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Environmental Radiological Protection and Monitoring During Demolition of Contaminated Facilities Criteria and Review Approach Document		
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1.0 PURPOSE

The mission of the U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments (EA-30) is to assess the effectiveness of safety and emergency management systems and practices used by line and contractor organizations and to provide clear, concise, rigorous, and independent evaluation reports of performance in protecting workers, the public, and the environment from the hazards associated with DOE activities.

In addition to the general independent oversight requirements and responsibilities specified in DOE Order 227.1A, *Independent Oversight Program*, this criteria and review approach document (CRAD), in part, fulfills the responsibility assigned to the Office of Enterprise Assessment (EA) in the DOE Order (O) 226.1B, *Implementation of Department Energy Oversight Policy*, to conduct independent oversight and assessments of high consequence activities. This CRAD specifically relates to assessments of environmental radiological protection and monitoring programs applied to demolition of contaminated facilities in accordance with DOE O 458.1, *Radiation Protection of the Public and the Environment*, and other applicable requirements.

The CRADs are available to DOE line and contractor assessment personnel to aid them in developing effective DOE oversight, contractor self-assessment, and corrective action processes. The current revision of EA's CRADs are available at http://www.energy.gov/ea/criteria-and-review-approach-documents.

2.0 APPLICABILITY

The following CRAD is approved for use by the Office of Nuclear Safety and Environmental Assessments (EA-31).

3.0 FEEDBACK

Comments and suggestions for improvements on this CRAD can be directed to the Director, Office of Nuclear Safety and Environmental Assessments.

4.0 CRITERIA AND REVIEW APPROACH

The review of environmental radiological protection and monitoring programs applied to demolition of contaminated facilities will evaluate whether appropriate controls and contingency measures are being planned and/or implemented in accordance with applicable requirements to ensure public protection from radiological effluents transmitted through air pathways. This review will focus on the suitability of the radiation protection planning in addressing the environmental radiological requirements of DOE O 458.1, and other relevant requirements, although the resulting documents such as ALARA reviews and radiological work permits also address worker safety and health under 10 CFR 835. The objectives, criteria, and lines of inquiry to be used for this assessment are presented below.

The objectives, criteria, and lines of inquiry in this CRAD are supported by the following regulations, orders, and standards:

- 10 CFR 830, *Nuclear Safety Management*
- 10 CFR 835, *Occupational Radiation Protection*
- 40 CFR Part 61, Subpart H, *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities*
- DOE Order 458.1, *Radiation Protection of the Public and the Environment*
- DOE Order 426.2, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*
- DOE Policy 450.4, *Integrated Safety Management Policy*

  See also DOE Handbook 1216 *Environmental Radiological Effluent Monitoring and Environmental Surveillance* for guidance in this area.

OBJECTIVES

ER.1: The site's environmental radiological protection program addresses potential impacts from decommissioning and demolition activities including possible emission sources, transport modeling, dose consequences to the public, and all applicable environmental and radiation protection policies and directives. (DOE O 458.1 Section 4.a.)

Criteria:

1. A documented environmental radiological protection program has been established and is implemented by trained staff in accordance with applicable requirements. (DOE O 458.1 Section 4.a.1.a; DOE O 426.2, Attachment 1, Chapter I)

2. Programs and procedures are in place to ensure airborne emission of radionuclides (other than radon) are controlled such that no member of the public would receive an effective dose equivalent of more than 10 millirems/year (0.1 millisievert/year). (40 CFR Part 61.92, National Emission Standards for Hazardous Air Pollutants (NESHAP), Subpart H)
3. A documented ALARA process has been implemented to optimize control and management of radiological activities to keep doses to members of the public (both individual and collective) and releases to the environment as low as reasonably achievable. The ALARA process appropriately considers sources, modes of exposure, and all pathways which potentially could result in the release of radioactive materials into the environment, or exposure to the public. (DOE O 458.1 Section 4.d.)

Lines of Inquiry

- Does the environmental radiological protection program contain the necessary elements such as an overall program document with linkage to plans, procedures, protocols, etc. for meeting Order requirements for public dose limits, ALARA, airborne radioactive effluents, and records and reporting?
- Have applicable lessons learned and operating experience from previous demolition activities across the DOE complex been incorporated into the processes and plans for environmental radiological protection?
- Has the site defined the requirements for education, experience, knowledge, skills, and abilities for personnel providing radiological environmental monitoring during demolition? Has the site maintained adequate technical capabilities (either on site or through support contractors) and experience to assess routine and unplanned releases of radioactive materials, consistent with the types of radioactive materials released, release modes, and demolition activities conducted?
- How are monitoring and associated quality assurance and assessment data tracked, reviewed, and trended to ensure that changes in environmental conditions are fully identified and reported? Are procedural controls consistent with line management expectations established for trending and reporting anomalous conditions?
- Are radiation monitoring data reviewed regularly to determine if modifications or improvements to the overall design (sampling methods, location, and analysis) are needed to meet data quality objectives or overall program performance?
- How are occupational and environmental sampling and analysis methods and approaches systematically reviewed and evaluated to ensure they are sufficient to demonstrate compliance with applicable limits and provide an adequate technical basis for the environmental radiation monitoring program?
- Is a program in place to evaluate non-routine releases and assess the impacts of such releases on the public and the environment?
- How has the characterization of risk associated with open-air demolition been analyzed within the site's ALARA program?

ER 2: Methods are in place to characterize and minimize the radiological contamination from the demolition activities. (10 CFR 835; DOE O 458.1 Section 4.e.)

Criteria:

1. A process has been established to characterize radionuclide contamination in the facility prior to declaration of readiness for demolition. (DOE O 458.1 Section 4.e.)
2. Appropriate fixatives and dust mitigation techniques have been identified to reduce potential for airborne emissions. (10 CFR 835.404, 10 CFR 835.1001)

Lines of Inquiry

- Have the types and quantities of potential airborne effluents (i.e., statistical sampling scheme, types of measurements conducted, treatment of heterogeneity, etc.) been appropriately characterized?
- Has the effectiveness of previous effluent treatment and controls been evaluated in their capability in reducing airborne effluents? If they were not adequate, what changes were made to ensure airborne effluents will remain within acceptable levels?
- Is the expected radioactive source appropriately characterized based on radionuclide assessment, dust generated, fixing agents and phased approach of demolition?
- Is there a documented radiological protection program that addresses the flow down of regulatory requirements and integrates radiological work control processes with other site work planning and control processes to ensure synergy of controls for different hazards?
- Are procedures and written work authorizations such as radiological work permits (RWPs) or other technical work documents approved by the radiological control organization and used to control work performed in contaminated demolition areas? Do these authorizations adequately specify the hazards and appropriate radiological control measures (e.g., radiological conditions, limiting conditions, hold points, etc.) as it relates to potential airborne environmental releases?
- Is the ALARA process formally defined and effectively used to evaluate and control all occupational exposures and to ensure dose to the public is as low as reasonably achievable? How is information gained through routine radiological monitoring used to support the ALARA process and evaluate its effectiveness?

ER 3: The dose evaluations to demonstrate compliance with the public dose limit from radiological releases to the environment resulting from demolition activities utilizes atmospheric dispersion modeling and airborne monitoring techniques. (DOE O 458.1 Section 4. e.)

Criteria:

1. Doses to members of the public [including both the maximally exposed individual and the populations in the vicinity of the site] from airborne effluents have been evaluated with the CAP-88 model or another EPA-approved model or method. (DOE O 458.1 Section 4.e.8)
2. Meteorological monitoring is sufficient [and site-specific] to characterize atmospheric dispersion and model the dose to members of the public over distances commensurate with the magnitude of potential source terms and possible pathways to the atmosphere. (DOE O 458.1 Section 4.e.9.c)
3. Site-specific environmental monitoring criteria have been established to ensure that representative measurements of quantities and concentrations of [potentially airborne] radiological contaminants are conducted and that the effects from DOE demolition activities on members of the public and the environment are monitored sufficiently to demonstrate compliance with applicable dose limits. (DOE O 458.1 Section 4.e.10)
4. Processes and procedures have been established to ensure that airborne radiological effluent monitoring and sampling are effectively performed to identify airborne releases and trends, and to identify and address environmental impacts. (DOE O 458.1 Section 4.e.9)

Lines of Inquiry

- Has an approved atmospheric dispersion model been established for evaluating doses to the public and the environment considering relevant exposure modes and pathways from DOE activities? What were the criteria for selecting this model? Are doses less than DOE's all-pathways limit of 100 mrem/year and ALARA? Are doses through the air pathway less than 10 mrem/year?

- Is there a program in place to obtain representative meteorological data necessary to provide input into the atmospheric dispersion model and to assess the impact of routine and non-routine releases commensurate with the level of site activities?
- Are parameter sensitivities and uncertainties in modeling results properly justified and documented?
- Have results obtained through computer-based modeling of airborne radiological effluents been compared and evaluated against modeling performed for the site's Annual Site Environmental Report, as well as previous demolition activities, and field or laboratory data? How did they compare and how were differences justified?
- Does the documentation for selection of the site's radiological air effluent monitoring instruments include the rationale for the design and selection of monitoring locations, procedures and equipment, frequency and analyses for each sample extraction, minimum detectable concentration and uncertainty, quality assurance components, and investigation and alarm levels?
- Have applicable lessons learned and operating experience related to dose evaluations from radiological releases to the environment been incorporated into the processes and plans?
- Are self- and performance assessments of the radiological air effluent monitoring program periodically conducted to document acceptable performance and continuous improvement in the effluent monitoring program?
- What systems are in place for performing and recording calibration and maintenance activities associated with field and laboratory instrumentation?
- Is a validated and consistent approach to guide sample acquisition, sample handling, sample preparation, sample analysis, and statistical treatment of the resulting data, and quality assurance verifications applied to ensure data meet program-specific needs and requirements?
- How are analytical methods and results systematically reviewed and evaluated to demonstrate compliance with applicable limits and provide an adequate technical basis for the environmental radiation monitoring program?

ER 4: Environmental monitoring, including airborne radiological effluent monitoring and meteorological monitoring has been planned and/or implemented to detect and characterize routine and non-routine releases of radioactive material during decommissioning and demolition activities. (DOE O 458.1 Section 4.e.)

Criteria:

1. Effluent monitoring for radiological contamination deposition and air sampling will be conducted (e.g., using continuous air monitors (CAMs) and Fixed Air Samplers (FASs)) at strategic locations and in real-time/near-real-time to evaluate radiological conditions and environmental impacts. (10 CFR 835.403.a.3; DOE O 458.1 Section 4.e.9)
2. Real-time meteorological monitoring will be used during demolition to determine if actual weather conditions are within parameters used for planning and to make necessary adjustments to operations. (DOE O 458.1 Section 4.e.)

Lines of Inquiry

- Is a program in place to evaluate non-routine releases and assess the impacts of such releases on the public and the environment? How well does it provide the data needed to help determine the transport and fate of radionuclides released to the atmosphere, and the assessment of their impacts on the public and the environment?
- How are continuous monitoring results addressed when a significant potential exists for approaching or exceeding a large fraction of the emission standard (e.g., 20 percent)? Do these systems have alarms that provide timely warnings to signal the need for pausing work and taking corrective actions?

- Have applicable lessons learned and operating experience related to environmental monitoring been incorporated into the processes and plans?
- Is real-time meteorological data available to assess the impact of non-routine releases commensurate with the level of site activities?
- What are the meteorological criteria that are used to determine if weather conditions the day of demolition are within those used to estimate dose to the public through atmospheric modeling?

REVIEW APPROACH

Conducting an assessment remotely relies heavily on document reviews and personnel interviews, with no opportunities for direct observations of jobs being performed. These document reviews, and interviews, along with video conferences and photographs will be used as the basis to verify the assessment criteria.

Record Reviews:

Contractor Documents:

- Contractor organization charts showing management and staff involved in environmental and occupational radiation protection, monitoring, and reporting
- Documented demolition plans to include:
  - Method to characterize radiological contamination within the facility being demolished (include references to alternate methodology as applicable)
  - Meteorological data used for input to the atmospheric dispersion model
  - Radiological records and data used for input to the atmospheric dispersion model
- Roles and responsibilities of contractor management relative to demolition activities
- Environmental radiation protection policies, program plans, and implementing procedures (with those procedures and programs specific to open-air demolition noted)
- ALARA Program information including rationale for open-air demolition
- Annual Site Environmental Reports (most current, and the preceding 4 years, or other specific periods when demolition activities were conducted), and associated back-up or source documentation
- Training and qualification records for personnel doing environmental radiological monitoring
- Listing of radiological monitoring equipment (to include associated detection capabilities, location, frequency of collection and analysis, etc.)
- Radiological monitoring data from previous demolition activities on site (a sample of results from direct reading instrumentation and laboratory analysis to allow review of methodology and results for comparison)
- List of previous demolition activities on site, and approximate dates
- Documentation of lessons-learned from previous DOE complex demolition activities (e.g., Hanford PFP contamination event, etc.) and previous site-specific demolition activities, and evidence that these lessons were reviewed and incorporated into the planning for open-air demolition
- Recent internal and external environmental radiation protection audits and assessment reports (covering current and previous 4 years)
- Documentation of recent issues, non-conformances, causal analysis, and corrective actions related to environmental radiation protection (covering current and previous 4 years)
- Printouts/electronic files of the atmospheric dispersion model
- Contract List B, or other list of applicable codes, especially state environmental codes & requirements

DOE Documents:

- DOE Field Office organization chart office showing management and staff involved in environmental radiation protection, monitoring, and reporting
- Roles and responsibilities of DOE Field office management relative to demolition activities
- Training and qualification records for DOE Field office personnel performing oversight of the environmental radiation protection program for demolition
- List and contact information for EPA regulators responsible for review and approval of demolition plans
- Correspondence between DOE and EPA relative to demolition planning

Interviews:

- DOE Field Office Executive Management
- DOE Field Office managers and SMEs for environmental radiation protection
- DOE Facility Representatives
- Contractor Program Managers as well as radiological engineers, supervisors, technicians, and other staff responsible for radiation protection, including ALARA reviews, RWP preparation, and occupational and environmental radiological surveys and monitoring
- Contractor personnel responsible for development of atmospheric dispersion model, including inputs and assumptions
- Contractor personnel responsible for effluent environmental radiological control, monitoring and surveillance
- Contractor or subcontractor personnel involved in environmental radiological laboratory and sample analysis

Observations (remotely):
Note: Actual remote observations are dependent on planned work scopes and availability of contractor work groups during the assessment period. The contractor should make every effort to support the remote assessment by enabling remote observations of relevant environmental and radiological work activities, as listed below.

- Pictures and/or video tours of proposed demolition work zone
- Pictures and map(s) of site and surrounding area showing locations of existing or planned environmental radiological monitoring stations for use during demolition activities. Photos and map(s) should also indicate 1) radiological buffer and contamination zones, 2) site boundaries and location (direction and distance) to closest public receptor (maximally exposed offsite individual).
- Pictures of activities involving detection and control of radiological effluents
- Remote observation of field activities involving onsite and offsite walkdowns and inspections of environmental radiological monitoring stations
- Remote observation of work activities involving radiological sample handling and laboratory analysis
- Remote observation of planning meetings for demolition effort
- Remote observation of ALARA review committee