Independent Oversight Review of Oak Ridge Environmental Management Radiological Controls Activity Level Implementation

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Acronyms

ALARA	As Low As Reasonably Achievable
ARA	Airborne Radiation Area
BCS	Boundary Control Station
CA	Contamination Area
CFR	Code of Federal Regulations
CRAD	Criteria, Review, and Approach Document
CSE	Cognizant System Engineer
D&D	Decontamination and Decommissioning
DAC	Derived Air Concentration
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EM	DOE Office of Environmental Management
ETTP	East Tennessee Technology Park
FR	DOE Facility Representative
HCA	High Contamination Area
HEPA	High Efficiency Particulate Air
HRA	High Radiation Area
HSS	DOE Office of Health, Safety and Security
IAP	Integrated Assessment Program
LOI	Line of Inquiry
OFI	Opportunity for Improvement
ORNL	Oak Ridge National Laboratory
PAM	Personal Air Monitor
PAPR	Powered Air Purifying Respirator
PRDI	Personal Radiation Detection Instrument
POD	Plan of the Day meeting
PPE	Personal Protective Equipment
R2A2	Roles, Responsibilities, Authorities, and Accountabilities
RA	Radiation Area
RPP	Radiation Protection Program
RPT	Radiological Protection Technician
RWP	Radiation Work Permit
S&M	Surveillance and Maintenance
SIH	Standard Industrial Hazard
SME	Subject Matter Expert
SSO	Safety System Oversight
STARRT	Safety Task Analysis Risk Reduction Talk
TBD	Technical Basis Document
Tc	Technetium
TQP	Technical Qualification Program
TWD	Technical Work Document
UCOR	URS | CH2M Oak Ridge, LLC
Y-12	Y-12 National Security Complex

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Radiological Controls Activity Level Implementation

1.0 PURPOSE

This report documents an independent review by the Office of Enforcement and Oversight (Independent Oversight) within the Office of Health, Safety and Security (HSS) of radiological protection program (RPP) activity-level implementation for Oak Ridge Environmental Management operations conducted by URS CH2M Oak Ridge, LLC (UCOR) and its subcontractors. The review was performed by the HSS Office of Safety and Emergency Management Evaluations within the broader context of an ongoing program of targeted assessments of radiological control programs, with an emphasis on the implementation of radiological work planning and control across U.S. Department of Energy (DOE) sites that have hazard category 1, 2, and 3 facilities. The purpose of this set of facility specific Independent Oversight targeted reviews is to evaluate the flowdown of occupational radiation protection requirements, as expressed in facility RPPs, to work planning, control, and execution processes, such as radiological work authorizations, including radiological work permits (RWPs) and other technical work documents (TWDs). To meet the goals of the targeted review, Independent Oversight performs assessments that are primarily driven by activity-level observations. Once each facility specific review is completed a compiled analysis will report on the performance throughout the DOE complex.

This targeted review was performed at Oak Ridge during the period of March 3-22, 2013. This report discusses the background, scope, methodology, results, and conclusions of the review, as well as items identified for further follow-up by Independent Oversight.

2.0 SCOPE

The scope of this review consisted of a review of activity level implementation of radiological control activities associated with Decontamination and Decommissioning (D&D) and Surveillance and Maintenance (S&M) activities under the UCOR RPP in Oak Ridge, Tennessee. Key observations and themes from this review are presented in Section 5.0.

3.0 BACKGROUND

The Oak Ridge Reservation was first established as part of the Manhattan District Project in the 1940s and over the years operated research and isotope production reactors, hot cells, chemical and metallurgical facilities, and uranium enrichment facilities. The Oak Ridge Reservation includes operations managed by the Office of Science, the National Nuclear Security Administration, and the Office of Environmental Management (EM). The facilities are principally found at three different locations: Oak Ridge National Laboratory (ORNL), the Y-12 National Security Complex (Y-12), and East Tennessee Technology Park (ETTP). EM manages decontamination and decommissioning (D&D) and surveillance and maintenance (S&M) activities in facilities at all three locations. In addition, EM manages facilities for processing or treatment, packaging, shipment, and disposal of waste generated as part of D&D activities. To perform these technical operations EM relies primarily on three prime contractors: UCOR; LATA-Sharp Remediation Services, LLC; and Wastren Advantage, Inc. This review concentrated on the radiological control processes applied at the work activity level for the active D&D being performed by UCOR at the K-25 and K-27 gaseous diffusion facilities at ETTP.

Title 10 CFR Part 835, *Occupational Radiation Protection*, explains the requirements for developing, implementing, and maintaining an RPP. Title 10 CFR 835.101(a), *Radiation protection programs*, states that "A DOE activity shall be conducted in compliance with a documented radiation protection program (RPP) as approved by the DOE." Each DOE site that works with radiological material has developed an RPP and supporting implementing procedures for radiological control.

The UCOR RPP is documented in UCOR-4161, Radiation Protection Program for 10 Code of Federal Regulations 835 Occupational Radiation Protection Oak Ridge, Tennessee. This RPP applies to all operations involving potential exposure to ionizing radiation at ETTP, ORNL, Y-12, and any other sites or facilities within the prime contract scope of work where UCOR conducts operations for DOE.

4.0 METHODOLOGY

This review was guided by HSS Criteria, Review, and Approach Document (CRAD) 45-35, Rev. 1, *Occupational Radiation Protection Program Inspection Criteria, Approach, and Lines of Inquiry*. This targeted review area assesses contractor implementation of RPP radiological work planning and control commitments by observing the conduct of work activities involving radiological hazards. Observed radiological work activities and practices are reviewed against site radiological control implementing procedures, the RPP, and 10 CFR 835, as indicated in HSS CRAD 45-35, Rev 1. In addition, elements of HSS CRAD 45-21, Rev 1, *Feedback and Continuous Improvement Inspection Criteria and Approach – DOE Field Element*, were used to collect and analyze data on site office oversight activities.

5.0 RESULTS

Observations associated with the observed radiological work are discussed below. Conclusions are summarized in Section 6, opportunities for improvement (OFIs) are listed in Section 7, and items for follow-up are discussed in Section 8.

UCOR RPP Organization and Administration

UCOR has an effective radiation protection infrastructure staffed by qualified and experienced personnel across all levels, ranging from management and support staff to field radiological protection technicians (RPTs). UCOR's RPP is managed by a Radiological Protection Manager, who reports directly to the UCOR Environment, Safety, Health and Quality Manager. The Radiological Protection Manager is supported by field radiation protection managers and support staff for each of the D&D projects, by other technical support staff that include a dosimetry and instrumentation group, and by several other radiation protection functional support personnel. A good percentage of the UCOR radiation protection managers and professional staff have certifications and/or advanced degrees in health physics or related disciplines. Many of the radiological protection staff and RPTs have many years of experience and were found to be very knowledgeable in their areas of responsibility.

While UCOR has an appropriately comprehensive RPP document hierarchy, there is insufficient linkage between the regulatory requirements, the radiation protection program policy statements in the DOE-approved UCOR RPP, and the implementing procedures, to demonstrate the intended flowdown mechanisms for each of the RPP compliance commitments.

While not required, the following is excerpted from the DOE Guide 441.1-1C, *Radiation Protection Programs Guide*, Section 3.1:

The approved RPP details how a DOE activity shall be in compliance with 10 CFR 835 and should identify the functional elements appropriate for that activity. Additional documentation should be developed and maintained to supplement the approved RPP to demonstrate that an RPP can be effectively managed and administered to achieve compliance with 10 CFR 835. This documentation typically includes a site radiological control manual developed to the guidance contained in the RCS [Radiological Control Standard, DOE-STD-1098-99]*, as well as detailed implementing procedures, appropriate management policy statements, and technical basis documentation. While this documentation need not be part of the RPP, it should be clearly linked to the compliance commitments contained in the RPP*.

UCOR has developed appropriate programmatic radiological protection documentation, including management policy statements, implementing procedures, and technical basis documents (TBDs). However this information is not formally linked to the DOE-approved UCOR RPP and implementing procedures. (see Section 7, **OFI-1**) The UCOR Radiological Protection Manager maintains an informal 10 CFR 835 flowdown matrix that could be used to fulfill this expectation. However, contrary to the guidance, DOE reviewers have not expected the UCOR RPP to contain this linkage.

Radiological Work Planning, Exposure, and Contamination Control

UCOR maintains effective boundary control stations (BCSs) staffed by knowledgeable workers and supplied with quality personal protective equipment (PPE) and well-maintained monitoring equipment. The K-25 and K-27 D&D projects comprise the majority of the ongoing hands-on work at ETTP, and a large number of personnel require PPE to enter and exit radiological areas on a regular basis. UCOR has established single point of access and egress BCSs to facilitate efficient flow of workers into and out of the radiological areas. The BCSs are located in large trailers that are well stocked with disposable PPE and staffed with personnel responsible for replenishing stock and assisting workers with the donning and doffing processes as needed. Respiratory protection and breathing zone air samplers are also issued by support staff assigned to these locations. While some personnel use full face air purifying respirators, many individuals opt for powered air purifying respirators (PAPRs), which present unique challenges (decontamination and functional checks of helmets, seals, hoses, fan motors, batteries, belts, etc.) due to their size and needed accessories. UCOR has also staffed separate areas within the BCSs for managing PAPR issuance and retrieval, where staff personnel are responsible for verifying user training and medical authorizations, maintaining pre-use inspection documentation, storing each worker's PAPR when not in use, and issuing and surveying PAPRs after each use.

Workers are experienced in the using PPE and implementing contamination control practices, and RPTs provide support as needed. Observation of donning and doffing practices and work activities indicated that workers were generally well versed in the use of PPE and respiratory protection, as well as contamination control. In both K-25 and K-27, workers often had to traverse between contamination areas (CAs) and high contamination areas (HCAs), and they took appropriate measures, such as removing outermost booties and gloves when exiting an HCA to a CA. The work observed during this review involved system breaches and the potential for changing conditions, so they required continuous RPT coverage. The RPTs covering these jobs provided generally effective support, including periodic frisking of personnel who contacted process equipment, as well as routine job coverage radiological surveys.

A number of RWPs are broadly written to cover a variety of operations and conditions and long periods of time, and thus may not be sufficient to ensure that current radiological conditions are communicated to the work groups and that controls and work processes are tailored to specific work being performed. The following examples were identified where the RWP governing the work did not meet institutional requirements for RWPs and/or tailor hazards and controls to the specific work: (see **OFI-2**)

- At the time of the review, the K-25 building was posted in its entirety as an airborne radiation area (ARA), for which UCOR requires the use of respiratory protection. However K-25 RWPs governing intrusive work in this building had not been updated to reflect this status, and they contained unnecessary conditional controls that were not applicable or appropriate. For example, statements such as "up-post area to ARA if pre-job data indicates total alpha or beta-gamma contamination > 100,000 dpm/100cm^2" and "No respiratory protection required unless working within a posted ARA" were unnecessary and could be confusing.
- Several K-25 RWPs referenced obsolete work instructions and/or failed to include linkage to current procedures as required by procedure. For example, Procedure KD-9002 governs removal of pipe greater than two inches in diameter, but was not listed on RWP W29910 or in the RWP file as required. The RWP also referred to outdated work instructions for this activity. A similar problem existed with RWP 29911 for foaming operations, which did not list the applicable procedure used to govern the work.
- For all jobs observed in K-27, the RWPs assigned to the tasks did not identify the associated TWDs as required by procedure but instead contained a blanket statement to "See RWP file for associated technical procedures and work packages." However, the examined files did not contain the referenced procedures or list the previously approved tasks associated with the RWP.
- K-25 RWP 29898 for minor maintenance activities incorrectly contained PPE requirements for intrusive activities on process gas systems.
- Contamination control expectations and practices used to limit spread of contamination when work requires multiple entries and exits between HCAs and CAs were not documented in the K-25 or K-27 RWPs that were reviewed. For example, expectations include the practice of doffing outer gloves and booties when exiting an HCA, and ensuring in advance that sufficient layers of outer gloves and booties are donned and maintained for re-entries into HCAs.
- Radiological hold points were appropriately used in the field at K-27, but were not required in applicable RWPs or work instructions. For example, during duct cutting, one radiological survey of a removed metal section detected contamination greater than the RWP voiding limit. In response, the work was appropriately controlled and the area was upgraded to an HCA. However, these surveys are not required as hold points under the RWP or work instructions governing duct cutting, and therefore do not have to be performed. According to PROC-RP-4030, "A good example of a hold point would be a radiation measurement taken after a hatch is opened to make sure the limiting conditions on the RWP are not exceeded." To assure necessary monitoring is appropriatately performed; hold points should be written into the work instructions, RWPS, or both.
- K-25 and 27 RWPs contain limiting conditions for airborne radioactivity in terms of the derived air concentration (DAC), which cannot be seen or implemented in real time. For example, airborne radioactivity greater than ten times the DAC would not be recognized until after the air samples are counted. Given the necessary lag in laboratory level counting, implementing this work process control with the existing processes and available equipment would be impractical.

Pre-job and Safety Task Analysis Risk Reduction Talk (STARRT) briefings were not always comprehensive or effective in communicating job-specific hazards. For example, for K-27 duct cutting, hot tapping, and venting activities, observed briefings did not review the warnings in the governing procedures or discuss the required radiological surveys and when they are appropriate and/or tied to work sequence steps. In K-25, some STARRT briefings were conducted at the job site with full PPE including hearing protection and respiratory protection, potentially inhibiting communications. During the Monday formal pre-job briefing for foaming, some workers left the briefing to do other things, and there were multiple conversations in the space because some workers not involved in the briefing were present. (see **OFI-3**)

RWP briefings were not always comprehensive or effective. RWP briefings were inconsistent in content and delivery. A few observed briefings only addressed voiding conditions, while others read the RWP verbatim (contrary to procedure). Opportunities to review applicable lessons learned, recent experiences, or pertinent information from As Low As Reasonably Achievable (ALARA) reviews were not included in RWP briefings. For example, an RWP void limit was reached during duct cutting, but this condition was not discussed during any briefings on the following day. Workers' retention of information from RWP briefings may be jeopardized due to the long duration of most RWPs and the requirement for only a single briefing; there appears to be no mechanism to ensure refresher reviews for long-durations RWPs. Lastly, the records of one recently issued RWP suggest that some individuals who signed in on the RWP had not received the required briefing. (see **OFI-4**)

Some isolated examples of ineffective application of radiological controls were observed. During K-27 converter sampling, placement of point source ventilation was not maintained within three inches as required by the RWP, and the available point source ventilation was insufficient to cover all process equipment openings as required by the RWP. In K-25, an RWP requirement for hand frisking during pipe cutting operations at K-25 was not rigorously implemented for all workers with direct pipe contact. Also, the access point to one HCA was roped but not properly posted with a visible HCA sign. As isolated examples, none of these individually rise to a level of a programmatic weakness. However, they suggest a greater attention to detail may be in order. The contractor might consider performing an extent of condition assessment for implementation of similar radcon program fundamentals. (see **OFI -5**)

Radiological Surveys and Monitoring

UCOR's record keeping system effectively tracks and provides comprehensive linking of workers to the jobs and associated airborne monitoring surveillances for assignment of doses. Because of the potential for internal exposures, UCOR conducts extensive personal air monitoring on representative groups of personnel entering ARAs to conduct work. Breathing zone samples are assigned to one individual within each work group consisting of no more than five members, all of whom are assigned the same amount of internal exposure based on air sample analysis. This process is accomplished by recording the badge numbers of the members of each work group on the air sample envelope, along with the relevant sampling parameters; these are then sent for laboratory analysis. Sample results are uploaded to UCOR's WebAir database program, where they are available for review by facility radiological engineers and supervisors. Results exceeding certain thresholds are automatically flagged by the database for review. Separate database programs have been developed to use the air sampling data to generate reports that allow the internal dosimetry group to easily track the number of DAC-hours accumulated by each worker so that workers can be placed in the bioassay program if appropriate. The capability for handling large amounts of data and generating cohesive automated reports is a program strength.

RPTs provided effective job coverage and documentation for observed work with potential for changing radiological conditions. The work observed during this review involved system breaches and the potential for changing conditions, requiring continuous RPT coverage. Thus, RPTs were an integral part of most work observed during this review. With a few exceptions, RPTs provided effective support, including area characterization and job coverage radiological surveys, as well as appropriate frisking of personnel whenever hands-on contact with process equipment or other contaminated surfaces was needed. In addition, the use of the I-Solo counters allowed prompt and effective response to potential off-normal conditions. Radiological survey records associated with RPT job coverage and routines were found to be legible and complete.

Required air sampling and monitoring were not always effectively implemented in both K-25 and K-27. Institutional procedures require several types of air sampling and monitoring during intrusive work

in ARAs. These include boundary air samples, job-specific general area air samples, high efficiency particulate air (HEPA) exhaust air samples, and personal (breathing zone) air monitoring. Problems involving proper implementation of each of these required air sampling and monitoring evolutions were observed on multiple work evolutions, indicating a need for additional rigor in this area. (see **OFI-6**) For example:

- Boundary and job-specific general area air samples were not taken during some evolutions, and when taken, they were not placed and/or oriented as needed to collect a representative sample (e.g., located much higher or lower than the breathing zone, or located away from the work being performed). The sample heads were often not properly positioned to collect a representative sample (i.e., facing away from the work area). In addition, it was unclear whether the low volume flow and restrictive orifice of the personal air monitors (PAMs) would be able to capture a representative sample. The site TBD for air sampling does not cite the specific industry sources used as a basis for determining the efficacy of the 4mm orifice in collecting a representative sample.
- Required HEPA exhaust sampling was sometimes placed and oriented inappropriately to effectively monitor the exhaust (i.e., more than three feet from the exhaust point). HEPA exhaust sampling was also performed using PAMs, and it is uncertain whether the low volume flow and restrictive orifice of the PAMs would capture a representative particulate sample from the high flow rate of the exhaust stream.
- The informal process for assigning lapel samplers does not ensure that the work group members with the highest exposure potential are actually selected for sampling during each discrete work evolution. Appropriate identification of such personnel is particularly important because the K-25/27 bioassay protocol compares accumulated DAC-hours of the work group with a 20 DAC-hour threshold as a basis for enrollment in the bioassay program each quarter.

Training and Qualification

Observed radiological training was comprehensive and qualifications were effectively verified in the field. Independent Oversight team members took the Radworker II training and found the content and delivery to be comprehensive and applicable to position and access requirements. In addition, the LEARN system for assigning other required training has been implemented and is well managed. Respirator qualification of workers was proactively verified at the point of issuance, and all radiological workers displayed Radworker II credentials and expiration date on a card with their security badges.

Internal Dosimetry

The technical basis for bioassay and air sampling for technetium (Tc)-99 and its possible chemical forms was unclear at the time of this review. The Independent Oversight team was unable to find adequate documentation or study data to answer the following questions. (see **OFI-7**) These could impact the accuracy of radiological data and/or the assumptions in existing technical basis documentation for air sampling and internal dosimetry:

- What is the technical basis for classification of all Tc-99 contaminants as absorption Type M in the Site Internal Dosimetry TBD?
- Could the short biological clearance for typical Tc compounds result in possible missed dose for a monthly or quarterly frequency bioassay program?
- Is the collection efficiency of the air sample and/or respirator filter media sufficient for a soluble or volatilized form of Tc that could be created in some operations?

DOE Oversight

DOE field element oversight for the UCOR RPP is systematically performed using an assessment schedule that is developed and conducted in accordance with EM procedures. EM Procedure 3.6, "Assessment Program Committee and the EM Integrated Assessment Schedule," defines development of assessment schedules on an annual basis, and EM procedure 3.3, "Integrated Assessment Program," guides the conduct of assessments. Consistent with 10 CFR 835, radiological assessment schedules are designed to cover a three-year cycle to ensure that all functional elements of the program are assessed periodically. Direct oversight interaction with the contractor's operational and technical staff is mostly performed by Facility Representatives (FRs), safety system oversight personnel (SSOs), and subject matter experts (SMEs). The roles, responsibilities, authorities, and accountabilities (R2A2) of the FRs are presented in EM procedure 3.2 rev 6. The FRs serve as DOE line management's principal personnel to ensure operational awareness of the contractor's performance. They are responsible for daily walkthroughs of the facility and for monitoring and reporting the contractors' activities. It should be noted that although updated as recently as February 2011, the procedure references an outdated Orion system for reporting and some organizational structures that have been superseded by more recent reorganizations. **(**see **OFI-8**)

Training and qualifications of Federal oversight personnel are adequate. All the FRs who were interviewed during this assessment have accumulated years of experience as FRs. Qualification records were reviewed for three EM FRs assigned to ETTP facilities operated by UCOR. Qualification card sign-offs for two of the three were completed over the year preceding this assessment. These two individuals exhibited detailed awareness of the facilities, operations, and contractor activities for which they were assigned. The third FR had been transferred to the ETTP facility from another FR assignment just two months before this assessment, so although he is properly qualified and knowledgeable of the FR's duties and responsibilities, he has not yet developed sufficient familiarity and full knowledge of the facility and operations to satisfy the facility-specific qualifications requirements. (see **OFI-9**)

Two SMEs serve EM for oversight of the contractors' radiological protection safety management programs. The first serves EM based on a staff augmentation contractual relationship with the service center. He has been with DOE for a significant period of time, having started initially as a National Registry of Radiation Protection Technologists (NRRPT) certified technician with a contractor's RPP. He has a BS in Health Physics, and worked as a contract HP for NNSA for 3 year prior to becoming a direct DOE employee. This individual's technical qualification program (TQP) certificate indicates that he has received training and is qualified under DOE-STD-1174, "Radiation Protection Functional Area Qualification Standard." It should be noted that the standard states: "certification by the American Board of Health Physics is highly recommended." This SME has not yet completed that level of certification but has taken part one of the exam, indicating progress toward certification. In keeping with the standard, all federal HP SMEs should be encouraged and supported in completing that process. The second SME works directly for EM. This individual, a relatively recent hire, has an advanced degree in health physics but has not yet fully qualified under the TQP standard. At the time of the review, although the position description identifies specific duties and responsibilities, this individual's qualification card and TQP elements were still being developed. From observation, it was apparent that while academically qualified, she still needs a certain level of hands-on field experience and mentoring before being fully independent as a facility SME in conformance to DOE Standard 1174. (see **OFI-8**)

FRs demonstrated the ability to perform effective oversight of contractor radiological work. Independent Oversight followed FRs during their daily routines, observing management meetings, work planning and scheduling meetings, contractor's plan-of-the-day work coordination briefings, work task "tail gate" safety briefings, and work observations. Two of the three FRs exhibited strong working knowledge of the operations and were fully engaged with the operations staff and management on

oversight activities. The third, having recently transferred to this facility, did not yet have sufficient in-facility experience to serve independently as our escort, but was knowledgeable of the contractor's operations and staff, and able to get any necessary support and timely answers to inquiries (see **OFI-9**)

Expectations for Federal radiological SMEs are not well defined or formalized, and SMEs appear to rely too heavily on FR observations to identify potential radiological concerns in active D&D work. Per DOE Standard 3009, the safety basis for each facility is expected to include contractor commitments for establishing and maintaining specific safety management programs and outlining how various elements of those programs will be implemented. In general, SMEs are expected to provide technical expertise, assessments, and program element review to ensure that the contractors' safety management programs are functional and effective and that they conform to regulatory and contractual requirements. EM assigns SMEs with specific oversight activities as part of the integrated assessment program, but there appears to be no established written policy or procedure that outlines generic SME R2A2 or training and proficiency requirements. Instead, each individual SME has an individual position description, qualification card, and performance management plan specifying varying degrees of expertise and effectiveness. (see **OFI-8**)

During the assessment, the SMEs performed a demonstration observation of facility signage and posting, primarily outside ETTP facility buildings. They also conducted walkthrough facility inspections of several EM facilities (building 7503, Molten Salt Reactor Experiment; building 3038, Radioisotope lab hot cell; building 3042, Oak Ridge Research Reactor) that are currently in the S&M mode (not yet undergoing active D&D processes). It was clear from observations that the senior SME was familiar with the status and conditions in the facilities and had an active working relationship with the contractor's facility radiation protection staff. However, when asked how often they performed observation of active contractor work processes in either K-25 or K-27, the SMEs indicated that while they had observed contractor plan-of-the-day meetings and various activity planning or issues meetings, they had not recently entered active work areas to observe ongoing operations in those facilities. Instead, they relied primarily on observations and reports from the FRs. (see **OFI-10**)

DOE assessments and surveillances of radiological work are not sufficiently rigorous or performance based to be able to identify radiological work control weaknesses. EM procedure EM 3.3 identifies a variety of oversight activities, including audits, formal assessments, informal assessments, and walkthrough surveillances. Each of these has a different level of formality, planning, and expected documentation. During this assessment, Independent Oversight reviewed the integrated assessment schedules and several previous reports from the SMEs responsible for RPP oversight. Each review targeted a specific topic of the contractor's programs and used an appropriate level of targeted lines of inquiry (LOIs). The targeted topics that were reviewed included sealed source leak test surveillance and inventory control, area access and RWP controls, emergency exposure assessment and controls, and posting and signage. The LOIs were comprehensive and uniformly applied across contractors. However, the documented reports consisted primarily of cross-walks between the regulatory requirements and the contractor's implementing procedures, review of written programs, or review of contractor-performed self-assessments, with little evidence of performance-based reviews that included field work observations. In some cases, the reports indicated that field walk downs or observations had been performed, and "time in the field" was documented as a metric of performance, but there was little or no documentation of what areas, operations, or conditions were observed, and little documentation of the conclusions or course of action resulting from the surveillance activity. (see **OFI-10**)

Compensatory measures in lieu of active safety systems should have comparable oversight review. The nature of D&D work at ETTP provides limited ability for reliance on installed credited active safety systems to support D&D operations. As a noteworthy practice, an SSO has been assigned to oversee the use of personal ionizing radiation detectors (PRDIs) as a supplemental system, instead of a functional

criticality accident alarm system. Other areas that lack active credited safety systems rely significantly on portable devices and PPE, or administrative controls, to ensure worker safety. These controls include local filtered ventilation, PAMs and job-specific air monitoring, PAPRs and other PPE, fire watches and fire extinguishers, fall protection, and portable survey instrumentation for non-destructive assay to determine the source terms. Since these do not rise to the level of credited active safety systems, no cognizant system engineers (CSEs) or SSOs have been specifically assigned. However, as noted in other portions of this report, there may be some weaknesses in the efficacy or application of some of these safety devices or monitoring capabilities. Considering that these systems and devices replace active installed systems for worker protection and facility safety, there may be some benefit to establishing assignments similar to a CSE/SSO or SME (as is used for the PRDIs) to ensure the functionality, operability, and reliability of these components or devices. A program of rigorous, performance-based assessments by the FRs and SMEs is critical to ensure the adequacy of the compensatory safety measures that are relied upon in lieu of active credited safety systems. (see **OFI-11**)

6.0 CONCLUSIONS

Independent Oversight determined that UCOR has a strong radiation protection infrastructure staffed by qualified and experienced personnel. UCOR has also developed an appropriately comprehensive RPP document hierarchy including management policy statements, implementing procedures, and TBDs. However, there is insufficient linkage through the DOE-approved UCOR RPP policy statements to the implementing procedures to demonstrate the intended flowdown of the regulatory requirements for each of the RPP compliance commitments.

Radiological work planning, exposure, and contamination control processes are generally effectively implemented. BCSs are staffed by knowledgeable workers and supplied with quality PPE and well-maintained monitoring equipment, and workers and RPTs are experienced in using PPE and implementing contamination control practices. A concern was noted, however, in that many RWPs are broadly written to cover a variety of operations and conditions, and used over long periods of time, so they may not be sufficient to ensure that current radiological conditions are sufficiently communicated to work groups and that the controls and work processes are adequately tailored to the specific work being performed. In addition, the required pre-job, STARRT, and RWP briefings are not always used effectively to convey important information to workers before the start of work.

Radiological survey and monitoring activities are effectively implemented in most areas. In many situations which had the potential for changing radiological conditions, RPTs provided effective continuous job coverage and documentation for the observed work. Also, UCOR has a comprehensive record keeping system that effectively tracks and provides comprehensive linking of individual workers to the jobs and associated airborne monitoring surveillances; this is used to assign doses and enroll workers in the bioassay program. Weaknesses were observed in the rigor and effectiveness of each of the various types of required air sampling, including boundary sampling, breathing zone sampling, HEPA exhaust sampling, and job-specific area sampling. Lastly, the established technical bases for bioassay and air sampling for Tc-99 may be insufficient, due to potential variations in the chemical forms that may exist.

The DOE EM site office has a generally effective system of oversight based on the development of the annual assessment schedule and active interaction of the FRs with the contractors activities. However, opportunities for improvement were identified in the implementing procedures and expectations for performance and documentation of activity level performance based formal assessments. Well qualified FRs are actively engaged in operational awareness activities. Oversight is further supported by SMEs

and SSOs. Although the written procedures governing the FRs and SSOs were updated as recently as 2011, they are not in accordance with current organizational or reporting structures and should be updated. There appears to be no overarching procedure for SME assignments of R2A2 or training and qualifications that would be analogous to the procedures for FRs or SSOs. Most of the formal assessment reports prepared by the SMEs were "paper" reviews that cross-walked the contractors' written programs against the regulatory requirements. The quality and value of the SME assessments could be improved by more active and documented field observations to assess performance-based implementation of the written programs. Additionally, because the nature of a D&D or S&M process reduces the ability to depend on active engineered systems or features to ensure worker or facility safety, there is an increased dependence on local portable or temporary systems, PPE, and other compensatory measures. As a noteworthy practice, EM uses an SSO-like assignment to ensure the functionality, operability, and reliability of the PRDIs. There would be some benefit to extending that practice to other devices or compensatory measures considered important to safety.

7.0 OPPORTUNITIES FOR IMPROVEMENT

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

Contractor Related OFIs

OFI-1: Establish formal linkage between UCOR's RPP document hierarchy and the formally documented RPP. Specifically, supplement the existing RPP with a compliance matrix showing the linkage and flowdown of each compliance commitment to specific implementing mechanisms and TBDs. (NOTE: This OFI applies both to UCOR RPP managers and DOE management reviewers / approvers).

OFI-2: Improve the clarity and specificity of RWPs. Specific actions to consider include:

- Review a sampling of RWPs to identify if there are additional errors and inconsistencies that warrant an extent of condition review. Revise and re-issue deficient RWPs as appropriate.
- Ensure that RWPs are revised and re-issued whenever external factors may affect the accuracy of the RWP. For example, if a building is posted as an ARA, ensure that the RWP controls reflect this status. In addition, implement revisions whenever there are significant changes to a governing TWD.
- Ensure that RWPs, (or work instructions), properly identify hold points when measurements are employed to pause work and/or ensure integrity of radiological conditions (or other hazard conditions) and RWP void limits, as called for by procedure.
- Ensure that RWP void limit conditions can be detected and assessed in an adequately timely manner with the available equipment and technology to ensure worker safety.

OFI-3: Improve pre-job and STARRT briefings. Specific actions to consider include:

- Ensure discussion of warnings or other information related to hazards and controls that are documented in procedures and/or job hazards analyses are discussed.
- Hold STARRT briefings in an unencumbered location away from the job site where PPE and respiratory protection cannot hinder effective communication. Follow up at the job site, allowing workers to inspect work areas and ensure that conditions are as expected and as discussed during the briefing.

- If possible, hold Monday briefings in dedicated conference rooms to limit the number of personnel and extraneous conversations that may hinder effective communications. Require all personnel to be present for the entire duration of the briefing.

OFI-4: Improve RWP briefings. Specific actions to consider include:
- Provide guidance to RPTs on expectations for conducting effective RWP briefings without reading the RWP verbatim. Consider using a checklist of topics to discuss.
- Ensure that RWP briefings review any applicable lessons learned and operational experience from similar work evolutions.
- For long-duration RWPs, implement a periodicity for required refresher briefings.

OFI-5: The contractor should consider performing an extent of condition assessment for implementation of radcon good work practice fundamentals such as use and change out of multiple layers of PPE, performance of periodic contamination checks/frisking during operations, pre-staging and use of local contamination controls and criticality safe spill containments, placement of local ventilations, and posting and maintenance of work zone boundary area control points.

OFI-6: Improve the rigor and effectiveness of air sampling and monitoring. Specific actions to consider include:
- Assess the extent of condition and root causes for the air sampling weaknesses observed during this review. Provide additional training to RPTs on expectations for the various types of air sampling and monitoring that must be conducted, including proper placement and orientation of sample heads.
- Consider using the STARRT briefings as a more formal mechanism to properly and systematically identify the workers with the highest potential for exposure who must wear breathing zone samplers for each anticipated entry for the upcoming shift.
- Provide additional detail in RWPs as to specific expectations for each type of air sampling to be conducted.
- Consider modifying the site TBD for air sampling to include specifics on the justification of adequacy of the 3 to 8 liter per minute air samplers for use as general area air samplers as well as the 4mm orifice size capture efficiency. This effort should include an assessment of the efficacy of sampling in high-velocity local ventilation filter effluent streams.

OFI-7: Clarify the technical basis for Tc-99 air sampling and bioassay. Specifically, update TBDs to more specifically address the physical and chemical properties of Tc-99 to substantiate the efficacy of filter media for sampling and respiratory protection, as well as to substantiate the assumed biological clearance times used in minimum detectable dose calculations at various bioassay frequencies.

DOE Site Office Related OFIs

OFI-8: Improve or update the DOE EM procedures. Specific actions to consider include:
- The site office should continue current efforts to update EM procedures governing the annual assessment schedule and FR, SME, and SSO oversight to reflect the current organizational structure and reporting systems.
- Establish procedures that programmatically define the R2A2, training and qualifications, and expected oversight performance and outcomes for the SMEs with respect to the required safety management programs. These may be analogous to procedures EM 2.2, EM 2.5, and EM 2.9, which govern the FR and SSO programs.

OFI- 9: Continue progress on training and qualifications to ensure that all oversight personnel (FRs, SMEs, and SSOs) are fully trained, functionally qualified, and credentialed in their assigned facilities, programs, or systems, and their areas of technical expertise. Specific actions to consider include:

- Provide assignments, on-the-job training, and hands-on practical proficiency training to continue to aid these personnel in gaining the experience needed to complete the TQP.
- DOE should continue development and completion of TQP training and qualification card sign-offs for more recently assigned or hired oversight personnel.

OFI-10: Strengthen the quality and impact/value of DOE radiological oversight reports by further emphasizing documentation of field observations to assess implementation of the contractor's written policy. Specific actions to consider include:

- Emphasize that reports should include description of field operations or conditions observed, comparison with program or procedural requirements, and provide conclusions or course of action resulting from the of the surveillance activity.
- Apply these measures to SMEs and SSO assignments and revise written procedures and the format of electronic systems report forms to reflect this emphasis.
- Encourage SMEs to maintain practical proficiency and awareness of conditions by more frequent or routine observation of field operations.

OFI 11: Ensure the functionality, operability, and reliability of components, monitoring devices, and other local or personal safety devices that are used as compensatory measures in lieu of installed active safety systems in facilities undergoing D&D or S&M activities. Specific actions to consider include:

- Establish CSE/SSO-like assignments, similar to the one used for the PRDIs.
- Ensure that assigned DOE oversight personnel (SMEs or SSOs) maintain awareness of the analyses and conclusions of contractor "white papers" or TBD analyses of the efficacy of the compensatory measures, and that they verify those conclusions.

8.0 ITEMS FOR FOLLOW-UP

While Independent Oversight does not consider most of the concerns leading to the above listed OFIs to rise to the level of findings because they did not appear to be systematic or widespread, the weaknesses in air sampling and RWPs were more systematic and warrant continued oversight attention. In identifying these two items as OFIs rather than findings, Independent Oversight considered improvement initiatives and very recently instituted corrective actions generated in response to other recent assessments that have not been in effect for sufficient time to determine effectiveness. All the OFIs represent a potential for improvement in safety processes and oversight at the work implementation level. Through the site lead program, Independent Oversight will continue to monitor site office and contractor progress in improving the areas of weakness identified in this report.

APPENDIX A
Supplemental Information

Review Dates

March 3-22, 2013

Office of Health, Safety and Security Management

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

Quality Review Board

William Eckroade
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Thomas Staker
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Michael Kilpatrick
George Armstrong
Robert Nelson

Independent Oversight Site Lead for Oak Ridge Site

Timothy Mengers

Independent Oversight Team Members

Timothy Mengers, PE, CHP
Mario Vigliani, CHP
Joseph Lischinsky, CHMM

APPENDIX B
Documents Reviewed

- UCOR Radiological Protection (RP) Organization Chart
- UCOR Training Position Descriptions for Field Radiological Engineer, Field Radiological Protection Manager, RP Technicians and RP Supervisor
- UCOR Guidance for Radiological Controls During Decontamination and Demolition of Technetium (99Tc) Contaminated Gaseous Diffusion Facilities, UCOR-4140
- PROC-PQ-1420, Rev. 0, *Management Assessment*
- PROC-RP-4030, Rev. 2, *Radiological Area Entry Control*
- PROC-RP-4504, Rev. 0, *ALARA Reviews*
- PROC-RP-4506, Rev. 1, *Radiological Protection Internal Audit Program*
- PROC-RP-4512, Rev. 2, *Internal Dosimetry*
- PROC-RP-4513, Rev. 2, *Workplace Monitoring*
- PROC-RP-4514, Rev. 0, *Workplace Air Monitoring for Radioactivity*
- PROC-RP-4515, Rev. 0, *Radiation Surveys*
- PROC-RP-4516, Rev. 4, *Radioactive Contamination Control and Monitoring*
- PROC-RP-4517, Rev. 2, *Posting and Labeling*
- PROC-RP-4518, Rev. 1, *Radiation Protection Program Records*
- PROC-RP-4521, Rev. 0, *Radiological Accidents and Emergencies*
- PROC-RP-4522, Rev. 0, *Radiological Project Walk Downs*
- PROC-RP-4540, Rev. 0, *Radiological Protection and Survey Technician Training*
- PROC-RP-4548, Rev. 2, *Air Sample Collection, Handling and Documentation*
- PROC-FS-1001, Rev. 2, *Integrated Work Control Program*
- PROC-KD-9003, Rev. 5, Technical Procedure, *Vent, Purge, Drain and Inspect of Process Gas System Piping*
- ALARA Review Number K25-28528AR, Rev 2. Dated 11/15/11
- Pre-Job ALARA Review Number 2012-AR-015, Rev 1. Dated 2/13, *K-27 D&D Work in ARAs and HCAs*
- PROC-KD-9019, Rev. 6, Technical Procedure, *Duct Cutting/Draining in K25/K27*
- PROC-KD-9049, Rev. 0, Technical Procedure, *Drilling Access Holes and Perform Foaming Operations*
- PROC-KD-9002, Rev. 0, Technical Procedure, *Removing PG Coolers and Piping*
- RPWDC dated 10/29/12, K-27 Demo
- RPWDC dated 12/26/12, North Area D&D and the Tc-99 Area,
- Internal Dosimetry Technical Basis Document
- K-25/K-27 Project Bioassay/Air Sampling Protocol (K25/K27 BP-01, Rev.3)
- K-25 D&D Air Sampling Plan for Tc99 Area (2011 WHP-013) dated October 2011
- Radiological Survey Report (RSR) 13-AREAK-0391, dated 02/19/13
- RSR 13- AREAK-0198
- RSR 13- AREAK-0445
- RSR 13- AREAK-0063
- RSR 13- AREAK-0383
- RSR 13- AREAK-0193
- RSR 13- AREAK-0210
- RSR 13- AREAK-0412
- RSR 13- AREAK1-0613

- RSR 13- AREAK1-0619
- RSR 13- AREAK1-0615
- RSR 13- AREAK1-0616
- DOE Guide 441.1-1C, dated 5/19/08, *Radiation Protection Program Guide*
- Selected RP staff resumes, training and experience records
- RWP W29987, K-25/27 D&D Miscellaneous Support, Minor Maintenance Activities
- RWP W29908, K-25, Venting, Purging, Draining and Inspecting of Process Gas System Piping
- RWP W29910, K-25, Activities Associated with Process Gas System Pipe/Component Removal and Interference Piping
- RWP W29911, K-25, Drilling Access Holes and Perform Foaming Operations
- RWP W29933, K-25, Tours/Walk-downs/Inspections/Audits/Monitoring of Tc-99 CAs, ARAs or HCAs
- RWP W29927, K-25, Operations Associated with the K25 Demolition
- RWP W30001, K-27, Non-Intrusive Work in Contamination Areas (CAs)
- RWP W30003, K-27, Intrusive Work in Airborne Radioactivity Areas (ARAs)/High Contamination Areas (HCAs)
- RWP W30004, K-27, Hot Work in CAs or Airborne Radioactivity Areas (ARAs)/ Contamination Areas (CAs)
- RWP W30005, K-27, Hot Work in HCAs or Airborne Radioactivity Areas (ARAs)/High Contamination Areas (HCAs)
- Response Reports: RIR I0080882, I0080870, I0080878 and unnumbered event observed on 3/18/13 at K275 402-1 Cell 8
- Work Package Number: 9043, *Foaming Operations*
- AMSTS org Chart 12/3/2012
- EM-90 Org chart 8/15/2012
- EM-2.2 rev 4 Safety System Oversight Program
- EM-2.4 rev 3 Preparation and Management of Policies and Procedures
- EM-2.5 rev 4 Facility Representative Training and Qualification Program
- EM-2.9 rev 0 Safety System Oversight Training and Qualification Program
- EM-3.2 rev 6 Facility Representative Program
- EM-3.3 rev 8 Integrated Assessment Program
- EM-3.4 rev 0 Code of Record for EM Nuclear Facilities
- EM-3.6 rev 0 Assessment Program Committee
- DOE O 426.1 appendix D Safety System Oversight Duties Responsibilities, Knowledge Skills and Abilities
- EM-Active Safety System Oversight Coverage (March 2013)
- Position descriptions for various DOE FRs and SMEs
- Qualifications cards for various DOE FRs and SMEs
- Various EM SME radcon program reviews reports for UCOR and WAI including source inventory, emergency exposures, and entry controls.