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Low-Level Radioactive Waste Management Criteria Review and Approach Document		
Authorization and Approval	C.E. (Gene) Carpenter, Jr. Director Office of Nuclear Safety and Environmental Assessments, EA-31 Date: March 25, 2019	Lead, Timothy F. Mengers Nuclear Engineer EA-31 Date: March 25, 2019

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 responsibilities referenced in DOE Order 435.1, *Radioactive Waste Management*, section 5 and assigned to EA in in section I 2 C of DOE manual 435.1-1, *Radioactive Waste Management Manual*, to conduct independent appraisals and audits of DOE waste management programs and to review site waste management plans with regard to compliance with DOE environment, safety, and health 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 is available at http://www.energy.gov/ea/criteria-and-review-approach-documents.

2.0 APPLICABILITY

This CRAD is approved for use by assessment teams within the Office of Environment, Safety and Health Assessments, EA-30. This CRAD only applies to reviews associated with radioactive waste categorized as low-level waste (LLW), as defined by the *Nuclear Waste Policy Act of 1982*, as amended. This CRAD does not address spent nuclear fuel, high-level waste, or transuranic waste. Unless managed in a low-level waste facility, this CRAD does not address utilization of by-product material as defined by the *Atomic Energy Act of 1954*, as amended, or naturally occurring radioactive material.

3.0 FEEDBACK

Comments and suggestions for improvements on this CRAD can be directed to the Director, Office of Environment, Safety and Health Assessments, at (301) 903-5392.

4.0 CRITERIA REVIEW AND APPROACH

The basic principles of an effective low-level radioactive waste management program for DOE operations must accomplish the goals of Federal and State laws and regulations and Government and Department policy. These are reflected in DOE requirements including DOE Order 435.1, and by reference with DOE Manual 435.1-1, as well as DOE Order 458.1, *Radiation Protection of the Public and the Environment*. Guidance for implementation of DOE M 435.1-1 are provided in DOE Standard 5002-2017, *Disposal Authorizations and Tank Closure Documentation*, and DOE Guide 435.1-1, *Implementation Guide for use with DOE M435.1-1*.

Additional regulations from the Environmental Protection Agency, from the Department of Transportation and other DOE orders may also be applicable to various DOE radioactive waste management operations. Applicable EPA regulations include portions of the *Resource Conservation and Recovery Act* (RCRA) (40 CFR Parts 239-282) applied to hazardous wastes; *Toxic Substance Control Act* (TSCA) (40 CFR Parts 700-799), which principally address wastes containing PCBs or asbestos; and, the *Comprehensive Environmental Response, Compensation , and Liability Act* (CERCLA) (42 USC 9601). These requirements are implemented through the federal and State EPA and through various state agreements. DOT requirements for packaging and transportation of wastes on public off-site roadways is found in 49 CFR Part 173.

Radioactive waste management programs are complex and should incorporate the guiding principles and core functions of integrated safety management (ISM). The safety management practices for low-level radioactive waste facilities incorporate general facility safety management programs and processes as required by DOE Order 420.1 C, *Facility Safety*, DOE STD 3009, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, and other DOE policies, orders, and standards including conduct of operations, maintenance, engineering, materials handling, occupational safety, radiation safety, criticality safety, chemical safety, quality assurance, and emergency management, as well as specific criteria for protection of the environment and long-term potential for risks to members of the public. The requirements of these programs are incorporated into waste management performance objectives, as applicable.

The majority of the criteria identified in this CRAD are drawn directly from DOE Manual 435.1-1, *Radioactive Waste Management Manual* Chapter I and Chapter IV unless otherwise noted.

Radioactive waste management is divided into functional areas with distinct hazards and controls governed by specific regulatory criteria identified in the order and the manual. This CRAD is organized into criteria and lines of inquiry applicable to each area as follows:

- 4.1 Radioactive Waste Management Planning and Generic Safety Requirements
- 4.2 Radioactive Waste Identification, Characterization, and Monitoring
- 4.3 Radioactive Waste Generation
- 4.4 Radioactive Waste Accumulation, Storage, or Staging
- 4.5 Processing, Treatment, and Packaging Operations
- 4.6 Waste Transportation
- 4.7 Waste Disposal
    - 4.7.1 Disposal Facility Siting and Approval
    - 4.7.2 Disposal Facility Design and Operations
    - 4.7.3 Facility Closure and Post-Closure Surveillance and Maintenance
- 4.8 DOE Field Element Oversight

Review of activities at any facility involving radioactive waste will include applicable elements of 4.1 and 4.2. Review of activities at specific facilities may include some or all of the additional functional areas described in 4.3 through 4.7 of this CRAD.

4.1 Radioactive Waste Management Planning and Generic Safety Requirements

OBJECTIVE

Radioactive waste management activities shall be systematically planned, documented, executed, and evaluated to protect site workers, public health and safety, and the environment by ensuring that waste will be properly managed from generation to disposal in accordance with applicable regulations and DOE programs. (DOE Order 435.1, DOE Manual 435.1-1 Chapters I and IV.)

CRITERIA

1. <u>Radioactive Waste Management Basis.</u> Facilities, operations, and activities that generate, handle, process, store, package, transport or dispose of low-level waste shall have a radioactive waste management basis consisting of physical and administrative controls to ensure the protection of workers, the public, and the environment.

    - Has a site-wide waste management strategy been developed?
    - Has a radioactive waste management basis (RWMB) been established encompassing each facility, operation, and activity involving radioactive waste?
    - Has the RWMB been reviewed, and approved by the appropriate DOE authorities?
    - Does the radioactive waste management basis include
        - identification of the Waste Acceptance Criteria (WAC) for each type of radioactive waste to be handled;
        - analysis of the hazards and controls associates with each type of waste; and,
        - limitations on the total inventory and aggregation of wastes?
    - Does the RWMB reference the applicable elements identified in Chapter IV, Section D of DOE

Manual 435.1-1 or cross walk DOE directives to the equivalent protective functions that conform to the EPA (CERCLA) or other state or local requirements and agreements?

- Does planning for new projects identify activities and processes with potential to generate mixed or radioactive waste and consider processes for waste minimization or elimination?
- Does the waste management aspect of the project planning incorporate ISM through identification and analysis of the hazards, and development of appropriate controls?
- Are pathways for processing and disposal identified for each type of waste or are appropriately evaluated long term safe storage strategies identified and approved?

2. Site Evaluation and Facility Design. Proposed locations for low-level waste facilities shall be evaluated to identify relevant features that should be avoided or must be considered in facility design and analyses. Each site proposed for a new low-level waste facility or expansion of an existing low-level waste facility shall be evaluated considering environmental characteristics, geotechnical characteristics, and human activities. Sites with environmental characteristics, geotechnical characteristics, and human activities for which adequate protection throughout the performance life of the facility cannot be provided through facility design shall be deemed unsuitable for the location of the facility.

   - Does the site characterization address environmental characteristics, geotechnical characteristics, and human activities, that could impact the safety of the facility for its useful life?

3. Hazards Analysis and Controls. Hazards associated with the planned radioactive waste management facility, operation, and activity have been identified, analyzed, and documented. (Hazards and controls associated with specific radioactive waste management activities are discussed in the following sections.)

   - Do hazards identification processes comprehensively address hazards associated with waste handling?
   - Do control processes adequately address identified hazards associated with waste handling?
   - Are work monitoring processes capable of detecting and responding to off normal conditions in an effective and timely manner?

4. Worker Safety and Health – Industrial Safety. Policies, procedures, available maintained equipment, and personnel training assure safe material handling practices are implemented.

   - Are adequate programs, procedures, practices, and equipment in place to assure safety of workers with respect to industrial hazards (10 CFR 851) associated with waste generation, handling, processing, storage, packaging, transporting and disposal (e.g., lifting and rigging, stacking, LOTO, container degradation, reactivity, and pressurization)?

5. Training and Qualification of Personnel. Training is provided to all personnel associated with the management of radioactive wastes, including planning, identification, characterization, monitoring, generation, storing, staging, processing, treating, packaging, transportation and disposal to ensure they are competent commensurate with their responsibilities for compliance with the requirements of applicable regulations and DOE programs.

   - Is a documented and approved technical training and qualification program effectively implemented to ensure that workers have the appropriate knowledge, skills, and abilities to perform their required duties?

6. Quality Assurance Program. All radioactive waste facilities, operations, and activities have a quality assurance program (QAP) in accordance with applicable regulations and DOE programs. The QAP is implemented commensurate with the radiological hazards and risks to ensure the protection of workers, the public, and the environment.

   - Has the site developed and maintained a written QAP for all radioactive waste facilities, operations, and activities that takes into account training and qualifications, quality improvement, document and records management, process design, material and service procurement, inspections and acceptance testing, and independent assessments?

   - Are quality reviews and assessments performed to verify implementation of the QAP for radioactive waste management?

7. Work Planning and Control. Work planning and control processes are established in procedures and effectively implemented. These processes include task or job-specific hazard analysis, hazard controls, job planning, work authorization, coordination and communications with operations and maintenance personnel, and after-action critique for lessons learned.

   - Are work planning and control processes established and effectively implemented?
   - Do these work planning and control processes include processes to identify and control job specific hazards, work planning, work authorization, communications, and after action critique, as necessary depending upon the level of complexity of the activity?
   - Do work planning and control processes adequately address monitoring and controls specific to the hazards for unique operations or for plausible off normal conditions.

8. Integrated Safety Management. Appropriate safety management programs and practices including Radiation Control, Industrial Hygiene, Fire Protection and Emergency Management, Criticality Safety (as applicable), Maintenance, Industrial Safety, Training and Qualifications are established and implemented in effective procedures.

   - Are Safety Management Programs required by the safety basis such as Radiation Control, Industrial Hygiene, Fire Protection and Emergency Management, Criticality Safety (as applicable), Maintenance, Industrial Safety, and Training and Qualifications, properly implemented in procedures and supported with adequate technical capability?

9. Waste Minimization and Pollution Prevention. Radioactive waste management facilities, operations, and activities shall implement waste minimization and pollution prevention to meet the requirements of Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*, and Executive Order 13101, *Greening the Government through Waste Prevention, Recycling, and Federal Acquisition,* and DOE Order 436.1, *Departmental Sustainability*. To the extent practical, processes should be analyzed and designed to minimize the generation of radioactive or hazardous wastes.

   - Has the site developed and implemented a radioactive waste minimization program as part of the DOE-wide annual waste minimization plan?
     - Does the program include the elements identified in the DOE and U.S. Environmental Protection Agency (EPA) guidance documents?
     - Is the program compliant with the requirements of the Pollution Prevention Awareness Plan and specific substitution and recycling guidelines?

- Is there is a process for conducting cost-benefit analyses to determine the feasibility of radioactive waste minimization and pollution prevention projects?
- Are volume reduction and source reduction an integral part of the management of radioactive wastes?
- Are radioactive wastes that are potentially amenable to treatment evaluated for treatment as required?

  - Are wastes potentially amenable to recycling evaluated as part of the overall site waste management plan?

10. Life Cycle Asset Management. Planning for processes that generate radioactive waste shall incorporate Life Cycle Asset Management. Prior to waste generation, planning shall be performed to address the entire life cycle for all low-level waste streams. To the extent feasible wastes should not be generated unless a clear disposal path has been identified. Generation processes shall include planning for necessary radioactive waste characterization, segregation, processing, packaging transportation and final disposal.

- Is planning performed to address the entire life cycle for all radioactive waste prior to waste generation (cradle to grave)?
  - Has process knowledge been incorporated for legacy wastes?
- Is a site-wide program for life cycle asset management effectively implemented to assure all new processes that generate radioactive waste streams are identified?
- Are characterization processes and estimates determined before the generation or receipt of radioactive waste at a treatment, storage, or disposal facility?
- Are Disposal paths determined before the generation or receipt of radioactive waste at a treatment, storage, or disposal facility?
- Has a process been developed and implemented to identify a path for disposition for each waste?
- Has approval of generation of wastes with no identified path to disposal been based on a review of the programmatic need for generation of the wastes, characteristics and issues preventing disposal, and safe storage of the wastes until disposal can be achieved?
- Has DOE headquarters line management been notified of wastes with no identified path for disposal?

11. Records Management. A records management system is established and maintained to document radioactive waste generated, treated, stored, transported or disposed. The applicable requirements of DOE Order 200.1 *Information Management Program* and DOE Order 414.1 *Quality Assurance* are included. Additional records for mixed hazardous waste are provided, as needed.

- Has the facility developed a records-keeping system consistent with DOE and other regulatory agency requirements?
- Is there a clearly defined procedure for records management and archiving?
- Are records maintained on the waste characterization and generation rates?
- Are inventory, characterization, and monitoring records appropriately reviewed, analyzed for significance and/or compliance, documented, and archived?
- Are waste shipping papers maintained at the site for inspection purposes in accordance with applicable requirements?
- Are records of waste shipments, waste placements, and cell inventories properly maintained and archived in accordance with an established plan?

- Are records of all required environmental monitoring (for example, fence line monitoring, in facility monitoring, effluent monitoring, ground water, leachate, and surface water monitoring) maintained in accordance with an established data and records management plan?
- Are records maintained in a retrievable format and stored in an environmentally-controlled location?
- Are retention periods clearly defined and adequate to support uses during long term institutional control and monitoring periods?

- Do records provide sufficient detail and explanation for accurate interpretation by future reviewers?

12. Federal, State and Local Government Controls. The accumulation, storage or staging of radioactive wastes shall conform to applicable Federal, state or local environmental, effluent, permitting, transportation, emergency response, and community right to know requirements. If appropriate, compliance agreements and memorandum of understanding (MOUs) are established and maintained.

    - Does the facility conform to local or state environmental, effluent, permitting, transportation, emergency response, and community right to know requirements?
    - Are MOUs and other compliance agreements in place, maintained, and current?

13. Emergency Planning. The facility must establish or be included in an emergency management program that provides effective organizational management and administrative control of the facility/activity emergency management program by establishing and maintaining authorities and resources necessary to plan, develop, implement, and maintain a viable, integrated, and coordinated Comprehensive Emergency Management System in accordance with DOE Order 151.1D.

    - Is an Emergency Response Organization (ERO) established and maintained for the facility or activity?
    - Do facility personnel participate in a continuing emergency preparedness program of training, drills, and exercises?
    - Do facility personnel maintain up to date instructions or procedures for recognizing and declaring facility alert or emergency conditions?
    - Are facility personnel knowledgeable of alert and emergency response procedures?
    - Have facility personnel exercised, drilled, and/or demonstrated competence with alert and emergency response procedures in accordance with required drill and exercise frequencies?
    - Are emergency notification contacts maintained up to date and accessible to facility personnel?
    - Are communications and emergency notification systems tested and verified to be functional in accordance with established procedures and frequencies?

14. Waste with No Identified Path to Disposal. Headquarters shall be notified of the decisions to generate a waste with no identified path to disposal. Low-level waste streams with no identified path to disposal shall be generated only in accordance with approved conditions which, at a minimum, shall address:

    (a) Programmatic need to generate the waste;
    (b) Characteristics and issues preventing the disposal of the waste;
    (c) Safe storage of the waste until disposal can be achieved; and
    (d) Activities and plans for achieving final disposal of the waste.

- Has headquarters been notified prior to the generation of radioactive waste with no identified path to disposal, including conditions under which radioactive waste may be generated?

- Are all wastes that are potentially amenable to treatment evaluated for treatment as required? Are wastes potentially amenable to recycling evaluated as part of overall site waste management plans?

15. Analysis of Environmental Impacts. Existing and proposed radioactive waste management facilities, operations, and activities shall meet the requirements of 10 CFR Part 1021, *National Environmental Policy Act Implementing Procedures*; and DOE Order 451.1A, *National Environmental Policy Act Compliance Program*.

16. Analysis of Operations Information. Data that measure the environment, safety, and health performance of radioactive waste management facilities, operations, and activities shall be identified, collected, and analyzed as required by DOE Order 210.1, *Performance Indicators and Analysis of Operations Information*.

4.2 Radioactive Waste Identification, Characterization, and Monitoring

OBJECTIVE

Programs are in place to ensure that:

- Radioactive waste is managed in a manner that both protects facility workers, co-located workers, the public, and the environment, and meets the waste management requirements of DOE, Environmental Protection Agency (EPA), Department of Transportation (DOT), and State and local regulations.
- Radioactive waste streams are identified and the physical, chemical, and radiological characteristics of the waste are adequately determined.
- Monitoring and assessment of the physical, chemical, and radiological characteristics of the waste at each phase of the radioactive waste management process assures conformance with the WAC and safe handling requirements. (DOE Order 435.1, DOE Manual 435.1-1 Chapters I and IV.)

CRITERIA

1. Waste Stream Identification and Characterization**.** The facility has established processes that assure hazardous and radioactive waste streams are properly identified and characterized. Waste stream characterization and analysis processes and capabilities are designed and implemented to verify conformance with the WAC. Processes incorporate appropriate levels of documentation and clearly defined data quality objectives and limiting conditions.

   - Are effective processes in place for monitoring and accurately characterizing waste streams?
   - Is a site-wide program effectively implemented to assure all new process that generate or receive radioactive waste streams are identified?
   - Are appropriate test methods and/or process knowledge used to determine the regulatory/program status (, high-level, transuranic, or low-level radioactive, etc.) of existing and new waste streams?
   - Does characterization data, at a minimum, include physical and chemical characteristics; volume, including any solidification, stabilization or absorbent material; identities, activities and

concentrations of radionuclides or source information and specific chemicals of concern, e.g., chlorinated solvents; weight of containers; characterization date; generating source; packaging date?

- Are change control processes implemented for modification in the characterization procedures and/or measurement and test equipment?
- Are periodic quality control or validation measurements and analysis performed to identify changes in the waste streams that could impact the initial waste characterizations and waste stream profiles?

2. <u>Waste Acceptance Criteria</u>: Each facility receiving waste for: accumulation, storage, or staging; processing, treatment, or repackaging; shipping; or, final disposal, shall have a defined WAC. The waste acceptance requirements for all low-level waste operations and activities shall specify, at a minimum, the following:

   (a) Allowable activities and/or concentrations of specific radionuclides.
   (b) Acceptable waste form and/or container requirements that ensure the chemical and physical stability of waste under conditions that might be encountered during storage, treatment, transportation, or disposal.
   (c) Restrictions or prohibitions on waste, materials, or containers that may adversely affect the safety of the waste handlers or compromise facility or waste container performance.

   - Are appropriate WAC, conforming to the facility's radioactive waste management basis and safety basis, established and approved for each type of waste in the facility?

3. <u>Monitoring to Certify WAC conformance</u>: Each facility that receives and handles low-level radioactive waste shall have effective analysis, monitoring, and/or inventory records processes to certify the wastes conform to the WAC, the facility safety basis, and inventory limitations. Measurement, analysis, and process records techniques shall be sufficient to verify all aspects of WAC compliance (radiological, chemical, and physical attributes). Characterization data shall, at a minimum, include the following information relevant to the management of the waste:

   (a) Physical and chemical characteristics;
   (b) Volume, including the waste and any solidification media;
   (c) Radionuclides or source information sufficient to describe the approximate radionuclide content of the waste; and
   (d) Sufficient data to clearly identify any hazardous characteristics that may degrade the ability of packages or facility structures, systems, and components to perform their radioactive waste management and safety functions.

   - Are adequate receipt, shipment, and inventory records reviewed and maintained to verify conformance to the WAC and safety basis limitations?
   - Are periodic surveillances, measurements, or analysis performed to verify conformance to the WAC and safety basis limitations?
   - Do monitoring, testing, and assay processes include appropriate methods to detect hazardous waste constituents, potential incompatibilities of the wastes constituents, and characteristics that could adversely impact the health and safety of the workers, impact facility operations, degrade the integrity of waste containers, or impact the stability of the disposal facility?

- Do characterization measurement and analysis processes effectively address all critical characteristics of the WAC?
- Are effective change control processes implemented such that waste streams are re-characterized whenever the production processes generating the waste, or treatment processing and packaging processes are modified?
    - Is a change control process implemented to address changes in the receiving facility WAC?
- Do waste characterization programs take into account decay and ingrowth of radionuclides?
- Is there an effective measurement system to classify waste prior to disposal to assure efficiency and effective use of disposal facility capacity?
- Does the facility have an effective disposal change control procedure (i.e., Unreviewed Disposal Question Evaluation and Special Analyses) to verify changes that potentially impact waste disposal have been reviewed and approved?

4. <u>Data Quality</u>: A data quality objectives process, or a comparable process, shall be used for identifying characterization parameters and acceptable uncertainty in characterization data. Measurement and analysis procedures shall clearly define acceptance criteria and response actions for non-conforming results. Measurement and analysis shall be conducted using established, documented, and effective calibration, instrument maintenance, and measurement quality control processes.

    - Is a data quality objective process, or comparable process, established and effective for identifying characterization parameters and acceptable uncertainty?
    - Is an established and effective measurement quality control process implemented assuring measurement and test equipment are calibrated, maintained, and functionally capable of accurately performing the intended measurements?
    - Are measurement and analysis procedures established and effectively implemented with clearly defined acceptance criteria and response actions for non-conforming results?
    - Are measurement processes and instruments maintained with appropriate calibrations and data quality controls?

5. <u>Certification for Transfer</u>. A documented waste certification process shall be established and implemented assuring:

    (a) Waste packages are appropriately assessed and certified prior to transfer.
    (b) Documentation of the package contents and characteristics is transferred to receiving facilities and appropriately archived.
    (c) Designation and training of officials who have the authority to certify and release waste for shipment;
    (d) Specification of what review, analysis, and documentation is required for waste generation, characterization, shipment, and certification.
    (e) Provisions are included for traceability of the records to the specific identifiable waste generators, packages, and/or bulk shipments.
    (f) Provisions are included for auditability, retrievability, and storage of required documentation with a specified records retention period.

    - Is a documented and approved certification process established and effectively implemented prior to transfer of wastes that satisfies the requirements of the DOE Manual 435.1?
    - Do the certification programs ensure that the waste acceptance requirements of off- and on-site treatment, storage, and disposal facilities are met?

4.3 Radioactive Waste Generation

OBJECTIVE

Generators of radioactive waste shall develop, submit for review and approval, and implement a program for waste generation planning. This program shall address identification and characterization of waste, collection and segregation of the waste, life cycle planning for treatment and disposal options, preparation of waste for transfer, certification that waste meets the receiving facility's radioactive waste acceptance criteria, and transfer of waste. (DOE Order 435.1, DOE Manual 435.1-1 Chapters I and IV.)

CRITERIA

In addition to the generic criteria from sections 4.1 and 4.2 that apply, the following specific criteria should be considered:

1. <u>Identification and Characterization</u>. The waste generation facility has established processes that assure hazardous and radioactive waste streams are properly identified and characterized. Waste stream characterization and analysis processes and capabilities are designed and implemented to verify conformance with the WAC**.** Processes incorporate appropriate levels of documentation and clearly defined data quality objectives and limiting conditions.

    - Does a site-wide program exist and is it effectively implemented to assure all new processes that generate radioactive waste streams are identified?
    - Is this program described in the approved Radioactive Waste Management Basis covering that facility, operation, or activity?
    - Are effective processes in place for monitoring and accurately characterizing waste streams?
    - When historic process information or acceptable knowledge (AK) is used as a basis to determine waste characterization, are adequate quality assurance verification or measurement processes used to identify anomalies?

2. <u>Hazards Analysis and Control</u>. Hazards associated with the generation and handling of wastes are identified. Processes are developed, designed, and implemented for the safe collection, segregation, and analysis of generated wastes. Appropriate control sets are developed and implemented to address these hazards. Control sets include engineered controls, administrative process controls, training, and monitoring. Where applicable, these hazards and controls are documented and addressed in the facility safety basis, technical safety requirements, and implementing procedures.

    - Does the radioactive waste management basis (RWMB) adequately identify types of radioactive waste generated, hazards associated with the waste, controls for the hazards, and pathways for disposition?
    - Are hazards associated with the generation, handling, and analysis of wastes identified and adequately communicated to the appropriate personnel?
    - Are hazards controls adequately identified in procedures and appropriately implemented?
    - Are monitoring processes adequate to identify off normal conditions that may impact worker of facility safety?
    - Are monitoring, detection, and task specific controls adequate to protect workers and facilities from reasonably foreseeable off-normal conditions?
    - Are limitations on aggregation and storage or staging of wastes properly implemented?

3. Mixed Low-Level Waste. Low-level waste determined to contain source, special nuclear, or byproduct material subject to the *Atomic Energy Act of 1954*, as amended, and a hazardous waste component subject to RCRA, as amended, shall be managed in accordance with the requirements of both RCRA and DOE Order 435.1, *Radioactive Waste Management*. Low-level radioactive waste containing polychlorinated biphenyls, asbestos, or other such regulated toxic components shall be managed in accordance with requirements derived from both the *Toxic Substances Control Act*, as amended, and DOE Order 435.1, *Radioactive Waste Management*.

   - Are appropriate controls in place to identify, assess, monitor, and control RCRA and TSCA regulated mixed wastes?
   - Has an appropriate crosswalk been performed assuring conformance to DOE (Manual 435.1) and applicable EPA (RCRA, TSCA, CERCLA) requirements?
   - Has the site evaluated Federal and state requirements for mixed waste management under Federal and state regulations and agreements such as the Federal Facility Compliance Act?
   - Are compliance agreements established which the site tracks and regularly reports the status of?
   - If milestones are missed, is the site taking appropriate action to ensure that the waste continues to be managed safely?

4. Waste Stream Disposition. Waste treatment or disposal paths are identified for each waste stream. Waste Acceptance Criteria for treatment, storage, or disposal facilities are identified, incorporated into procedures and practices, and communicated to applicable personnel.

   - Are processes for identifying waste streams implemented and communicated to applicable personnel?
   - Are all waste streams adequately identified and characterized?
   - Are waste handling and disposition processes adequately implemented and communicated to the appropriate personnel?
   - Do all waste handling facilities have adequately developed Waste Acceptance Criteria?
   - Are WAC and inventory controls for each facility adequately maintained and implemented?

5. Packaging. Waste packaging procedures are developed and implemented that conform to the WAC and applicable transportation regulations. Packaging processes must ensure compatibility with waste constituents. Change control and review processes are implemented to assure material compatibility and conformance to the WAC.

   - Is off-site packaging and shipping performed in accordance with applicable DOT regulations?
   - Does on-site storage packaging adequately consider the time period for storage and potential for package degradation, pressurization, or constituent reactivity?

6. Certification and Documentation. A documented waste certification process has been established and implemented. (This may or may not be incorporated in the RWMB). Waste packages are appropriately certified prior to transfer. Documentation of the package contents and characteristics is transferred to receiving facilities and appropriately archived. The waste certification program shall designate the officials who have the authority to certify and release waste for shipment; and specify what documentation is required for waste generation, characterization, shipment, and certification. The program shall provide requirements for auditability, retrievability, and storage of required documentation and specify the records retention period.

   - Is a documented waste certification procedure developed and implemented?

- Does the procedure adequately identify the data quality objectives, and acceptable assay or data collection processes required for characterization?
- Are certification officials appropriately trained and authorized?
- Is characterization and WAC compliance appropriately certified for each package or shipment prior to transfer?
- Is documentation of waste package contents and characteristics transferred to the receiving facility and appropriately archived?
- Are records management and archiving requirements including auditability, retrievability, and data retention identified in the procedures and adequately implemented?

7. Transfer. Acceptance by the receiving facility is verified prior to transfer of wastes. Shipping or transfer to other facilities is performed and documented in accordance with applicable transportation regulations, implemented in accordance with appropriate local procedures, and performed by trained and knowledgeable personnel.

   - If being transferred to a DOE-owned facility, are receiving facilities approving transfers based on WAC compliance certification prior to transfer?
   - Prior to transfer or wastes, has the receiving facility been notified and agreed to receipt?
   - Are transfers of wastes conducted in accordance with applicable transportation regulations and/or on-site transfer procedures?

4.4 Radioactive Waste Accumulation, Storage, or Staging.

OBJECTIVE

Waste accumulated, stored, or staged with the intent for further actions (i.e., analysis and characterization, packaging, long-term storage, treatment, transportation, disposal or recycle) is collected in appropriately designed, maintained, and controlled facilities, using equipment and procedures to minimize potential for exposure to personnel, risks to members of the public, and environmental release of contaminants. (DOE Order 435.1, DOE Manual 435.1-1 Chapters I and IV, 10 CFR 851, DOE Order 420.1C, Attachment 2)

CRITERIA

In addition to the generic criteria from sections 4.1 and 4.2 that apply, the following specific criteria should be considered:

1. Hazards Analysis and Controls. Hazards associated with the accumulation, storage, and staging of wastes have been identified, analyzed, and documented. An appropriate set of controls have been identified in the facility safety basis and implementing procedures. Hazard analysis and controls consider: Material at Risk inventory limits; potential emergency situations such as fires, or natural phenomenon hazards; criticality if applicable; container degradation process such as corrosion, chemical reactivity, pressurization, flammable gas generation, and radiolytic processes; off gassing and facility ventilation controls; and biological intrusion.

   - Does the RWMB reference the appropriate documents which identify each type of waste received; analyze the hazards and controls associated with each type of waste; specify limitations on the total inventory and aggregation of wastes; identify path ways for disposition of the wastes; and, identify the WAC for subsequent processing or disposal facilities?

- Does the facility's Safety Basis address hazards unique to the aggregation or accumulation of wastes such as potential for criticality, container degradation processes such as corrosion, chemical reactivity, pressurization, flammable gas generation, radiolytic processes; off gassing and facility ventilation controls; and biological intrusion?
- Are hazards associated with the handling, analysis, and aggregation of wastes identified?
- Are personnel trained on the hazards, as appropriate for their job?
- Are appropriate controls in place to mitigate the hazards?

2. Handling Capacity. Facilities shall be designed to accommodate the projected volume of waste to be received. Engineering controls shall be incorporated in the design to monitor volume inventory data and to prevent spills, leaks, and overflows from tanks or confinement systems.
   - Does the facility maintain sufficient capacity for handling anticipated volumes of waste and appropriate contingencies for off normal conditions or process disruptions?
   - Are appropriate systems or procedures in place to monitor inventories?
   - Are engineering controls implemented and maintained to prevent or contain spills, leaks or overflows?

3. WAC and Inventory Control. Waste acceptance criteria for receipt of material for accumulation, storage or staging are established based on the facility allowable inventories and handling capabilities in conformance to the facility Safety Basis and hazards analysis. Processes are established and implemented to assure inventory controls, WAC conformance, and documentation of wastes container constituents. Receipt shall not be authorized unless the supplying facility can certify and document conformance to the WAC. Facility inventory records are maintained to accurately reflect receipt, effluent release, transformation, and transfer of wastes and hazardous materials. Audit and inventory reconciliation processes are implemented.

   - Are received wastes verified by certification and monitoring to conform to the WAC and inventory limitations?
   - Are prohibitions on waste characteristics that could adversely impact the safety of workers or the facility identified, understood, and maintained?
   - Do inventory control processes assure inventory records accurately reflect the physical inventories? Are inventories periodically audited and reconciled?
   - Are WACs for subsequent treatment or disposal facilities identified for each waste type received?
   - Is an adequate monitoring and assessment process developed and implemented supporting certification of conformance to the WACs for subsequent facilities prior to transfer?
   - Are processes established to address receipt, handling, and/or return of non-conforming wastes?

4. Storage Prohibitions: Low-level waste in storage shall not be readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water. Prior to storage, pyrophoric materials shall be treated, prepared, and packaged to be nonflammable. Low-level waste that has an identified path to disposal shall not be stored longer than one year prior to disposal, except for storage for decay, or as otherwise authorized by the Field Element Manager.

   - Is the composition of the waste sufficiently stable to provide assurance that the waste will not detonate, explode, deflagrate, or otherwise react in a dangerous manner during handling and storage?
   - Does treatment and packaging assure the waste will remain nonflammable under expected storage conditions?
   - Are limitations on the time of storage properly implemented or addressed with required authorizations?

- Is the field manager notified if wastes must be stored for longer than the one year?

5. Storage Integrity. Low-level waste shall be stored in a location and manner that protects the integrity of waste for the expected time of storage. Storage facilities are designed and maintained with environmental controls appropriate for conditions to maintain waste container integrity for the duration of the storage period, i.e., temperature, humidity. Processes are established to monitor and assure container integrity. Changes in container conditions or packaging are evaluated and addressed through documented engineering review, change control, lessons learned, and/or corrective action processes as applicable.

   - Are facilities designed and maintained with appropriate environmental controls to maintain waste container integrity?
   - Are adequate procedures developed and implemented to monitor container integrity?
   - Do procedures for monitoring consider ALARA risk controls for workers?
   - Are procedures in place to safely respond to identified degradation of waste packaging?
   - Are appropriate engineering review and lessons learned procedures and practices implemented to address changes in container and packaging conditions, certifications, or requirements?

6. Facility Design and Operation. Storage facilities are designed and maintained with appropriate ventilation controls considering both normal conditions such as regular container off-gassing, and/or potentially off-normal situations such as a container breach. Storage facilities are designed and maintained to control contamination or prevent release of the material during normal operations and during off-normal conditions such as the breach of a container, or emergency event. Storage facilities are designed and maintained with appropriate monitoring and controls for personnel exposures to direct radiation, contamination, chemical, and physical hazards, considering both normal and potential off-normal situations.

   - Are facility structures, systems and components including ventilation systems, containment systems, leak detection systems, emergency detection and alarm systems, fire suppression systems, monitoring systems, and environmental controls adequately designed and maintained to assure the safety of workers, the public, and the environment during normal and reasonably anticipated off-normal conditions?
   - Are appropriate programs, procedures and practices in place to monitor and protect workers from exposure to radiation and/or chemical hazards?
   - Are adequate procedures and practices in place and implemented to assess and control effluents, facility contamination, and other exposures?

7. Disposition. Waste treatment or disposal paths are identified for each waste type in storage. WAC for subsequent treatment or disposal facilities are identified, incorporated into procedures and practices, and communicated to applicable staff.

   - Are waste treatment or disposal paths identified for each type of waste in storage?
   - Are handling, storage, treatment, WAC and disposition requirements and limitations identified and incorporated into procedures?
   - Are staff appropriately trained and knowledgeable of the handling, storage, treatment, WAC and disposition requirements and limitations?

8. Certification and Documentation. A documented waste certification process is established and implemented. Waste packages are appropriately monitored and documentation is reviewed to certify the waste conforms to the receiving facility WAC prior to transfer. Documentation of the package

contents and characteristics is transferred to receiving facilities and appropriately archived. The waste certification program shall designate the officials who have the authority to certify and release waste for shipment; and specify what documentation is required for waste generation, characterization, shipment, and certification. The program shall provide requirements for auditability, retrievability, and storage of required documentation and specify the records retention period.

- Is a documented waste certification procedure developed and implemented?
- Are waste packages are appropriately monitored and is documentation is reviewed to certify the waste conforms to the receiving facility WAC prior to transfer?
- Is documentation of the package contents and characteristics is transferred to receiving facilities?
- Are authorized certification officials appropriately designated and trained to specify, review and certify the characterization and shipping documentation?
- Do procedures include data management requirements for auditability, retrievability, and storage of documentation and specify the records retention periods?
- Are data management requirements adequately implemented?

9. Transfer: Acceptance by the receiving facility is verified prior to transfer of wastes. Shipping or transfer to other facilities is performed and documented in accordance with applicable transportation regulations, implemented with appropriate local procedures, and performed by trained and knowledgeable personnel.

   - Are receiving facilities approving transfers based on WAC compliance certification prior to transfer?
   - Are transfers of wastes conducted in accordance with applicable transportation regulations or on site transfer procedures?

4.5 Processing, Treatment, and Packaging Operations

OBJECTIVE

Waste processing, treatment and packaging operations (activities performed to: separate wastes; reduce volumes; remove or reduce chemical, physical, or other characteristic hazards; stabilize waste form; repackage; or otherwise modify wastes to conform to a WAC) are appropriately designed and implemented. The facilities, equipment, and procedures used in these operations are maintained and controlled as necessary to ensure potential for exposures or risks to facility personnel, co-located workers, the public, and the environment are as low as reasonably achievable (ALARA). (DOE Order 435.1, DOE Manual 435.1-1 Chapters I and IV, 10 CFR 851)

CRITERIA

In addition to the generic criteria from sections 4.1 and 4.2 that apply, the following specific criteria should be considered:

1. Hazards Analysis and Controls. Hazards associated with the processing, treatment and packaging of waste have been identified, analyzed, and documented. An appropriate set of controls have been identified in the facility safety basis and implementing procedures. Hazard analysis and controls consider: Material at Risk inventory limits; potential emergency situations such as fires, or natural phenomenon hazards; criticality if applicable.

- Is a documented radioactive waste management basis established for the facility?
- Does the facility safety basis incorporate an accurate and complete analysis of the hazards associated with the processes and operational activities considering both normal and reasonably anticipated off-normal conditions?
- Does the facility safety basis incorporate an adequate set of hazard controls to assure the safety of the workers, co-located workers, members of the public, and the environment?

2. WAC and Inventory Control. WAC for receipt of material to the facility are established based on the facility process capabilities in conformance to the facility safety basis and hazards analysis. Transfer for receipt shall not be authorized unless the supplying facility can certify conformance to the WAC. Proper documentation is received, reviewed, approved, and records are retained. Facility inventory records are maintained to accurately reflect receipt, effluent release, transformation, and transfer of wastes and hazardous materials. Effective audit and inventory reconciliation processes are implemented.

    - Does the radioactive waste management basis include identification of the WAC for each type of received waste; analysis of the hazards and controls associates with each type of waste, limitations on the total Material at risk inventory and aggregation of wastes; identified treatment path ways for disposition of the wastes; and identified WAC for subsequent disposal or long term storage facilities?
    - Are received wastes verified by certification and monitoring to conform to the WAC and inventory limitations?
    - Are prohibitions on waste characteristics that could adversely impact the safety of workers or the facility identified, understood by facility personnel, verified and maintained?
    - Do inventory control processes assure inventory records accurately reflect the physical inventories? Are inventories periodically audited and reconciled?

3. Ventilation Controls. Treatment and process facilities are designed and maintained with appropriate ventilation controls considering both normal conditions that may be encountered during the anticipated processing activities, such as off gassing while opening received containers or process generated particulates, gasses, or aerosols, and/or potentially off normal situations such as an energetic event, or process area fire. Ventilation controls shall prevent deflagration or detonation; protect health and safety of facility workers from acute and chronic exposures; assure airborne effluents are maintained within applicable requirements and guidelines.

    - Are ventilation controls installed to support current missions including waste inspection, analysis, processing, stabilization, sorting, and repackaging and storage?
    - Are ventilation controls as installed adequate to prevent deflagration or detonation; protect health and safety of facility workers from acute and chronic exposures; assure airborne effluents are maintained within applicable requirements and guidelines?
    - Are ventilation systems appropriately designed, monitored, and maintained?

4. Facility Design and Operation. Treatment and process facilities are designed and maintained with appropriate monitoring and controls for personnel exposures to direct radiation, contamination, chemical, and physical hazards, considering both normal and potential off normal situations. Treatment and process facilities are designed and maintained to control contamination or prevent or minimize release of the material during normal operations and during off normal conditions or emergency events. Engineering controls shall be incorporated in the design and engineering of low-level waste process and treatment facilities to provide process volume inventory data and to prevent spills, leaks, and overflows from tanks or confinement systems. Monitoring and/or leak detection

capabilities shall be incorporated in the design and engineering of low-level waste processing and treatment facilities to provide rapid identification of failed confinement and/or other abnormal conditions. Areas in new and modifications to existing low-level waste management facilities that are subject to contamination with radioactive or other hazardous materials shall be designed to facilitate decontamination. For such facilities a proposed decommissioning method or a conversion method leading to reuse shall be described.

- Are installed designed features adequate for the current missions?
- Are installed design features appropriately monitored and maintained?
- Are appropriate administrative procedures, and monitoring capabilities implemented to control personnel exposures to direct radiation, contamination, chemical, and physical hazards, considering both normal and potential off normal situations?
- Are effective contamination controls implemented and maintained to prevent or minimize release of the material during normal operations and during off normal conditions or emergency events?
- Are appropriate and effective design features, administrative controls, and monitoring in place to prevent spills or leaks, and to detect and respond to leaks in a timely manner?
- Are decontamination and decommissioning plans in place and considered as part of the facility design?
- Do decontamination and decommissioning plans address the changing missions and need for additional controls for invasive system inspections and dismantling, waste processing and stabilization, and waste packaging.

5. <u>Worker Safety and Health – Industrial Safety</u>. Process and treatment facilities and systems are designed, maintained, and managed in conformance to 10 CFR 851 *Worker Safety and Health*. Policies, procedures, available maintained equipment, and personnel training assure safe material handling practices are implemented. Appropriate testing, surveillance, and maintenance; configuration management; change controls; and procurement inspection quality controls, and calibrations are established for structures, systems, components, and monitoring and test equipment, and personal protective equipment that could impact worker health and safety.

   - Does the facility conform to applicable NFPA requirements? Are life safety code egress distances, markings, and lighting appropriate, maintained, and tested? Are fire detection and alarm capabilities adequately designed, installed, maintained, and tested? Are fire suppression systems adequately designed, installed, maintained, and tested? Are emergency response plans and capabilities established and exercised?
   - Are industrial safety hazards in process activities identified and controlled with appropriate design features and administrative controls assuring conformance to 10CFR851? Are processes for configuration management; testing, surveillance, and maintenance; calibration; change control; and procurement inspection quality controls effectively implemented for systems, structures, and components (SSCs), monitoring and test equipment, PPE and work planning that could impact worker health and safety?

6. <u>Safety Management Programs</u>. Appropriate Safety Management Programs and practices including Radiation Control, Industrial Hygiene, Fire Protection and Emergency Management, Criticality Safety (as applicable), Maintenance, Industrial Safety, Training and Qualifications are established and implemented in effective procedures.

   - Are safety management plans (SMPs) for Radiation Control, Industrial Hygiene, Fire Protection and Emergency Management, Criticality Safety (as applicable), Maintenance, Industrial Safety, Training and Qualifications incorporated into procedures, adequately supported, integrated into work planning and controls, and effectively implemented?

7. Change Control. Change control, engineering review, and unresolved safety question determination (USQD) processes are implemented to assure safety throughout the processing and treatment operations and to assure material compatibility and conformance to the disposal or receiving storage facility WAC.

8. Waste Forms. Low-level waste processing, treatment, and packaging must contribute to long-term stability and performance of the subsequent disposal or storage facility, minimizing subsidence, contact of water with waste, and the need for long-term active maintenance, and provide more stable waste forms for final disposal:

   (a) Void spaces within the waste and, if containers are used, between the waste and its container shall be reduced to the extent practical.
   (b) Liquid low-level waste or low-level waste containing free liquid must be converted into a form that contains as little freestanding liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the waste volume when the low-level waste is in a disposal container, or 0.5 percent of the waste volume after it is processed to a stable form.
   (c) Low-level waste must not be readily capable of detonation or of explosive decomposition or reaction at anticipated pressures and temperatures, or of explosive reaction with water. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable.
   (d) Low-level waste must not contain, or be capable of generating by radiolysis or biodegradation, quantities of toxic gases, vapors, or fumes harmful to the public or workers or disposal facility personnel, or harmful to the long-term structural stability of the disposal site.
   (e) Low-level waste in a gaseous form must be packaged such that the pressure does not exceed 1.5 atmospheres absolute at 20°C.
   (f) Packaging must ensure compatibility of waste constituents.

   - Do facility processes adequately address final waste form stabilization criteria?
   - Is the facility meeting standards pertaining to use and management of containers (condition, compatibility, kept closed, markings, and quantity restrictions)?

9. Characterizations and Waste Product Analysis. Waste product characterization and analysis processes and capabilities are designed and implemented to verify conformance with all aspects of the WAC. Processes incorporate clearly defined data quality objectives, limiting conditions, and acceptance criteria, and specify appropriate levels of documentation. Measurement and analysis equipment is verified to perform the intended function and an appropriate calibration and measurement data quality control and review process is implemented.

   - Are final form waste characterization and analysis capabilities adequate to assure conformance to all required aspects of the disposition facility WACs?

10. Certification and Documentation. A documented waste certification process has been established and implemented. Waste packages are appropriately certified prior to transfer. Documentation of the package contents and characteristics is transferred to receiving facilities and appropriately archived. The waste certification program shall designate the officials who have the authority to certify and release waste for shipment; and specify what documentation is required for waste generation, characterization, shipment, and certification. The program shall include provisions for auditability, retrievability, and storage of required documentation and specify the records retention period.

- Are appropriate waste certification processes established and effectively implemented?

11. Transfer. Acceptance by the receiving facility is verified prior to transfer of wastes. Waste packaging procedures are developed and implemented that conform to the WAC of the receiving facility and applicable transportation regulations, implemented in accordance with appropriate local procedures, and performed by trained and knowledgeable personnel.

    - Is acceptance of the characterization and approval for transport from the receiving facility verified prior to shipment?
    - Are waste transfers conducted in accordance with applicable DOT and/or local site transportation requirements?

4.6 Waste Transportation

OBJECTIVE

Radioactive waste shall be packaged and transported in accordance with DOE Order 460.1A, *Packaging and Transportation Safety*, and DOE Order 460.2, *Departmental Materials Transportation and Packaging Management,* using adequate packaging, placarding, marking, and labeling, and means of transport, as well as proper documentation as prescribed by applicable EPA, DOT, DOE, and State regulatory programs (see 49 CFR 173 subpart I). This includes adherence to DOT regulations (or site-specific procedures providing equivalent measures of safety) when transporting materials classified as hazardous materials within site boundaries. (DOE Order 435.1, DOE Manual 435.1-1 Chapters I and IV.)

CRITERIA

In addition to the generic criteria from sections 4.1 and 4.2 that apply, the following specific criteria should be considered:

1. Packaging: Wastes are contained in a manner that prevents release or distribution under conditions reasonably anticipated during transportation. Wastes prepared for transportation are packaged in accordance with applicable DOT or site transportation requirements. Waste packaging conforms to the applicable DOT package types and certifications or for on-site transport, a locally approved equivalent. (See 49 CFR §173.410 – 440.)

    - Do waste packages conform to the appropriate DOT requirements for package type and integrity?
    - Do the shipping organizations have documentation of the testing, certification, and QA of the packages?

2. Transport Classification: Wastes are classified appropriately in accordance with DOT 173.1 (typically class 7 radioactive materials with appropriate subsidiary classifications).

    - Do waste shipments off-site conform to DOT requirements?
    - Are DOT requirements applied to on-site transfers of waste between facilities? If not, what are the differences, and do they provide an equivalent level of safety and control of the material?

3. Labeling: Wastes containers are labeled in accordance with the applicable DOT or site requirements based on the classifications, package types, specific activities, dose rates, waste forms, and other contents.

    - Are waste packages properly labeled?

4. Placarding: Transport vehicles are appropriately placarded in accordance with applicable requirements based on the waste characteristics.

    - Are waste transport vehicles properly placarded?

5. Monitoring: Waste container and transport vehicles are monitored for accessible contamination prior to shipments and levels are verified to conform to applicable limits in 49 CFR 173. Levels are verified to conform to the appropriate limitations considering the type of packaging, transport vehicle, and route controls. Transport vehicles and packages are monitored for radiation levels and contamination upon receipt. Empty vehicles are monitored for radiation levels and contamination prior to release. Processes are in place to identify and respond to variations between pre and post shipment monitoring results, non-conformance with the radiation and contamination limitations for the type of shipment, or issues with the release of the empty transport vehicles or containers.

    - Are adequate surveys of waste containers and shipment transport vehicles conducted, documented and reviewed prior to release of each shipment? Are pre and post shipment measurements compared and discrepancies addressed?
    - Are shipment monitoring results consistent with waste characterization and certification information?
    - Are adequate receipt surveys of shipments conducted, reviewed, and documented? Is there an effective process for responding to non-conforming shipments?
    - Are adequate clearance surveys conducted prior to release of empty transport vehicles? Is a process established to respond to residual contamination or increases radiation levels?
    - Are effective emergency notification and response procedures established for transportation incidents?

6. Manifests and Documentation: Shipment manifests, package labeling, and supporting documentation are accurate. Records are properly reviewed, approved, and archived in accordance with established procedures.

    - Are manifests properly prepared for waste shipments?
    - Are shipping manifests consistent with package characterization and WAC certification documentation?
    - Do manifests accurately reflect pre-and post shipment monitoring and measurement records and results?
    - Do manifests include appropriate transportation incident emergency notifications and response instructions?

7. Training and Authorizations: Personnel involved with the monitoring, certification, packaging, labeling, placarding, manifest document preparation and transport are trained and qualified for the assigned duties.

    - Are all individuals associated with packaging, shipment surveillance, and transport properly trained and re-trained in accordance with DOT requirements?

4.7 Waste Disposal

OBJECTIVE

Low-level radioactive waste disposal facilities are sited, designed, operated, and closed in a manner that protects site workers, current and future public health and safety, and the environment by ensuring that waste will be properly managed in accordance with applicable regulations and DOE programs. Specifically, there should be a reasonable expectation that the following performance objectives will be met.

(a) Dose (total effective dose equivalent from all exposure pathways, excluding the dose from radon and its progeny in air) to representative members of the public shall not exceed 25 mrem in a year.
(b) Dose (total effective dose equivalent, excluding the dose from radon and its progeny) to representative members of the public via the air pathway shall not exceed 10 mrem in a year.
(c) Release of radon shall be less than an average flux of 20 pCi/m2/s at the surface of the disposal facility. Alternatively, a limit of 0.5 pCi/1 of air may be applied at the boundary of the facility. (DOE Order 435.1, DOE Manual 435.1-1 Chapters I and IV.)

4.7.1 Disposal Facility Siting and Approval

CRITERIA

In addition to the generic criteria from sections 4.1 and 4.2 that apply, the following specific criteria should be considered:

1. <u>Site Characteristics</u>: In addition to the site evaluation required during life-cycle radioactive waste planning (see 4.1), the following criteria apply:

   (a) Each site proposed for a new low-level waste facility or expansion of an existing low-level waste facility shall be evaluated considering environmental characteristics, geotechnical characteristics, and human activities, including for a low-level waste disposal facility, the capability of the site to demonstrate, at a minimum, whether it is:

      1. Located to accommodate the projected volume of waste to be received;
      2. Located in a flood plain, a tectonically active area, or in the zone of water table fluctuation; and,
      3. Located where radionuclide migration pathways are predictable and erosion and surface runoff can be controlled.

   (b) Proposed sites with environmental characteristics, geotechnical characteristics, and human activities for which adequate protection cannot be provided through facility design shall be deemed unsuitable for the location of the facility.
   (c) Low-level waste disposal facilities shall be sited to achieve long-term stability and to minimize, to the extent practical, the need for active maintenance following final closure.

   - Has a site evaluation been developed incorporating adequate analysis of geotechnical characteristics (ground water tables and mobility, soil composition, soil and slope mechanics) and environmental conditions (surface water, precipitation and run off, vegetation, animal activity, wind conditions, temperature and humidity conditions), and human activities that could affect the performance of the facility?

- Are the site and facility characteristics and design adequate for protection of the public and environment throughout the evaluation periods?
- Are the site characteristics and facility design adequate to achieve long term stability and minimize to the extent practical the need for active maintenance following final closure?

2. Performance Assessment: A site-specific radiological performance assessment and composite analysis shall be prepared and maintained. The performance assessment shall include calculations of potential releases from the facility and calculation of potential doses to representative future members of the public over a 1,000 year period after closure to provide a reasonable expectation that the performance objectives are not exceeded as a result of operation and closure of the facility.

   - Has a performance assessment been developed that establishes projected release rates for toxic or hazardous materials, and verifies projected doses over a 1000 year period are within the performance objectives? Are appropriate exposure scenarios and time frames considered for the assessments?
   - Has sufficient site assessment and monitoring been completed to support the assumptions in the performance assessment?
   - Has a WAC and total inventory limit been established considering the performance criteria?
   - Did the performance assessment consider conditions and data from other facilities in the area?
   - Did the performance assessment consider the impact of other co-located or adjacent facilities on site performance and monitoring?

3. Monitoring Plan: A preliminary monitoring plan for a low-level waste disposal facility shall be prepared and submitted to Headquarters for review with the performance assessment and composite analysis. Plans shall be implemented to assure sufficient monitoring of ground water, surface water, and gaseous or particulate effluent releases, and ambient radiation conditions to evaluate conformance to the Performance Assessment and Composite analysis objectives.

   - Has a monitoring plan been developed and approved by DOE HQ?
   - Is the monitoring plan adequate to inform and validate performance assessment modeling and assumptions?
   - Is the monitoring plan adequate to support continuing re-verification of the Performance Assessment and Composite Analysis?
   - Is the monitoring plan adequate to detect trends or conditions that could challenge the performance objectives?

4. Disposal Authorization Statement: Based on the performance assessment and composite analysis, a Disposal Authorization Statement (DAS) shall be obtained prior to construction of a new low-level waste disposal facility or expansion of an existing low-level waste disposal facility.

   - Has a DAS been approved and issued?
   - Are the terms and limiting conditions of the DAS implemented?

4.7.2 Disposal Facility Design and Operations

CRITERIA

In addition to the generic criteria from sections 4.1 and 4.2 that apply, the following specific criteria should be considered:

1. Hazards Analysis and Control: Hazards associated with the handling, sample or assay analysis, and disposal of waste have been identified, analyzed, and documented. An appropriate set of controls have been identified in the facility safety basis and implementing procedures. Hazard analysis and controls consider normal operations and potential off-normal conditions such as a container breach, facility fire, or natural phenomenon events.

   - Does a documented hazard analysis adequately address the issues for handling the wastes?
   - For each of the identified hazards, are appropriate engineering controls (SSCs) and/or administrative controls identified in the safety basis and implemented with appropriate procedures?
   - Are hazards associated with the handling, analysis, and aggregation of wastes identified and understood by the appropriate personnel? Are appropriate controls in place to mitigate theses hazards?
   - Is operational monitoring designed for the specific hazards and capable of detecting plausible off normal conditions in a timely manner?
   - Are controls stablished for the specific hazards and capable of addressing plausible off normal conditions when detected.

2. WAC and Inventory Control: Waste acceptance criteria for receipt of material to the facility are established based on the facility capabilities in conformance to the facility safety basis, hazards analysis, and limitations in the DAS. Processes are established and implemented to assure inventory controls, WAC conformance, and documentation of wastes container constituents. Facility inventory records are maintained to accurately reflect receipt, disposal, effluent (leachate or off-gassing) release, and decay transformation of wastes and hazardous materials. Audit and inventory reconciliation processes are implemented. Records archive processes are established to assure retrievability and traceability to specific waste generators, shipments, and packages.

   - Does the facility maintain sufficient capacity for handling anticipated volumes of waste and appropriate contingencies for off normal conditions or process disruptions?
   - Are received wastes verified by certification and monitoring to conform to the WAC, inventory limitations, and shipping manifests? Are prohibitions on waste characteristics that could adversely impact the safety of workers or the facility identified, understood, and maintained?
   - Are processes and procedures established and implemented for responding to waste shipments that do not conform to the WAC, inventory limitations, or documented shipping manifests?
   - Do inventory control processes assure inventory records accurately reflect the physical inventories? Are inventories periodically audited and reconciled?

3. Receipt Acceptance: A process is established to verify conformance to the WAC. The process may include a review of certification documentation, shipping manifests, periodic sampling, and/or monitoring of received packages or shipments. Transfer for receipt shall not be authorized unless the supplying facility can certify conformance to the WAC. The WAC certification documentation shall, at a minimum, specify conformance to the following:

   (a) Allowable activities and/or concentrations of specific radionuclides.
   (b) Acceptable waste form and/or container requirements that ensure the chemical and physical stability of waste under conditions that might be encountered during handling, transportation, storage as well as following final placement of the wastes.
   (c) Restrictions or prohibitions on waste, materials, or containers that may adversely affect waste handlers or compromise facility or waste container performance.

4. Support Facility and Disposal Cell Design and Operations: The following facility requirements and general design criteria, at a minimum, apply:

   (a) Low-level waste systems and components shall be designed to maintain waste confinement.
   (b) Ventilation: Staging, assay, and disposal facilities are designed and maintained with appropriate ventilation controls considering both normal conditions that may be encountered during the anticipated handling activities, such as off gassing and/or potentially off normal situations such as an energetic event, or area fire. Ventilation controls shall prevent deflagration or detonation; protect health and safety of facility workers from acute and chronic exposures; assure airborne effluents are maintained within applicable requirements and guidelines.
   (c) Disposal facilities are designed and maintained with appropriate monitoring and controls for personnel exposures to direct radiation, contamination, chemical, and physical hazards, considering both normal and potential off normal situations.
   (d) Disposal facilities are designed and maintained to control contamination or prevent or minimize release of the material during normal operations and during off normal conditions or emergency events.
   (e) Facilities shall include sufficient capacity for controlling site run off and dewatering of disposal cell operations (i.e., removal, containment, monitoring, and if necessary treatment, and/or effluent release of leachate and contact water).
   (f) Disposal facilities and systems are designed, maintained, and managed, to conform to applicable NFPA code requirements.

   - Are adequate ventilation controls designed, implemented, and maintained for receipt, analysis, and staging facilities?
   - Are adequate ventilation controls designed, implemented, and maintained for disposal emplacement activities?
   - Do ventilation controls adequately address radiological and hazardous materials releases for protection of the workers, public, and the environment?
   - Do ventilation controls adequately address potential for container pressurization, venting, radiolytic processes, and flammable gas generation and protection against deflagration or detonation?
   - Are adequate in-facility and site boundary airborne and radiation monitoring processes, practices, and equipment implemented and maintained?
   - Do airborne and area monitoring results verify conformance to the performance objectives and worker exposure limitations?
   - Are adequate SSC installed and administrative controls implemented to control contamination and prevent release of material during normal and off normal conditions?
   - Is appropriate equipment deployed, maintained, calibrated, and appropriately used to monitor for contamination in the facility, and allow monitored clearance of material, personnel, equipment, and vehicles from the site?

5. Worker Safety and Health: Disposal facilities and systems are designed, maintained, and managed in conformance to 10 CFR 851, *Worker Safety and Health*. Specifically procedures and practices address materials handling, fall protection, excavation and trench controls, and heavy equipment and lifting operations. Appropriate procedures and practices are implemented for: inspection, testing, and maintenance of equipment; procurement inspection quality controls for equipment and personal protective equipment; and calibrations of surveillance and test equipment. Configuration management and change controls processes are established for structures, systems, components and operating practices that could impact worker health and safety.

- Are adequate policies, practices, and training implemented to assure worker safety and health conforming to 10 CFR 851? Specifically do these address industrial hazards related to excavation, lifting and rigging, respiratory protection, fall protection, LOTO?
- Is adequate equipment provided and properly maintained to address hazards regulated under 10 CFR 851?

6. Closure Plan: The disposal facility design and operation must be consistent with the disposal facility closure plan and lead to disposal facility closure that provides a reasonable expectation that performance objectives will be met:

(a) Operating procedures shall be developed and implemented for low-level waste disposal facilities that protect the public, workers, and the environment; ensure the security of the facility; minimize subsidence during and after waste emplacement; achieve long-term stability and minimize the need for long-term active maintenance; and meet the requirements of the closure/post-closure plan.
(b) Permanent identification markers for disposal excavations and monitoring wells shall be emplaced.
(c) Low-level waste placement into disposal units shall minimize voids between waste containers. Voids within disposal units shall be filled to the extent practical. Un-containerized bulk waste shall also be placed in a manner that minimizes voids and subsidence.
(d) Operations are to be conducted so that active waste disposal operations will not have an adverse effect on any other disposal units.
(e) Operations shall include a process for tracking and documenting low-level waste placement in the facility by generator source.

- Is void space in containers minimized to reduce long-term subsidence?
- Are voids between wastes containers adequately filled and compacted to minimize long-term subsidence?
- Is subsidence monitoring conducted and does it support the performance assessment assumptions?
- Are waste placements recorded to allow tracking of source terms to specific generators or shipments?
- Are waste placements consistent with the approved facility design and supportive of long term closure plans and site stability?

7. Monitoring: Capabilities and procedures shall be implemented to assure sufficient monitoring of ground, surface water, leachate or contact water, gaseous or particulate effluent releases, and ambient radiation conditions to evaluate conformance to the Performance Assessment. The monitoring plan shall be updated within one year following issuance of the disposal authorization statement to incorporate and implement conditions specified in the disposal authorization statement and address changes identified during operations. Plans will be reviewed and updated whenever changes in conditions or operations are identified.

(a) The site-specific performance assessment and composite analysis shall be used to determine the media, locations, radionuclides, and other substances to be monitored.
(b) The environmental monitoring program shall be designed to include measuring and evaluating releases, migration of radionuclides, disposal unit subsidence, and changes in disposal facility and disposal site parameters which may affect long-term performance.
(c) The environmental monitoring programs shall be capable of detecting changing trends in performance to allow application of any necessary corrective action prior to exceeding the performance objectives.

- Are monitoring plans and installed capabilities adequate to inform, evaluate, or validate the modeling parameters and assumptions supporting the performance assessment and composite analysis and DAS approval conditions?
- Does the monitoring include analytes that appropriately represent the waste constituents and mechanisms of migration?
- Are the monitoring locations and analysis techniques sufficient to detect migration of wastes that could challenge the performance objectives?
- Are results and trends of ground water, site runoff, and leachate analysis reviewed, incorporated into annual reports, and compared against modeling assumptions that supporting Performance Assessment and Composite Analysis and DAS? Are the monitoring results consistent with the performance assessment?

8. <u>Performance Assessment and Composite Analysis Maintenance</u>: The performance assessment and composite analysis shall be maintained to evaluate changes that could affect the performance, design, and operating bases for the facility. Performance assessment and composite analysis maintenance shall include the conduct of research, field studies, and monitoring needed to address uncertainties or gaps in existing data.

   (a) Performance assessments and composite analyses shall be reviewed and revised when changes in waste forms or containers, radionuclide inventories, facility design and operations, closure concepts, or the improved understanding of the performance of the waste disposal facility in combination with the features of the site on which it is located alter the conclusions or the conceptual model(s) of the existing performance assessment or composite analysis.
   (b) A determination of the continued adequacy of the performance assessment and composite analysis shall be made on an annual basis, and shall consider the results of data collection and analysis from research, field studies, and monitoring.
   (c) Annual summaries of low-level waste disposal operations shall be prepared with respect to the conclusions and recommendations of the performance assessment and composite analysis and a determination of the need to revise the performance assessment or composite analysis.

- Does the Performance Assessment indicate the performance objectives continue to be satisfied?
- Are the modeling assumptions and parameters adequately representative of the facility conditions as built and operated?
- Is the performance assessment modeling adequately updated and consistent with the results of monitoring and testing?
- Are the annual summaries submitted and reviewed in accordance with the expectations of DOE manual 435.1, the supporting guide, and DOE standard 5002?
- Do the annual summaries indicate continued adequacy of the performance assessments and reasonable assurance that the performance objectives will continue to be satisfied throughout the evaluation period?
- Does the composite analysis verify that projected doses to members of the public will remain within the specified dose limitations throughout the evaluation period?
- Is the composite analysis up to date and representative of current conditions as site remediation activities progress?
- Is the composite analysis appropriately used as a planning tool when evaluating remediation options?
- Are the modeling systems and platforms (computer software and hardware) used for the performance assessment and the composite analysis up to date and supportable

4.7.3 Disposal Facility Closure and post Closure Surveillance and Maintenance

CRITERIA

In addition to the generic criteria from sections 4.1 and 4.2 that apply, the following specific criteria should be considered.

1. <u>Closure Plan Development and Maintenance</u>: A preliminary closure plan shall be developed and submitted to Headquarters for review with the performance assessment and composite analysis. The closure plan shall be updated following issuance of the disposal authorization statement to incorporate conditions specified in the disposal authorization statement. Closure plans shall:

   (a) Be updated as required during the operational life of the facility.
   (b) Include a description of how the disposal facility will be closed to achieve long-term stability and minimize the need for active maintenance following closure and to ensure compliance with the requirements of DOE Order 458.1, *Radiation Protection of the Public and the Environment*.
   (c) Include the total expected inventory of wastes to be disposed of at the facility over the operational life of the facility.

   - Has a closure plan been developed and approved by DOE HQ line management?
   - Has the closure plan been updated, reviewed and approved as required?
   - Have appropriate ownership, management, and funding mechanisms been established to support post closure monitoring and maintenance during the institutional controls period?

2. <u>Prompt Closure Processes</u>: Closure of a disposal facility shall occur within a five-year period after it is filled to capacity, or after the facility is otherwise determined to be no longer needed.

   (a) Prior to facility closure, the final inventory of the low-level waste disposed in the facility shall be prepared and incorporated in the performance assessment and composite analysis which shall be updated to support the closure of the facility.
   (b) A final closure plan shall be prepared based on the final inventory of waste disposed in the facility, the plan implemented, and the updated performance assessment and composite analysis prepared in support of the facility closure.
   (c) Institutional control measures shall be integrated into land use and stewardship plans and programs, and shall continue until the facility can be released pursuant to DOE Order 458.1, *Radiation Protection of the Public and the Environment*.
   (d) The location and use of the facility shall be filed with the local authorities responsible for land use and zoning.

   - Are actual inventories consistent with (less than or equal to) approved final inventories?
   - Has the performance assessment and composite analysis been updated to reflect the final inventories?
   - Was final capping and closure implemented within 5 years of completion of active waste placement activities?
   - Has an adequate institutional control and stewardship plan been implemented including performance monitoring, site maintenance, and site security?
   - Have appropriate land use and permitting restrictions been filed with the local authorities?

3. Final Covers: Final covers shall be installed in a manner that supports long term conformance to the performance criteria. Final covers shall be installed to:

   (a) minimize intrusion of water in contact with the waste;
   (b) minimize migration of the waste into local ground or surface water;
   (c) minimize potential for future inadvertent intruders to penetrate into the waste following a period of administrative control; and
   (d) minimize potential for erosion, subsidence, or biologic activity to penetrate and expose the waste during the performance period.

   - Does the final cover as installed include adequate capabilities to minimize intrusion of water into the wastes and minimize migration of materials via ground water?
   - Does the final cap include provision to minimize potential for future inadvertent intruders to excavate into the waste?
   - Does the final grading and vegetation minimize the potential for erosion or contaminated run off?
   - Is adequate cell ventilation installed?

4. Institutional Controls and Monitoring Plans: Monitoring plans shall be implemented to support verification of performance objectives during a period of post closure administrative control.

   - Are monitoring wells in place to verify performance objectives are met during the institutional control period? Are monitoring wells appropriately placed to assess waste migration in accordance with a well-defined monitoring plan? Are monitoring wells appropriately identified with permanent warning markers?
   - Is a process established to assure monitoring and analysis during the institutional control period? Does this process include appropriately data quality objectives, defined result limits, and guidance on response to non-conforming results?
   - Are monitoring results periodically reviewed and analyzed for changes or trends that may indicate performance issues?
   - Is a records archive system in place that assures data will be safely maintained, retrievable, and readable throughout the institutional control period? Do records provide sufficient explanatory information or instruction so they can be properly interpreted by future reviewers?

5. Markers: Permanent cell closure warning markers shall be placed to identify the locations and boundaries of the closed waste cells.

   - Have permanent warning markers been properly place to identify the boundaries of the waste cells?

6. Institutional Controls and Monitoring for facilities that have been closed:

   - Is the monitoring plan appropriately implemented?
   - Is the monitoring and surveillance adequate to identify subsidence or other factors that could degrade facility performance?
   - Is the monitoring adequate to identify migration of wastes that could challenge the performance objectives?
   - Is maintenance adequately performed on the monitoring systems, ground vegetation, closure caps, and access barriers to support the long term performance of the facility?
   - Are the institutional controls sufficiently enforced and monitored to prevent inadvertent intruders or other inappropriate access to the wastes?
   - Are inventory and waste disposal records appropriately archived and maintained in a retrievable

and readable manner?
- If monitoring and surveillance indicates that the performance objectives may be challenged, are adequate actions taken to assure timely and effective remediation?

4.8 DOE Field Element Oversight

OBJECTIVE

DOE line management has established and implemented effective oversight processes that evaluate the adequacy and effectiveness of the contractor's radioactive waste management program. (DOE Order 226.1B)

DOE Line management maintains sufficient technical capability and knowledge of site and contractor activities to make informed decisions about hazards, risks, and resource allocation; provide direction to contractors; and evaluate contractor performance. (DOE Order 226.1B)

CRITERIA

1. Reports, Notifications and Approvals: DOE Field Offices submit reports to and request approvals from the Office of Environmental Management or other line management in coordination with the Low-Level Waste Disposal Facility Federal Review Group as required. This may include RWMB documents, initial and revised Disposal Authorization Statements, annual Performance Assessment and Composite Analysis reports and annual activity reports.

    - Does the Field Element Manager ensure radioactive waste management program activities are conducted in accordance with a RWMB and meet the requirements for radioactive waste management?
    - Are annual activity, composite analysis, and performance assessment reports provided to EM management for review?

2. Site Office Oversight Program: Oversight processes are tailored according to the effectiveness of contractor assurance systems, the hazards at the site/activity, and the degree of risk, giving additional emphasis to potentially high consequence activities.

    - Does the DOE field element oversight program include written plans and schedules for planned assessments, focus areas for operational oversight, and reviews of the contractor's self-assessment of processes for SSCs and SMPs?
    - Does the DOE field element have an effective issues management process that is capable of categorizing findings based on risk and priority; ensuring relevant line management findings are effectively communicated to the contractor; ensuring that problems are elevated and effectively corrected in a timely manner; and lessons learned are disseminated to address extent of condition issues.
    - Does the DOE field element maintain adequate technical capabilities (either on site or through agreements with headquarters, integrated service centers, or independent support contractors) to perform oversight and contractor performance evaluations with respect to all safety class and safety significant systems and safety management programs as required by applicable DOE orders?
    - Does the field element perform adequate independent evaluation and verification of contractor performance?

3. Facility Representatives (FRs): FRs provide effective routine operational awareness to determine that the contractor is operating DOE facilities in a safe manner.

   - Are FRs well-trained and qualified according to an established facility training and qualification program?
   - Is there adequate FR coverage for the facilities?
   - Are FRs performing facility assessments, surveillances, and reviews as scheduled and are the findings meaningful and consistent with facility performance?
   - Are FRs documenting operational awareness activities regularly and in accordance with implementing procedures?
   - Are FRs reviewing occurrence reports in a timely manner and ensuring that the root cause has been accurately determined and effective corrective action proposed and implemented?
   - Are FRs and safety basis reviewers provided guidance and appropriate training for recognition of issues where SSO or SME consultation or integration into assessment and oversight is necessary?

4. Safety System and Safety Management Program Oversight: The DOE field element has established and implemented effective processes using SSO and Subject Mater Expert (SME) in formal assessments and routine operational awareness activities (or comparable processes involving appropriately qualified FRs) to apply engineering and/or discipline specific expertise in its oversight of the assigned safety systems, to monitor performance of the contractor's cognizant system engineer (CSE) programs, and to provide assessment and oversight of the safety basis, and associated safety management programs.

   - Are SSOs and SMEs well-trained and qualified according to an established site and facility training and qualifications programs?
   - Is there adequate SSO and SME coverage and familiarity of the facilities systems and programs and procedures?
   - Do SSO personnel periodically assess the contractor's CSE programs?
   - Do SSOs perform periodic planned and documented assessments of safety system performance, equipment configuration, and material condition of assigned systems to verify the CSEs determinations assuring functionality, operability, reliability, and performance of assigned safety systems?
   - Are SMEs routinely participating in periodic assessments of implementation of the Safety Management Programs?
   - Are SMEs routinely included in reviews and assessments of safety basis related changes?
   - Are sufficient independent assessments performed to verify contractor performance?
   - Are appropriate technical reviews performed to evaluate long term stability and performance of facilities?
   - Do site office oversight activities ensure adequate recognition, control, and protection from long term risks and DOE liabilities?

APPROACH

The following provides an overview of the typical activities that will be performed to collect information to evaluate the management of radioactive wastes.

Record Reviews:
Review radioactive waste management and control policies and implementing procedures. Review site,

project, or facility policies, procedures, and corresponding documentation related to ISM core function and nuclear safety implementation. Review of documentation of specific radioactive waste management activities. The specific documents or procedures will vary depending on the facility type or activities assessed. The following is a generic list of typical documents to be reviewed, including both contractor and DOE field office documents.

Contractor Documents:

- Organizational charts showing all levels of staff involved in handling or processing radioactive materials, and the associated generation, accumulation, packaging, transportation, assay or analysis, and disposal of radioactive wastes
- Radioactive Waste Management Basis
- Radioactive Waste Management Plan(s)
- Radioactive Waste Transportation Plan(s), shipping manifests and procedures
- Waste Minimization and Pollution Prevention Plans for radioactive waste
- Radioactive Waste Spill Prevention and Control Plan
- Environmental Monitoring Plans and Schedules
- Documented Safety Analyses for the selected facility(s)
- Facility Radioactive Waste Acceptance Criteria, radioactive waste certification programs, and supporting analysis
- Radioactive Waste Inventory and Audit/Reconciliation Procedures
- Radioactive Waste Inventory Records
- Disposal Authorization Statements (for disposal facilities)
- Radioactive Waste characterization, analysis, and monitoring procedures
- Operating procedures associated with the selected radioactive waste management work activities.
- Institutional and/or facility-specific procedures involving radioactive wastes, including procedures (working level documents) for radioactive waste planning, identification, generation, characterization, packaging, accumulation, inspection, and preparation for shipment
- Procedures for performing Pre- and Post-Job Reviews, including Job Hazards Analysis
- Procedure for the development, preparation, revision, and use of procedures
- Samples of several current work packages in progress or scheduled for near term execution (including SOPs, etc.) for work involving radioactive wastes. Include associated job-specific hazard identification/assessments and ALARA reviews, if applicable
- List of training procedures, courses, lessons plans, and qualification requirements for radioactive waste operations management and staff
- Qualification records for key environmental protection and radioactive waste management personnel
- Lists of contractor assessments (including management and independent assessments) related to radioactive waste management, including generation, packaging, shipping, disposing (if appropriate) etc.

DOE Site Office Documents:

- Site Office organization chart
- Oversight Program implementing plans, procedures, and instructions/guidance, (including subordinate program and activity requirements documents, readiness reviews, contract performance evaluations, self-assessments, and issues management programs)
- Site Office programs, responsibilities, authorities, and expectations for safety basis reviewers, FRs, and SMEs related to oversight of the contractor

- Qualifications and training for site office oversight personnel [safety basis reviewers, safety system oversight, FR, SME, etc.]
- Contract List A and B requirements for the associated contract(s) for the selected facilities and radioactive waste management activities
- Contract performance objectives and criteria involving radioactive waste management, and DOE evaluation reports on these objectives and criteria for the current and past two years
- Safety Evaluation Reports or safety basis review tie-down documents relating to radioactive waste operations
- Examples of recent documents communicating the results of field element oversight results concerning radioactive waste management (e.g., periodic reports from the FR and/or SME walk-downs and reviews, issues, and findings transmitted to the contractor)
- List of corrective actions implemented by the contractor as a result of field element oversight of the contractor's management of radioactive wastes
- Site Office assessment plans and schedules for the past 3 years and the current fiscal year at the selected facility
- List of assessments (including internal self-assessments and external program reviews) performed in the last 3 years involving the contractor's management of radioactive wastes
- Lists of deficiencies, findings, observations, etc. associated with the management of radioactive materials and waste identified by the Site Office within the past 3 years
- Copy of last two Site Office or support center oversight assessments involving the contractor's management of radioactive materials and waste
- Documentation of reviews and approvals for storage of radioactive wastes in excess of 1 year if applicable
- Correspondence and/or approvals from EM HQ regarding site radioactive waste management basis
- Correspondence and/or approval documentation from EM HQ regarding use of commercial or off-site radioactive waste process, treatment, storage, or disposal options
- Correspondence and/or approval documentation from EM HQ regarding generation of radioactive wastes with no defined disposal options

Interviews:
Interview personnel including: those responsible for waste management oversight and supervision, subject matter experts, and implementing staff. The specific personnel interviewed will vary depending on the facility type or activities assessed. The following is a generic list of typical interview requests:

- Site Office Safety Basis reviewers
- Site Office SME for Radioactive Waste Management
- Site Office SME for Radiological Protection
- Site Office SME for Environmental Monitoring
- Site Office SME for Industrial Hygiene
- Facility Representatives
- Waste Management Program Manager
- Waste Management Program Supervisors
- Waste Operations Manager
- Waste Operations Supervisor
- Waste Operations Personnel
- Transportation Manager
- Transportation Coordinator
- Transportation Personnel
- Waste Engineering Manager

- Radiation Protection Manager
- Radiation Protection Supervisors
- Radiation Protection Technician(s)
- Measurements Laboratory personnel
- Environment, Safety, Health, and Quality Director
- Environmental Monitoring specialists and technicians
- Industrial Hygienists
- Permitting and MOU Coordinators
- Work Planning and Control Coordinator
- Pollution Prevention Coordinator
- Training Coordinator

Observations:

Perform facility/building walk downs and inspections, and observe selected work activities, such as waste treatment, storage, transport, and disposal facility operations.

- Facility operational demonstrations
- Facility and building walkdowns and reviews
- Facility or waste container radiological surveys
- Waste non-destructive assay or characterization activities
- Waste container loading operations
- Waste container overpacking operations
- Operational demonstration of waste handling and packaging activities
- Operational demonstration of waste transportation activities
- Operational demonstration of waste disposal

Appendix A

Acronyms used in this document:

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
CSE	Cognizant System Engineer
DOE	US Department of Energy
DOT	US Department of Transportation
EA	Office of Enterprise Assessments
EPA	US Environmental Protection Agency
FR	Facility Representative
ISM	Integrated Safety Management
LOTO	Lock-Out, Tag-Out
LLW	Low Level Waste
MOU	Memorandum of Understanding
NFPA	National Fire Protection Association
RCRA	Resource Conservation and Recovery Act
RWMB	Radioactive Waste Management Basis
SME	Subject Matter Expert
SMP	Safety Management Plan
SSC	Systems, Structures, and Components
SSO	Safety System Oversight
TQP	Technical Qualification Program
TSR	Technical Safety Requirement
TSCA	Toxic Substance Control Act
USQD	Unresolved Safety Question Determination
WAC	Waste Acceptance Criteria