ADMINISTRATIVE CHANGE TO
DOE M 435.1-1, Chg 1, Radioactive Waste Management Manual

LOCATION OF CHANGES:

Page	Paragraph	Changed	To
I-8	I.F.(4)(e)	Headquarters shall be notified of any exemption allowing use of a non-DOE disposal facility and the Office of the Assistant Secretary for Environment, Safety and Health (EH-1) shall be consulted prior to the disposal facility exemption being executed.	The Office of Health, Safety and Security, the Office of Environmental Management, and the Program Secretarial Officer shall be notified of the basis for using any non-DOE radioactive waste disposal facility prior to the use of such facilities.

MANUAL

DOE M 435.1-1

Approved: 7-09-99
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Certified: 1-9-07
Change 2: 6-8-11

RADIOACTIVE WASTE MANAGEMENT MANUAL

U.S. DEPARTMENT OF ENERGY

Distribution:
All Departmental Elements

Initiated By:
Office of Environmental Management

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RADIOACTIVE WASTE MANAGEMENT MANUAL

1. PURPOSE. This Manual further describes the requirements and establishes specific responsibilities for implementing DOE O 435.1, *Radioactive Waste Management*, for the management of DOE high-level waste, transuranic waste, low-level waste, and the radioactive component of mixed waste. The purpose of the Manual is to catalog those procedural requirements and existing practices that ensure that all DOE elements and contractors continue to manage DOE's radioactive waste in a manner that is protective of worker and public health and safety, and the environment.

2. APPLICABILITY. The requirements set forth in this Manual apply to DOE elements, and contractors as set forth in DOE O 435.1, *Radioactive Waste Management*.

3. SUMMARY. This Manual is organized into four (4) chapters. Chapter I, *General Requirements and Responsibilities*, contains requirements and responsibilities which are applicable to all radioactive waste types and delineates responsibilities for radioactive waste management decision-making at the complex-wide and Field Element levels. Chapters II through IV contain those requirements that are applicable to high-level waste, transuranic waste, and low-level waste including the radioactive component of mixed low-level waste, respectively.

4. IMPLEMENTATION. The requirements of this Manual apply to all new and existing DOE radioactive waste management facilities, operations, and activities. Implementation of the requirements shall begin at the earliest possible date, and all DOE entities shall be in compliance with this directive within one year of its issuance. Compliance with this directive includes implementing the requirements or an approved implementation or corrective action plan. If compliance with this Order cannot be achieved within one year of its issuance, the Field Element Manager must request approval to extend the compliance date to no later than October 1, 2001, from the cognizant Program Secretarial Officer (PSO). Failure to implement the requirements of this directive shall, through the appropriate lines of management, result in corrective actions including, if necessary, shutdown of radioactive waste management facilities, operations, or activities until the appropriate requirements are implemented. Any of the requirements in this Manual may be waived or modified through application of a DOE-approved requirements tailoring process, such as the "Necessary and Sufficient Closure Process" in DOE P 450.3 and DOE M 450.3-1 and DOE P 450.4, *Safety Management System Policy*, the applicable or relevant and appropriate requirements identification process for actions taken pursuant to the Department's CERCLA authorities, or by an exemption processed in accordance with the requirements of DOE M 251.1-1A, *Directives System Manual.*

5. REVISIONS. Systematic planning, execution, and evaluation of radioactive waste management facilities, operations, and activities will provide the basis for evaluating the adequacy of and, if necessary, revising the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual. The revision process will be based on DOE P 450.4, *Safety Management System Policy*, and will implement continuous improvement for management of radioactive waste. The process includes: identifying the functions

necessary to execute radioactive waste management responsibilities; conducting an analysis of the hazards associated with performing those functions; developing and implementing the proper controls to mitigate any associated hazards; developing and implementing a periodic assessment of work performance; and providing feedback to revise the work processes and incorporate lessons learned, as appropriate. Administrative requirements of the Order and Manual will be revised as needed to support safe and efficient waste management.

6. DEFINITIONS. Definitions for DOE M 435.1-1, *Radioactive Waste Management Manual*, are provided in Attachment 2.

7. REFERENCE. DOE O 435.1, *Radioactive Waste Management*, dated 7-09-99.

8. CONTACT. Call the Office of Waste Management at (202) 586-0370.

BY ORDER OF THE SECRETARY OF ENERGY:

THOMAS T. TAMURA
Acting Director of
Management and Administration

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CHAPTER I

GENERAL REQUIREMENTS AND RESPONSIBILITIES

1. REQUIREMENTS

A. Delegation of Authority. Managers charged with responsibilities within this Manual may delegate authority for these tasks to another manager. All delegations of authority shall be documented.

B. Use of Guidance. Additional information supporting the requirements in this Manual is contained in the Implementation Guide for use with DOE M 435.1-1, *Radioactive Waste Management Manual*. This Guide, DOE G 435.1-1, *Implementation Guide for DOE M 435.1-1*, shall be reviewed when implementing the requirements of this Manual. The Guide provides additional information and acceptable methods for meeting the requirements. Other methods may be used but must ensure an adequate level of safety commensurate with the hazards associated with the work and be consistent with the radioactive waste management basis.

C. Radioactive Waste Management. All radioactive waste subject to DOE O 435.1, *Radioactive Waste Management*, and the requirements of this Manual shall be managed as high-level waste, transuranic waste, low-level waste, or mixed low-level waste.

D. 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 O 451.1A , *National Environmental Policy Act Compliance Program*. All reasonable alternatives shall be considered, as appropriate. Nothing in this Order is meant to restrict consideration of alternatives to proposed actions.

E. Requirements of Other Regulations and DOE Directives. The following requirements and DOE directives are required for all DOE radioactive waste management facilities, operations, and activities as applicable. Any of the requirements for the following Departmental directives may be waived or modified through application of a DOE-approved requirements tailoring process, such as the "Necessary and Sufficient Closure Process" in DOE P 450.3 and DOE M 450.3-1 and DOE P 450.4, *Safety Management System Policy*, or by an exemption processed in accordance with the requirements of that directive or DOE M 251.1-1A, *Directives System Manual*.

(1) **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 O 210.1, *Performance Indicators and Analysis of Operations Information*.

(2) **Classified Waste**. Radioactive waste to which access has been limited for national security reasons and cannot be declassified shall be managed in accordance with the requirements of DOE 5632.1C, *Protection and Control of Safeguards and Security Interests*, and DOE 5633.3B, *Control and Accountability of Nuclear Materials*.

(3) **Conduct of Operations**. Radioactive waste management facilities, operations, and activities shall be conducted in a manner based on consideration of the associated hazards. Waste management facilities, operations, and activities shall meet the requirements of DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*.

(4) **Criticality Safety**. Radioactive waste management facilities, operations, and activities shall be covered by a criticality safety program in accordance with DOE O 420.1, *Facility Safety*.

(5) **Emergency Management Program**. Radioactive waste management facilities, operations, and activities shall maintain an emergency management program in accordance with DOE O 151.1, *Comprehensive Emergency Management System.*

(6) **Environmental and Occurrence Reporting**. Radioactive waste management facilities, operations, and activities shall meet the reporting requirements of DOE O 231.1, *Environment, Safety and Health Reporting*, and DOE O 232.1A, *Occurrence Reporting and Processing of Operations Information*.

(7) **Environmental Monitoring**. Radioactive waste management facilities, operations, and activities shall meet the environmental monitoring requirements of DOE 5400.1, *General Environmental Protection Program,* and DOE 5400.5, *Radiation Protection of the Public and the Environment*.

(8) **Hazard Analysis Documentation and Authorization Basis**. Radioactive waste management facilities, operations, and activities shall implement DOE Standards, DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23, Nuclear Safety Analysis Reports*, and/or DOE-EM-STD-5502-94, *DOE Limited Standard: Hazard Baseline Documentation,* and shall, as applicable, prepare and maintain hazard analysis documentation and an authorization basis as required by DOE O 425.1A , *Startup and Restart of Nuclear Facilities*, DOE O 5480.21, *Unreviewed Safety Questions*, DOE 5480.22, *Technical Safety Requirements*, and DOE 5480.23, *Nuclear Safety Analysis Reports*.

(9) **Life-Cycle Asset Management**. Planning, acquisition, operation, maintenance, and disposition of radioactive waste management facilities shall be in accordance with DOE O 430.1A, *Life-Cycle Asset Management*, and DOE 4330.4B , *Maintenance Management Program* , including a configuration management process to ensure the integrity of physical assets and systems. Corporate physical asset databases shall be maintained as complete, current inventories of physical assets and systems to allow reliable analysis of existing and potential hazards to the public and workers.

(10) **Mixed Waste**. Radioactive waste that contains both source, special nuclear, or by-product material subject to the *Atomic Energy Act of 1954*, as amended, and a hazardous component is also subject to the *Resource Conservation and Recovery Act* (RCRA), as amended.

(11) **Packaging and Transportation**. Radioactive waste shall be packaged and transported in accordance with DOE O 460.1A, *Packaging and Transportation Safety*, and DOE O 460.2, *Departmental Materials Transportation and Packaging Management*.

(12) **Quality Assurance Program**. Radioactive waste management facilities, operations, and activities shall develop and maintain a quality assurance program that meets the requirements of 10 CFR 830.120, *Quality Assurance Requirements*, and DOE O 414.1, *Quality Assurance*, as applicable.

(13) **Radiation Protection**. Radioactive waste management facilities, operations, and activities shall meet the requirements of 10 CFR Part 835, *Occupational Radiation Protection,* and DOE 5400.5, *Radiation Protection of the Public and the Environment*.

(14) **Records Management**. Radioactive waste management facilities, operations, and activities shall develop and maintain a record-keeping system, as required by DOE O 200.1, *Information Management Program*, and DOE O 414.1, *Quality Assurance*. Records shall be established and maintained for radioactive waste generated, treated, stored, transported, or disposed. To the extent possible, records prepared in response to other requirements may be used to satisfy the documentation requirements of this Manual. Additional records may be required to satisfy the regulations applicable to the hazardous waste components of mixed waste.

(15) **Release of Waste Containing Residual Radioactive Material**. Processes for determining and documenting that waste is suitable to be released and managed without regard to its radioactive content shall be in accordance with the criteria and requirements in DOE 5400.5, *Radiation Protection of the Public and the Environment*.

(16) **Safeguards and Security**. Appropriate features shall be incorporated into the design and operation of radioactive waste management facilities, operations, and activities to prevent unauthorized access and operations, and for purposes of nuclear materials control and accountability, where applicable; and shall be consistent with DOE O 470.1, *Safeguards and Security Program*.

(17) **Safety Management System**. Radioactive waste management facilities, operations, and activities shall incorporate the principles of integrated safety management as described in DOE P 450.4, *Safety Management System Policy*, and DOE P 450.5, *Line Environment, Safety and Health Oversight*, and meet the requirements of the safety management systems sections of 48 CFR Chapter 9, *Department of Energy Acquisition Regulations* and DOE M 411.1-1, *Manual of Safety Management Functions, Responsibilities, and Authorities*.

(18) **Site Evaluation and Facility Design**. New radioactive waste management facilities, operations, and activities shall be sited and designed in accordance with DOE O 420.1, *Facility Safety*, and DOE O 430.1A, *Life-Cycle Asset Management*.

(19) **Training and Qualification**. A training and qualification program shall be implemented for radioactive waste management program personnel, and shall meet the requirements of DOE O 360.1, *Training*, and DOE 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*.

(20) **Waste Minimization and Pollution Prevention**. Waste minimization and pollution prevention shall be implemented for radioactive waste management facilities, operations, and activities 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 5400.1, *General Environmental Protection Program*.

(21) **Worker Protection**. Radioactive waste management facilities, operations, and activities shall meet the requirements of DOE O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*.

2. RESPONSIBILITIES

A. Program Secretarial Officers. Program Secretarial Officers with radioactive waste management facilities, operations, or activities are responsible, within their

respective programs for ensuring that the Field Element Managers meet the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual.

B. Assistant Secretary for Environmental Management. The Assistant Secretary for Environmental Management is responsible for:

(1) **Complex-Wide Radioactive Waste Management Programs**. Establishing and maintaining integrated Complex-Wide Radioactive Waste Management Programs for high-level, transuranic, low-level, and mixed low-level waste. These programs shall use a systematic approach to planning, execution, and evaluation to ensure that waste generation, storage, treatment, and disposal needs are met and coordinated across the DOE complex.

(2) **Changes to Regulations and DOE Directives**. Ensuring changes to regulations and DOE directives are reviewed and, when necessary, incorporated into revisions of this Manual to ensure the basis for safe radioactive waste management facilities, operations, and activities is maintained.

C. Assistant Secretary for Environment, Safety, and Health. The Assistant Secretary for Environment, Safety and Health is responsible for providing an independent overview of DOE radioactive waste management and decommissioning programs to determine compliance with DOE environment, safety, and health requirements and applicable Environmental Protection Agency (EPA) and state regulations, including:

(1) Advising the Secretary of the status of Departmental compliance with the requirements of DOE O 435.1, this Manual, and applicable provisions of other DOE Orders.

(2) Conducting independent appraisals and audits of DOE waste management programs

(3) Reviewing site Waste Management Plans with regard to compliance with DOE environment, safety, and health requirements.

D. Deputy Assistant Secretary for Waste Management. The Deputy Assistant Secretary for Waste Management is responsible for:

(1) **Complex-Wide Radioactive Waste Management Program Plans**. Developing, implementing, and maintaining integrated Complex-Wide Radioactive Waste Management Program Plans for high-level, transuranic, low-level, and mixed low-level waste. Each plan shall, at the DOE complex-wide level, describe the functional elements, organizations, responsibilities, and activities that comprise the system needed to store,

treat and dispose of radioactive waste in a manner that is protective of the public, workers, and the environment. In addition, the plans shall:

(a) Present a waste management strategy that integrates waste projections and life-cycle waste management planning into complex-wide facility configuration decisions; and

(b) Describe the approach to research and technology development being pursued to improve safety and/or efficiency in managing radioactive waste.

(2) **Waste Management Data System**. Establishing and maintaining a system to compile waste generation projection data and other information concerning radioactive waste management facilities, operations, and activities across the complex.

E. Deputy Assistant Secretaries for Waste Management and Environmental Restoration. The Deputy Assistant Secretary for Waste Management and the Deputy Assistant Secretary for Environmental Restoration are responsible for the following activities for facilities under their purview:

(1) **Disposal**. Reviewing and approving, along with EH-1, transuranic waste disposal facility performance assessments and other disposal documents as required in waste specific chapters for which DOE is responsible for making compliance determinations. Reviewing and approving performance assessments and composite analyses, or appropriate CERCLA documentation, for low-level waste disposal facilities, and issuing disposal authorization statements.

(a) The Deputy Assistant Secretaries shall establish a review panel consisting of DOE personnel to review low-level waste disposal facility performance assessments and composite analyses, review appropriate CERCLA documentation, recommend low-level waste disposal facility compliance determinations to the Deputy Assistant Secretaries and develop disposal authorization statements.

(b) The Deputy Assistant Secretaries shall issue disposal authorization statements containing conditions that low-level waste disposal facilities must meet in order to operate with an approved radioactive waste management basis.

(2) **Site Closure Plans**. Reviewing and approving closure plans and other closure documentation for deactivated high-level waste facilities/sites and issuing authorization for closure activities to proceed.

F. Field Element Managers. Field Element Managers are responsible for:

(1) **Site-Wide Radioactive Waste Management Programs**. Developing, documenting, implementing, and maintaining a Site-Wide Radioactive Waste Management Program. The Program shall use a systematic approach for planning, executing, and evaluating the site-wide management of radioactive waste in a manner that supports the Complex-Wide Radioactive Waste Management Programs and ensures that the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual are met.

(2) **Radioactive Waste Management Basis**. Ensuring a radioactive waste management basis is developed and maintained for each DOE radioactive waste management facility, operation, and activity; and ensuring review and approval of the basis before operations begin. The Radioactive Waste Management Basis shall:

(a) Reference or define the conditions under which the facility may operate based on the radioactive waste management documentation;

(b) Include the applicable elements identified in the specific waste-type chapters of this Manual; and

(c) Be developed using the graded approach process.

(3) **Waste Minimization and Pollution Prevention**. Ensuring implementation of waste minimization and pollution prevention programs.

(4) **Approval of Exemptions for Use of Non-DOE Facilities**. DOE waste shall be treated, stored, and in the case of low-level waste, disposed of at the site where the waste is generated, if practical; or at another DOE facility. If DOE capabilities are not practical or cost effective, exemptions may be approved to allow use of non-DOE facilities for the storage, treatment, or disposal of DOE radioactive waste based on the following requirements:

(a) Such non-DOE facilities shall:

1. Comply with applicable Federal, State, and local requirements;

2. Have the necessary permit(s), license(s), and approval(s) for the specific waste(s); and

3. Be determined by the Field Element Manager to be acceptable based on a review conducted annually by DOE.

(b) Exemptions for the use of non-DOE facilities shall be documented to be cost effective and in the best interest of DOE, including consideration of alternatives for on-site disposal, an alternative DOE site, and available non-DOE facilities; consideration of life-cycle cost and potential liability; and protection of public health and the environment.

(c) DOE waste shall be sufficiently characterized and certified to meet the facility's waste acceptance criteria.

(d) Appropriate *National Environmental Policy Act* (NEPA) review must be completed. For actions taken under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), it is DOE's policy to incorporate NEPA values into the CERCLA documentation.

(e) The Office of Health, Safety and Security, the Office of Environmental Management, and the Program Secretarial Officer shall be notified of the basis for using any non-DOE radioactive waste disposal facility prior to the use of such facilities.

(f) Host States and State Compacts where non-DOE facilities are located shall be consulted prior to approval of an exemption to use such facilities and notified prior to shipments being made.

(5) **Environmental Restoration, Decommissioning, and Other Cleanup Waste**. Ensuring the management and disposal of radioactive waste resulting from environmental restoration activities, including decommissioning, meet the substantive requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual. Environmental restoration activities using the CERCLA process (in accordance with Executive Order 12580) may demonstrate compliance with the substantive requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual (including the Performance Assessment and performance objectives, as well as the Composite Analysis) through the CERCLA process. However, compliance with all substantive requirements of DOE O 435.1 not met through the CERCLA process must be demonstrated. Environmental restoration activities which will result in the off-site management and disposal of radioactive waste must meet the applicable requirements of DOE O 435.1, *Radioactive Waste Management*, and this

Manual for the management and disposal of those off-site wastes. Field Elements performing environmental restoration activities involving development and management of radioactive waste disposal facilities under the CERCLA process shall:

(a) Submit certification to the Deputy Assistant Secretary for Environmental Restoration that compliance with the substantive requirements of DOE O 435.1 have been met through application of the CERCLA process; and

(b) Submit the decision document, such as the Record of Decision, or any other document that serves as the authorization to dispose, to the Deputy Assistant Secretary for Environmental Restoration for approval.

(6) **Radioactive Waste Acceptance Requirements**. Ensuring development, review, approval, and implementation of the radioactive waste acceptance requirements for facilities that receive waste for storage, treatment, or disposal. Radioactive waste acceptance requirements shall establish the facility's requirements for the receipt, evaluation, and acceptance of waste.

(7) **Radioactive Waste Generator Requirements**. Ensuring development, review, approval, and implementation of a program for waste generation planning, characterization, certification, and transfer. This program shall address characterization of waste, preparation of waste for transfer, certification that waste meets the receiving facility's radioactive waste acceptance requirements, and transfer of waste.

(8) **Closure Plans**. Ensuring development, review, approval, and implementation of closure plans for radioactive waste management facilities in accordance with the applicable requirements in the waste-type chapters of this Manual.

(9) **Defense-In-Depth**. Ensuring defense-in-depth principles are incorporated where potential uncertainties or vulnerabilities warrant their use when reviewing and approving radioactive waste management activities and documents. These principles advocate the use of multiple levels of engineered and administrative controls to provide protection to the public, workers, and the environment.

(10) **Oversight**. Ensuring oversight of radioactive waste management facilities, operations, and activities is conducted. Oversight shall ensure radioactive waste management program activities are conducted in accordance with a radioactive waste management basis and meet the

requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual.

(11) **Training and Qualification**. Ensuring a training and qualification program is implemented for designated radioactive waste management program personnel, and the training is commensurate with job duties and responsibilities. Only those personnel who have been trained and qualified shall design or operate safety (safety class and safety significant) structures, systems, and components.

(12) **As Low As Reasonably Achievable (ALARA)**. Ensuring ALARA principles for radiation protection are incorporated when reviewing and approving radioactive waste management activities.

(13) **Storage**. Ensuring all radioactive waste is stored in a manner that protects the public, workers, and the environment in accordance with a radioactive waste management basis, and that the integrity of waste storage is maintained for the expected time of storage and does not compromise meeting the disposal performance objectives for protection of the public and environment when the waste is disposed.

(14) **Treatment**. Ensuring all radioactive waste requiring treatment is treated in a manner that protects the public, workers, and the environment and in accordance with a radioactive waste management basis.

(15) **Disposal**. Ensuring radioactive waste is disposed in a manner that protects the public, workers, and the environment and in accordance with a radioactive waste management basis. Reviewing specific transuranic or low-level waste documentation including the performance assessment and composite analysis, or appropriate CERCLA documentation, prior to forwarding them to Headquarters for approval, and obtaining and ensuring the facility is operated in accordance with the disposal authorization statement. Conducting performance assessment and composite analysis maintenance.

(16) **Monitoring**. Ensuring monitoring is conducted for all radioactive waste management facilities as required. Ensuring that disposal facilities are monitored, as appropriate, for compliance with conditions of the disposal authorization statement.

(17) **Material and Waste Declassification for Waste Management**. Ensuring, to the extent practical, radioactive material and waste generated under a program that is classified for national security reasons is declassified or rendered suitable for unclassified radioactive waste management.

(18) **Waste Incidental to Reprocessing**. Ensuring that waste incidental to reprocessing determinations are made by either the "citation" or "evaluation" process described in Chapter II of this Manual. Ensuring consultation and coordination with the Office of Environmental Management for waste determined to be incidental to reprocessing through the "evaluation" process.

(19) **Waste With No Identified Path to Disposal**. Ensuring a process is developed and implemented for identifying the generation of radioactive waste with no identified path to disposal, and reviewing and approving conditions under which radioactive waste with no identified path to disposal may be generated. Headquarters shall be notified of the decisions to generate a waste with no identified path to disposal.

(20) **Corrective Actions**. Ensuring a process exists for proposing, reviewing, approving, and implementing corrective actions when necessary to ensure that the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual are met, and to address conditions that are not protective of the public, workers, or the environment. The process shall allow workers, through the appropriate level of management, to stop or curtail work when they discover conditions that pose an imminent danger or other serious hazard to workers or the public, or are not protective of the environment.

G. All Personnel. All personnel are responsible for:

(1) **Problem Identification**. Identifying and reporting radioactive waste management facilities, operations, or activities that do not meet the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual, or that pose a threat to the safety of the public, workers, or the environment.

(2) **Shutdown or Curtailment of Activities**. Stopping or curtailing work, through the appropriate level of management, to prohibit continuation of conditions or activities which pose an imminent danger or other serious hazard to workers or the public, or are not protective of the environment.

CHAPTER II

HIGH-LEVEL WASTE REQUIREMENTS

A. Definition of 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 in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation.

B. Waste Incidental to Reprocessing. Waste resulting from reprocessing spent nuclear fuel that is determined to be incidental to reprocessing is not high-level waste, and shall be managed under DOE's regulatory authority in accordance with the requirements for transuranic waste or low-level waste, as appropriate. When determining whether 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:

(1) **Citation**. Waste incidental to reprocessing by citation includes spent nuclear fuel reprocessing plant wastes that meet the description included in the Notice of Proposed Rulemaking (34 FR 8712) for proposed Appendix D, 10 CFR Part 50, Paragraphs 6 and 7. These radioactive wastes are the result of reprocessing plant operations, such as, but not limited to: contaminated job wastes including laboratory items such as clothing, tools, and equipment.

(2) **Evaluation**. Determinations that any waste is incidental to reprocessing by the evaluation process shall be developed under good record-keeping practices, with an adequate quality assurance process, and shall be documented to support the determinations. Such wastes may include, but are not limited to, spent nuclear fuel reprocessing plant wastes that:

(a) Will be managed as low-level waste and meet the following criteria:

1. Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and

2. Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and

3. Are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance

with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.

(b) Will be managed as transuranic waste and meet the following criteria:

1. Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and

2. Will be incorporated in a solid physical form and meet alternative requirements for waste classification and characteristics, as DOE may authorize; and

3. Are managed pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, in accordance with the provisions of Chapter III of this Manual, as appropriate.

C. Management of Specific Wastes. The following provide for management of specific wastes as high-level waste in accordance with the requirements in this Chapter:

(1) **Mixed High-Level Waste**. Unless demonstrated otherwise, all high-level waste shall be considered mixed waste and is subject to the requirements of both the *Atomic Energy Act of 1954*, as amended, the *Resource Conservation and Recovery Act*, as amended, DOE O 435.1, *Radioactive Waste Management*, and this Manual.

(2) **TSCA-Regulated Waste**. High-level waste containing polychlorinated biphenyls, asbestos, or other such regulated toxic components shall be managed in accordance with requirements derived from the *Toxic Substances Control Act*, as amended, DOE O 435.1, *Radioactive Waste Management*, and this Manual.

D. Complex-Wide High-Level Waste Management Program. A complex-wide program and plan shall be developed as described under *Responsibilities*, 2.B and 2.D, in Chapter I of this Manual.

E. Site-Wide Radioactive Waste Management Program. In addition to the items in Chapter I of this Manual, documentation of the Site-Wide Radioactive Waste Management Program shall include a description of the High-Level Waste Systems

Engineering Management Program to support decision-making related to nuclear safety, including high-level waste requirements analysis, functional analysis and allocation, identification of alternatives, and alternative selection and system control.

F. 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:

(1) **Generators**. The waste certification program.

(2) **Pretreatment and Treatment Facilities**. The waste acceptance requirements and waste certification program.

(3) **Storage Facilities**. The waste acceptance requirements and the waste certification program.

G. Quality Assurance Program. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Product Quality**. The requirements of RW-0333P, *Quality Assurance Requirements and Description,* shall apply to those high-level waste items and activities important to waste acceptance/product quality.

(2) **Audits and Assessments**. The evaluation and assessment requirements of RW–0333P, *Quality Assurance Requirements Document and Description*, and associated implementing procedures shall be met for high-level waste acceptance and product quality activities, in addition to the assessment requirements of other DOE directives and requirements identified in Chapter I of this Manual.

H. Contingency Actions. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Contingency Storage**. For off-normal or emergency situations involving high-level waste storage or treatment, spare capacity with adequate capabilities shall be maintained to receive the largest volume of waste contained in any one storage vessel, pretreatment facility, or treatment facility. Tanks or other facilities that are designated for high-level waste contingency storage shall be maintained in an operational condition when waste is present and shall meet all the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual.

(2) **Transfer Equipment**. Pipelines and auxiliary facilities necessary for the transfer of waste to contingency storage shall be maintained in an operational condition when waste is present and shall meet the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual.

I. Corrective Actions. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Order Compliance**. Corrective actions shall be implemented whenever necessary to ensure the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual are met.

(2) **Operations Curtailment**. Operations shall be curtailed or facilities shut down for failure to establish, maintain, or operate consistent with an approved radioactive waste management basis.

J. Waste Acceptance. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Technical and Administrative**. Waste acceptance requirements for all high-level waste storage, pretreatment, or treatment facilities, operations, and activities shall specify, at a minimum, the following:

(a) Allowable activities and/or concentrations of specific radionuclides;

(b) Acceptable waste form that ensures the chemical and physical stability of the waste under conditions that might be encountered during transfer, storage, pretreatment, or treatment;

(c) 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. Each exception request shall be documented, including its disposition as approved or not approved; and

(d) Pretreatment, treatment, storage, packaging, and other operations shall be designed and implemented in a manner that will ultimately comply with DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms*, or DOE/RW-0351~~P~~, *Waste Acceptance System Requirements Document*, for non-vitrified, immobilized high-level waste.

(2) **Evaluation and Acceptance**. The receiving facility shall evaluate waste for acceptance, including confirmation that the technical and administrative

requirements have been met. A process for the disposition of non-conforming wastes shall be established.

K. Waste Generation Planning. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Life-Cycle Planning**. Prior to waste generation, planning shall be performed to address the entire life cycle for all high-level waste streams.

(2) **Waste With No Identified Path to Disposal**. High-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 (compliance with DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms*).

L. Waste Characterization. High-level 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.

(1) **Data Quality Objectives**. The data quality objectives process, or a comparable process, shall be used for identifying characterization parameters and acceptable uncertainty in characterization data.

(2) **Minimum Waste Characterization**. 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) Any other information which may be needed to demonstrate compliance with the requirements of the 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.

(3) **Hazardous Characteristics**. Waste characterization processes shall yield sufficient chemical and physical data to clearly identify any hazardous characteristics that may degrade the ability of structures, systems, and components to perform their radioactive waste management function.

M. 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.

(1) **Certification Program**. 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.

(2) **Certification Before Transfer**. High-level waste shall be certified as meeting the waste acceptance requirements before it is transferred to the facility receiving the waste.

(3) **Maintaining Certification**. 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.

N. Waste Transfer. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Authorization**. 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.

(2) **Data**. 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.

(3) **Records and Transfer Reporting**. The records and transfer requirements for canistered high-level waste forms shall comply with DOE/EM-0093, *Waste Acceptance Product Specification for Vitrified High-Level Waste*

Forms, or DOE/RW-0351~~P~~, *Waste Acceptance System Requirements Document*, for non-vitrified, immobilized high-level waste.

O. Packaging and Transportation. The following requirement is in addition to those in Chapter I of this Manual.

(1) **Canistered Waste Form**. Immobilized high-level waste shall meet the requirements of the DOE/EM-0093, *Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms*, or DOE/RW-0351~~P~~, *Waste Acceptance System Requirements Document*, for non-vitrified, immobilized high-level waste.

P. Site Evaluation and Facility Design. The following requirements are in addition to those in Chapter I of this Manual.

(1) **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.

(a) 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.
(b) 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.

(2) **Facility Design**. The following facility design requirements, at a minimum, apply:

(a) **Safety (Safety Class and Safety-Significant) Structures, Systems, and Components**. Safety structures, systems, and components for high-level waste storage, pretreatment, and treatment facilities shall be designated and designed consistent with the provisions of DOE O 420.1, *Facility Safety;* DOE 5480.22, *Technical Safety Requirements*; and DOE 5480.23, *Nuclear Safety Analysis Reports*.

(b) **Confinement**. High-level waste systems and components shall be designed to maintain waste confinement. The following requirements apply to new or modifications to existing high-level waste systems, ancillary systems, and components:

1. Secondary confinement systems shall be designed to prevent any migration of wastes or accumulated liquid out of the

waste system; shall be capable of detecting, collecting, and retrieving releases into the secondary confinement; and shall be constructed of, or lined with, materials that are compatible with the waste(s) to be placed in the waste system.

2. Tank and piping systems used for high-level waste collection, pretreatment, treatment, and storage shall be welded construction, except where remote configurations or periodic rerouting of high-level waste streams require non-welded construction.

(c) **Lifting Devices**. The design of hoisting and rigging devices shall comply with the following specific requirements.

1. Lifting devices that are designated as safety class or safety significant shall be designed to prevent free fall of loads.

2. Loading and unloading systems for lifting devices that are designated as safety class or safety significant shall be designed with a reliable system of interlocks that will fail safely upon malfunction.

(d) **Ventilation**.

1. Design of high-level waste pretreatment, treatment, and storage facilities shall include ventilation through an appropriate filtration system to maintain the release of radioactive material in airborne effluents within the applicable requirements.

2. When conditions exist for generating gases in flammable and 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.

(e) **Consideration of Decontamination and Decommissioning**. Areas in new and modifications to existing high-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.

(f) **Maintenance Exposure Reduction**. Remote maintenance features and other appropriate techniques to maintain as low as reasonably achievable (ALARA) personnel exposures shall be incorporated into each high-level waste facility.

(g) **Facilities for Receipt and Retrieval of High-Level Waste**.

1. Designs for storage facilities shall incorporate features to facilitate retrieval capability.

2. High-level waste receipt and retrieval systems shall be designed to complement the existing storage facilities for safe storage and transfer of high-level waste.

(h) **Structural Integrity**. Designs for new tanks shall contribute to the confinement requirement at Section II.P.(2)(b) of this Manual by:

1. Incorporating features to avoid critical degradation modes at the proposed site where practicable, or minimize degradation rates for the critical modes; and

2. Incorporating features to facilitate execution of the Structural Integrity Program required by Section II.Q.(2) of this Manual.

(i) **Instrumentation and Control Systems**. 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, leaks and overflows from tanks or confinement systems.

(j) **Volume Monitoring Systems**. Monitoring and/or leak detection capabilities shall be incorporated in the design and engineering of high-level waste storage, pretreatment, and treatment facilities to provide rapid detection of failed confinement and/or other abnormal conditions.

Q. Storage. The following requirements are in addition to those in Chapter I of this Manual and also apply to facilities intended for management of high-level waste awaiting pretreatment, treatment or disposal, unless stated otherwise.

(1) **Operation of Confinement Systems**.

(a) Confinement systems shall be operated and maintained so as to preserve the design basis.

(b) Secondary confinement systems, where provided, shall be operated to prevent any migration of wastes or accumulated liquid out of the waste confinement systems.

(2) **Structural Integrity Program**.

(a) **Leak-Tight Tanks In-Service**. 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. The program shall be capable of:

1. Verifying the current leak-tightness and structural strength of each tank in service;
2. Identifying corrosion, fatigue, and other critical degradation modes;
3. Adjusting the chemistry of tank waste, calibrating cathodic protection systems, wherever employed, and implementing other necessary corrosion protection measures;
4. Providing credible projections as to when structural integrity of each tank can no longer be assured; and
5. Identifying the additional controls necessary to maintain an acceptable operating envelope.

(b) **In-Service Tanks that Have Leaked or Are Suspect**. For each high-level waste storage tank in-service that is known to have leaked, or is suspect, a modified structural integrity program shall be developed and implemented to identify the safe operational envelope. The modified program shall be capable of:

1. Verifying the structural strength of each tank in-service which has leaked or is suspect;
2. Identifying corrosion, fatigue and other critical degradation modes;
3. Adjusting the chemistry of tank waste, calibrating cathodic protection systems, wherever employed, and implementing other necessary corrosion protection measures;
4. Determining which of the tanks that have leaked or are suspect may remain in service by identifying an acceptable safe operating envelope;

5. Providing credible projections as to when the acceptable safe operational envelope can no longer be assured; and

6. Identifying the additional controls necessary to maintain the acceptable safe operational envelope.

When physical activities, as part of a structural integrity program, pose additional vulnerabilities, alternative measures shall be implemented to provide an acceptable storage operational envelope.

(c) **Other Storage Components**. The structural integrity of other storage components shall be verified to assure leak tightness and structural strength.

(3) **Canistered Waste Form Storage**. Canisters of immobilized high-level waste awaiting shipment to a repository shall be:

(a) Stored in a suitable facility;

(b) Segregated and clearly identified to avoid commingling with low-level, mixed low-level, or transuranic wastes; and

(c) Monitored to ensure that storage conditions are consistent with DOE/EM–0093, *Waste Acceptance Product Specifications for Vitrified High-level Waste Forms*, or DOE/RW-0351, *Waste Acceptance System Requirements Document,* for non-vitrified immobilized high-level waste. Facilities and operating procedures for storage of vitrified high-level waste shall maintain the integrity of the canistered waste form.

R. Treatment. Treatment shall be designed and implemented in a manner that will ultimately comply 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.

S. Disposal. Disposal of high-level waste must be in accordance with the provisions of the *Atomic Energy Act of 1954*, as amended, the *Nuclear Waste Policy Act of 1982*, as amended, or any other applicable statutes.

T. Monitoring. High-level waste pretreatment, treatment, storage, and transportation facilities shall be monitored for chemical, physical, radiological, structural, and other changes that could indicate failure of system confinement, integrity, or safety, and which could lead to abnormal events or accidents. Parameters that shall be sampled or monitored, at a minimum, include: temperature, pressure (for closed systems),

radioactivity in ventilation exhaust and liquid effluent streams, flammable or explosive mixtures of gases, level and/or waste volume, and significant waste chemistry parameters for non-immobilized high-level waste. Facility monitoring programs shall also include physical inspections to verify that control systems have not failed.

U. Closure. The following requirements for closure of deactivated high-level waste facilities and sites are in addition to those in Chapter I of this Manual.

(1) **Decommissioning**. Deactivated high-level waste facilities/sites shall meet the decommissioning requirements of DOE O 430.1A, *Life-Cycle Asset Management* and the requirements of DOE 5400.5, *Radiation Protection of the Public and the Environment*, for release; or

(2) **CERCLA Process.** Deactivated high-level waste facilities/sites shall be closed in accordance with the CERCLA process as described in Section I.2.F.(5); or

(3) **Closure**. Deactivated high-level waste facilities/sites shall be closed in accordance with an approved closure plan as specified below. Residual radioactive waste present in facilities to be closed shall satisfy the waste incidental to reprocessing requirements of this Chapter.

(a) **Facility/Site Closure Plans**. A closure plan shall be developed for each deactivated high-level waste facility/site being closed that defines the approach and plans by which closure of each facility within the site is to be accomplished. This plan shall be completed and approved prior to the initiation of physical closure activities, and updated periodically to reflect current analysis and status of individual facility closure actions. The plan shall include, at a minimum, the following elements:

1. Identification of the closure standards/performance objectives to be applied from Chapter III or IV, as appropriate;

2. A strategy for allocating waste disposal facility performance objectives from the closure standards identified in the closure plan among the facilities/units to be closed at the site;

3. An assessment of the projected performance of each unit to be closed relative to the performance objectives allocated to each unit under the closure plan;

4. An assessment of the projected composite performance of all units to be closed at the site relative to the performance

objectives and closure standards identified in the closure plan; and

5. Any other relevant closure controls including a monitoring plan, institutional controls, and land use limitations to be maintained in the closure activity.

V. Specific Operations. Specific requirements are provided for the operation of lifting devices and facilities for receipt and retrieval of high-level waste.

(1) **Operation of Lifting Devices**. Hoisting and rigging activities shall be conducted in accordance with the guidance provided in the DOE Standard "Hoisting and Rigging" (DOE-STD-1090-~~96~~).

(2) **Operation of Facilities for Receipt and Retrieval of High-Level Waste**. High-level waste receipt and retrieval systems shall be operated and maintained consistent with high-level waste system features incorporated in the facilities. Strategies for retrieval of waste shall be analyzed to ensure that structural and radiological impacts are consistent with the facility design basis.

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CHAPTER III

TRANSURANIC WASTE REQUIREMENTS

A. Definition of Transuranic Waste. Transuranic waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for:

(1) High-level radioactive waste;

(2) Waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or

(3) Waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61.

B. Management of Specific Wastes. The following provide for management of specific wastes as transuranic waste in accordance with the requirements in this Chapter:

(1) **Mixed Transuranic Waste**. Transuranic waste determined to contain both a hazardous component subject to the *Resource Conservation and Recovery Act* (RCRA), as amended, and a radioactive component subject to the *Atomic Energy Act of 1954*, as amended, shall be managed in accordance with the requirements of RCRA and DOE O 435.1, *Radioactive Waste Management*, and this Manual.

(2) **TSCA-Regulated Waste**. Transuranic waste containing polychlorinated biphenyls, asbestos, or other such regulated toxic components shall be managed in accordance with requirements derived from the *Toxic Substances Control Act*, as amended, DOE O 435.1, *Radioactive Waste Management*, and this Manual.

(3) **Pre-1970 Transuranic Waste**. Transuranic waste disposed of prior to implementation of the 1970 Atomic Energy Commission Immediate Action Directive regarding retrievable storage of transuranic waste is not subject to the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual.

C. Complex-Wide Transuranic Waste Management Program. A complex-wide program and plan shall be developed as described under *Responsibilities*, 2.B and 2.D, in Chapter I of this Manual.

D. Radioactive Waste Management Basis. Transuranic 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:

(1) **Generators**. The waste certification program.

(2) **Treatment Facilities**. The waste acceptance requirements and the waste certification program.

(3) **Storage Facilities**. The waste acceptance requirements and the waste certification program.

(4) **Disposal Facilities**. The performance assessment, disposal authorization statement, waste acceptance requirements, and monitoring plan.

E. Contingency Actions. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Contingency Storage**. For off-normal or emergency situations involving liquid transuranic waste storage or treatment, spare capacity with adequate capabilities shall be maintained to receive the largest volume of liquid contained in any one storage tank or treatment facility. Tanks or other facilities that are designated transuranic waste contingency storage shall be maintained in an operational condition when waste is present and shall meet the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual.

(2) **Transfer Equipment**. Pipelines and auxiliary facilities necessary for the transfer of liquid waste to contingency storage shall be maintained in an operational condition when waste is present and shall meet the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual.

F. Corrective Actions. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Order Compliance**. Corrective actions shall be implemented whenever necessary to ensure the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual are met.

(2) **Operations Curtailment**. Operations shall be curtailed or facilities shut down for failure to establish, maintain, or operate consistent with an approved radioactive waste management basis.

G. Waste Acceptance. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Technical and Administrative**. Waste acceptance requirements for all transuranic waste storage, treatment, or disposal facilities, 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 transportation, storage, treatment, or disposal;

(c) Restrictions or prohibitions on waste, materials, or containers that may adversely affect waste handlers or compromise facility or waste container performance;

(d) Requirement to identify transuranic waste as defense or non-defense, and limitations on acceptance; and

(e) 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. Each exception request shall be documented, including its disposition as approved or not approved.

(2) **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 non-conforming wastes shall be established.

H. Waste Generation Planning. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Life-Cycle Planning**. Prior to waste generation, planning shall be performed to address the entire life cycle for all transuranic waste streams.

(2) **Waste With No Identified Path to Disposal**. Transuranic 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.

I. 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.

(1) **Data Quality Objectives**. The data quality objectives process, or a comparable process, shall be used for identifying characterization parameters and acceptable uncertainty in characterization data.

(2) **Minimum Waste Characterization**. 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 stabilization or absorbent media;

(c) Weight of the container and contents;

(d) Identities, activities, and concentrations of major radionuclides;

(e) Characterization date;

(f) Generating source;

(g) Packaging date; and

(h) Any other information which may be needed to prepare and maintain the disposal facility performance assessment or demonstrate compliance with applicable performance objectives.

J. Waste Certification. A waste certification program shall be developed, documented, and implemented to ensure that the waste acceptance requirements of facilities receiving transuranic waste for storage, treatment, or disposal are met.

(1) **Certification Program**. 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.

(2) **Certification Before Transfer**. Transuranic waste shall be certified as meeting waste acceptance requirements before it is transferred to the facility receiving the waste.

(3) **Maintaining Certification**. Transuranic waste that has been certified as meeting the waste acceptance requirements for transfer to a storage, treatment, or disposal facility shall be managed in a manner that maintains its certification status.

K. Waste Transfer. A documented process shall be established and implemented for transferring responsibility for management of transuranic waste and for ensuring availability of relevant data. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Authorization**. Transuranic waste shall not be transferred to a storage, treatment, or disposal facility until personnel responsible for the facility receiving the waste authorize the transfer.

(2) **Data**. Waste characterization data, container information, and generation, storage, treatment, and transportation information for transuranic waste shall be transferred with or be traceable to the waste.

L. Packaging and Transportation. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Packaging**.

(a) Transuranic 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 is removed from the container.

(b) Vents or other mechanisms to prevent pressurization of containers or generation of flammable or explosive concentrations of gases shall be installed on containers of newly-generated waste at the time the waste is packaged. Containers of currently stored waste shall meet this requirement as soon as practical unless analyses demonstrate that the waste can otherwise be managed safely.

(c) When transuranic waste is packaged, defense waste shall be packaged separately from non-defense waste, if feasible.

(d) Containers of transuranic waste shall be marked such that their contents can be identified.

(2) **Transportation**. To the extent practical, the volume of waste and number of transuranic waste shipments shall be minimized.

M. Site Evaluation and Facility Design. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Site Evaluation**. Proposed locations for transuranic waste facilities shall be evaluated to identify relevant features that should be avoided or must be considered in facility design and analyses.

(a) Each site proposed for a new transuranic waste facility or expansion of an existing transuranic waste facility shall be evaluated considering environmental characteristics, geotechnical characteristics, and human activities.

(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.

(2) **Facility Design**. The following facility requirements and general design criteria, at a minimum, apply:

(a) **Confinement**. Transuranic waste systems and components shall be designed to maintain waste confinement.

(b) **Ventilation**.

1. Design of transuranic 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.

2. When conditions exist for generating gases in flammable or explosive concentrations in treatment or storage facilities, ventilation 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.

(c) **Consideration of Decontamination and Decommissioning**. Areas in new and modifications to existing transuranic 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.

(d) **Instrumentation and Control Systems**. Engineering controls shall be incorporated in the design and engineering of transuranic waste treatment and storage facilities to provide volume inventory data and to prevent spills, leaks, and overflows from tanks or confinement systems.

(e) **Monitoring**. Monitoring and/or leak detection capabilities shall be incorporated in the design and engineering of transuranic waste storage, treatment, and disposal facilities to provide rapid identification of failed confinement and/or other abnormal conditions.

N. Storage. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Storage Prohibitions**. Transuranic 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.

(2) **Storage Integrity**. Transuranic waste shall be stored in a location and manner that protects the integrity of waste for the expected time of storage and minimizes worker exposure.

(3) **Container Inspection**. A process shall be developed and implemented for inspecting and maintaining containers of transuranic waste to ensure container integrity is not compromised.

(4) **Retrievable Earthen-Covered Storage**. Plans for the removal of transuranic waste from retrievable earthen-covered storage facilities shall be established and maintained. Prior to commencing waste retrieval activities, each waste storage site shall be evaluated to determine relevant information on types, quantities, and location of radioactive and hazardous chemicals as necessary to protect workers during the retrieval process.

O. Treatment. Transuranic waste shall be treated as necessary to meet the waste acceptance requirements of the facility receiving the waste for storage or disposal.

P. Disposal. Transuranic waste shall be disposed in accordance with the requirements of 40 CFR Part 191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes*.

Q. Monitoring. The following requirements are in addition to those in Chapter I of this Manual.

(1) **All Waste Facilities**. Parameters that shall be sampled or monitored, at a minimum, 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.

(2) **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.

(3) **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.

CHAPTER IV

LOW-LEVEL WASTE REQUIREMENTS

A. 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 (as defined in section 11e.(2) of the *Atomic Energy Act of 1954*, as amended), or naturally occurring radioactive material.

B. Management of Specific Wastes. The following provide for management of specific wastes as low-level waste in accordance with the requirements in this Chapter:

(1) **Mixed Low-Level Waste**. Low-level waste determined to contain both source, special nuclear, or byproduct material subject to the *Atomic Energy Act of 1954*, as amended, and a hazardous component subject to the *Resource Conservation and Recovery Act* (RCRA), as amended, shall be managed in accordance with the requirements of RCRA and DOE O 435.1, *Radioactive Waste Management*, and this Manual.

(2) **TSCA-Regulated Waste**. Low-level waste containing polychlorinated biphenyls, asbestos, or other such regulated toxic components shall be managed in accordance with requirements derived from the *Toxic Substances Control Act*, as amended, DOE O 435.1, *Radioactive Waste Management*, and this Manual.

(3) **Accelerator-Produced Waste**. Radioactive waste produced as a result of operations of DOE accelerators is low-level waste and shall be managed in accordance with DOE O 435.1, *Radioactive Waste Management*, and this Manual, and all applicable Federal or State requirements.

(4) **11e.(2) and Naturally Occurring Radioactive Material**. Small quantities of 11e.(2) byproduct material and naturally occurring radioactive material may be managed as low-level waste provided they can be managed to meet the requirements for low-level waste disposal in Section IV.P of this Manual.

C. Complex-Wide Low-Level Waste Management Program. A complex-wide program and plan shall be developed as described under *Responsibilities*, 2.B and 2.D, in Chapter I of this Manual.

D. Radioactive Waste Management Basis. Low-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:

(1) **Generators**. The waste certification program.

(2) **Treatment Facilities**. The waste acceptance requirements and the waste certification program.

(3) **Storage Facilities**. The waste acceptance requirements and the waste certification program.

(4) **Disposal Facilities**. The performance assessment, composite analysis, disposal authorization statement, closure plan, waste acceptance requirements, and monitoring plan.

E. Contingency Actions. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Contingency Storage**. For off-normal or emergency situations involving high activity or high hazard liquid low-level waste storage or treatment, spare capacity with adequate capabilities shall be maintained to receive the largest volume of liquid contained in any one storage tank or treatment facility. Tanks or other facilities that are designated low-level waste contingency storage shall be maintained in an operational condition when waste is present and shall meet the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual.

(2) **Transfer Equipment**. Pipelines and auxiliary facilities necessary for the transfer of high activity or high hazard liquid low-level waste to contingency storage shall be maintained in an operational condition when waste is present and shall meet the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual.

F. Corrective Actions. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Order Compliance**. Corrective actions shall be implemented whenever necessary to ensure the requirements of DOE O 435.1, *Radioactive Waste Management*, and this Manual are met.

(2) **Operations Curtailment**. Operations shall be curtailed or facilities shut down for failure to establish, maintain, or operate consistent with an approved radioactive waste management basis.

G. Waste Acceptance. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Technical and Administrative**. Waste acceptance requirements for all low-level waste storage, treatment, or disposal facilities, 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 transportation, storage, treatment, or disposal.

(c) Restrictions or prohibitions on waste, materials, or containers that may adversely affect waste handlers or compromise facility or waste container performance.

(d) The following are additional waste acceptance requirements that shall be specified in low-level waste disposal facility waste acceptance requirements:

1. 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.

2. 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.

3. 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.

4. 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.

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

(e) 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. Each exception request shall be documented, including its disposition as approved or not approved.

(2) **Evaluation and Acceptance**. The receiving facility shall evaluate waste for acceptance, including confirmation that the technical and administrative requirements have been met. A process for the disposition of non-conforming wastes shall be established.

H. Waste Generation Planning. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Life-Cycle Planning**. Prior to waste generation, planning shall be performed to address the entire life cycle for all low-level waste streams.

(2) **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.

I. Waste Characterization. Low-level 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.

(1) **Data Quality Objectives**. The data quality objectives process, or a comparable process, shall be used for identifying characterization parameters and acceptable uncertainty in characterization data.

(2) **Minimum Waste Characterization**. 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 stabilization or absorbent media;

(c) Weight of the container and contents;

(d) Identities, activities, and concentrations of major radionuclides;

(e) Characterization date;

(f) Generating source; and

(g) Any other information which may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with applicable performance objectives.

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

(1) **Certification Program**. 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.

(2) **Certification Before Transfer**. Low-level waste shall be certified as meeting waste acceptance requirements before it is transferred to the facility receiving the waste.

(3) **Maintaining Certification**. Low-level waste that has been certified as meeting the waste acceptance requirements for transfer to a storage, treatment, or disposal facility shall be managed in a manner that maintains its certification status.

K. Waste Transfer. A documented process shall be established and implemented for transferring responsibility for management of low-level waste and for ensuring availability of relevant data. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Authorization**. Low-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.

(2) **Data**. Waste characterization data, container information, and generation, storage, treatment, and transportation information for low-level waste shall be transferred with or be traceable to the waste.

L. Packaging and Transportation. The following requirements are in addition to those in Chapter I of this Manual.

(1) **Packaging**. If containers are used:

(a) 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.

(b) 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.

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

(2) **Transportation**. To the extent practical, the volume of waste and number of low-level waste shipments shall be minimized.

M. Site Evaluation and Facility Design. The following requirements are in addition to those in Chapter I of this Manual.

(1) **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.

(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.

(2) **Low-Level Waste Treatment and Storage Facility Design**. The following facility requirements and general design criteria, at a minimum, apply:

(a) **Confinement**. Low-level waste systems and components shall be designed to maintain waste confinement.

(b) **Ventilation**.

1. 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.

2. 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.

(c) **Consideration of Decontamination and Decommissioning**. 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.

(d) **Instrumentation and Control Systems**. Engineering controls shall be incorporated in the design and engineering of low-level waste treatment and storage facilities to provide volume inventory data and to prevent spills, leaks, and overflows from tanks or confinement systems.

(e) **Monitoring**. Monitoring and/or leak detection capabilities shall be incorporated in the design and engineering of low-level waste treatment and storage facilities to provide rapid identification of failed confinement and/or other abnormal conditions.

(3) **Low-Level Waste Disposal Facility Design**. The following facility requirements and general design criteria, at a minimum, apply:

(a) **Confinement**. Low-level waste systems and components shall be designed to maintain waste confinement.

(b) **Ventilation**.

1. Design of low-level waste disposal 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.

2. 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.

(c) **Stability**. 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.

(d) **Control of Water**. Low-level waste disposal facilities shall be designed to minimize to the extent practical, the contact of waste with water during and after disposal.

N. Storage and Staging. The following requirements are in addition to those in Chapter I of this Manual.

(1) **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.

(2) **Storage Limit**. 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.

(3) **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 and minimizes worker exposure.

(4) **Waste Characterization for Storage**.

(a) Low-level waste that does not have an identified path to disposal shall be characterized as necessary to meet the data quality objectives and minimum characterization requirements of this Chapter, to ensure safe storage, and to facilitate disposal.
(b) Characterization information for all low-level waste in storage shall be maintained as a record in accordance with the requirements for Records Management in Chapter I of this Manual.

(5) **Container Inspection**. A process shall be developed and implemented for inspecting and maintaining containers of low-level waste to ensure container integrity is not compromised.

(6) **Storage Management**. Low-level waste storage shall be managed to identify and segregate low-level waste from mixed low-level waste.

(7) **Staging**. Staging of low-level waste shall be for the purpose of the accumulation of such quantities of waste as necessary to facilitate transportation, treatment, and disposal. Staging longer than 90 days shall meet the requirements for storage above and in Chapter I of this Manual.

O. Treatment. Low-level waste treatment to provide more stable waste forms and to improve the long-term performance of a low-level waste disposal facility shall be implemented as necessary to meet the performance objectives of the disposal facility.

P. Disposal. Low-level waste disposal facilities shall meet the following requirements.

(1) **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:

(a) 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.

(b) 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.

(c) 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.

(2) **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 in this Chapter are not exceeded as a result of operation and closure of the facility.

(a) Analyses performed to demonstrate compliance with the performance objectives in this Chapter, and to establish limits on concentrations of radionuclides for disposal based on the performance measures for inadvertent intruders in this Chapter shall be based on reasonable activities in the critical group of exposed individuals. Unless otherwise specified, the assumption of average living habits and exposure conditions in representative critical groups of individuals projected to receive the highest doses is appropriate. The likelihood of inadvertent intruder scenarios may be considered in interpreting the results of the analyses and establishing radionuclide concentrations, if adequate justification is provided.

(b) 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.

(c) Performance assessments shall address reasonably foreseeable natural processes that might disrupt barriers against release and transport of radioactive materials.

(d) Performance assessments shall use DOE-approved dose coefficients (dose conversion factors) for internal and external exposure of reference adults.

(e) The performance assessment shall include a sensitivity/uncertainty analysis.

(f) Performance assessments shall include a demonstration that projected releases of radionuclides to the environment shall be maintained as low as reasonably achievable (ALARA).

(g) 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.

(h) 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 assumed to 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.

(3) **Composite Analysis**. For disposal facilities which received waste after September 26, 1988, a site-specific radiological composite analysis shall be prepared and maintained that accounts for all sources of radioactive material that may be left at the DOE site and may interact with the low-level waste disposal facility, contributing to the dose projected to a hypothetical member of the public from the existing or future disposal facilities. 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 future use commitments to minimize 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.

(4) **Performance Assessment and Composite Analysis Maintenance**. 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. The performance assessment shall be updated to support the final facility

closure. Additional iterations of the performance assessment and composite analysis shall be conducted as necessary during the post-closure period.

(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.

(5) **Disposal Authorization**. A disposal authorization statement shall be obtained prior to construction of a new low-level waste disposal facility. Field Elements with existing low-level waste disposal facilities shall obtain a disposal authorization statement in accordance with 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, composite analysis, 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.

(6) **Disposal Facility Operations**. 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. Low-level waste shall be disposed in such a manner that achieves the performance objectives stated in this

Chapter, consistent with the disposal facility radiological performance assessment. Additional requirements include:

(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. Uncontainerized 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.

(7) **Alternate Requirements for Low-Level Waste Disposal Facility Design and Operation.** Requirements other than those set forth in this Section for the design and operation of a low-level waste disposal facility may be approved on a specific basis if a reasonable expectation is demonstrated that the disposal performance objectives will be met.

Q. Closure. The following requirements are in addition to those in Chapter I of this Manual.

(1) **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:

(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 5400.5, *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.

(2) **Disposal Facility Closure**. 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 5400.5, *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.

R. Monitoring. The following requirements are in addition to those in Chapter I of this Manual.

(1) **All Waste Facilities**. Parameters that shall be sampled or monitored, at a minimum, 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.

(2) **Liquid Waste Storage Facilities**. For facilities storing liquid low-level waste, the following shall also be monitored: liquid level and/or waste volume, and significant waste chemistry parameters.

(3) **Disposal Facilities**. 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. 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.

(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 in this Chapter.

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DEFINITIONS

As used in the DOE 435.1 directives, the following terms have the meanings indicated.

1. AUTHORIZATION BASIS. Those aspects of the facility design basis and operational requirements relied upon by DOE to authorize operation. They are considered to be important to the safety of the facility operations. The authorization basis is described in documents such as the facility Safety Analysis Report and other safety analysis; Hazard Classification Documents, Technical Safety Requirements, DOE-issued safety evaluation reports, and facility-specific commitments made in order to comply with DOE Orders or policies. [Adapted from: DOE Glossary, DOE 5480.21 and DOE 5480.23]

2. BYPRODUCT MATERIAL. (1) Any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material, and (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. [Source: *Atomic Energy Act of 1954*, as amended, section 11(e)]

3. CANISTERED WASTE FORM. High-level waste form in a sealed canister. [Source: EM-WAPS, DOE/EM-0093]

4. CLOSURE. Deactivation and stabilization of a radioactive waste facility intended for long-term confinement of waste. [No other source of definition identified]

5. COMPOSITE ANALYSIS. An analysis that accounts for all sources of radioactive material that may contribute to the long-term dose projected to a hypothetical member of the public from an active or planned low-level waste disposal facility. The analysis is a planning tool intended to provide a reasonable expectation that current low-level waste disposal activities will not result in the need for future corrective or remedial actions to ensure protection of the public and the environment. [Adapted from: Revised Interim DOE Policy on Management Direction and Oversight of Low-Level Radioactive Waste Management Disposal]

6. CONFINEMENT. The control or retention of radioactive materials within a designated boundary. Primary confinements are process enclosures and other spaces normally containing radioactive material. Secondary confinement surrounds one or more primary confinement systems. [Adapted from: DOE 6430.1A]

7. CONTAINER. See WASTE CONTAINER.

8. DEACTIVATED HIGH-LEVEL WASTE FACILITY. A high-level waste facility that has been put into a stable condition through the removal of readily retrievable hazardous and radioactive materials to protect the worker, public health and safety, and the environment,

thereby limiting the long-term cost of surveillance and maintenance. A facility in a deactivated status has not had all necessary decontamination performed, e.g., removal of contamination remaining in fixed structures and equipment after deactivation. [Adapted from: DOE O 430.1A]

9. DEFENSE-IN-DEPTH. The practice of using physical systems and administrative systems in a structure of mutual reenforcement to avoid exposure of the public, the workforce, and the environment to nuclear radiation and to radioactive materials. [Source: DNFSB/TECH-6]

10. DEPARTMENTAL ELEMENTS. First-tier organizations at Headquarters and in the Field. First-tier at Headquarters is the Secretary, Deputy Secretary, Under Secretary, and Secretarial Officers (Assistant Secretaries and Staff Office Directors). First-tier in the Field is Managers of the eight Operations Offices, Managers of the three Field Offices, and the Administrators of the Power Marketing Administrations. Headquarters and Field Elements are described as follows: (1) Headquarters Elements are DOE organizations located in the Washington, DC, Metropolitan Area; and (2) Field Elements is a general term for all DOE sites (excluding individual duty stations) located outside of the Washington, DC, Metropolitan Area. [Source: DOE Glossary]

11. DESIGN BASIS. Information that identifies the specific functions to be performed by a structure, system, or component of a facility, and the specific values or range of values chosen for controlling parameters as reference bounds of design. These values may be (1) restraints derived from generally accepted "state of the art" practices for achieving functional goals, or (2) requirements derived from analyses (based on calculations and/or experiments) of the effects of a postulated accident for which a structure, system, or component must meet its functional goals. [Adapted from: 10 CFR Part 50]

12. DISPOSAL. Emplacement of waste in a manner that ensures protection of the public, workers, and the environment with no intent of retrieval and that requires deliberate action to regain access to the waste. [Adapted from: DOE 5820.2A]

13. DISPOSAL AUTHORIZATION STATEMENT. Documentation authorizing operation (or continued operation) of a low-level waste disposal facility resulting from the DOE Headquarters review and acceptance of the facility's performance assessment, composite analysis, and other information and evaluations. 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. [Adapted from: Revised Interim DOE Policy Management Direction and Oversight of Low-Level Radioactive Waste Management and Disposal]

14. DISPOSITION. Those activities that follow generation of a waste and which constitute completion of the life cycle of management of the waste, including, but not limited to,

stabilization, deactivation, disposal, decommissioning, dismantlement, and/or reuse. [Adapted from: DOE O 430.1]

15. EFFLUENT. Any treated or untreated air emission or liquid discharge at a DOE site or from a DOE facility. [Source: DOE 5400.1]

16. FACILITY. See RADIOACTIVE WASTE MANAGEMENT FACILITY.

17. FIELD ELEMENT. See DEPARTMENTAL ELEMENTS.

18. FIELD ELEMENT MANAGER. See DEPARTMENTAL ELEMENTS.

19. GENERATOR. Organizations within DOE or managed by DOE whose act or process produces radioactive waste or, for the purposes of the generator requirements in this Order and Manual, transfer radioactive waste to a treatment, storage, or disposal facility. [Adapted from: 40 CFR Part 270]

20. GRADED APPROACH. A process by which the level of analysis, documentation, and actions necessary to comply with a requirement are commensurate with (1) the relative importance to safety, safeguards, and security; (2) the magnitude of any hazard involved; (3) the life cycle stage of a facility; (4) the programmatic mission of a facility; (5) the particular characteristics of a facility; and (6) any other relevant factor. [Source: 10 CFR 830.3]

21. HAZARD. A source of danger (i.e., material, energy source, or operation) with the potential to cause illness, injury, or death to personnel or damage to an operation or to the environment (without regard for the likelihood or credibility of accident scenarios or consequence mitigation). [Source: DOE M 411.1-1]

22. 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 in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation. [Adapted from: *Nuclear Waste Policy Act of 1982*, as amended]

23. LESSONS LEARNED. The process for communicating a "good work practice" or innovative approach that should be implemented or an adverse work practice or experience that should be avoided. [Adapted from: DOE M 232.1-1A]

24. LIFE CYCLE. The life of a waste from generator planning through generation, storage, treatment, and disposal. [Adapted from: DOE O 430.1A]

25. LOW-LEVEL WASTE. Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as

defined in section 11e.(2) of the *Atomic Energy Act of 1954*, as amended), or naturally occurring radioactive material. [Adapted from: *Nuclear Waste Policy Act of 1982*, as amended]

26. MAINTENANCE. Day-to-day work, including preventive and predictive maintenance, that is required to maintain and preserve plant and capital equipment in a condition suitable for it to be used for its designated purpose. [Source: DOE O 430.1A]

27. MIXED WASTE. Waste that contains both source, special nuclear, or by-product material subject to the *Atomic Energy Act of 1954*, as amended, and a hazardous component subject to the *Resource Conservation and Recovery Act*. [Adapted from: *Federal Facility Compliance Act of 1992*]

28. NATURALLY OCCURRING RADIOACTIVE MATERIAL (NORM). Naturally occurring materials not regulated under the *Atomic Energy Act of 1954*, as amended whose composition, radionuclide concentrations, availability, or proximity to man have been increased by or as a result of human practices NORM does not include the natural radioactivity of rocks or soils, or background radiation. [Adapted from: January 1997 Draft Part N, Regulation and Licensing of Naturally Occurring Radioactive Material, Conference of Radiation Control Program Directors, Inc.]

29. NEAR SURFACE DISPOSAL. Disposal of radioactive waste on or near the earth's surface. The term encompasses a wide range of methods, including disposal in earthen trenches several meters deep, disposal in engineered structures constructed on or below the surface, and disposal in structures or rock caverns tens of meters below the earth's surface. Near surface disposal does not include disposal in a deep geologic repository. [Adapted from: IAEA Safety Standard No. 111-S-3]

30. NECESSARY AND SUFFICIENT PROCESS. The sets of standards which are the product of the "Necessary and Sufficient Process" of DOE M 450.3-1. That process establishes the sets of agreed upon standards to ensure adequate protection of the safety and health of workers and the public and the protection of the environment against the hazards associated with performing the work of the Department of Energy. [Adapted from: DOE G 450.3-1]

31. OVERSIGHT. The responsibility and authority assigned to line management to assess the adequacy of DOE and contractor performance. Independent Oversight refers to the responsibility and authority assigned to the Assistant Secretary for Environment, Safety and Health to independently assess the adequacy of DOE and contractor performance. [Adapted from: DOE M 411.1-1]

32. PERFORMANCE ASSESSMENT. An analysis of a radioactive waste disposal facility conducted to demonstrate there is a reasonable expectation that performance objectives

established for the long-term protection of the public and the environment will not be exceeded following closure of the facility. [Adapted from: DOE 5820.2A]

33. PROGRAM SECRETARIAL OFFICER. Head of a Departmental Element who has responsibility for a specific program or facility(ies). These include the Deputy Administrator for Defense Programs; the Assistant Secretaries for Energy Efficiency and Renewable Energy, Environmental Management, and Fossil Energy; and the Directors of the Offices of Civilian Radioactive Waste Management, Science, and Nuclear Energy; and (2) a Cognizant Secretarial Officer is a DOE official at the Assistant Secretary level who is responsible for the assignment of work, the institutional overview of any type of facility, or both, and the management oversight of a laboratory. [Source: DOE M 232.1-1A]

34. RADIOACTIVE MIXED WASTE. See MIXED WASTE.

35. RADIOACTIVE WASTE. Any garbage, refuse, sludges, and other discarded material, including solid, liquid, semisolid, or contained gaseous material that must be managed for its radioactive content. [Adapted from: 40 CFR Part 240]

36. RADIOACTIVE WASTE MANAGEMENT BASIS. The radioactive waste management controls applied to DOE facilities, operations, and activities to provide near- and long-term protection of public, workers, and the environment. The radioactive waste management basis consists of controls and analyses such as facility waste certification programs, facility waste acceptance requirements, low-level waste disposal facility closure plans, performance assessments, composite analyses, and other facility-specific processes, procedures, and analyses made to comply with DOE O 435.1 and its Manual. [No other source of definition identified]

37. RADIOACTIVE WASTE MANAGEMENT FACILITY/OPERATIONS/ACTIVITIES. All land, structures, other appurtenances, and improvements on the land which generate, treat, store, or dispose of radioactive waste, and the operations and activities associated therewith. [Adapted from: DOE 5820.2A]

38. RECORD. A completed document or other medium that provides objective evidence of an item, service, or process. [Source: 10 CFR 830.3]

39. RELEASE. Any discharging, dumping, emitting, emptying, escaping, injecting, leaching, leaking, pouring, pumping, spilling of radioactive substances into the environment including abandoning any type of receptacle containing radioactive substances, but does not include disposal in a permitted disposal facility. [Adapted from: DOE Glossary]

40. RELEASE OF WASTE. The exercising of DOE's authority to release property that has been declared waste from its control after confirming that residual radioactive material on the waste has been determined to meet the guidelines for residual radioactive material in

accordance with DOE 5400.5, *Radiation Protection of the Public and the Environment*, and other applicable radiological requirements. [Adapted from: DOE 5400.5]

41. SITE. A geographic entity comprising leased or owned land, buildings, and other structures required to perform program activities. [Source: DOE O 430.1A]

42. SOURCE MATERIAL. (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of (i) uranium, (ii) thorium or (iii) any combination thereof. Source material does not include special nuclear material. [Source: 10 CFR Part 40]

43. SPECIAL NUCLEAR MATERIAL. (1) Plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which is determined, pursuant to the provisions of section 51 [of the *Atomic Energy Act of 1954*, as amended], to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material. [Source: *Atomic Energy Act of 1954*, as amended]

44. SPENT NUCLEAR FUEL. Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing. Test specimens of fissionable material irradiated for research and development only, and not production of power or plutonium, may be classified as waste, and managed in accordance with the requirements of this Order when it is technically infeasible, cost prohibitive, or would increase worker exposure to separate the remaining test specimens from other contaminated material. [Adapted from: DOE 5820.2A]

45. STAGING. Storing waste for the purpose of accumulation to facilitate transportation, transfer, treatment, and/or disposal. [Adapted from: Surplus Plutonium Disposition Draft Environmental Impact Statement, July 1998]

46. STORAGE. The holding of radioactive waste for a temporary period, at the end of which the waste is treated, disposed of, or stored elsewhere. [Adapted from: 40 CFR Part 260]

47. STORAGE FOR DECAY. Storage of radioactive waste for a period of time sufficient for radionuclide(s) of concern to be reduced in concentration, by radioactive decay, to a level of lower concern. [Source: DOE 5820.2A]

48. SYSTEMS ENGINEERING. A total systematic approach for the development of systems in response to a defined need. It involves a comprehensive, structured and disciplined approach to all life-cycle phases. Systems Engineering employs a multi-discipline team to iteratively define and refine solutions to problems throughout the system life cycle. Preferred alternatives are selected based on cost, schedule, performance and risk. Management of risk is integral to the process. Progressive verification, from individual

components up through the total system, is required. [Source: EIA-632, Systems Engineering]

49. TRANSURANIC WASTE. Transuranic waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level radioactive waste; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the Environmental Protection Agency, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61. [Source: *WIPP Land Withdrawal Act of 1992*, as amended]

50. TREATMENT. Any method, technique, or process designed to change the physical or chemical character of waste to render it: less hazardous; safer to transport, store, or dispose of; or reduce its volume. [Source: DOE 5820.2A]

51. WASTE ACCEPTANCE CRITERIA (WAC). Waste acceptance criteria are the technical and administrative requirements that a waste must meet in order for it to be accepted at a storage, treatment, or disposal facility. [Adapted from: DOE 5820.2A]

52. WASTE ACCEPTANCE REQUIREMENTS. Waste acceptance requirements are waste acceptance criteria, and all other requirements that a facility receiving radioactive waste for storage, treatment, or disposal must meet to receive waste (e.g., waste acceptance program requirements, receiving facility operations manual). [Adapted from: DOE O 5820.2A]

53. WASTE CHARACTERIZATION. The identification of waste composition and properties, by review of acceptable knowledge (which includes process knowledge), or by nondestructive examination, nondestructive assay, or sampling and analysis, to comply with applicable storage, treatment, handling, transportation, and disposal requirements. [Adapted from: DOE Glossary ("Characterization" definition) and Federal Register, Vol. 62, No. 224]

54. WASTE CERTIFICATION. A process by which a waste generator affirms that a given waste or waste stream meets the waste acceptance criteria of the facility to which the generator intends to transfer waste for treatment, storage, or disposal. [Adapted from: DOE 5820.2A]

55. WASTE CONTAINER. A receptacle for waste, including any liner, shielding, or material that is intended to accompany the waste in disposal. [Adapted from: DOE 5820.2A]

56. WASTE MANAGEMENT. The planning, coordination, and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated surveillance and maintenance activities. [Source: DOE 5820.2A]

57. WASTE STREAM. A waste or group of wastes from a process or a facility with similar physical, chemical, or radiological properties. [Adapted from: DOE 5820.2A]