



Independent Assessment of Safety System Management for Liquid and Gaseous Waste Operations at Oak Ridge National Laboratory

May 2022

Office of Enterprise Assessments
U.S. Department of Energy

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Acronyms

CAMS	Corrective Action Management System
CFR	Code of Federal Regulations
CM	Configuration Management
CSE	Cognizant System Engineer
DCN	Design Change Notice
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
EI	Engineering Instruction
FR	Facility Representative
GW	Gaseous Waste
IF	Issue Form
LEARN	Local Education Administrative Requirements Network
LGWO	Liquid and Gaseous Waste Operations
LLLW	Liquid Low-level Waste
M&TE	Measurement and Test Equipment
NMMDD	Nuclear Maintenance Management Description Document
NMMP	Nuclear Maintenance Management Program
OFI	Opportunity for Improvement
OREM	Oak Ridge Office of Environmental Management
PM	Preventive Maintenance
PW	Process Waste
QAPP	Quality Assurance Program Plan
S&T	Surveillance and Testing
SDD	System Design Description
SHR	System Health Report
SMA	Subject Matter Area
SR	Surveillance Requirement
SS	Safety Significant
SSCs	Structures, Systems, and Components
SSO	Safety System Oversight
TSR	Technical Safety Requirement
UCOR	URS CH2M Oak Ridge, LLC
USQ	Unreviewed Safety Question
WOCC	Waste Operations Control Center

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT FOR LIQUID AND GASEOUS WASTE OPERATIONS AT OAK RIDGE NATIONAL LABORATORY

Executive Summary

The U.S. Department of Energy Office of Enterprise Assessments (EA) conducted an independent assessment of safety system management for Liquid and Gaseous Waste Operations (LGWO) at Oak Ridge National Laboratory from November 29 to December 3, 2021. The Oak Ridge Office of Environmental Management (OREM) is responsible for management and oversight of LGWO. This assessment evaluated the effectiveness of management and operating contractor, URS|CH2M Oak Ridge, LLC (UCOR), processes and activities used to manage and maintain the performance of risk-significant structures, systems, and components (SSCs) within the LGWO complex that may impact nuclear safety, and site actions taken in response to key recommendations from the 2016 UCOR study, *Liquid and Gaseous Waste Operations Engineering Evaluation and Extended Life Study*, and an associated 2018 Phase 2 follow-on study. Additionally, this assessment evaluated OREM oversight of LGWO safety system management.

EA identified the following strengths, including one best practice:

- LGWO safety and mission-essential SSC maintenance activities are effectively planned; coordinated well between operations, maintenance, engineering, safety, and work control organizations; and allocated adequate resources.
- UCOR has implemented an effective configuration management program. LGWO system design changes are properly evaluated through the unreviewed safety question process and undergo appropriate performance assessments to ensure that safety functions of updated SSCs are maintained.
- LGWO operational activities are effectively performed according to applicable procedures. The required reading program is an exceptionally efficient mechanism for communicating, implementing, and tracking LGWO operational process and procedural updates. (Best Practice)
- OREM uses an experienced Facility Representative who is highly knowledgeable of LGWO operations to provide oversight.

EA also identified several weaknesses:

- LGWO operating procedures do not explicitly define independent verifier qualification requirements.
- The current number of full-time LGWO Facility Representatives is not consistent with the approved OREM staffing analysis.
- The current UCOR issues tracking system has limited issue categorization and trending capabilities.

In summary, UCOR and OREM have taken considerable actions to identify, prioritize, and resolve challenges related to LGWO safety and mission-essential system performance and maintenance. Through recently completed and ongoing major facility and work management process upgrades, UCOR and OREM are currently demonstrating a strong commitment to improving LGWO safety and reliability. The identified weaknesses are currently being addressed by UCOR and OREM and do not substantially detract from the effective programs and processes established by UCOR and OREM for the management of LGWO safety systems.

INDEPENDENT ASSESSMENT OF SAFETY SYSTEM MANAGEMENT FOR LIQUID AND GASEOUS WASTE OPERATIONS AT OAK RIDGE NATIONAL LABORATORY

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Safety and Environmental Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the effectiveness of URS|CH2M Oak Ridge, LLC (UCOR) safety system management and Oak Ridge Office of Environmental Management (OREM) oversight activities for Liquid and Gaseous Waste Operations (LGWO) at the Oak Ridge National Laboratory in Oak Ridge, Tennessee. Remote assessment planning and document collection activities began in October 2021, with onsite assessment activities conducted from November 29 to December 3, 2021. This assessment was performed at the request of OREM.

LGWO represents a sitewide complex of piping, tanks, and buildings responsible for processing and treating radiological and non-radiological gaseous, wastewater, and liquid low-level waste (LLLW) streams generated by the Oak Ridge National Laboratory research facilities and OREM cleanup activities. As stated in the *Plan of the Independent Assessment of Safety System Management for Liquid and Gaseous Waste Operations at the Oak Ridge Office of Environmental Management, November – December 2021*, this assessment evaluated the effectiveness of UCOR and OREM activities as they relate to managing and maintaining the performance of risk-significant structures, systems, and components (SSCs) and processes within the LGWO complex that may impact nuclear safety. Many LGWO SSCs are operating beyond their expected lifetimes and have required extensive planned and unplanned maintenance to sustain minimum performance and safety standards. While several LGWO systems have recently undergone upgrades, the site has identified recurring challenges with effectively prioritizing and addressing equipment aging issues and deferred maintenance backlogs.

The assessment primarily focused on the LLLW System, a hazard category 2 nuclear facility that presents the highest level of radiological risk in the LGWO complex and contains the majority of the LGWO safety significant (SS) SSCs (no SSCs are credited as safety class controls) related to nuclear safety. Other assessment areas included: recent mission-essential upgrades to the LGWO Process Waste (PW) and Gaseous Waste (GW) systems; the LGWO life extension programs; and site actions taken in response to key recommendations from the 2016 UCOR study, *Liquid and Gaseous Waste Operations Engineering Evaluation and Extended Life Study*, and an associated 2018 Phase 2 follow-on study, to prioritize and resolve LGWO equipment aging, degraded system performance, and deferred maintenance backlog challenges. The assessment also included a review of DOE oversight conducted by OREM of LGWO safety system performance.

LGWO operates in either the “Limited Operations” or “Operations” mode as defined in the LLLW System documented safety analysis (DSA). The Limited Operations mode allows for all LGWO waste processing activities except Moyno pump LLLW transfers, which are only allowed in the Operations mode. These transfers present the highest level of radiological release risk per the LLLW System safety basis and require that applicable LGWO safety systems meet all the technical safety requirements (TSRs) for surveillance, testing, functionality, and operations while in the Operations mode. Currently, Moyno pump LLLW transfers occur on an infrequent basis (e.g., annually to semiannually). During this assessment, LGWO was operating in the Limited Operations mode, which has less restrictive requirements for safety system operability.

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which is implemented through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms “best practices, findings, deficiencies, and opportunities for improvement (OFIs)” as defined in DOE Order 227.1A.

As identified in the assessment plan, the criteria used to guide this assessment were based on objectives SS.3 through SS.9 of EA Criteria and Review Approach Document (CRAD) 31-15, Rev. 1, *Safety Systems Management Review*. In addition, EA used elements of CRAD EA-30-07, Rev. 0, *Federal Line Management Oversight Processes*, to collect and analyze data on OREM oversight activities. To gather relevant assessment data, EA reviewed UCOR policies, processes, procedures, and records supporting LGWO safety system maintenance and work planning, surveillance and testing (S&T), operations, training and qualification, and issues management. EA observed routine operational activities and work planning meetings. EA also interviewed key contractor and Federal personnel responsible for LGWO safety system management. The members of the assessment team, the Quality Review Board, and management responsible for this assessment are listed in appendix A.

There were no previous findings for follow-up addressed during this assessment.

3.0 RESULTS

3.1 Configuration Management

The objective of this portion of the assessment was to verify that UCOR effectively implements configuration management (CM) to maintain consistency between requirements, documents, and physical configuration; control system changes; and performs system assessments to ensure that the selected SS SSCs can reliably perform their intended safety functions.

Consistency between Requirements, Documents, and Physical Configuration

UCOR implements an adequate CM program that meets the requirements of DOE Order 420.1C, *Facility Safety*, and DOE-STD-1073-2016, *Configuration Management*. DSA requirements, performance criteria, documentation, and physical configuration were consistent for the observed SS SSCs. During walkdowns of the PW Treatment Complex and the Evaporator System facilities, EA observed that components were properly labeled; materials and system components were installed in accordance with requirements as specified in the system design descriptions (SDDs); and “as-built” drawings of systems in these two facilities accurately reflected system configuration. UCOR effectively uses quality control and assurance requirements to ensure that performance criteria are maintained. For example, commercial grade dedication and product specifications were appropriately specified in design change notices (DCNs) and engineering instructions (EIs) for the PCV-J1050 and J1002 flow control valve replacements.

Change Control

Reviewed system modification documentation demonstrates effective control to ensure that systems continue to meet the functional requirements specified in the safety basis. Interviewed cognizant system engineers (CSEs) and unreviewed safety question (USQ) evaluators demonstrated excellent understanding of the USQ process and when it was required. Three reviewed DCNs were evaluated by UCOR nuclear safety specialists using the USQ process and all were properly screened out, as they did not involve a

previously unanalyzed condition potentially impacting the approved safety basis. Proposed system changes were described in sufficient detail to enable a thorough understanding of the design, component specifications, and potential impacts. EIs for proposed changes clearly identified the existing component, the new component, and the differences between the old and new components. All documents affected by the proposed changes (e.g., EIs, SDDs, and system drawings) were identified and included in the change process. These DCNs were reviewed by all necessary individuals, including the CSE, an independent CSE reviewer, and the project engineer. The DCNs were also appropriately approved by the senior design authority.

System Assessments

Reviewed system assessments demonstrate that UCOR performs required physical configuration assessments and periodic performance assessments in accordance with DOE-STD-1073-2016. Physical configuration assessments (performed to ensure consistency between the physical configuration and the facility or activity documentation) are required by PROC-DE-1038, *System Health Reporting*. Periodic performance assessments (performed to verify that systems and components continue to meet design and performance requirements in their current configurations) are appropriately conducted through surveillance testing of the SSCs (see section 3.3). Also, three reviewed annual system assessment checklists demonstrate that the safety functions of the SS SSCs are being met. However, UCOR has not developed a system health report (SHR) based on system assessment results since the January 2020 issuance of PROC-DE-1038 but is currently drafting an SHR for the PW Treatment Complex, Building 3608. This weakness is further discussed in section 3.5 of this report.

Configuration Management Conclusions

UCOR implements an adequate CM program that meets the requirements of DOE Order 420.1C and DOE-STD-1073-2016. System configurations were in agreement with design requirements, and system changes were properly evaluated through the USQ process. Physical configuration assessments confirm that the physical configuration of the system is in alignment with the documentation and requirements. Performance assessments demonstrate that the safety functions of the SS SSCs are being met.

3.2 Safety System Maintenance

The objective of this portion of the assessment was to verify that UCOR implements an approved maintenance plan and processes, conducts periodic inspections and preventive maintenance (PM), implements predictive maintenance techniques, performs corrective maintenance, and manages the maintenance backlog. The focus of EA's verification was on maintenance of SS SSCs, although a portion of the evaluation included mission-essential equipment.

Maintenance Plan and Processes

UCOR has appropriately established a documented nuclear maintenance management program (NMMP) to maintain LGWO safety systems and mission-essential equipment and manage the maintenance backlog. UCOR's NMMP is documented in UCOR-4357, *Nuclear Maintenance Management Description Document (NMMDD)*. This revision was appropriately screened through the USQ process and addresses all aspects of DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*. However, prior to the onsite visit, EA determined that UCOR-4357, which had been previously revised in response to an OREM finding, had not been approved by the field office in accordance with DOE Order 433.1B, attachment 2, paragraph 1.e. In response, UCOR issued a letter to OREM on November 23, 2021, requesting the required approval; OREM approved the NMMDD on December 13, 2021.

The NMMP is effectively implemented throughout UCOR LGWO nuclear facilities. The UCOR Nuclear Maintenance Manager, who is responsible for the NMMP, is experienced and qualified and demonstrated a thorough knowledge of maintenance processes. UCOR uses PROC-FS-1001, *Integrated Work Control Program*, to effectively apply a graded approach in accordance with the classification of the equipment (SS, defense in depth, or balance of plant) and the complexity of the work to be performed. Work is effectively coordinated among project management, project/task superintendents, task leads, and first-line supervisors representing operations, nuclear safety, plant engineering, CSE, environment, safety and health, maintenance, and work control. This coordination is effectively accomplished through a weekly schedule, daily activity lists, work development meetings, plan-of-the-day meetings, and the weekly nuclear operations accountability meeting (a longer-term strategic planning meeting). Observed interactions during one work development meeting, five plan-of-the-day meetings, and one nuclear operations accountability meeting demonstrated effective information sharing, planning of maintenance activities, and resource allocations necessary to support completion of equipment maintenance.

Inspections and Preventive Maintenance

UCOR's documented process and completed records demonstrate adequate performance of inspections and PM on reviewed LGWO SS and other SSCs. PROC-FO-3030, *UCOR Preventive Maintenance*, establishes inspection requirements and PM in accordance with vendor recommendations for installed equipment, such as pumps (alignment checks and the greasing of bearings), heating ventilation and air conditioning (condenser coil cleaning and belt inspection and adjustment), and spare equipment in storage, such as motors (insulation resistance testing and rotation of motors equipped with anti-friction bearings). Four reviewed SS SSC inspection checklists demonstrated adequate identification and resolution of age-related system degradation that could affect system reliability and were properly based on relevant source documents, such as vendor manuals, maintenance history, industry standards, and DOE directives. Records of PM on the SS storage tank level indicators, for example, demonstrated that the components were scheduled for maintenance and calibrated every six months as required by the TSRs and vendor recommendations. Additionally, three observed mission-essential level detector calibrations were performed by qualified instrument and control technicians, in accordance with the procedure, using proper measurement and test equipment (M&TE); required data sheets were completed, maintenance history was recorded, and proper supervision was present to oversee the work and approve the completed work package. Approximately 90% of PM work (including all PMs for SS SSCs) was completed on or before the planned completion date, at the time of this assessment, no PMs on SS SSCs were delinquent.

Predictive Maintenance

UCOR appropriately uses predictive maintenance techniques as part of its PM program. UCOR's use of predictive maintenance techniques is thoughtful and systematic across all relevant equipment. For example, thermal imaging is used for PM associated with electrical equipment, and vibration analysis is used for pumps. The UCOR Nuclear Maintenance Manager recently identified an additional predictive maintenance technique (oil analysis of pumps and generators) and contracted with a company to perform this analysis and monitor equipment performance.

Corrective Maintenance and Backlog Management

Reviewed corrective maintenance records demonstrated that UCOR is effectively performing timely corrective maintenance of LGWO SS SSCs. Approximately 90% of SS SSC corrective maintenance was completed on or before the planned completion date and, over the past 6 months, all were completed within 30 days after the planned completion date and the delays were justified. Four reviewed SS SSC corrective maintenance work packages, associated with Tanks C-1 and C-2 at Building 2531, were well

developed to support safe and compliant performance. For example, a work package written to replace a failed SS level detector with a new model appropriately contained a job description, a job hazard analysis, a pre-job briefing checklist, a work status log, related lessons learned, the DCN that documents the engineering equivalency evaluation for procurement of the new component to meet the safety basis performance criteria, work instructions based on the vendor manual's installation instructions, a post-job review, and the maintenance history. Additionally, the work status log demonstrated that the maintenance activities were well controlled and performed by qualified workers.

The aging and degradation of many mission-essential SSCs have resulted in significant corrective maintenance backlog challenges, which UCOR has taken steps to address. The Performance Objectives, Measures, and Commitments (POMC) monthly maintenance metrics show that the corrective maintenance backlog for mission-essential SSCs continues to be high over the last six months. Approximately 60% of the mission-essential items on the backlog list have been awaiting corrective maintenance for more than 180 days. Recognizing this trend, UCOR prioritized work requests, added work coordinators, established a maintenance scheduling protocol, and increased field support staffing. UCOR is making progress to improve the backlog situation. Four reviewed self-assessments performed by the UCOR Nuclear Maintenance Manager, which were rigorous and thorough, resulted in corrective actions to address the corrective maintenance backlog and deficient equipment challenges. Corrective actions included instituting a new computer maintenance management system program (MAXIMO®), and developing a more thorough master equipment list, which are effective mechanisms used by other DOE sites. While UCOR continues to address the challenging corrective maintenance backlog for mission-essential SSCs, there have been no impacts on SS SSCs and no recent unplanned shutdowns, resulting in continuous availability to support waste generating facilities.

Safety System Maintenance Conclusions

UCOR has appropriately established and implemented a DOE-approved NMMDD to maintain safety systems and mission-essential equipment and manage the maintenance backlog. The NMMDD is implemented throughout UCOR LGWO nuclear facilities. The reviewed SS SSCs maintenance procedures and work packages are well developed to support safe and compliant work performance. UCOR adequately performs inspections and PM activities for reviewed LGWO SS and other non-safety SSCs. UCOR uses predictive maintenance techniques as part of its PM program. UCOR effectively manages and performs corrective maintenance for LGWO SS SSCs. However, the aging and degradation of many LGWO mission-essential SSCs have resulted in significant corrective maintenance backlog challenges, which are being adequately addressed by UCOR.

3.3 Safety System Surveillance and Testing

The objective of this portion of the assessment was to verify that UCOR effectively performs S&T to ensure system operability and uses proper M&TE for S&T activities.

Surveillance and Testing

UCOR adequately implements an S&T program to ensure that LGWO SS SSCs can accomplish their safety functions and continue to meet applicable system requirements and performance criteria. UCOR uses a manual tracking system that ensures that surveillance requirements (SRs) are performed at TSR-defined frequencies. There have been no TSR violations in the last three years related to SS SSC failures or missed SRs. Additionally, the TSRs do not require SS SSC operability unless LLLW transfers are being performed. During this assessment, UCOR was transitioning from its manual tracking system to an automated system (MAXIMO®), which will provide greater capability to track S&T and scheduling information.

UCOR performs approximately 75 routine SR activities on SS SSCs over a 6-month period. During LLLW transfers, SR activities are performed approximately every 20 minutes. Three reviewed SR work package records demonstrated adequate completion of SR activities for SS SSCs. The SR work packages cited applicable safety requirements; identified precautions, as well as system and test prerequisite conditions; and included clear performance steps. The included performance data sheets specified the correct acceptance criteria, identified calibrated measuring equipment, and provided the final test results, which demonstrated that the system met TSRs for operability. The SR work packages also included provisions for listing discrepancies and notifying facility management of any test failure to declare a system inoperable and take actions necessary to place the plant in a safe condition. The Facility Manager's signature appropriately documented the review and acceptance of final test results.

Measurement and Testing Equipment

M&TE used in the three reviewed completed SR work packages was properly calibrated and maintained at prescribed intervals (or before use) against reference calibration standards having traceability to nationally recognized standards or a documented basis. The calibration documentation included all required information (i.e., identification, traceability to the calibration standard, calibration data, recalibration due date or interval, and identification of the individual performing the calibration). The calibrated M&TE identified in the three SR work packages was properly labeled, tagged, or suitably marked to indicate a due date or interval of the next calibration and uniquely identified to provide traceability to its calibration data.

Interviews with the M&TE Coordinator, reviews of completed M&TE documentation, and observations of M&TE use in the field confirmed that calibrated M&TE is appropriately handled and stored to maintain accuracy. Out-of-calibration M&TE is properly controlled (tagged, segregated, etc.). If the calibration due date or interval has passed without recalibration, or the device produces questionable results, then the M&TE is identified as out of calibration and not used until it is recalibrated as specified in PROC-DE-1022, *Control of Measuring and Test Equipment*. M&TE lost or damaged is documented as a nonconforming item. After calibration personnel identified two nonconformances (i.e., M&TE found to be out-of-tolerance during calibration), CSEs determined the validity of previous measurement results obtained using this equipment since its last successful calibration.

Safety System Surveillance and Testing Conclusions

UCOR adequately implements an S&T program to ensure that LGWO SS SSCs can accomplish their safety functions and continue to meet applicable system requirements and performance criteria. During this assessment, UCOR was transitioning from its manual tracking system to an automated system (MAXIMO®), which will provide greater capability to track S&T and scheduling information. Additionally, UCOR uses calibrated and controlled M&TE to perform LGWO S&T activities.

3.4 Operations

The objective of this portion of the assessment was to verify UCOR's implementation of conduct of operations principles, including operator training and qualification and procedure development, use, and adherence to ensure the availability and functionality of LGWO safety and mission-essential systems.

Conduct of Operations

UCOR LGWO operations personnel effectively implement conduct of operations requirements as described in PROC-OR-1017, *ORNL Nuclear Operations (Nuc Ops) Conduct of Operations*, and UCOR-

4628, *Conduct of Operations Applicability Matrix for the Liquid Low-Level Waste System at the Oak Ridge National Laboratory*. These documents incorporate the requirements of DOE Order 422.1, *Conduct of Operations*, and define the roles, responsibilities, policies, programs, and procedures governing LGWO conduct of operations.

UCOR LGWO operations personnel perform routine operational activities, including operator rounds and system walkdowns, system testing and monitoring, and chemical adjustments. Observed shift turnovers conducted at the Waste Operations Control Center (WOCC) and several facilities located throughout the LGWO Tank Farm were conducted thoroughly in a distraction-free environment in accordance with PROC-FO-1026, *Shift Turnover*, and associated checklists. Operators clearly articulated the status of systems under their purview, reviewed system trends and alarms, updated operator narrative logs, discussed activities for the upcoming shift, and walked down relevant system indicators and displays. Narrative logs were current with consistent documentation of key shift activities. Upon turnover completion, the incoming operator formally logged their acceptance of the shift prior to the outgoing operator's departure.

During operator rounds, EA observed organized workstations with up-to-date approved operator aids and relevant procedures readily accessible. Access to the WOCC and Tank Farm facilities was controlled and monitored. Field and WOCC operators used approved checklists and formal three-way communications to confirm key system parameters, alarm status, and system configurations. During the assessment, two SS tank level indicators in the LLLW Evaporator System facility were out of service and scheduled for repair. As described in the LLLW System safety basis, the sensors are not required to be operable during Limited Operations. The sensor displays in the field were appropriately administratively tagged, and the administrative tags were properly logged in accordance with PROC-FO-1066, *Administrative Tagging*.

Interviewed operators and managers demonstrated a strong questioning attitude throughout the LGWO operations organization. New and experienced operators stated in interviews that all personnel have stop-work authority, they do not fear retaliation for reporting safety concerns, and management consistently values safe operations above schedule pressures. During interviews and observed interactions with field personnel, operations management expressed support of the UCOR iQuestion program, a rewards program that encourages personnel to report safety and operational concerns.

Operator Training and Qualification

UCOR has robust LGWO initial operator training, continuing education, and requalification programs that incorporate the requirements of DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, to ensure that operators are sufficiently knowledgeable and skilled to safely operate LGWO systems. UCOR-4113, *UCOR LLC Nuclear and Radiological Facilities Qualification Standard*, defines the initial training and requalification requirements for the two qualified operator positions at LGWO (i.e., LGWO Chemical Operator and LGWO Shift Foreman).

The initial and continuing training programs for both positions consist of computer-based training, significant required reading, on-the-job training, and written and oral examinations. Because LGWO chemical operators and shift foremen must be able to safely operate all three major systems within the LGWO complex (i.e., LLLW, PW, and GW systems), initial and continuing operator training requirements are comprehensive. Interviews with experienced and recently qualified LGWO chemical operators and review of required coursework further demonstrated a rigorous training process, with strong emphasis on operating SSCs in accordance with applicable requirements.

The UCOR-4113 requalification program is also sufficiently rigorous. Operators are required to requalify for their positions every two years. The requalification process shares similar levels of rigor as initial training and takes place continuously throughout the two-year cycle. To successfully complete requalification, operators must systematically review every LGWO operating procedure, pass associated knowledge tests, and demonstrate proficiency in executing key operational tasks throughout the two-year cycle. LGWO uses the UCOR Local Education Administrative Requirements Network (LEARN) as an effective centralized training and qualification tracking tool that provides operators and management with real-time notifications regarding qualification status and upcoming training requirements.

Procedure Development, Use, and Adherence

PROC-OS-1107, *Performance Document Process*, provides requirements for LGWO operating procedure development, validation, issuance, and revision in accordance with DOE Order 422.1. EA observed appropriate procedural use for routine operational activities, including operator rounds, system monitoring, alarm response, and functional testing. Operators had ready access to hard copies of procedures in the WOCC and at various workstations throughout the Tank Farm. These procedures were properly marked and were the correct revision.

To evaluate procedural use and adherence during the infrequent times that LGWO is in the Operations mode, EA reviewed documentation from the most recent Moyno pump LLLW transfer performed in March 2021. PROC-LGWO-611.2.6, *Transfers to the MVST Facility*, and its associated checklists served as the primary performance documents of record for the March 2021 evolution. The completed procedures, calibration sheets, configuration checklists, and tank level monitoring calculation sheets documented that SS SSC operability was maintained in accordance with applicable requirements throughout the transfer.

While independent verifications were properly performed by qualified chemical operators and appropriately documented during the March 2021 transfer activities, the applicable operating procedures did not explicitly identify independent verifier qualification requirements. (See **OFI-UCOR-1**.) Interviews with current operators, LGWO management, and UCOR training staff confirmed that operations personnel are aware of the DOE Order 422.1 requirement that only individuals qualified on the systems to be verified can serve as an independent verifier.

UCOR has established robust practices for revising LGWO procedures and communicating updates to operations personnel. During recent LGWO SSC upgrades and associated procedural changes, operations management, safety basis subject matter experts, training coordinators, and procedure writers closely coordinated to ensure that proposed updates considered impacts on safe and efficient SSC operations.

The UCOR required reading program, which is documented in UCOR PROC-TC-0750, *Required Reading Program*, provides an exceptionally thorough and systematic approach for ensuring that LGWO operators remain current on updated processes and procedures. The program leverages the LEARN tool to notify operators of procedural changes and associated training requirements, provide immediate access to focused computer-based training for highlighting the key procedure updates, and communicate training completion to applicable operations and training management. (**Best Practice**)

Operations Conclusions

Overall, LGWO operational activities involving safety and mission-essential systems are effectively performed in accordance with DOE Order 422.1. A strong questioning attitude exists throughout the LGWO operations organization, and operators understand the potential impacts of their work on nuclear safety. Initial, continuing, and requalification training programs for operators are well developed,

rigorous, and systematically maintained in accordance with DOE Order 426.2. LGWO operating procedures are properly developed, validated, issued, implemented, and revised. While independent verifications were conducted appropriately during the March 2021 transfer, current LGWO operating procedures do not explicitly identify independent verifier qualification requirements. The UCOR required reading program efficiently communicates, implements, and tracks LGWO process and procedural updates and is cited as a Best Practice.

3.5 Cognizant System Engineer Program

The objective of this portion of the assessment was to verify the adequacy of UCOR's CSE program implementation, SDDs, and CSE system assessments.

CSE Program Implementation

UCOR effectively implements the CSE program through training and qualification, a documented list of all active SS SSCs, and active CSE support of operations and maintenance personnel.

All active SS SSCs are assigned a qualified CSE, and these assignments are adequately captured in a configuration-controlled document. UCOR-4113 defines the CSE training and qualification program. Three of five qualification cards reviewed demonstrated that they have completed all training and qualification program requirements and an oral board examination, which aligns with DOE Orders 420.1C and 426.2 requirements. During interviews and system walkdowns of the LLLW Evaporator System and PW Treatment Complex facilities, CSEs were thoroughly knowledgeable of their assigned systems and understood their CSE role.

UCOR has appropriately established a list of all active SS SSCs and design features in UCOR-4107, *UCOR List of Active Safety Systems (LASS) and List of Design Features (LDF)*. This document accurately reflects all the active SS SSCs and design features credited in the DSA. However, the document was missing the revision information on all pages after the cover sheet, which UCOR personnel corrected during the assessment.

CSEs actively support operations and maintenance personnel. For example, an observed pre-job walkdown for a system modification to replace old, corroded pipe with stainless steel pipe was led by the CSE to assist in identifying the scope of the job and to develop the work instructions. The walkdown was supported by project management, project engineering, craft supervision, the work planner, and safety organizations demonstrating excellent teamwork and coordination. Three EIs for corrective maintenance activities were reviewed and found to provide thorough and concise technical direction to operations and maintenance personnel.

System Design Descriptions

UCOR has developed adequate SDDs that identify the requirements and performance criteria associated with the SS SSCs credited in the safety basis. SDDs meet the requirements of DOE Order 420.1C, as they are developed in accordance with DOE-STD-3024-2011, *Content of System Design Descriptions*. Three reviewed SDDs for the LLLW facility waste pump discharge/transfer system and two facilities' pump electrical disconnect systems accurately reflect safety basis requirements, including system testing. The SDDs appropriately address off-normal operations, such as loss of power to displays or components, to assess potential failure modes and system weaknesses. CSEs demonstrated excellent knowledge, understanding, and ownership of their assigned safety systems and associated SDDs.

CSE System Assessments

CSEs adequately perform and document monthly and annual system assessments addressing system operability, reliability, and material condition of safety systems on system assessment checklists in accordance with DOE Order 420.1C and PROC-LGWO-606.16, *System Engineering Program for the LLLW System*. The monthly checklists provide a high-level evaluation of the safety systems' material condition and the potential impact on system reliability or availability. The annual checklist is a broader evaluation that addresses the DSA/TSR and CM elements, including surveillance test results, the maintenance backlog, and overall system reliability or availability. The CSEs demonstrated a clear understanding of the checklist intent. Review of completed monthly and annual checklists demonstrated that CSEs are noting issues (e.g., system degradations and open work orders) on the checklists and that the systems can meet the functional requirements contained in the DSA, but UCOR does not effectively use this information for trending.

PROC-DE-1038 requires CSEs to complete annual SHRs in accordance with DOE Order 420.1C, attachment 2, chapter V, section 3.d.(6) for performing operations and maintenance trending. Contrary to PROC-DE-1038, CSEs did not complete any annual SHRs. UCOR self-identified this issue in self-assessment MA-EN-22-001, *System Engineering Program*; entered the issue into its issues management system; and developed a thorough and timely corrective action plan, which was then approved in December 2021.

Cognizant System Engineer Program Conclusions

UCOR implements an adequate CSE program. Qualified CSEs are assigned to all active SS SSCs. SDDs have been developed and are maintained to reflect system requirements and performance criteria in accordance with safety basis requirements. Moreover, CSEs are knowledgeable of their assigned safety systems. However, CSEs have not been producing SHRs with trending information related to system performance, a weakness that UCOR self-identified and is correcting.

3.6 Federal Oversight

The objective of this portion of the assessment was to verify that OREM has established and implemented an effective oversight program for ensuring that safety systems can reliably perform as intended.

Safety System Oversight and Facility Representative Programs

The safety system oversight (SSO) program at OREM is implemented by OREM procedure OREM-ESH-IP-01, *Safety System Oversight Program*, which incorporates the requirements of DOE Order 426.1A, *Federal Technical Capability Program*, appendix C. OREM is aware that DOE Order 426.1A was superseded by DOE Order 426.1B, *Federal Technical Capabilities*, in March 2020 and during this EA assessment was revising OREM-ESH-IP-01 to reflect DOE Order 426.1B. The Facility Representative (FR) program is implemented by OREM procedure OREM-FO-IP-03, *Facility Representative Program*, which incorporates the requirements of DOE Order 226.1B, *Implementation of DOE Oversight Policy*, criterion 4, and DOE-STD-1063-2011, *Facility Representatives*.

Within OREM, the Operations Management Division houses the Engineering Branch and the Facilities Oversight Branch, which execute the SSO and FR roles, respectively. According to the most recent OREM staffing analysis, approximately two full-time equivalents are needed for LGWO coverage; the current staffing level for performing oversight functions is only one full-time equivalent. To mitigate the staffing shortfall in the near term, OREM is actively cross-training a current FR supporting Y-12 National Security Complex activities to serve as an LGWO FR. The cross-trained FR will support the current

LGWO FR a fraction of the time and would eventually assist in training future full-time LGWO FR new hires. The Federal oversight personnel currently assigned to LGWO are very knowledgeable of safety systems and current system status and are adequately providing oversight. The OREM qualification program ensures that SSO and FR personnel can carry out their assigned duties. The SSO qualification program is guided by OREM procedure OREM-TQ-IP-03, *Safety System Oversight Training and Qualification Program*.

Federal Oversight and Assessments

Oversight personnel routinely interface with UCOR, conduct system walkdowns, perform program and document reviews, and observe activities in the field. EA accompanied Federal oversight personnel on walkthroughs of LLLW System Building 7856 and LLLW System Building 7966. SSO personnel routinely accompany CSEs on walkthroughs of LGWO, such as the monthly tank level walkdown. Assessments of safety systems are effectively performed and documented in accordance with OREM procedure OREM-OM-IP-06, *Formal and Informal Assessments*. Findings identified through these activities are tracked and resolved in the field office Activity and Issues Management System (AIMS). OREM also establishes detailed assessment schedules in accordance with OREM procedure OREM-OM-IP-01, *Integrated Assessment Program*.

The OREM fiscal year 2022 integrated assessment schedule included the annual LGWO SSO assessment in the first quarter of fiscal year 2022. Specifically, OREM's *Informal Assessment Report for the Evaluation of the UCOR LLC Liquid Gaseous Waste Operations Liquid Low-Level Waste System Fiscal Year 2022 First Quarter* found no safety issues, findings, or OFIs. The assessment verified that the SS SSCs and/or design features installed were consistent with the safety basis, that the safety basis controls and requirements were incorporated in appropriate facility documents and work instructions, that safety basis controls and requirements have been implemented, and that contractor personnel are knowledgeable of safety basis controls and requirements.

Federal Oversight Conclusions

Overall, OREM is meeting the requirements of DOE Order 426.1A, appendix C, and DOE Order 226.1B, criterion 4, implementing effective Federal oversight. However, the current level of full-time LGWO FR staffing is not consistent with the approved OREM staffing analysis.

3.7 Issues Management and Performance Improvement

The objective of this portion of the assessment was to verify that the UCOR feedback and improvement processes are effective in addressing and preventing the recurrence of safety system issues.

Problem Identification, Evaluation, and Resolution

UCOR effectively uses feedback from a variety of sources, including workers, managers, and external assessors and auditors, to improve work performance. The UCOR issues management program is implemented by PROC-PQ-1210, *Issues Management Program*, and the UCOR Quality Assurance Program Plan (QAPP), section 4: Criterion 3 – *Quality Improvement*, which incorporate the requirements of 10 CFR 830.122, *Quality assurance criteria*, criterion 3, *Management/Quality Improvement*. PROC-PQ-1210 establishes the working level requirements and responsibilities for the timely identification and evaluation of events or conditions, and development of corrective actions, if applicable, to improve performance.

Furthermore, the issues management program includes appropriate processes for managing and tracking issues and corresponding corrective actions, if applicable, identified during assessments, self-evaluations, or other reviews of project or functional activities. The software-based Corrective Action Management System (CAMS) module in the Quality Assurance System effectively tracks UCOR issues and resultant actions to closure through the use of electronic issue forms (IFs). Twenty-nine sampled IFs that were generated in the past two years demonstrated that UCOR staff has a low threshold for formally documenting issues and a rigorous process for tracking and resolving issues associated with SS SSCs in a timely manner.

Two observed issues screening team meetings demonstrated consistent processing of issues. The screening process, formalized in PROC-PQ-1210, was appropriately implemented by engaged team members who exhibited questioning attitudes that prioritized issues. However, EA observed a weakness that could inhibit the ability to analyze trends. Specifically, the issues screening team entered (binned) five issues in the subject matter area (SMA) of “readiness review” because the issues were identified during an informal management review of a planned maintenance activity. The issues included inadequacies associated with work planning and scoping, subcontractor training and qualification, worker knowledge of the stop-work program, and unavailability of long-reach tools for simulation of work activities during the management review. The issues screening team’s reasoning for categorizing all of the issues as “readiness review” was that this can help establish a trend of engaged and insightful management assessment activities. However, binning these issues solely in the readiness review SMA shifts the focus away from the actual issues and their causes and can mask negative trends in other SMAs.

UCOR has taken the initiative to improve its issues management system. UCOR previously identified a weakness in the CAMS software in that it does not allow assignment of multiple SMA codes. UCOR has subsequently obtained funding for a more modern software package, with implementation anticipated for early 2022. The ability to assign multiple SMA codes, if applicable, will provide more opportunities for tracking and trending issues.

Assessments

UCOR maintains effective assessment programs to monitor work performed under its contract to evaluate compliance with applicable environmental, health, safety, quality, and regulatory requirements and evaluate process performance to promote improvement. The assessment programs at UCOR are implemented by PROC-PQ-1401, *Independent Assessment*, as invoked by the QAPP and the contractor assurance program description, and by PROC-PQ-1420, *Assessments*, which is also invoked by the QAPP. Together, these programs implement the requirements of DOE Order 226.1B, attachment 1, for monitoring and evaluating performed work to ensure that it meets contractual requirements. UCOR has committed to conducting independent assessments for each of the 10 quality assurance program criteria over a two-year cycle. Since these required independent assessments are primarily compliance-based with a focus on organizational implementation of quality assurance requirements, independence is maintained using the team approach as needed, led by an organizationally independent, qualified, and certified Lead Assessor. Lead Assessors are, at a minimum, familiar with the area being evaluated, and have independence in that they do not evaluate work or records for which they are directly responsible or have approved. The assessments covered by PROC-PQ-1420 are management assessments and lower-level self-assessments, and generally focus both on work performance, program implementation, and the effectiveness of the programs managed by the functional organizations in meeting contractual and regulatory requirements.

UCOR personnel routinely perform periodic self-assessments, management assessments, and independent assessments of process performance, including CM, maintenance, work planning, and operations processes. EA reviewed 12 assessments performed during the last two years and found them to be

thorough and comprehensive. Documented assessment results communicated an adequate basis for any identified findings and OFIs. Assessment results were formally entered into the CAMS using IFs, evaluated, and resolved, with associated causal evaluations, extent-of-condition reviews, and actions to prevent recurrence being performed as needed.

As part of this process UCOR performed two assessments (the 2016 UCOR study, *Liquid and Gaseous Waste Operations Engineering Evaluation and Extended Life Study*, and the 2018 follow-on *Phase 2 Liquid and Gaseous Waste Operations Engineering Evaluation and Extended Life Study*) to prioritize and resolve LGWO equipment aging, degraded system performance, and the backlog of deferred (delinquent) maintenance. In response to key recommendations from these assessments, UCOR identified and then implemented mission-essential upgrades to the LGWO PW and GW systems and put in place LGWO life extension programs. These actions increase system availability and reliability.

Issues Management and Performance Improvement Conclusions

Overall, UCOR adequately involves workers, managers, and external assessors and auditors in performance monitoring, issues management/corrective action resolutions, and worker feedback on field performance for the issues reviewed. Feedback information is used regularly to focus attention on issues and improve performance. UCOR performs periodic self-assessments, management assessments, and independent assessments to evaluate compliance with applicable regulatory requirements for environmental, health, safety, and quality programs and to evaluate process performance to promote improvement. EA observed a weakness that could inhibit the ability to analyze trends; UCOR had previously identified a related weakness in CAMS, which UCOR is taking action to resolve.

4.0 BEST PRACTICES

Best practices are safety-related practices, techniques, processes, or program attributes observed during an assessment that may merit consideration by other DOE and contractor organizations for implementation. The following best practice was identified as part of this assessment:

The UCOR required reading program, documented in UCOR PROC-TC-0750, provides an exceptionally thorough and systematic approach using a software tool to notify operators of procedural changes and associated training requirements, provide immediate access to focused computer-based training for the key procedure updates, and communicate training completion to management to ensure that LGWO operators remain current on updated processes and procedures.

5.0 FINDINGS

No findings were identified during this assessment.

6.0 DEFICIENCIES

No deficiencies were identified during this assessment.

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified one OFI to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in assessment reports, they may

also address other conditions observed during the assessment process. These OFIs are offered 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.

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OFI-UCOR-1: Consider identifying independent verifier qualification requirements within applicable LGWO operating procedures. Because of the importance of independent verification in ensuring safe LLLW transfers, directly including independent verifier qualification requirements in applicable LGWO procedures would provide an added layer of defense and reduce the potential vulnerability of unqualified individuals verifying key SS SSC alignments.

Appendix A Supplemental Information

Dates of Assessment

Onsite Assessment: November 29 – December 3, 2021

Office of Enterprise Assessments (EA) Management

John E. Dupuy, Director, Office of Enterprise Assessments
William F. West, Deputy Director, Office of Enterprise Assessments
Kevin G. Kilp, Director, Office of Environment, Safety and Health Assessments
David A. Young, Deputy Director, Office of Environment, Safety and Health Assessments
Kevin M. Witt, Director, Office of Nuclear Safety and Environmental Assessments
Charles C. Kreager, Director, Office of Worker Safety and Health Assessments
Jack E. Winston, Director, Office of Emergency Management Assessments
Joseph J. Waring, Director, Office of Nuclear Engineering and Safety Basis Assessments

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