U.S. Department of Energy Orders Self-Study Program

DOE O 435.1

RADIOACTIVE WASTE MANAGEMENT

ALBUQUERQUE OPERATIONS OFFICE

Change No: 0
DOE O 435.1
Level: Familiar
Date: 6/15/01

DOE O 435.1
RADIOACTIVE WASTE MANAGEMENT
FAMILIAR LEVEL

OBJECTIVES

Given the familiar level of this module and the resources listed below, you will be able to

1. Discuss the purpose and scope of DOE O 435.1, Radioactive Waste Management.

Note: If you think that you can complete the practice at the end of this level without working through the instructional material and/or the examples, complete the practice now. The course manager will check your work. You will need to complete the practice in this level successfully before taking the criterion test.

RESOURCES

DOE O 435.1, Radioactive Waste Management, 7/09/99.
DOE G 435.1-1, Implementation Guide for use with DOE M 435.1-1, 7/09/99.
DOE M 435.1-1, Radioactive Waste Management Manual, 7/09/99.
DOE Order 5400.5, Radiation Protection of the Public and the Environment, change 2, 1/7/93.
DOE/EM-0093, Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms, revision 1, May 1995.
DOE/RW-0333P, Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program, December 1998.
DOE/RW-0351P, Waste Acceptance System Requirements Document, revision 3, 1999.
10 CFR 61, Licensing Requirements for Land Disposal of Radioactive Waste.
40 CFR 191, Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes.
42 U.S.C. 2011-2259, Atomic Energy Act of 1954.
42 U.S.C. 6901 et. seq, Resource Conservation and Recovery Act of 1976, as amended.

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INTRODUCTION

DOE Order 5820.2A, Radioactive Waste Management, was issued by DOE in September 1988. As early as 1990, DOE began analyzing, assessing, and reviewing the process of implementing the Order. DOE revised the Order on radioactive waste management for several reasons:

- After thorough technical reviews and analyses, DOE and the Defense Nuclear Facilities Safety Board concluded that DOE Order 5820.2A did not adequately address the Department's radioactive waste management and disposal practices.
- There had been significant advances in radioactive waste management practices and changes in DOE since the Order was issued in 1988.
- Risk-based and performance-based requirements were determined to be prudent and necessary components of DOE's new directives system.
- Opportunities for stakeholder involvement, a key element of DOE decision making, needed to be provided.
- The technical basis for the DOE's radioactive waste management requirements and guidance needed to be documented.

The revised DOE Order, DOE O 435.1, with its accompanying contractor requirements document, Manual, and guidance documents, governs the management of DOE's radioactive wastes: high-level waste, transuranic waste, low-level waste, and the radioactive component of mixed waste.

The Order itself does not contain sufficient information to warrant much attention. This module will concentrate on the Guide and the Manual. We will cover the material in three sections:

- High-Level Waste Requirements
- Transuranic Waste Requirements
- Low-Level Waste Requirements

We have provided examples and a practice in the module to help familiarize you with the material. The practice will help prepare you for the criterion test.

Before continuing, you should obtain a copy of the resources. Copies of these documents are available on the Office of Management and Administration's Web site at http://www.directives.doe.gov or through the course manager. You may need to refer to these documents to complete the examples, practice, and criterion test.

SECTION 1 – HIGH-LEVEL WASTE REQUIREMENTS

DEFINITION OF HIGH-LEVEL WASTE

High-level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel. High-level waste includes

- liquid waste produced directly in reprocessing;
- any solid material derived from such liquid waste that contains fission products; and
- other highly radioactive material that requires permanent isolation.

WASTE INCIDENTAL TO REPROCESSING

Waste resulting from reprocessing spent nuclear fuel that is incidental to reprocessing is not high-level waste and shall be managed under DOE's regulatory authority according to the requirements for transuranic waste or low-level waste. When determining if spent nuclear fuel reprocessing plant wastes shall be managed as another waste type or as high-level waste, either the citation or evaluation process described below shall be used.

Citation waste includes spent nuclear fuel reprocessing plant wastes. These radioactive wastes are the result of reprocessing plant operations. Examples of wastes that have been characterized as citation waste include

- contaminated job wastes, a general category of wastes that are generated during high-level waste transfer, pretreatment, treatment, storage and disposal activities;
- protective clothing, personal protective equipment, work tools, ventilation filter media, and other job-related materials necessary to complete high-level waste management activities;
- sample media such as sampling vials, crucibles, and other hardware;

- decontamination media and decontamination solutions such as swabs and other decontamination work-related materials; and
- laboratory clothing, tools, and equipment.

Evaluation wastes may include spent nuclear fuel reprocessing plant wastes that will be managed as low-level or transuranic waste and meet the following criteria:

- residual radioactive tank wastes whose removal is not considered to be technically and economically practical;
- contaminated storage, pretreatment, and treatment equipment such as tank pumps and waste slurry processing tanks;
- thermocouple trees;
- vitrification melter components;
- failed vitrification melters;
- process filter media; and
- other process equipment that contains some amounts of waste in the form of slurry, salt, or glass.

The distinction between the two processes is important because it is clear from background events that citation process waste streams were so identified because of the ease of determining that they do not pose the long-term hazards associated with high-level waste. Evaluation process wastes, on the other hand, generally require a case-by-case evaluation and determination. Consistent with this understanding, the responsibility for citation interpretations rests solely with the field element manager, although consultation with the Office of Environmental Management is encouraged. However, the Office of Environmental Management consultation is required for waste that has been determined to be incidental through the evaluation process. Additionally, consultation with the Nuclear Regulatory Commission (NRC) should be considered for evaluation process determinations, although this is not required.

MANAGING SPECIFIC WASTES

Unless demonstrated otherwise, all high-level waste shall be considered mixed waste and is subject to the requirements of the Atomic Energy Act of 1954 and the Resource

Conservation and Recovery Act, as amended; DOE O 435.1, Radioactive Waste Management; and DOE M 435.1, Radioactive Waste Management Manual. High-level waste containing polychlorinated biphenyls, asbestos, or other such regulated toxic components shall be managed according to the Toxic Substances Control Act, as amended and DOE O 435.1, Radioactive Waste Management, and the Manual.

RADIOACTIVE WASTE MANAGEMENT BASIS

High-level waste facilities, operations, and activities shall have a radioactive waste management basis consisting of physical and administrative controls to ensure the protection of workers, the public, and the environment. The following specific waste management controls shall be part of the radioactive waste management basis:

- generators
- pretreatment and treatment facilities
- storage facilities

If a high-level waste management facility operates under an approved authorization basis, it may not need any additional controls to demonstrate that it has a radioactive waste management basis. In this case, the authorization basis documentation should be reviewed and evaluated to determine if it covers the requirements for a radioactive waste management basis.

QUALITY ASSURANCE PROGRAM

A high-level waste management facility needs to develop a quality assurance program to ensure that those items and activities important to waste acceptance and product quality are identified and controlled. An effective quality assurance program implements the requirements of DOE/RW-0333P, Quality Assurance Requirements and Description for the Civilian Radioactive Waste Management Program, including the audit and assessment requirements.

WASTE ACCEPTANCE

Waste acceptance requirements for all high-level waste storage, pretreatment, or treatment facilities, operations, and activities shall specify, at a minimum, the following:

- allowable activities and concentrations of specific radionuclides;
- acceptable waste forms that ensure the chemical and physical stability of the waste under conditions that might be encountered during transfer, storage, pretreatment, or treatment;
- the basis, procedures, and levels of authority required for granting exceptions to the waste acceptance requirements, which shall be contained in each facility's waste acceptance documentation; and
- pretreatment, treatment, storage, packaging, and other operations shall be designed and implemented in a manner that complies with DOE/EM-0093, Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms, or DOE/RW-0351P, Waste Acceptance System Requirements Document, for non-vitrified, immobilized high-level waste.

The waste acceptance requirements need to specify waste streams, classes, or categories of waste that require specific physical or chemical stabilization methods. The waste acceptance requirements need to identify the following technical requirements that must be included to ensure that waste received at any storage, pretreatment, or treatment facility is consistent with the operating/authorization basis of the facility:

- allowable heat generation rates;
- any radionuclides or chemical or hazardous materials that are prohibited from acceptance at the facility; and
- any specific requirements associated with acceptance of high-level waste needing out-of-the-ordinary attention for receipt, storage, pretreatment, or treatment.

WASTE GENERATION PLANNING

Before waste is generated, planning should be performed to address the entire life cycle of all high-level waste streams. High-level waste streams without an identified path to disposal shall be generated under approved conditions, which shall address

- programmatic needs to generate the waste,
- characteristics and issues preventing the disposal of the waste,
- safe storage of the waste until disposal can be achieved, and
- activities and plans for achieving final disposal of the waste.

WASTE CHARACTERIZATION

Waste characterization is defined as the identification of waste composition and properties, such as by review of process knowledge, or by nondestructive examination, nondestructive assay, or sampling and analysis, to comply with applicable storage, treatment, handling, transportation, and disposal requirements.

High-level waste shall be characterized using direct or indirect methods, and the characterization shall be documented to ensure safe management and compliance with the waste acceptance requirements of the facility receiving the waste.

Characterization data include the following information:

- physical and chemical characteristics;
- volume, including the waste and any solidification media;
- radionuclides or source information; and
- any other information that may be needed to demonstrate compliance with the requirements.

WASTE CERTIFICATION

A waste certification program shall be developed, documented, and implemented to ensure that the waste acceptance requirements of facilities receiving high-level waste for storage, pretreatment, treatment, and disposal are met.

The waste certification program shall designate the officials who have the authority to certify and release waste for shipment. The program shall provide requirements for auditability, retrievability, and storage of required documentation and specify the records retention period.

High-level waste shall be certified as meeting the waste acceptance requirements before it is transferred to the facility receiving the waste.

High-level waste that has been certified as meeting the waste acceptance requirements for transfer to a storage, pretreatment, treatment, or disposal facility shall be managed in a manner that maintains its certification status.

WASTE TRANSFER

High-level waste shall not be transferred to a storage, treatment, or disposal facility until personnel responsible for the facility receiving the waste authorize the transfer.

Waste characterization data and generation, storage, pretreatment, treatment, and transportation information for high-level waste shall be transferred with or be traceable to the waste.

The records and transfer requirements for canistered high-level waste forms shall comply with the requirements for non-vitrified, immobilized high-level waste.

SITE EVALUATION AND FACILITY DESIGN

Site Evaluation

Proposed locations for high-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 high-level waste facility or expansion of an existing high-level waste facility shall be evaluated considering environmental characteristics, geotechnical characteristics, and human activities.

Proposed sites with environmental characteristics, geotechnical characteristics, or human activities for which adequate protection cannot be provided through facility design shall be deemed unsuitable for the location of the facility.

Facility Design

The following elements are requirements in facility design:

- Safety structures, systems, and components shall be designed to requirements.
- High-level systems and components shall be designed to maintain waste confinement.
- Lifting devices shall be designed to prevent free fall of loads.
- Loading and unloading systems shall be designed with a reliable system of interlocks that will fail safely upon malfunction.
- High-level waste pretreatment, treatment, and storage facilities shall include ventilation through an appropriate filtration system.
- When conditions exist for generating gases in flammable and explosive concentrations, a ventilation system shall be provided to keep the gases in a non-flammable and non-explosive condition.
- Remote maintenance features to maintain as-low-as-reasonably-achievable (ALARA) personnel exposure shall be incorporated into each high-level waste facility.
- Designs for storage facilities shall incorporate features to facilitate retrieval capability.
- Designs for new tanks shall contribute to the confinement requirement by incorporating features to avoid critical degradation modes at the proposed site where practicable, or minimize degradation rates for the critical modes, and by incorporating features to facilitate execution of the structural integrity program.
- Engineering controls shall be incorporated in the design and engineering of high-level waste treatment storage, pretreatment, and treatment facilities to provide volume inventory data and to prevent spills, leads, and overflows from tanks or confinement systems.

STORAGE

The following requirements apply to facilities intended for management of high-level waste:

- A structural integrity program shall be developed for each high-level waste storage tank site to verify the structural integrity and service life of each tank to meet operational requirements for storage capacity.
- Canisters of immobilized high-level waste awaiting shipment to a repository shall be stored in a suitable facility; segregated and identified to avoid commingling with low-level, mixed low-level, or transuranic wastes; and monitored to ensure that storage conditions meet requirements.

Note: You do not have to do example 1 on the following pages, but it is a good time to check your skill and knowledge of the information covered. You may do example 1 or go to section 2.

EXAMPLE 1

1. Define high-level waste.

2. List three waste management controls that are required parts of a radioactive waste management basis.

3. Discuss the purpose of waste certification.

Note: When you are finished, compare your answers to those contained in the example 1 self-check. When you are satisfied with your answers, go to section 2.

EXAMPLE SELF-CHECK

1. Define high-level waste.

   High-level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products, and other highly radioactive material that requires permanent isolation.

2. List three waste management controls that are required parts of a radioactive waste management basis.

   Generators, pretreatment and treatment facilities, and storage facilities

3. Discuss the purpose of waste certification.

   Waste certification ensures that the waste acceptance requirements of facilities receiving high-level waste for storage, pretreatment, treatment, and disposal are met.

SECTION 2 – TRANSURANIC WASTE REQUIREMENTS

DISCUSSION

Many of the waste management requirements are common to all types of waste. We will not repeat the common requirements here. This section will discuss the requirements that are unique to transuranic waste.

DEFINITION OF TRANSURANIC WASTE

Transuranic waste is radioactive waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for

- high-level radioactive waste;
- waste which the Secretary of Energy has determined does not need the degree of isolation required by 40 CFR 191, Environmental Radiation Protection Standards For Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes; and
- waste that the NRC has approved for disposal on a case-by-case basis in accordance with 10 CFR 61.

WASTE ACCEPTANCE

Technical and Administrative

Waste acceptance requirements for all transuranic waste storage, treatment, or disposal facilities, operations, and activities shall specify the following:

- allowable activities and concentrations of specific radionuclides;
- acceptable waste form and container requirements that ensure the chemical and physical stability of waste under conditions that might be encountered during transportation, storage, treatment, or disposal;

- restrictions or prohibitions on waste, materials, or containers that may adversely affect waste handlers or compromise facility or waste container performance;
- requirements to identify transuranic waste as defense or nondefense, and limitations on acceptance; and
- the basis, procedures, and levels of authority required for granting exceptions to the waste acceptance requirement.

Evaluation and Acceptance

The receiving facility shall evaluate waste for acceptance, including confirmation that technical and administrative requirements have been met. A process for the disposition of nonconforming wastes shall be established.

WASTE CHARACTERIZATION

Transuranic waste shall be characterized using direct or indirect methods, and the characterization documented in sufficient detail to ensure safe management and compliance with the waste acceptance requirements of the facility receiving the waste.

Minimum Waste Characterization

Characterization data shall include the following information relevant to the management of the waste:

- physical and chemical characteristics;
- volume, including the waste and any stabilization or absorbent media;
- weight of the container and contents;
- identities, activities, and concentrations of major radionuclides;
- characterization date;
- generating source;
- packaging date; and
- any other information that may be needed to prepare and maintain the disposal facility performance assessment or demonstrate compliance with applicable performance objectives.

MONITORING

All Waste Facilities

Parameters that shall be sampled or monitored include temperature, pressure (for closed systems), radioactivity in ventilation exhaust and liquid effluent streams, and flammable or explosive mixtures of gases. Facility monitoring programs shall include verification that passive and active control systems have not failed.

Stored Wastes

All transuranic wastes in storage shall be monitored, as prescribed by the appropriate facility safety analysis, to ensure the wastes are maintained in safe condition.

Liquid Waste Storage Facilities

For facilities storing liquid transuranic waste, the following shall also be monitored: liquid level and/or waste volume, and significant waste chemistry parameters.

SECTION 3 – LOW-LEVEL WASTE REQUIREMENTS

DISCUSSION

Many of the waste management requirements are common to all types of waste. We will not repeat the common requirements here. This section will discuss the requirements that are unique to low-level waste.

DEFINITION OF LOW-LEVEL WASTE

Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material, or naturally occurring radioactive material.

WASTE ACCEPTANCE

Waste acceptance requirements that apply to high-level and transuranic waste also apply to low-level waste. Additionally, the following waste acceptance requirements are specified for low-level waste:

- Low-level waste must contribute to and not detract from achieving long-term stability of the facility, minimizing the need for long-term active maintenance, minimizing subsidence, and minimizing contact of water with waste. Void spaces within the waste and if containers are used, between the waste and its container shall be reduced to the extent practical.
- 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.
- 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.

- 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.
- Low-level waste in a gaseous form must be packaged such that the pressure does not exceed 1.5 atmospheres absolute at 20ºC.

PACKAGING AND TRANSPORTATION

Low-level waste shall be packaged in a manner that provides containment and protection for the duration of the anticipated storage period and until disposal is achieved or until the waste has been removed from the container.

When waste is packaged, vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container.

Containers of low-level waste shall be marked such that their contents can be identified.

To the extent practical, the volume of waste and number of low-level waste shipments shall be minimized.

SITE EVALUATION AND FACILITY DESIGN

Site Evaluation

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, including for a low-level waste disposal facility, the capability of the site to demonstrate whether it is

- located to accommodate the projected volume of waste to be received;

- located in a flood plain, a tectonically active area, or in the zone of water table fluctuation; and
- located where radionuclide migration pathways are predictable, and erosion and surface runoff can be controlled.

Low-Level Waste Disposal Facility Design

The following facility requirements and general design criteria, at a minimum, apply:

- Low-level waste systems and components shall be designed to maintain waste confinement.
- Design of low-level waste treatment and storage facilities shall include ventilation, if applicable, through an appropriate filtration system to maintain the release of radioactive material in airborne effluents within the requirements and guidelines specified in applicable requirements.
- When conditions exist for generating gases in flammable or explosive concentrations, ventilation systems or other measures shall be provided to keep the gases in a non-flammable and non-explosive condition. Where concentrations of explosive or flammable gases are expected to approach the lower flammability limit, measures shall be taken to prevent deflagration or detonation.
- Low-level waste disposal facilities shall be designed to achieve long-term stability and to minimize to the extent practical, the need for active maintenance following final closure.
- Low-level waste disposal facilities shall be designed to minimize to the extent practical, the contact of waste with water during and after disposal.

DISPOSAL

Performance Objectives

Low-level waste disposal facilities shall be sited, designed, operated, maintained, and closed so that a reasonable expectation exists that the following performance objectives will be met for waste disposed of after September 26, 1988:

- Dose to representative members of the public shall not exceed 25 mrem (0.25 mSv) in a year total effective dose equivalent from all exposure pathways, excluding the dose from radon and its progeny in air.
- Dose to representative members of the public via the air pathway shall not exceed 10 mrem (0.10 mSv) in a year total effective dose equivalent, excluding the dose from radon and its progeny.
- Release of radon shall be less than an average flux of 20 pCi/m^2/s (0.74 Bq/m^2/s) at the surface of the disposal facility. Alternatively, a limit of 0.5 pCi/1 (0.0185 Bq/l) of air may be applied at the boundary of the facility.

Performance Assessment

A site-specific radiological performance assessment shall be prepared and maintained for DOE low-level waste disposed of after September 26, 1988. The performance assessment shall include calculations for a 1,000-year period after closure of potential doses to representative future members of the public and potential releases from the facility to provide a reasonable expectation that the performance objectives identified are not exceeded as a result of operation and closure of the facility.

- Analyses performed to demonstrate compliance with the performance objectives and to establish limits on concentrations of radionuclides for disposal based on the performance measures for inadvertent intruders shall be based on reasonable activities in the critical group of exposed individuals.
- The point of compliance shall correspond to the point of highest projected dose or concentration beyond a 100-meter buffer zone surrounding the disposed waste. A larger or smaller buffer zone may be used if adequate justification is provided.

- Performance assessments shall address reasonably foreseeable natural processes that might disrupt barriers against release and transport of radioactive materials.
- Performance assessments shall use DOE-approved dose coefficients (dose conversion factors) for internal and external exposure of reference adults.
- The performance assessment shall include a sensitivity analysis.
- Performance assessments shall include a demonstration that projected releases of radionuclides to the environment shall be maintained ALARA.
- For purposes of establishing limits on radionuclides that may be disposed of near-surface, the performance assessment shall include an assessment of impacts to water resources.
- For purposes of establishing limits on the concentration of radionuclides that may be disposed of near-surface, the performance assessment shall include an assessment of impacts calculated for a hypothetical person assumed to inadvertently intrude for a temporary period into the low-level waste disposal facility. For intruder analyses, institutional controls shall be effective in deterring intrusion for at least 100 years following closure. The intruder analyses shall use performance measures for chronic and acute exposure scenarios, respectively, of 100 mrem (1 mSv) in a year and 500 mrem (5 mSv) total effective dose equivalent excluding radon in air.

Composite Analysis

For disposal facilities that received waste after September 26, 1988, a radiological composite analysis shall be prepared that accounts for all sources of radioactive material that remains at the DOE site and could interact with the low-level waste disposal facility. Performance measures shall be consistent with DOE requirements for protection of the public and environment and evaluated for a 1,000-year period following disposal facility closure. The composite analysis results shall be used for planning radiation protection activities, and for minimizing the likelihood that current low-level waste disposal activities will result in the need for future corrective or remedial actions to adequately protect the public and the environment.

Disposal Authorization

A disposal authorization statement shall be obtained before constructing a new low-level waste disposal facility. Field elements with existing low-level waste disposal facilities shall obtain a disposal authorization statement according to the schedule in the Complex-Wide Low-Level Waste Management Program Plan. The disposal authorization statement shall be issued based on a review of the facility's performance assessment and composite analysis maintenance, preliminary closure plan, and preliminary monitoring plan. The disposal authorization statement shall specify the limits and conditions on construction, design, operations, and closure of the low-level waste facility based on these reviews. A disposal authorization statement is a part of the radioactive waste management basis for a disposal facility. Failure to obtain a disposal authorization statement by the implementation date of this Order shall result in shutdown of the disposal facility.

Disposal Facility Operations

The disposal facility design and operation must be consistent with the disposal facility closure plan and lead to a disposal facility closure that provides a reasonable expectation that performance objectives will be met. Low-level waste shall be disposed of in such a manner that achieves the performance objectives. Additional requirements include:

- 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 and post-closure plan.
- Permanent identification markers for disposal excavations and monitoring wells shall be emplaced.
- Low-level waste placement into disposal units shall minimize voids between waste containers. Voids within disposal units shall be filled to the extent practical. Uncontainerized bulk waste shall also be placed in a manner that minimizes voids and subsidence.
- Operations should be conducted so that active waste disposal operations will not have an adverse effect on any other disposal units.

- Operations shall include a process for tracking and documenting low-level waste placement in the facility by generator source.

CLOSURE

Disposal Facility Closure Plans

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

- be updated as required during the operational life of the facility;
- 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 5400.5, Radiation Protection of the Public and the Environment; and
- include the total expected inventory of wastes to be disposed of at the facility over the operational life of the facility.

Disposal Facility Closure

Closure of a disposal facility shall occur within five years after it is filled to capacity or after the facility is no longer needed.

Before a facility is closed, 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.

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.

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 5400.5, Radiation Protection of the Public and the Environment.

The location and use of the facility shall be filed with the local authorities responsible for land use and zoning.

Note: You do not have to do example 2 on the following pages, but it is a good time to check your skill and knowledge of the information covered. You may do example 2 or go to the practice.

EXAMPLE 2

1. Define transuranic waste.

2. Discuss the purpose of a disposal authorization statement.

3. Discuss the storage prohibitions for low-level waste.

Note: When you are finished, compare your answers to those contained in the example 2 self-check. When you are satisfied with your answers, go to the practice.

EXAMPLE 2 SELF-CHECK

1. Define transuranic waste.

   Transuranic waste is radioactive waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years.

2. Discuss the purpose of a disposal authorization statement.

   The disposal authorization statement constitutes approval of the performance assessment and composite analysis, authorizes operation of the facility, and includes conditions the disposal facility must meet.

3. Discuss the storage prohibitions for low-level waste.

   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. Before storage, pyrophoric materials shall be treated, prepared, and packaged to be nonflammable.

Change No: 0
DOE O 435.1
Level: Familiar
Date: 6/15/01

PRACTICE

This practice is required if your proficiency is to be verified at the familiar level. This practice will prepare you for the criterion test. You will need to refer to the Orders to answer the questions in the practice correctly. The practice and criterion test will also challenge additional skills that you have acquired in other formal and on-the-job training.

1. State the two processes that are used to determine if spent nuclear fuel reprocessing plant wastes are managed as high-level waste or another waste type.

2. State four parameters that must be sampled or monitored for high-level waste facilities.

3. Discuss the information that is included in the characterization of low-level waste.

Complete the following sentences by filling in the blanks with the correct terms.

4. The _____ is responsible for ensuring that a radioactive waste management basis is developed.
5. Lifting devices that are designated as safety class or safety significant shall be designed to _____.
6. For each high-level waste storage tank in service that is known to have leaked, a _____ shall be developed to identify the safe operational envelope.
7. A _____ shall be developed, documented, and implemented to ensure that the waste acceptance requirements are met.
8. Dose to representative members of the public shall not exceed _____ in a year total effective dose equivalent from all exposure pathways.
9. The _____ specifies the limits and conditions on construction, design, operations, and closure of a low-level waste facility.
10. A disposal facility should be closed within _____ after it is filled to capacity.

Change No: 0
DOE O 435.1
Level: General
Date: 6/15/01

DOE O 435.1
RADIOACTIVE WASTE MANAGEMENT
GENERAL LEVEL

OBJECTIVES

Given the familiar level of this module and a scenario, you will be able to perform the following:

1. List the key elements you would look for in the contractor's action plan to correct the situation described in the scenario; and
2. State which requirements, sections, or elements of DOE O 435.1 apply to the situation described in the scenario.

Note: If you think that you can complete the practice at the end of this level without working through the instructional material and/or the examples, complete the practice now. The course manager will check your work. You will need to complete the practice in this level successfully before taking the criterion test.

RESOURCES

DOE Orders Self-Study Program, DOE O 435.1, familiar level, 6/15/01.
DOE O 435.1, Radioactive Waste Management, 7/09/99.
DOE G 435.1-1, Implementation Guide for use with DOE M 435.1-1, 7/09/99.
DOE M 435.1-1, Radioactive Waste Management Manual, 7/09/99.

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Change No: 0
DOE O 435.1
Level: General
Date: 6/15/01

INTRODUCTION

The familiar level of this module introduced the purpose and scope of DOE O 435.1. Several definitions and the requirements associated with the Order were discussed. In the general level of this module, students are asked to apply the information contained in the familiar level, the Order, the Manual, and the Guide to a scenario related to the Order. Please refer to the resources listed on the previous page to make your analysis and answer the questions. You are not required to complete the example. However, doing so will help prepare you for the practice and criterion test.

Note: You do not have to do the example on the following page, but it is a good time to check your skill and knowledge of the information covered. You may do the example or go on to the practice.

EXAMPLE

Please review the following scenario, and then answer the questions that follow the scenario.

SCENARIO

Background

Hazardous waste regulations promulgated by states with the Resource Conservation and Recovery Act (RCRA) authority may be more restrictive than the federal regulations. The more restrictive requirements may include a broader definition of hazardous waste than the federal requirements or may impose another state's definition of hazardous waste when waste is received from that state. Waste management personnel therefore need to be aware of the requirements of the regulations in their state as well as the implications of the regulations in states to which they intend to transfer waste.

Scenario

State A invokes regulations that are equivalent to the Environmental Protection Agency (EPA) hazardous waste regulations. Waste oil that meets the criteria for low-level waste is not managed as mixed low-level waste. State A regulations also require that waste be considered to be as it was categorized in the state of origin. State B regulations define waste oil as hazardous waste.

1. If waste oil is shipped from state A to state B, should the waste be packaged, manifested, transported, and stored as hazardous waste or mixed low-level waste?
2. If the direction of the waste transfer in question 1 is reversed, should the waste be declared mixed waste or hazardous waste?

Write your answers below, and then compare your answer to those contained in the example self-check.

EXAMPLE SELF-CHECK

1. If waste oil is shipped from state A to state B, should the waste be packaged, manifested, transported, and stored as hazardous waste or mixed low-level waste?

   In a state that invokes regulations equivalent to the EPA hazardous waste regulations, waste oil that meets the criteria for low-level waste should not be managed as mixed low-level waste. However, if the oil were to be shipped to another state in which the state regulations define hazardous waste to include waste oil, the waste would have to be packaged, manifested, transported, and stored as a mixed waste.

2. If the direction of the waste transfer in question 1 is reversed, should the waste be declared mixed waste or hazardous waste?

   If the direction of waste transfer in the above example is reversed, the waste would be declared a mixed waste in the state of origin because the state regulations have a broader definition of hazardous waste. The state to which it is to be shipped does not specifically regulate waste oil as a hazardous waste. However, the state regulations of the receiving site require that waste be considered to be as it was categorized in the state of origin. In this case, the waste would still be considered to be mixed waste and need to be managed as such, even after it was shipped to a state that did not explicitly regulate waste oils.

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PRACTICE

This practice is required if your proficiency is to be verified at the general level. The practice will prepare you for the criterion test. You may need to refer to the Orders, the Guide, and the Manual to answer the questions in the practice correctly. The practice and criterion test will also challenge additional analytical skills that you have acquired in other formal and on-the-job training.

Please review the following scenario and answer the following questions.

1. Was the situation handled correctly? If not, what should have been done?
2. Was the list of requirements, sections, and elements complete and correct? If not, state the correct or omitted requirements.

SCENARIO

During a routine walkthrough of one of your facilities, you note corrosion on the lid of a 55-gallon drum that is labeled as transuranic waste. Following a discussion with the facility manager, he directed the following immediate actions:

- All drums containing the same transuranic waste were segregated, overpacked, and taken to the site reduction facility.
- Samples were taken from the discovered drum and the other drums containing the same transuranic waste.
- All drums that exhibited corrosion were overpacked.

Applicable DOE requirements:

DOE M 435.1-1, chapter III, Transuranic Waste Requirements

Take some time to review the scenario and the actions the contractor took or didn't take to correct the situation. Then decide if the contractor's actions were complete and correct. Finally, determine if the requirements, sections, or elements cited in the scenario were correct.

Write your answer below and then bring the completed practice to the course manager for review.

Note: The course manager will check your practice and verify your success at the general level. When you have successfully completed this practice, the course manager will give you the criterion test