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Statement:

Radiological contamination events have occurred at civilian sites, DOE sites and areas around the world. Recently, the Department of Energy began investigations into two incidents over the past year where workers at the Nevada National Security Site were exposed to potential contamination due to "losses of contamination control of highly enriched uranium" at the lab while conducting nuclear weapons activities (ref 1). In addition, there are numerous incidents of civilian contamination due to issues such as the loss of control of radioactive sources (ref 2). These incidents highlight the need to have effective radiation protection programs in place and in use throughout the DOE complex.

It is the policy of Department of Energy (DOE) to conduct its radiological operations in a manner that ensures the health and safety of all its employees, contractors, and the general public. In achieving this objective, the Department needs to ensure that radiation exposures to its workers and the public and releases of radioactivity to the environment are maintained below regulatory limits and that deliberate efforts are taken to further reduce exposures and releases as low as reasonably achievable. A recent review of 10 DOE sites conducted from September 2012 to August 2014 indicated that although the department certainly has site-wide program strengths, there were some common weaknesses across the complex in several areas including:

- Regulatory required radiation protection program documentation
- Radiological work planning
- Contamination controls and associated radiological surveys
- Aspects of radiological air sampling and monitoring
- Effectiveness of DOE program and site office oversight

These weaknesses can hinder the effectiveness of radiological controls, reduce the accuracy of internal dose assessments, and hinder the ability to identify and ensure timely correction of performance issues.

Discussion:

Title 10 CFR Part 835, Occupational Radiation Protection, establishes Radiation Protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from conducting DOE activities. Title 10 CFR 835.101(a), Occupational Radiation Protection, states, "A DOE activity shall be conducted in compliance with a documented Radiation Protection Plan as approved by the DOE." Each DOE site that works with radiological material must develop an RPP and supporting documentation for radiological control.

To assist its operating entities in achieving and maintaining compliance with the requirements of 10 CFR 835, DOE has established its primary regulatory guidance in the DOE G 441.1-1C Guide, Radiation Protection Programs Guide for use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection. The Guide is structured to assist RP professionals in developing the documented RPP required by 10 CFR 835.101 and the supporting site- and facility-specific policies, programs, and procedures that are necessary to ensure compliance with the related regulatory requirements. DOE has also developed a technical standard DOE-STD-1098-2008, Radiological Control, which supplements the DOE G 441.1-1C Guide and serves as a secondary source of guidance for achieving compliance with 10 CFR 835.

To ensure compliance with the above standard, DOE projects should establish and maintain a system of regulatory policy and guidance reflective of national and international radiation protection standards and recommendations. They should ensure that the personnel responsible for performing radiological work activities are appropriately trained and are technically competent for implementing and overseeing the radiological control program. Projects should establish and maintain, at all levels, line management involvement and accountability for departmental radiological performance, while ensuring that radiological measurements, analyses, worker monitoring results and estimates of public exposures are accurate and appropriately made. Management should ensure that radiological operations are conducted in a manner that controls the spread of radioactive materials and reduces exposure to the workforce and the general public. In addition, they need to ensure that all processes used seek exposure levels as low as reasonably achievable (ALARA). Site plans should incorporate features that minimize dose, contamination, and waste into the design of new facilities and significant modifications to existing facilities in the earliest planning stages. Finally, DOE should conduct oversight to ensure departmental requirements are being complied with and appropriate radiological work practices are being implemented.

Analysis:

The following areas were reviewed with common weaknesses identified:

- Radiation Protection Organization and Administration
 - Lack of specific linkage of the implementing mechanisms to compliance commitments contained in the RPP which resulted in redundant or conflicting procedures and/or the lack of procedures
- Radiological Work Planning, Exposure, and Contamination Control
 - Issues include preparation of radiological work authorizations, effectiveness of ALARA reviews for higher hazard radiological work, and the rigor and verification of contamination control practices designed to limit contamination spread to clean areas.
- Radiological Work Authorizations
 - Overly broad work scope, which hindered the ability to perform effective identification and analysis of specific radiological hazards and requisite controls; and lack of proper integration with associated work control documents such as the job hazard analyses or procedures controlling the work.
- ALARA Reviews
 - Insufficient definition of methods and expectations for performing and documenting the ALARA reviews, poor instructions for completion of ALARA review checklists.
- Contamination Control Practices
 - Inadequate doffing and frisking practices and insufficient verification through radiological surveys that contamination control measures were effective
- Radiological Surveys and Monitoring
 - Inadequate job specific air sampling during work with respiratory protection or with the potential to create airborne activity, possibly leading to mischaracterizing airborne concentrations in the workers breathing zone.

Actions:

For DOE Site Offices:

- Improve oversight of contractor RPPs to ensure the RPP elements are adequately assessed to inform management on performance such as:
 - Ensure there is a defined method such that all elements of contractor Radiation Protection performance are specifically reviewed during oversight activities.
 - Establish clear requirements and responsibilities for RP assessments, self-assessments, external reviews, and annual assessment reports.
 - Focus more attention in the review of RPP submittals to the linkage of site documents and level of detail provided.

For Site Contractors:

- Increase attention toward improvement of RPPs, radiological work authorization such as radiological work permits (RWPs), ALARA reviews, contamination control practices, and radiological air sampling and monitoring. Some specific actions are:
 - Revise RP plans and procedures to require specific linkage between RWPs and all associated procedures and work instructions
 - Revise RP plans and procedures to provide better RWP work scope guidance and to prohibit language in RWPs that refer a worker to the discretion of RP personnel for authorized activities or radiological controls.
 - Consider establishing procedures to govern selection and conduct of ALARA reviews, including proper use of thresholds, clear expectations for content and level of detail for each required review element, and proper flowdown of controls into the RWPs or other technical work documents.
 - Consider adding radiological work planner position(s) responsible to support existing RP personnel and/or radiological control technicians in preparing RWPs.
 - Increase periodic surveillances by qualified health and safety personnel to observe and provide feedback on contamination control practices of radiation workers/researchers.
 - Increase the frequency of performing documented radiological surveys as necessary to verify effectiveness of controls during and after work
 - Ensure air sampling programs are designed and implemented in a manner that ensures collection of representative air samples.
 - Review existing airflow studies or conduct additional studies to ensure adequacy of the basis for air sampler placement

Critical Decision(s): CD-2 to CD-4

Facility Type(s): All

Work Function(s): ES&H, Project Management

Technical Discipline(s): All



Transportation of special uranium-tainted waste for disposal at the Nevada National Security Site would involve this type of truck and nuclear waste package (DOE photo)

References:

1. "DOE probes worker radiation exposure at test site", Las Vegas Review-Journal, June 18, 2015, <http://www.reviewjournal.com/news/nevada/doe-probes-worker-radiation-exposure-test-site>.
2. "The Radiological Incident in Goiania", IAEA, STI/PUB/815 ISBN 92-0-129088-8, Vienna, 1988
3. Lessons Learned From Targeted Reviews of Radiological Controls Activity-Level Implementation, Office of Nuclear Safety and Environmental Assessments, Office of Environment, Safety and Health Assessments, Office of Enterprise Assessments, U.S. Department of Energy, January 2015
4. DOE-STD-1098-2008, DOE Standard Radiological Control, Chg 1, May 2009
5. DOE G 441.1-1C Guide, Radiation Protection Programs Guide for use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection, May 19, 2008

Questions about the EM Lessons Learned program? Contact Johnnie Newson at johnnie.newson@em.doe.gov.