. This distribution of senior managers does not present an additional burden for managers and fosters effective working relationships between senior managers and workers.

SRR has an extensive and active communication program for both internal and external communications. The communication team uses a variety of media, including printed bulletins, e-mail, Web pages, videos, and television monitors located around the facilities. The communication staff also helps prepare materials for All-Hands meetings and accompanies the

company president during roundtable meetings with employees. During these meetings, the communications staff records employee questions and answers, keeps track of questions that the company president cannot immediately answer, and provides answers as soon as possible. The communications staff also reviews all questions for trends or bigger issues and prepares releases to workers to address those issues and trends. Finally, SRR uses an Employee Environment Team (EET) to monitor the effectiveness of communications. EET members are volunteers throughout the organization that provide valuable feedback to the communications staff, test whether the employees receive the information, and help SRR avoid communication errors.

Staffing levels for safety and health disciplines are adequate for the current level of effort. SRR assigns safety and health personnel to specific facilities, and those personnel work closely with facility operators and maintenance craft. By distributing personnel, SRR ensures the safety and health staff is aware of potential issues, is familiar to facility personnel, and can react quickly and effectively when issues arise. In addition to permanent staff, SRR, through its parent corporations, can *reach back* for specific expertise on a temporary basis.

SRR has committed resources and funding to programs that promote and improve worker health and wellness. For example, SRR worked to make Fit-Bit® activity trackers that monitor the number of steps workers walk each day available for purchase to employees at a reduced cost. Workers were also given opportunities to earn wellness credits toward reductions in their health insurance deductibles by completing two activities, such as participation in weight loss or smoking cessation initiatives, completing an annual physical with their physician, and completing an online health survey. SRR also conducts health and safety fairs to inform workers and promote healthier life styles. SRR sponsors health promotion campaigns, such as the *Biggest Winner* challenge, where individuals and teams competed to demonstrate health improvements through weight loss, blood pressure reduction, and other health indicators.

SRR embraces an effective culture of self-assessment to drive improvements. Throughout the year, SRR conducts a range of internal assessments, as well as an Integrated Independent Evaluation (IIE) process. The IIE process covers a variety of topical areas related to environment, safety, and health. IIE reports categorize results as observations, findings, and opportunities for improvement. SRR enters findings and opportunities for improvement into the Site Tracking, Analysis, and Reporting (STAR) system. That system serves as the repository for evaluation and closure of corrective actions. A review of several STAR entries over the past year demonstrated that SRR closed some issues based on a plan being in place rather than an evaluation that the action was effectively completed. In those cases, the plans required more time to execute, and SRR may be closing actions to demonstrate shorter times to correct issues. SRR should carefully review decisions to close corrective actions based on plans and ensure it does not put unnecessary pressure on managers to close corrective actions prematurely.

Opportunity for Improvement: SRR should carefully review decisions to close corrective actions based on plans and ensure it does not put unnecessary pressure on managers to close corrective actions prematurely.

SRR makes extensive use of *Lean* events to drive process improvements, add value, and make better use of limited resources. *Lean* is a well-defined process that uses a team approach to evaluate processes and conditions to eliminate waste and add value. Rapid improvement events, part of the *Lean* process, have centered on supply chain management, work planning and control, waste tank retrieval and closure, procedure revision, and construction tool issue and inventory.

Making processes more efficient, as well as responsive to necessary changes, increases worker confidence in raising issues or concerns.

Subcontractor controls and oversight are effective. SRR provides guidance to suppliers regarding safety and health plans and other requirements. Subcontractor technical representatives (STR) provide frequent oversight and communication. SRR has a large set of focused observation checklists that STRs can use to perform oversight. These checklists provide guidance and prompts that help STRs conduct thorough assessments and observations. SRR does not use a system to modify a subcontractor's Experience Modification Rate based on the subcontractor's previous performance at the site, although SRR is looking for a means to accomplish this. Health and safety performance by SRR subcontractors for the past 3 years has been excellent with no recordable injuries attributed to subcontractors.

The SRR company president convenes an Executive Safety Quality Board (ESQB) once or twice a month depending on current issues. The ESQB reviews collective significance of events, occurrences, assessments, and observations. Managers are informed in advance of topics they will present to the ESQB, including analysis and proposed corrective actions. Records of those reviews are available on the SRR Intranet to anyone with access to the Intranet. Recent topics included repeat events over the preceding 3 years involving loss of breathing air to personnel in supplied air respirators, events involving powered industrial lift trucks (forklifts), and lessons learned from the February 2014 fire and radiological release events at WIPP.

Finally, SRR managers actively support many outreach efforts to both DOE-VPP and the community. SRR personnel supported DOE-VPP reviews, provided training presentations at the annual Voluntary Protection Programs Participants' Association conferences, mentoring and internship opportunities to local schools and colleges. SRR employees participate in local assistance efforts that build and repair homes or facilities used by charitable organizations. During these activities, SRR employees demonstrate the safety practices established at SRS and help promote a stronger safety culture in the community.

Conclusion

SRR managers continue to demonstrate a high level of management commitment to safety and health excellence as a prerequisite for mission performance. Managers remain visible, approachable, and credible to the workforce. Although resources to perform the mission remain tightly constrained, managers are appropriately prioritizing the work, supporting efforts to increase efficiency and remove barriers, and empower workers to pause or stop work. SRR fully demonstrates the Management Leadership commitment expected of a DOE-VPP Star participant.

IV. EMPLOYEE INVOLVEMENT

Employees at all levels must continue to be involved in the structure and operation of the safety and health program and in decisions that affect employee health and safety. Employee Involvement is a major pillar of a strong safety culture. Employee participation is in addition to the individual right to notify appropriate managers of hazardous conditions and practices. Managers and employees must work together to establish an environment of trust where employees understand that their participation adds value, is crucial, and welcome. Managers must be proactive in recognizing, encouraging, facilitating, and rewarding workers for their participation and contributions. Both employees and managers must communicate effectively and collaboratively participate in open forums to discuss continuing improvements, recognize and resolve issues, and learn from their experiences.

In 2011, the Team identified Employee Involvement as a strength of the SRR safety program. SRR provided employees with multiple opportunities to participate on safety committees and identify process and safety improvements. In addition, employees were encouraged to use the timeout process to ensure they performed work safely and effectively. The Team identified the next major challenge for SRR was encouraging workers to ask difficult questions regarding safety observations and use those workers' observations to identify potentially systemic weaknesses or improvements.

There are four functioning Local Safety Improvement Teams (LSIT): Helping All Workers Keep Safe (HAWKS), Safety Wins All the Time (SWAT), FRITSTONE, and SAFE-T that meet on a monthly basis. SRR relies on these teams to implement the behavior-based safety (BBS) observation processes. LSIT members represent a cross section of the workforce who volunteered to become trained observers. Each LSIT maintains an action-tracking list that incorporates observed at-risk behaviors. LSIT meeting minutes demonstrate significant LSIT involvement in solving problems and issues. LSIT meetings frequently discuss observed potential hazards. These may include potential slip, trip, or fall hazards; degraded postings; degraded walkways; or degraded traffic markings.

During interviews, workers clearly voiced their knowledge and understanding of their "stop work" authority. Two operators described how they recently used the stop work process with positive results. Workers believe their hazard identification training empowers them to take ownership of, and be involved in, changes to operating procedures. They also use a "time out" or "pause" if there is a question about a work or procedural step that is unclear rather than a full stop work. None of the workers encountered by the Team expressed any concern about retribution or retaliation for raising a concern.

Employees have several avenues to express concerns or make suggestions. In most cases, they go to their firstline supervisor to resolve issues. They can also raise issues to their LSIT. Finally, they have access to either the SRR employee concerns program or the DOE employee concerns program. Most employees indicated that they rarely have to go any farther than their supervisor to resolve health or safety issues. Employees are comfortable bringing concerns to their immediate supervisors and are well aware how to elevate unresolved concerns. Supervisors are responsive to employee concerns, and concerns rarely need to be elevated.

SRR continues to encourage employee suggestions to improve safety and efficiency. For example, an employee-suggested idea resulted in an improved method to remove samples from waste tanks using a fishing reel instead of manually pulling up the sample. After using mockups

to test different techniques, SRR adopted the suggestion. In another case, employees played a significant role in developing the "heat oasis islands" to reduce the effects of heat stress during periods of extreme heat days (see Hazard Prevention and Control). These islands include large basins of cold water for workers to immerse their arms, area overhead misters, air-conditioned rooms to cool down, and water or electrolyte drinks to rehydrate.

SRR continues to encourage workers to recommend and develop solutions to address more challenging work activities. For example, the tank farm maintenance shop developed an engineered jumper pipe gasket placement tool to reduce potential worker radiation exposure. Workers frequently replace gaskets on jumpers used inside the tank farms, exposing them to potentially high radiation. Using the tool, workers remain at least 12 inches from a radiation source limiting unnecessary exposure. The maintenance workers have spent years developing and refining the now patented "jumper" tool.

As discussed in the 2011 review, SRR workers continue to actively participate in prejob briefings. Workers discuss the workscope, hazards and hazards analysis, and required controls. The reverse prejob briefing is still an effective tool to ensure worker involvement in the prejob briefing and ensures greater worker retention of the activities' specifics. All prejobs observed by the Team covered hazards and work steps thoroughly and included the reverse prejob method. Most workers were very knowledgeable and able to explain their actions and roles in the work activity. (See the Hazard Prevention and Control section for additional discussion of prejob briefings.)

Workers may also participate in planning work or walkdowns in the planning process. *Work Planning,* SCD-15, paragraph 5.1.1 states: *"Planner may involve workers."* The Team observed a planning meeting for replacing a glass window in a glovebox that effectively involved workers in the process. This initial planning meeting included workers that had previously replaced glovebox windows, engineers, industrial hygienists, radiological protection supervisors, maintenance workers, managers, firstline supervisors, and safety professionals. The meeting went well with participation by all attendees. Particularly relevant to this work was the location of the replacement and the limited space to perform the work. Initial conversations included radiological hazards, chemical hazards, physical hazards, the need to fabricate a device to lift the 400-pound glass window out of the existing frame and install another piece weighing the same. Preliminary decisions included mockups of the work to assist in final planning and paths forward to accomplish the work.

Some maintenance workers said that they are not usually involved with initial work planning. Planners stated that they might contact workers for information prior to planning a work package if the proposed work is new or infrequently performed. The SRR work planning process expectation to involve workers depends upon the frequency and complexity of the work. In most cases, workers indicated they have the opportunity to walkdown jobs prior to performance of work. SRR should evaluate worker involvement in planning and executing maintenance work to determine if the current process is effectively using the knowledge and skills of the workforce.

Opportunity for Improvement: SRR should evaluate worker involvement in planning and executing maintenance work to determine if the current process is effectively using the knowledge and skills of the workforce.

As observed in 2011, getting employees to ask hard questions, look at their work areas with a fresh perspective, and continually identify improvements for themselves and their coworkers

remains a challenge for SRR. Several conditions observed by the Team, and discussed in Worksite Analysis, and Hazard Prevention and Control, indicated workers accepting hazards or deviations from expectations. SRR should continue seeking methods to ensure worker confidence does not lead to worker complacency.

Opportunity for Improvement: SRR should continue seeking methods to ensure worker confidence does not lead to worker complacency.

Conclusion

As in the 2011 review, SRR continues to provide many opportunities for workers to be actively involved. Team interviews indicated that SRR employee involvement and participation continue to be effective. SRR uses worker input extensively to identify and correct safety issues, improve work processes and mission execution, select controls, conduct prejob and postjob briefings, and perform work safely. Depending on the work location, workers help with control selection such that hazard controls do not impede work processes or introduce new hazards. SRR and SRNS continue to work together as a combined core team for VPP participation by sharing ideas and initiatives. SRR meets the expectations in Employee Involvement for continued participation in DOE-VPP.

V. WORKSITE ANALYSIS

Management of health and safety programs must begin with a thorough understanding of all hazards that might be encountered during the course of work and the ability to recognize and correct new hazards. Implementation of the first two core functions of ISMS, defining the scope of work and identify and analyzing hazards, form the basis for a systematic approach to identifying and analyzing all hazards encountered during the course of work. The results of the analysis must be used in subsequent work planning efforts. Effective safety programs also integrate feedback from workers regarding additional hazards that are encountered and include a system to ensure that new or newly recognized hazards are properly addressed. Successful Worksite Analysis also involves implementing preventive and/or mitigating measures during work planning to anticipate and minimize the impact of such hazards.

The 2011 Team found that SRR had well-established programs for developing work packages and performing work. The workforce was knowledgeable with a high level of confidence that they could perform work safely. SRR's excellent safety record and low rework frequency confirmed that SRR was planning and performing work effectively. The Team identified worksite analysis procedural changes to capture and institutionalize the logic for control selection and radiological work suspension limits as opportunities for improvement. Implementation of the Enterprise Integrated Safety Management-Exposure Assessment (EISM-EA) was underway, as well as other program improvements to enhance the industrial hygiene (IH) program throughout the facilities.

SRR continues to employ the established programs and processes to perform work safely and effectively with minimal rework. The improved worksite analysis process now captures the logic supporting the selection of controls based upon the hazard analysis. Radiological work permits (RWP) now include interim suspension limits and are now consistent with DOE Headquarters' recommendations for performing work in radiological controlled areas. SRR maintains a hazard baseline that meets 10 CFR 851, *Worker Safety and Health Programs,* requirements and updates that baseline periodically. SRR IH professionals are able to use the EISM-EA database to retrieve or review existing data. The baseline document and EISM-EA database provide inputs into work document development so planners and workers use the best information available to plan and execute work safely.

SRR identifies other appropriate exposure limits when Occupational Safety and Health Administration (OSHA) regulatory limits or American Council of Government Industrial Hygienists and the National Institute for Occupational Safety and Health recommendations do not apply. For example, SRR uses DOE Protective Action Criteria, such as Acute Exposure Guideline Levels, Emergency Response Planning Guidelines, and Temporary Emergency Exposure Limits, to augment hazard analysis. These are particularly helpful when developing work documents for tank farm activities where many different chemicals are part of the exposure profile. This approach indicates a strong process at SRR that recognizes that the use of these sources provides an additional analysis not available in the contemporary regulations, which strengthens SRR worker level controls.

SRR maintains the safety basis documents mandated by 10 CFR 830, subpart B, *Nuclear Safety Management,* implementing programmatic procedures, facility-specific procedures, and work documents. SRR manages three Category-2 Nuclear facilities and one radiological facility. One documented safety analysis (DSA), WSRC-SA-2002-00007, Revision 15*,(Concentration, Storage, and Transfer Facilities*),covers both HTF and FTF. This DSA addresses waste

evaporators and 51 underground waste storage tanks that store and handle liquid radioactive waste. SRR operates DWPF in accordance with the *Final Safety Analysis Report Savannah River Site Defense Waste Processing Facility*, WSRC-SA-6, revision 32. *The Saltstone Facility Documented Safety Analysis*, WSRC-SA-2003-00001, revision 10, provides the current safety basis to operate the Saltstone Facility. The Effluent Treatment Facility (ETF) is a radiological facility (based upon inventory) using low hazard chemicals and does not require a DSA report. SRR retains the original auditable safety analysis (ASA), *Auditable Safety Analysis for the Effluent Treatment Facility*, WSRC-TR-98-0379, revision 16, to document safety and health hazards and the programs to control those hazards, even though DOE no longer requires an ASA for radiological facilities. SRR reviews and updates these documents on a scheduled basis to ensure their accuracy.

As noted in the 2011 assessment, SRR maintains a robust work area evaluation program. Managers and workers perform weekly walkdowns of work areas to identify issues and suggest improvements. SRR enters information from the walkdowns of operating facilities into a database and trends those results to determine areas of increased focus. SRR prioritizes items identified as needing correction for resolution with safety items receiving additional scrutiny and prioritization.

SRR continues to use the site Manual 8Q, *Employee Safety Manual,* revision 9, which contains Procedure 122, *Task Level Hazards Analysis*. SRR uses this procedure in conjunction with the assisted hazard analysis (AHA) software to identify, analyze, and develop controls for work activities. The software is an effective tool that assists the users using a series of questions to evaluate the hazards and develop the controls. SRR requires subject matter experts (SME) to include their analysis of hazards within the AHA to capture assumptions and limits on the identified controls. In response to a worker injury while lifting, SRR developed a new hazard tree for lifting and worked with SRNS to incorporate that new hazard tree into the AHA. SRR provided training to all employees and placed new posters around SRR facilities to remind people of the limits on lifting.

Procedure 122, section 5.8, contains *Hazard Analysis for Work in Designated Shop Areas*. The procedure tasks the lead work group supervisor (LWGS) or designee with defining the shop areas, including whether it is outside or inside a permanent or temporary structure. The LWGS may use any of the available hazard analysis processes, including AHA, vendor recommendations, SME input, or worker input, to document Safe Work Rules and Guidelines (SWRG) for machinery, equipment, shop fabrication processes, or materials and chemicals used in a process or operation. The Team reviewed the SWRGs for the lathe and the milling machine in the DWPF maintenance shop. Both contained work steps, potential hazards, and controls. For maintenance or repair on the milling machine or lathe, the SWRG directs the user to the AHA.

Section 5.8.3 of Procedure 122 discusses *Hazard Controls for Shop Materials and Chemicals*. Embedded in that section are the following instructions: *"All methods used to analyze hazards and document controls for shop materials and chemicals shall be approved by Shop Supervisor and Industrial Hygiene (IH)."* Section 5.8.4 requires a task-specific hazard analysis using the AHA for nonroutine activities. In some cases, SRR has not effectively identified and analyzed all shop hazards and, in one case, had not specified appropriate controls. For example, the Team observed several chemicals used in a shop. Chemicals included aerosol cans of paint, Aerokroil®, Leak-Tec®, Never-Seez®, and Magnaflux®. The safety data sheet (SDS) information for these chemicals identified the petroleum distillates as an eye irritant. First-aid measures listed on the SDS include flushing the eye for 15 minutes and seeking immediate

medical attention. Emergency eyewash stations were located more than 10 seconds and over 50 feet away from the shop areas where these flammable cabinets and machinery were located. Also, the path to these stations was blocked by machinery and/or doors. SRR could not provide any analysis that addressed why eyewash equipment was not required in the shop area or how SRR arrived at the exemption in 8Q 52, *Safety Showers and Eyewash Facilities,* which states the following:

> *Some work activities involving minor exposure to injurious material may not involve exposure significant enough to require safety shower/eyewash equipment. Examples of work activities not requiring safety showers/eyewash are: (A). Pouring/dispensing fuel into portable equipment or vehicles; (B). Using marker board or eyeglass cleaner; (C). Using degreaser or cleaning solutions or aerosols; (D). Servicing copier toner; (E). Handling water sample bottles with preservatives; (F). Loading/unloading of cryogenic material such as liquid nitrogen from storage tanks, trucks or portable cryogenic containers; valving of cryogenic systems; handling of portable cryogenic containers.*

SRR should review the use of shop chemicals and ensure eyewash stations are readily available when SDS first-aid recommendations include a 15-minute flush for accidental exposure.

Opportunity for Improvement: SRR should review the use of shop chemicals and ensure eyewash stations are readily available when SDS first-aid recommendations include a 15-minute flush for accidental exposure.

The Team observed several examples of detailed analysis that resulted in effective controls. During a tour of the DWPF maintenance shop, the Team observed a posting in the welding area. SRR had analyzed and developed this aid to help plan welding activities based upon base material, filler material, and welding methods. This aid is a laminated copy of the table, *Welding, Brazing, Thermal Cutting, IH Minimum Fume Controls for Worker Protection,* from Manual Y16.2, Procedure 112. The notes and references identify requirements for a variety of situations, such as when ventilation is not possible or no IH sampling data exists. The table also identifies requirements that control lead and hexavalent chromium exposures, including OSHA airflow requirements, and types of respiratory protection needed to weld in the shop area. The Team also observed mobile crane activities in the tank farm. For work on or near tanks, SRR analyzes and documents mobile crane positions and types to address boom swing hazards, citing requirements to facilitate optimum effectiveness during lift activities, and minimize introduction of other hazards due to cab counterweight movement. SRR evaluates these considerations during every lifting activity at the tank farms due to limited space, radiological controls, and other physical hazards. Both the welding guide and the mobile crane position analysis developed by SRR demonstrate a proactive approach that integrates the analysis of multiple hazards and identifies appropriate controls for those activities.

During this assessment, SRR was performing repair work in a mercury resin column at ETF. The piping supports inside the column failed due to a water hammer, and workers were rewelding the supports. Operators flushed the column to remove residue. Workers then detached the column from the piping system and moved the column so they could make the repair. This work required a worker to enter into the column, lie down on a welding mat, and tack weld the supports while wearing a plastic suit with supplied air. To protect the welder's

hands, the worker was wearing two sets of rubber anticontamination gloves covered by leather welding gloves.

SRR considers the airborne exposure potential as bounding of the dermal contact exposure potential. The mercury in the resin column is mostly from evaporator overheads as the evaporator boils off excess liquids. The SRR threshold for respiratory protection is 0.008 mg/m3 total mercury, which it believes protects workers from vapor exposure if it were l00 percent di-methyl mercury (DMM). DMM is a known toxin and can be fatal if absorbed through the skin. SRR conducted a formal review of dermal exposure hazards associated with potential contact with liquid waste material. This review included collection of air and bulk samples in addition to an evaluation by a board certified toxicologist (WSMS-SAE-03-0017 and WSRC-STI-2007-00185). Additionally, SRR conducted DMM formation studies to improve understanding of evaporator/tank mercury chemistry (SRT-LWP-2003-00009). In particular, SRR identified the addition of anti-foam agent as a significant potential contributor to the formation of DMM. Based on findings from formation studies, SRR proactively discontinued addition of anti-foam to evaporators. Recent air sampling campaigns appear to validate the formation study findings and demonstrate a measurable reduction in DMM concentrations. The potential fraction of DMM contained in supernate, sludge waste, and overheads is low.

These analyses only evaluated worker contact with evaporator liquids to determine that no additional personal protective equipment (PPE) was necessary to prevent dermal exposure to DMM. These analyses did not evaluate potential exposure to components designed to concentrate mercury, such as the mercury resin column. SRR had not analyzed the amount of residue in the column that might be required to reach the airborne threshold, nor considered the work methods employed to validate if the rubber anticontamination gloves and plastic suit protected against that exposure. The worker had to crawl into the column and then perform welding, which could significantly increase the potential dermal exposure. DMM penetration times for rubber and nitrile gloves is very short, and other facilities in DOE use Silver-Shield® gloves to protect against dermal exposure. SRR should validate its assumptions regarding DMM exposure with a sampling that assures it adequately analyzes the dermal exposure hazard.

Opportunity for Improvement: SRR should validate its assumptions regarding DMM exposure with a sampling that assures it adequately analyzes the dermal exposure hazard.

The Team observed a prejob briefing at DWPF for workers that were preparing to perform maintenance on the third level of DWPF. The supervisor advised the workers that work had been stopped in the area the previous day because of a bad smell in the area when a Nylobraid® hose was removed from a fitting. The supervisor stated that industrial hygienists had sampled the area and that there was no hazard, but the area might still smell bad. None of the workers questioned this report. Upon further questioning by the Team regarding the source of the odor, the facility manager decided to delay the work until the industrial hygienists could investigate the odor. The industrial hygienists responding to the odor had drawn Drager® tube samples for formic acid and nitric acid, the two expected chemical hazards that might be present. Formic acid was detected, but not at actionable levels. The position of the hose that workers removed allowed a potential “dead leg” of nitric or formic acid in the hose. There had been some leakage of acid into the hose and that acid could have remained in the hose for several months. The analysis of the smell did not consider possible degradation byproducts from acid evaporating and concentrating in the hose or the possibility that those byproducts might be hazardous. The primary constituent of the hose is polyvinyl chloride with various additives to keep the hose

flexible. The manufacturer rates the hose as "Excellent" for use with 10 percent nitric acid, but only "Limited" for 68-percent nitric acid, and there was no data for formic acid. Evaporation in the "dead leg" could cause the nitric acid to concentrate up to 67 percent nitric acid. The hose was sealed in a plastic bag for disposal, the hose connection was sealed with a threaded pipe cap, all waste was removed from the area, and the smell dissipated from the area indicating that the hazard was abated. SRR never positively identified the actual cause of the odor and, therefore, could not prove that any residual smell was safe, contrary to the statement by the supervisor during the prejob brief. The workers' acceptance of that statement did not demonstrate a questioning attitude about an abnormal condition. SRR should ensure it trains workers and safety personnel to continually question abnormal or unexpected conditions and ensure hazard analyses prove conditions are safe.

Opportunity for Improvement: SRR should ensure it trains workers and safety personnel to continually question abnormal or unexpected conditions and ensure hazard analyses prove conditions are safe.

SRR tracks and trends a variety of items associated with performance and safety indicators. Injury metrics, contamination events, occurrences, and BBS observations are just a few of the many items that SRR tracks and evaluates. One of the challenges, as its safety culture continues to mature, is to assure a continued improving safety culture, quest for excellence, and minimize complacency with the status quo. When the Team discussed leading indicators with SRR, its dashboard only indicated two that SRR tracked: safety meeting attendance and BBS observations. SRR should continue to search for opportunities to use leading indicators for tracking and trending.

Opportunity for Improvement: SRR should continue to search for opportunities to use leading indicators for tracking and trending.

Conclusion

SRR continues to share programmatic processes for worksite analysis with SRNS. SRR augments these processes with facility-specific direction to address unique facility hazards. SRR uses ASAs to capture the identification and analysis of hazards in a radiological facility. Although DOE no longer requires this method, SRR continues this approach because it effectively documents the hazards analysis. SRR preanalyzed several common work evolutions: developed guidance documents for controlling exposures to welding fumes and guidance on placement of cranes in the tank farms to avoid suspended loads over vulnerable equipment analyzed in DSA. Both of these efforts are noteworthy since they provide proactive examples of continuous improvement. SRR can continue to improve its hazard analysis by validating that existing strategies effectively control exposures. SRR should also continue to seek ways to identify and use leading indicators to monitor safety campaigns' effectiveness. SRR continues to meet the expectation in Worksite Analysis for participation as a DOE-VPP Star participant.

VI. HAZARD PREVENTION AND CONTROL

The second and third core functions of ISMS, identify and implement controls and perform work in accordance with controls, ensure that once hazards have been identified and analyzed, they are eliminated (by substitution or changing work methods) or addressed by the implementation of effective controls (engineered controls, administrative controls, or PPE). Equipment maintenance processes to ensure compliance with requirements and emergency preparedness must also be implemented where necessary. Safety rules and work procedures must be developed, communicated, and understood by supervisors and employees. These rules and procedures must also be followed by everyone in the workplace to prevent, control the frequency of, and reduce the severity of mishaps.

SRR continues to effectively use the hierarchy of controls to protect workers and operations from hazards. At DWPF, engineers are developing a process to substitute formic acid with a weaker reducing agent, glycolic acid. Formic acid is associated with the production of hydrogen gas, an explosive hazard, during the processing of waste. Since the Savannah River National Laboratory's experiments with glycolic acid indicate less hydrogen gas production than with formic acid, the need to purge process tanks of hydrogen gas will decrease while improving material flow characteristics and production. The project has entered into the implementation phase with a target date of 2016 to complete the DWPF modifications and updates to documents and databases.

DWPF employs multiple engineered controls to minimize spread of contamination and prevent exposure to workers, the environment, and the surrounding public. The ventilation system maintains a negative pressure profile to control contamination. The system consists of three zones, with air moving from clean areas to contaminated areas with exhaust air passing through high efficiency particulate air filters and a sand filter to remove contamination. The system releases exhaust air through stacks to ensure any releases are elevated to minimize exposure in the event of an accidental release. In addition to the ventilation system, DWPF uses shield walls, remote handling equipment, and automated processes to further minimize worker exposures.

SRR uses mockups to develop, practice, and finalize procedure steps prior to performing work in a high-hazard environment. By developing work practices and the procedures in a mockup environment, SRR is able to minimize the risk of workers' exposure to high-level hazards. The mockups allow workers to evaluate work techniques, develop task proficiency, and identify alternative approaches. The Team observed the remnants of a mockup for dislodging a telescoping waste transfer jet stuck in a tank. The mockup included scaffolding supporting a waste transfer jet, an engineered cylindrical shield to reduce radiation exposure, and allowed for practicing the insertion of a hydrolance into the riser to remove salt from the transfer jet. The cylindrical shielding is a large diameter pipe that fits over the riser and has cutouts that workers can reach through with arms or tools to access the transfer jet. The cylindrical shielding keeps workers 10 to 12 inches from the radioactive, salt-covered transfer jet during removal.

In addition, to control radiation exposures, SRR replaces removed riser plugs with Lexan® covers. Holes cut into the Lexan® allow cameras and tools like the hydrolance into the riser while the Lexan® helps reduce radiation exposure. The tank farm maintenance shop fabricated the metal sheathing for the hydrolance, as well as other tools, to guide water jets into the riser or into the transfer jet. SRR continues to reduce radiation exposure from techniques adopted through the mockup process.

In April 2014, SRR received an enforcement letter from DOE's former Office of Health, Safety and Security (HSS) concerning a severe shoulder muscle tear of a worker from lifting a valve because SRR was not using sufficient lift prescreening thresholds. Since then, SRR has used mockups to demonstrate proper procedures for safely lifting objects. During a recent monthly safety meeting, workers commented that it would be helpful to develop a standard practice for lifting items over 50 pounds, and that practice should require two workers when mechanical means are not feasible. After discussing ways to expand safety awareness of proper lifting and developing presentations and handouts, the meeting attendees discussed the idea of using a mockup to demonstrate proper lifting techniques. After that meeting, SRR began communicating safe two-person lifting tips to employees and created a two-person lift mockup that employs various scenarios with the use of props that allows for the common simulation of construction equipment without the risk associated with the actual items.

The Team observed good use of controls in the Saltstone and DWPF maintenance shops and at the tank farm heavy fabrication shop. For example, workers use welding exhaust hoods to prevent worker exposure to welding fumes and vapors. Labels on the exhaust hoods include identification numbers, the survey date, the surveyor contact information, and the measured flowrate on the equipment, all of which informs the worker about the condition of the equipment. The Team observed workers using the welding exhaust hoods effectively and adhering to the requirements. The *SRR Welding, Thermal Cutting and Related Processes, Minimum Safe Practices*, Procedure 112, Manual Y-16.2, revision 5, emphasizes Table 1 as a means to communicate IH minimum controls for worker protection when performing welding, brazing, and thermal cutting (see Worksite Analysis).

The Team observations of the SRR maintenance workshops demonstrated effective use of machine guarding and welding screens around fabrication tables, arc cutting, welding, and grinding materials activities.

SRR constructs huts over areas of tanks that are undergoing maintenance. These ventilated huts not only protect workers from the weather, but also help prevent the spread of contamination. A few years ago, SRR began constructing *Oasis rooms* as part of its heat stress program. These sheds or huts, installed near the work areas, are air-conditioned so workers dressed in anticontamination clothing and bubble suits can retreat to a cool area. SRR also developed a water dispensing technique so workers can drink water while wearing anticontamination clothing without contaminating the water dispenser or risking internal contamination. Both of these controls, prompted by worker input and validated by radiological control personnel, allow workers to work efficiently while reducing the risks of heat stress and contamination spread.

When the hierarchy of controls has been exhausted, SRR uses administrative controls. For example, because of several incidents involving a loss of load or damage to other equipment, SRR established an administrative control prohibiting the use of a forklift without a trained spotter. Additionally, SRR developed a spotter exercise that uses mockups to train spotters. This exercise provides workers a risk-free environment for practicing spotter duties associated with moving motor-operated vehicles, such as pickup trucks, flatbeds, tractor-trailers, etc. SRR workers understand they may need to act as a spotter and must use consistent signals so driver and spotter communications are clearly understood. The exercise includes the standard industry hand signals for vehicle movement, as well as providing a safe environment for the employees to practice both the driver and spotter duties. The result is that spotters maintain control of the forklift movement and work area to minimize the potential for accidents.

SRR uses postings to notify workers of hazards in affected areas. Postings observed by the Team were specific regarding location of the hazards and appropriate distances where controls were required. A good practice employed at the tank farm fabrication shop is the posting of current noise assessments for the activities surveyed in the shop, as well as work on the concrete pads outside the shop. These postings augment the *Hearing Protection Required* signs.

Prejob briefings are formal and structured meetings that discuss the hazards, controls, and complexity of planned work. SRR uses the prejob briefing to confirm readiness before authorizing work activities and provides the job participants with a collective understanding of the assigned task. Topics discussed include requirements for performing the task, hazards and necessary controls, environmental impacts, current facility conditions, emergency contingency actions, and each individual's roles and responsibilities. The Team attended several prejob briefings that effectively discussed work hazards and controls between the field work supervisor and workers. For example, a prejob briefing at FTF for a critical lift plan demonstrated a well-planned strategy and coordination to ensure all workers were prepared to perform work.

At another prejob briefing in DWPF and HTF, both operations' persons in charge (PIC) used a dry erase board to draw a visual representation of the work and listed the major actions that the workers would perform during the work. Both PICs reviewed the RWP, hazardous configurations, and then performed a reverse prejob brief by letting different workers describe their activities for the work package. The prejob briefs were thorough and are consistently used across SRR.

Housekeeping is an important aspect of hazard control, and facilities and areas reviewed by the Team were clean and organized. Several Team members visited the warehouse, an electrical shop, an insulation shop, ironworker shop, pipefitters shop, sheet metal shop, and the facility and systems maintenance shops. The Team noted that all the shops and laydown areas were organized, walkways were easily passable, and the general areas were free of clutter.

SRR appropriately uses PPE as the last level in the hierarchy of controls throughout its facilities. The Team observed the use of hearing protection muffs for noise hazards, bubble plastic suits for radiological control, respirators, and arc flash equipment. At the DWPF electronics and instrumentation shop, arc flash equipment included a well-kept 40cal/cm2 suit, helmet and face shield, and leather gloves, but lacked approved rubber gloves. Workers were aware of this issue and stated they obtain approved gloves from the measuring and testing shop prior to any arc flash work. Workers at the tank farms have access to International Biomedical® radiation attenuating surgical gloves that are lead, latex, and powder free to protect their hands from high radiation levels found in the tanks. Based on the Team's observations, SRR workers properly use PPE and maintain it in good working condition.

In one case observed by the Team, the controls used for access to locked high radiation areas within the tank farm were not effective and did not ensure positive control. SRR locks these areas for several reasons, including radiological exposure and system configuration control. The Shift Operations Manager is supposed to control the keys to these locked areas, including sign out and return of keys. During a tank sampling evolution, the work supervisor properly signed out a key from the shift operations office. When the supervisor tried to unlock the area using the provided key, the key would not work. At that point, another worker, unassociated with the task, provided the supervisor with a key on the worker's personal key ring. That key worked. Neither the supervisor nor the workers for the job questioned the use of the key on a personal key ring or questioned whether they were attempting to unlock the wrong area. The Team notified SRR of

the observation and identified the potential concern that other workers might also be holding keys contrary to the SRR procedure. The Team believes these conditions might represent a specific noncompliance with an established regulation or standard, but the nature of the noncompliance was such that the condition could be corrected within 90 days. In response, SRR immediately stopped work requiring key access, put immediate compensatory measures in place to prevent workers from using keys that were not properly controlled, and began the procurement process for installing new locks and controlled keys to replace the existing locks. SRR completed corrective actions prior to the completion of this report, and DOE-SR validated the actions were effective.

Implementation of *Lean* techniques (see Management Leadership) has increased work efficiency by organizing work areas. For instance, at the DWPF radiological PPE room, prior to the *Lean* event, obtaining PPE was chaotic. The old process caused choke points and workers did not easily know if they had taken all the necessary PPE. Using worker suggestions, the workers and the *Lean* team reorganized the PPE room by placing PPE bins on one side of the room, designated one door as the entrance and the other as the exit to improve flow, and used other techniques. The new setup helps workers obtain the correct PPE efficiently.

During the summer of 2014, SRR contracted a heat stress consultant from the University of South Florida (USF) to identify improvements in its heat stress management process and is sharing that data with SRNS. The USF consultant analyzed typical clothing used at SRS and developed a clothing adjustment factor to more accurately define the potential for heat stress during SRR activities. SRR plans to incorporate worker monitoring and a comparison of calculated versus measured heat stress values into future heat stress evaluations. Additionally, SRR reviewed several heat stress programs across DOE and is adopting additional improvements. For example, SRR is testing heart rate monitors for workers that transmit data to an iPad® or similar device. It is also testing the Polar™ software that telemetrically monitors groups of workers at one time. SRR is continuing efforts to update the heat stress program to protect workers.

IH, safety, and radiation safety professionals are visible and readily available to workers to discuss or analyze potential hazards in the workplace. The certifications of these professionals include IH, safety, and the National Registry of Radiation Protection Technologists' certification. Industrial hygienists enter sampling data into the EISM-EA system, which provides a comprehensive database for work planning, activities, or tasks (see Worksite Analysis).

SRR tracks and trends maintenance activities to ensure adequate program operation. Trending for the fourth quarter in 2013 indicated the preventive maintenance (PM) and corrective maintenance (CM) programs were trending negatively and required additional action to meet expectations. A further review identified that issues, such as multiple pump failures at Saltstone and DWPF (plant condition), material acquisition delays, and facility production schedule, were reducing the maintenance organization's ability to meet its established goals. SRR had also been using overtime to keep up with PM and CM demand, and management recognized this was more than a "spike" in work orders but a resource issue. In response to these trends, SRR has implemented several improvements. The maintenance organization recently hired 5 electricians and 13 maintenance mechanics to ensure adequate staffing, and SRR created a new management position to improve outage planning. SRR will continue to monitor the maintenance programs' effectiveness as these improvements mature.

The SRR Emergency Preparedness (EP) program conducts annual drills and exercises at facilities and generates reports to validate or improve the response of the participants. Exercises can be either site-wide or localized to SRR facilities. Every 3 to 4 years, a site-wide exercise focuses on an SRR facility. However, SRR normally participates in all site-wide exercises. The Team reviewed the annual drill schedule for DWPF, ETP, and tank farms, and several drill reports that identify strengths, good practices, deficiencies, or opportunities for improvement. The STAR system tracks deficiencies and opportunities for improvement until actions are completed.

In May 2012, a site-wide seismic event exercise focused on HTF. Evaluators of the exercise included DOE Headquarters, DOE-SR, National Nuclear Security Administration's Savannah River Field Office, SRNS, SRR, and Wackenhut Security, Inc. (WSI). The exercise after action report evaluated 14 objectives, and found only two objectives received a "partially met" rating: radiological and chemical monitoring, and notifications. The report had multiple comments for each objective to improve future exercises. The Emergency Management Corrective Action Review Board developed and assigned corrective actions for the appropriate functional area manager. The STAR database tracked all the corrective actions until completed and approved by DOE-SR. In February 2014, SRR responded to an actual seismic event of 4.1 on the Richter scale in HTF. A review of the event demonstrated that the shift supervisors successfully used the updated earthquake emergency operations procedures and correctly assessed potential damage to facilities and operations because of the improvements developed from the 2012 assessment.

In other years, EP conducts local exercises in SRR facilities. An IIE team, which contains evaluators and observers, evaluates the exercise. In July 2014, an SRR local exercise simulated a fire in an open B-25 storage container in the tank farm. The IIE exercise after action report evaluated 12 objectives and found 2 objectives "unsatisfactory": radiological and chemical monitoring, and facilities and equipment. IIE did rate the overall exercise as "satisfactory." The report had many comments to improve future exercises and included eight opportunities for improvement.

SRR maintains emergency planning and hazard analysis (EPHA) documents for the Concentration, Storage, and Transfer Facilities (CSTF), DWPF, and the Saltstone Facility. These documents include operations and hazards of the facility or area, potential scenarios that may occur, and provide the emergency action to implement if it occurs. Each plan has current documentation from DOE-SR indicating the EPHA is current or changes to the EPHA are accepted. The CSTF EPHA includes a malevolent acts scenario in response to a finding from the former HSS' Office of Oversight Assessment review of the EPHA program at SRS. All the plans are thorough and well documented.

The Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2014-1, *Emergency Preparedness and Respons*e, dated September 2, 2014, recommended improvements to the DOE complex emergency preparedness and response program. The DNFSB staff's technical report supporting the recommendation identified that SRS specifically needs to: improve actions/detail planning to be taken by facility personnel in the immediate aftermath of a severe event, increase exercise scenario complexity, and change the scenario content between drills and exercises. In response to this recommendation, SRNS and DOE-SR are in the process of developing a response to address these recommendations as applicable to EP and response program and will forward those improvements to SRR for implementation.

SRR appropriately tracks and manages the recording and reporting of work-related injuries or illnesses. The injury and illness case manager maintains an accurate accounting of injuries and illnesses and works closely with safety and health professionals and the site medical staff to obtain an accounting of the injury and medical condition of the individual. When an injury or illness occurs that has potential for recurrence at other SRR facilities, the case manager may generate an article about the injury in the weekly Safety Culture Monitor or send out the article within a few days via a Safety Flash. The Team noted that some first aid cases had references from 29 CFR 1904 that documented the reason why the case was not a reportable illness or injury. This is a good practice to help document the basis for disposition of an injury, which SRR should apply to all injuries.

The site medical clinic, operated by SRNS, is located in N area. Medical support includes three full-time and one part-time medical doctors; a nurse practitioner of family medicine; and five registered nurses, including one with occupational medicine certification. The hospital provides services for SRR, SRNS, WSI, and DOE Federal employees. The fire department responds to medical emergencies from one of its three station houses and has three ambulances always available for transport. A fourth ambulance is available when another is in for maintenance. Paramedics occasionally consult with the site occupational medicine director for medical advice, care, and hospital selection when transported offsite. The medical clinic operates 12 hours per day, Monday through Thursday, and 10 hours on Friday.

The medical staff provides health care, injury disposition, and visits workplaces to evaluate individual workplace hazards and controls. Supervisors and employees jointly complete the physical demands worksheet and the supervisor enters the completed form into the employee job task analysis (EJTA) database. Employees complete the personal health history form and submit that paper copy directly to Site Medical, who then reviews the physical demands worksheet in EJTA, along with the employee's personal health history form to arrive at a fitness-for-duty conclusion. Based on potential exposures, workers are entered into medical surveillance programs for asbestos, lead, beryllium, or other hazardous materials. When the patients visit the medical clinic, their blood is drawn and they submit a urine sample. During the appointment, the patient receives the test results and avoids having to schedule a second visit. These improvements increase efficiency and help foster a positive experience from the medical clinic.

Conclusion

SRR continues to apply elimination of hazards as the preferred levels of control, such as substitution or engineered controls, to the hazards that are inherent in SRR operations and facilities. Other controls, such as administrative or PPE, reduce potential exposures and remain effective. SRR continues to improve the site-wide heat stress program. SRR is working with SRNS and DOE-SR to address needed improvements to make exercise scenarios challenging and decrease the overlap between drill and exercise scenarios. SRR continues to meet the Hazard Prevention and Control expectations of a Star participant in DOE-VPP.

VII. SAFETY AND HEALTH TRAINING

Managers, supervisors, and employees must know and understand the policies, rules, and procedures established to prevent exposure to hazards. Training for health and safety must ensure that responsibilities are understood, personnel recognize hazards they may encounter, and are capable of acting in accordance with managers' expectations and approved procedures.

SRR has effective training and qualifications programs that ensure employees can recognize the hazards of the work environment and protect themselves and their coworkers. *Training and Qualification Program,* Manual 4B, establishes a systematic approach to training that helps SRR work effectively and safely. The training and qualification program covers the knowledge, skills, and abilities workers need to perform tasks competently and safely. Training consists of a mixture of self-paced (i.e., self-study, computer-based training), classroom, seminars or briefings, mockups, on-the-job training, and under-instruction hands-on training (observed by a senior qualified person). SRR uses appropriate examinations to determine the effectiveness of training. Examinations can be written, computer-based, or practical examinations. Some job categories may require job performance evaluations, oral examinations, or oral boards and periodic proficiency performance. Employees interviewed by the Team believed the training they receive is pertinent to their job. Employees stated, "that all of the training, including all safety-related training is geared strictly for their jobs." Every 2 years the operators are required to *requalify* for their position through training.

SRR uses various methods to train workers on hazards found in workplaces. Several facilities use mockups that provide the capability to evaluate trainees under normal, abnormal, and emergency conditions. SRR also uses facility walkthroughs and performance evaluations to requalify employees. SRR uses more frequent and detailed evaluations as the potential hazards and complexity of the position increases. For example, SRR requires operators to requalify for their position through training every 2 years. Training replicates actual conditions within the facility whenever possible. The instructor identifies all safety precautions to the trainee prior to commencing the training, and the instructor, qualified worker, or evaluator monitors the trainee during training execution. The *Training and Qualification Program* applies to all employees and all aspects of the SRR operations, including personnel involved in operations, design, procurement, construction, and support activities.

SRR continues to apply a cross-training approach to leverage resources while increasing the monitoring of hazardous operations. SRR trains selected radiological control technicians (RCT) to perform direct-reading IH monitoring. SRR only allows adequately trained RCTs to perform IH sampling, and an industrial hygienist must be called prior to monitoring an activity. This process increases the number of available, qualified resources, which allows quick response to an abnormal odor or condition at the tank farms without impacting schedule in most cases due to lack of resources. SRR consolidated RCT's qualifications so they can perform work at both HTF and FTF. SRR also has consolidated operator qualification training for HTF and FTF so operators can be qualified in both farms provided they stay proficient. This allows workers to share lessons learned, as well as good practices between F and H areas.

SRR continues to use training leads and training coordinators to monitor and ensure workers' qualifications and proficiencies stay current. The training coordinator prepares 30, 60, and 90-day reminder lists for expiring training and provides that list to managers, supervisors, and workers. This redundancy ensures that workers' qualifications are current and helps prevent workers from missing required refresher training.

SRR training coordinators identified potential improvements they would like to see in the Training Record Automated Information Network (TRAIN) system. The coordinators indicated that a software update to allow more than one computer window to be open at a time would facilitate updating training and remove redundant actions for every member of a work organization. For example, if an organization needs training on a specific subject, each individual's training forecast must be opened separately, closed, then the next individual's training forecast opened, then closed, until the entire organization is scheduled for training. This requires the coordinator to open the class, add the employee, then close the windows and start over for the next employee. This makes it very cumbersome and overloads the system for the coordinators. SRR should request and implement guidance from SRNS on effective use of the TRAIN system to facilitate updating training and remove redundant actions for each member of a work organization.

Opportunity for Improvement: SRR should request and implement guidance from SRNS on effective use of the TRAIN system to facilitate updating training and remove redundant actions for each member of a work organization.

The Team attended a safety team session that used a professionally developed video portraying the importance of all aspects of safety. The video, produced locally by SRR, explains not only the importance of ISMS, but BBS, employee communication, teamwork, and clear and unambiguous direction and communication. The video used several movie clips to illustrate specific points of the presentation. In discussions with managers, it was evident that managers support a vigorous training program.

SRR personnel expressed satisfaction with the level, time, and quality devoted to training. It is evident with the enthusiasm and support provided by the training group that an extensive amount of effort is extended to make training standout as "better than the norm" not only on the site, but to be the best in DOE.

SRNS continues to provide support for SRR training. New hire requirements are continuously improved and tracked to ensure SMEs review course materials for adequacy and pertinence. SRR continues to use the SRNS Automated Qualification Matrix system. In addition, there is an effort to improve the training and qualification program by combining the operators' qualifications from both tank farms in F and H areas.

SRR encourages its employees to pursue certification for the Safety-Trained Supervisor (STS) through the Board of Certified Safety Professionals, but does not reimburse employees for the application, and examination fees, or annual certification fees. While this has not prevented some employees from seeking this certification, SRR should explore ways to encourage greater participation in STS certification as a means to prepare workers for future supervisory positions and improving safety culture.

Opportunity for Improvement: SRR should explore ways to encourage greater participation in STS certification as a means to prepare workers for future supervisory positions and improving safety culture.

SRR provides managers with numerous opportunities for leadership development, including forums, training courses, surveys, and professional development opportunities. SRR has developed and implemented "Leadership SRR", a course that includes skills development related

to effective presentations, team building, coaching, building trust, change management, and diversity, as well as a final group project.

Conclusion

SRR has a well-established training and qualification program that trains employees to recognize hazards and to protect themselves and coworkers. SRR training programs equip managers, supervisors, and employees with knowledge to understand the established safety and health policies, rules, and procedures in order to promote safe work practices and minimize exposure to hazards. SRR should consider working with SRNS to eliminate repetitive actions when updating training information and creating status reports. SRR meets the expectations of the Safety and Health Training tenet of DOE-VPP as a Star participant.

VIII. CONCLUSIONS

SRR continues to support a strong safety program that includes demonstrated management commitment and active employee involvement. Members of the LSITs and VPP Core Team are dedicated to improving safety and helping every worker return home safely. SRR's improvements to the hazard analysis processes effectively document the basis for hazard control decisions. Procedures, postings, work packages, and training ensure workers know the appropriate controls. Workers are confident in their knowledge, skills, and abilities to perform work safely and have no problem pausing or stopping work when questions or issues arise. In a few cases observed by the Team, this confidence may lead to complacency on the part of workers, who may accept deviations from established procedures and processes. SRR needs to find ways to continually combat the normal human tendency to normalize small deviations that might eventually lead to an accident or injury. The extent of this condition does not currently amount to a significant programmatic deviation, and the SRR culture that embraces self-assessment and observation ensures SRR can continue to improve. SRR restored programmatic controls for keys to locked areas in the tank farms, identified by the Team during the assessment, by corrective actions after the assessment, and DOE-SR verified the actions complete and effective. The Team recommends SRR continue to participate in DOE-VPP at the Star level.

Appendix A: Onsite VPP Assessment Team Roster

Management

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