IMPLEMENTATION GUIDE

for use with DOE M 435.1-1

Chapter III

Transuranic Waste Requirements

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III. 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.

Objective:

The objective of this requirement is to provide the criteria for determining if a waste is to be managed in accordance with DOE M 435.1-1, Chapter III, *Transuranic Waste Requirements*. Additionally, it is necessary to determine if a waste meets the definition of transuranic waste to enable the Department of Energy to comply with provisions in the *Waste Isolation Pilot Plant Land Withdrawal Act of 1992*, as amended.

Discussion:

Basis. This definition of transuranic waste is the definition used in the *Waste Isolation Pilot Plant* (WIPP) *Land Withdrawal Act of 1992*, as amended. This definition is functionally equivalent to that in 40 CFR Part 191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes*. The *WIPP Land Withdrawal Act of 1992*, as amended, defines transuranic waste and limits disposal at WIPP to transuranic waste resulting from atomic energy defense activities which meets this definition.

Interpretation and Application. In order to ensure consistent application, various terms used in the definition need to be clarified. First, the limit above which a waste is determined to be transuranic waste is based on an activity of 100 nanocuries (nCi) (3700 becquerels (Bq)) per gram of waste. The activity to be counted in making this determination is only that from the isotopes that would qualify a waste as transuranic waste as described in the following paragraphs. In other words, one would not include the activity from short-lived fission products (i.e., non-alpha emitters with half-lives less than 20 years) in calculating the concentration. The mass over which the activity is divided in making the waste determination is the waste matrix. This includes the waste material itself as well as any stabilization media that must be added to meet waste acceptance criteria for mobility, physical form, structural stability or free liquids. The mass of added shielding, the container, or any rigid liners is not included in the calculation.

The term transuranic means those elements with an atomic number greater than that of uranium (i.e., atomic number >92). Therefore, uranium wastes do not qualify as transuranic waste by virtue of their uranium concentration.

The transuranic radionuclides that are to be considered in making a transuranic waste determination must decay by emission of alpha particles and also must have a half-life greater than 20 years. Consistent with this portion of the definition, there are radionuclides with atomic numbers greater than 92 that would not cause a waste to be called transuranic waste.

> *Example: A waste is contaminated with americium-242 which predominantly decays by emission of a beta particle and has a 16-hour half-life. Even though americium-242 has an atomic number greater than 92, it cannot be considered in determining the waste type because it is not an alpha emitter and does not have a 20-year half life.*

Given the definition provided in the public law and its application pursuant to DOE M 435.1-1, the determination of transuranic waste should be made at the time of waste certification, that is, each time the waste is transferred to another person or facility (see guidance for DOE M 435.1-1, Section III.J).

> *Example 1: A waste is contaminated with curium-244 which is an alpha-emitter and has an atomic number greater than 92. Over a period of about 200 years, a sufficient inventory of curium-244 will decay to greater than 100 nCi/g of plutonium-240, an alpha emitter with a 6,750-year half-life. Regardless of the decay product, the curium-244 content of the waste is not relevant to the determination of whether the waste is transuranic because the curium has an 18.11-year half-life and the determination is made at the time the waste is certified as meeting a facility's waste acceptance criteria. However, even if the waste is determined to be a low-level waste, the method of disposal must be commensurate with the long-term hazard associated with the plutonium-240 decay product.*

> *Example 2: A waste is generated and placed in bags within 55-gallon drums. The waste has been characterized and certified as transuranic waste in accordance with the waste acceptance criteria of the facility receiving the waste. This same waste, if required to undergo solidification to enable shipment and disposal, could be re-certified after treatment by the treating facility as low-level waste, in the event that radioassay found*

that the solidification process reduced the concentration of relevant radioisotopes to less than 100 nCi (3700 Bq) per gram of waste matrix.

In the previous example, the waste form would be altered by the addition of solidifying agents that would be considered in the radioassay. In either of the two cases in the previous example, the determination would not consider the waste container or its rigid liner. Even if a waste container fails and has to be overpacked, the mass of the failed container does not need to be included in the transuranic waste determination.

Example: A 55-gallon drum is damaged, has leaked, and requires overpacking. The concentration determination would include the weights of the original waste matrix and interior bags, but not the weight of the failed drum.

It is also conceivable that a low-level waste could become sufficiently concentrated that it becomes a transuranic waste.

Example: A waste with a relatively high concentration of transuranic radionuclides (but less than 100 nCi (3700 Bq) per gram) is transferred to a treatment facility as low-level waste. The thermal treatment of the waste reduces the mass of the waste matrix enough that the resulting transuranic concentration exceeds 100 nCi (3700 Bq) per gram. If no additional treatment (e.g., stabilization) were necessary, the resulting waste would be categorized as transuranic waste.

Determining whether waste exceeds the 100 nCi/g (3700 Bq/g) shall be in accordance with the requirements and guidance issued by the Carlsbad Area Office in the *Transuranic Waste Characterization Quality Assurance Program Plan, Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, and/or other controlling documents. Waste which does not exceed the 100 nCi/g limit is to be managed in accordance with the low-level waste requirements of DOE M 435.1-1.

Dilution of a transuranic waste stream to reclassify the waste as low-level waste (i.e., reducing the concentration to less than or equal to 100 nCi (3700 Bq) per gram) is not permitted by the Department. While it is recognized that in the course of stabilizing a waste stream some changes in waste concentration may occur, actions to dilute a waste stream below the concentration limits for transuranic waste are prohibited. It is also recognized that actions taken to process a waste stream for safety or technological reasons that are justified, may result in the waste being reclassified after processing as low-level waste.

Example: Due to the moisture content of a transuranic waste sludge, the waste does not meet the WIPP WAC. The site evaluates several treatment options taking into consideration factors such as worker exposure, waste minimization, cost and complexity *of the treatment process and disposal facility waste acceptance requirements. The treatment process selected involves adding grout to the transuranic waste sludge to eliminate free liquids resulting in a solidified waste form that contains transuranic radionuclides in concentrations less than 100 nCi (3700 Bq) per gram and meets the waste acceptance criteria for a low-level waste disposal facility.*

There are three exceptions to the definition of transuranic waste: the high-level waste exception; the degree of isolation exception; and the NRC-approved disposal exception.

High-Level Waste Exception. The definition of transuranic waste includes exceptions for some wastes that would otherwise be considered transuranic waste. The first exception to the definition of transuranic waste is waste that meets the definition of high-level waste (see Definition of High-Level Waste guidance). Because high-level waste is generated by reprocessing spent nuclear fuel, much high-level waste contains concentrations of greater than 100 nCi (3700 Bq) per gram alpha-emitting radionuclides with half-lives greater than 20 years. Separate requirements apply to management of high-level waste, both within and external to DOE. This exception serves to distinguish high-level waste, as defined in DOE M 435.1-1, Chapter II, from transuranic waste.

Example: Waste in underground storage tanks at the Hanford Site contains long-lived, alpha-emitting plutonium and neptunium isotopes in excess of 100 nCi (3700 Bq) per gram. However, the waste is not categorized as transuranic waste because it is highly radioactive waste from reprocessing spent nuclear fuel; i.e., it is high-level waste.

Degree of Isolation Exception. The second exception to the definition of transuranic waste is waste that is determined to not need the degree of isolation that is provided by implementation of the disposal requirements of 40 CFR Part 191. This allows the Secretary of Energy to make a determination to remove these wastes from the transuranic waste definition based on an evaluation of a proposed disposal concept. Such a determination would have to be submitted to and concurred with by the EPA Administrator.

Example: A site is contemplating on-site disposal of a small quantity of a unique waste contaminated with greater than 100 nCi (3700 Bq) per gram of transuranic alpha-emitters with greater than 20-year half-lives. Site personnel submit a rationale for applying standards other than those for transuranic waste disposal, a conceptual disposal design, and a preliminary radiological impacts analysis to the cognizant Headquarters Program Office. The Program Office confers with the Offices of Environmental Management and Environment, Safety, and Health on the proposal. The Headquarters staff agrees with the site's approach, so the Office of Environment, Safety, and Health arranges a meeting with the Environmental Protection Agency. The meeting results in an agreement on the analyses that need to be conducted and the radiological performance measures that apply. Site personnel conduct the analyses, which project *that the performance measures will be met. The analyses are reviewed by Headquarters staff, then by EPA staff. Following resolution of any concerns, the Secretary of Energy determines, and the EPA Administrator concurs, that the waste does not need to be considered transuranic waste, but can be disposed of as low-level waste.*

NRC-Approved Disposal Exception. Under the current regulatory regime, this exception does not affect DOE's management of defense transuranic waste that is to be disposed of at WIPP. This exception gives the Nuclear Regulatory Commissioning (NRC) the latitude to not apply the disposal standards of 40 CFR Part 191 to waste which meets the concentration limits of transuranic waste if the waste is disposed of in an NRC-licensed facility. Waste generated by commercial activities could have concentrations of radionuclides that would result in categorization as transuranic waste. As long as the waste is not high-level waste, it could be accepted as Greater-than-Class-C low-level waste per the waste classification system in 10 CFR 61.55. In accordance with the *Low-Level Radioactive Waste Policy Act*, as amended, the Department is responsible for disposal of Greater-than-Class-C waste; however, disposal of Greater-than-Class C waste generated by an NRC licensee is to be in a facility licensed by the NRC.

The NRC issued a final rule requiring the disposal of Greater-than-Class C low-level radioactive waste in a geologic repository, unless disposal has been approved elsewhere (54 FR 22578, codified at 10 CFR Part 61). The rulemaking clarified that only the requirements governing disposal of high-level radioactive waste in geologic repositories (10 CFR Part 60) would be relevant to disposal of Greater-than-Class C waste in a geologic repository. Although the NRC has indicated that the disposal of Greater-than-Class C waste in near-surface disposal facilities is generally not acceptable, the requirements of 10 CFR Part 61 would be applicable to the disposal of commercially generated (NRC licensed) Greater-than-Class C waste in "intermediate" disposal facilities. The exception to the definition allows NRC to authorize such waste to be disposed without necessarily invoking the additional requirements of 40 CFR Part 191.

Supplemental References:

1. Cowan, 1996. Stephen P. Cowan to Distribution, memorandum, *Implementation Guidance Concerning "Atomic Energy Defense Activities" as Used in the Waste Isolation Pilot Plant Land Withdrawal Act*, U.S. Department of Energy, October 17, 1996.

2. NRC. *Disposal of High-Level Radioactive Wastes in Geologic Repositories*, 10 CFR Part 60, U.S. Nuclear Regulatory Commission, Washington, D.C.

3. NRC. *Licensing Requirements for Land Disposal of Radioactive Waste*, 10 CFR Part 61. U.S. Nuclear Regulatory Commission, Washington, D.C.

4. *Waste Isolation Pilot Plant Land Withdrawal Act of 1992*, as amended, October 30, 1992.

5. *Low-Level Radioactive Waste Policy Amendments Act of 1985*, as amended, January 15, 1986.

6. CAO, 1998. *U.S. Department of Energy, Transuranic Waste Characterization Quality Assurance Program Plan,* Revision 1, CAO-94-1010, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, December 18, 1998.

7. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 5, DOE/WIPP-069, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

8. NRC, 1989. "Final rule, 10 CFR Part 61, Disposal of Radioactive Waste," *Federal Register*, Vol. 54, No. 100, U.S. Nuclear Regulatory Commission, Washington, D.C., May 25, 1989.

9. EPA, 1985. "Final rule, 40 CFR Part 191, Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," *Federal Register*, Vol. 50, No. 182, U.S. Environmental Protection Agency, Washington, D.C., September 19, 1985.

III. 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.

Objective:

The objective of this requirement is to ensure that DOE transuranic waste is managed in accordance with the applicable requirements of external regulations, specifically those of the *Resource Conservation and Recovery Act* and the *Toxic Substances Control Act*, that address non-radiological hazards, in addition to being managed in accordance with the requirements of DOE O 435.1 and the *Radioactive Waste Management Manual*, DOE M 435.1-1.

Discussion:

The *Radioactive Waste Management Manual*, DOE M 435.1-1, contains requirements for managing the radioactive character of transuranic waste. Through the safety and hazards analysis process used in developing the Manual, non-radiological hazards associated with managing certain wastes were identified. During development of the requirements necessary to control the identified hazards, it was concluded that sufficient external regulations, promulgated pursuant to *Resource Conservation and Recovery Act* (RCRA) and *Toxic Substances Control Act* (TSCA), exist for controlling the non-radiological hazard.

In managing transuranic waste which are subject to RCRA and TSCA requirements, personnel should be aware of the requirements for storage and disposal of the waste. The ability to dispose of RCRA and TSCA waste that has a radioactive component is limited. The expectation is that certain mixed wastes can be disposed of at WIPP without treatment (refer to the *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*). Currently, no disposal facilities are available for TSCA-regulated transuranic wastes. Therefore, to the extent practical, waste generators should avoid generating mixed or TSCA-regulated transuranic waste, and generators and waste managers should avoid actions (e.g., commingling wastes with different regulatory requirements) that result in transuranic waste with no path to disposal (see guidance for DOE M 435.1-1, Section I.2.F.(19)).

> *Example: According to the Waste Acceptance Criteria for the Waste Isolation Pilot Plant, PCBs in concentrations greater than 50 ppm cannot be accepted for disposal. Therefore, in performing work involving PCBs (e.g., activities creating waste or waste management such as packaging) care should be taken to avoid commingling PCB contaminated materials with transuranic or mixed transuranic waste. Commingling the wastes could potentially result in a larger volume of waste with no path to disposal. Careful control and segregation of the PCB-contaminated material would result in a relatively small volume of waste that cannot be disposed of and the rest of the waste being eligible for disposal at WIPP*.

<u>RCRA and State Hazardous Waste Regulations</u>. *Resource Conservation and Recovery Act* required the Environmental Protection Agency to promulgate regulations for management of hazardous waste. The Act also provides for states to promulgate and implement hazardous waste regulatory programs that are at least as protective as the Federal program. The hazardous waste requirements that personnel must follow in managing (i.e., generating, transporting, treating, storing or disposing) mixed transuranic waste and in closing affected facilities are primarily in 40 CFR Parts 260 through 270, or authorized state regulations. A variety of guidance manuals and information relevant to the management of the hazardous component of mixed transuranic waste has been prepared both by the state regulatory agencies and the Environmental Protection Agency (see, for example, *U.S. Environmental Protection Agency, Catalog of Hazardous and Solid Waste Publications, EPA530-B-96-007, September, 1996)*. These guidance documents should be consulted when developing management programs for mixed transuranic waste.

Hazardous waste regulations promulgated by States with RCRA authority may be more restrictive than the Federal regulations. The more restrictive requirements may include more waste than the Federal requirements or may impose another state's definition of hazardous waste when waste is received from that state. Waste management personnel therefore need to be aware of the requirements of the regulations in their own state as well as the implications of the regulations in states to which they intend to transfer waste.

Example 1: In a state that invokes requirements equivalent to the EPA hazardous waste regulations, waste oil that meets the radiological criteria for being transuranic waste would not be managed as mixed waste. However, if the oil was to be shipped to another state in which the state-passed regulations had expanded the definition of hazardous waste to include waste oil, the waste would have to be packaged, manifested, transported and stored as a mixed waste.

Example 2: If the direction of waste transfer in the above example were reversed, a different situation could arise. The waste would be declared a mixed waste in the state of origin because the state regulations had a broader definition of hazardous waste. The state to which it was to be shipped did not specifically regulate waste oil as a hazardous waste. However, it may be that the state regulations require that waste be considered to be categorized as it was in the state of origin. Then the waste would still be considered mixed waste even after it was shipped to the state that did not explicitly regulate waste oils.

The RCRA requirements prohibit storage of hazardous (including mixed) waste restricted from land disposal except for purposes of accumulating sufficient quantities to facilitate recovery, treatment, or disposal. Capabilities and capacities to treat DOE mixed waste to the land disposal restriction treatment standards do not exist. Congress addressed this issue in 1992 with passage of the *Federal Facility Compliance Act of 1992* (FFCA). The FFCA required the Department to prepare site-specific treatment plans to address treatment of mixed waste to meet the land disposal restrictions at each facility at which DOE generates or stores mixed waste. To meet the requirement, site-specific treatment plans were developed, and through agreements or consent orders, commitments to schedules to treat or otherwise meet the land disposal restrictions were made. In accordance with the *WIPP Land Withdrawal Act of 1992,* as amended, transuranic mixed waste that is to be disposed at the Waste Isolation Pilot Plant (WIPP) is exempt from having to comply with the treatment standards and is not subject to the land disposal restrictions of 40 CFR Part 268. Therefore, management of most of the transuranic waste addressed in the agreements or consent orders is predicated on the assumption that mixed transuranic waste will be disposed at WIPP without treatment. Waste that is not eligible for disposal at WIPP, i.e., waste that cannot meet the *Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* must comply with RCRA treatment and disposal requirements, the *Federal Facility Compliance Act of 1992*, and consent orders and agreements with the States or EPA. This highlights the importance of avoiding actions in generating or managing waste that result in a waste not being acceptable for disposal at WIPP. Personnel should consult the site-specific treatment plans and agreements or consent orders as part of the life-cycle planning performed in accordance with Waste Generation Planning (DOE M 435.1-1, Section III.H).

PCB, Asbestos, and Other TSCA Wastes. Transuranic wastes contaminated with PCBs do not meet the definition of mixed waste, however, the situation is similar to RCRA in that there are external requirements promulgated under the authority of the *Toxic Substances Control Act* that need to be complied with in addition to the requirements of DOE O 435.1 and DOE M 435.1-1. Waste managers responsible for managing PCB-containing products should consult the EPA requirements at 40 CFR Part 761. The regulations impose requirements for the destruction, storage awaiting destruction, and disposal of PCBs. Unlike mixed wastes, there are no provisions to accommodate PCBs (exceeding 50 ppm) at WIPP. If transuranic waste contaminated with PCBs cannot be treated to reduce the PCB concentration to less than 50 ppm, then it is one of the wastes that currently has no path to disposal (see General Requirements, Section I.2.F.(19)). Waste managers responsible for managing materials containing asbestos should consult the EPA requirements at 40 CFR Part 61, Subpart M. These regulations impose requirements for the removal of asbestos during demolition and renovation and disposal of asbestos-containing waste. This regulation includes cross-references to several other regulations governing management of asbestos that may also apply. Planning for management of transuranic wastes that include a component which is regulated under TSCA is addressed in the Complex-Wide Transuranic Waste Management Program and the appropriate Site-Wide Waste Management Programs (see DOE M 435.1-1, Sections I.2.B.(1) and I.2.F.(1)).

The DOE M 435.1-1 requirements imposed on the radioactive component of RCRA or TSCA waste should not create a duplication of management activities that can be satisfied by compliance with a RCRA or TSCA requirement. Also, documentation required by RCRA or TSCA requirements which provides the same or similar information as required by DOE M 435.1-1 can be used to satisfy the DOE M 435.1-1 requirement.

> *Example: Mixed transuranic waste is being sent from one site to another for storage. The Uniform Hazardous Waste Manifest is prepared as required by 40 CFR Part 262. It is determined that the manifest satisfies the need to document the transfer of ownership of the waste, the transfer date, and physical location of the waste. If the waste acceptance requirements of the facility receiving the waste allow it, the manifest may also provide the necessary information on the chemical and physical characteristics of the waste.*

Compliance with these requirements is demonstrated if RCRA, state-hazardous, and TSCA-regulated radioactive wastes are being managed in compliance with applicable requirements and agreements or in accordance with a consent order, and consistent with the Transuranic Waste Requirements of DOE M 435.1-1.

<u>Pre-1970 Transuranic Waste</u>. A definition for transuranic waste was first put into operational use by the Department's predecessor in 1970. At that time, the decision was made to store waste exceeding the transuranic waste limit. 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 the *Radioactive Waste Management*

Manual. This interpretation is consistent with the decision of the Environmental Protection Agency as documented in the preamble to 40 CFR Part 191 (50 FR 38066). The Agency stated that the disposal standards do not apply to transuranic waste that already has been disposed of because the selection of disposal system site, design, and operational techniques are no longer available options. Therefore, "the Agency believes it appropriate that these disposal standards only apply to disposal occurring after the standards have been promulgated." Transuranic waste consists of waste generated by DOE activities that has been placed in retrievable storage since 1970, and waste that will continue to be generated as a result of plutonium stabilization and management activities, environmental restoration (including remediation of some sites where transuranic waste was previously buried), decontamination and decommissioning, waste management, and testing and research. Transuranic waste that was disposed of prior to 1970, retrieved as part of environmental restoration activities, may be managed in accordance with the requirements of the *Radioactive Waste Management Manual.*

Supplemental References:

1. EPA. 40 CFR Parts 260-270, U.S. Environmental Protection Agency, Washington, D.C.

2. EPA. *Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions*, 40 CFR Part 761, U.S. Environmental Protection Agency, Washington, DC.

3. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* Revision 5, DOE/WIPP-069, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

4. EPA, 1996. *U.S. Environmental Protection Agency Catalog of Hazardous and Solid Waste Publications,* EPA530-B-96-007, U.S. Environmental Protection Agency, Washington, D.C., September 1996.

5. *Federal Facility Compliance Act of 1992,* as amended, October 6, 1992.

6. *Resource Conservation and Recovery Act of 1976*, as amended, October 21, 1986.

7. *Toxic Substances Control Act*, as amended, October 11, 1976.

8. EPA, 1973. *National Emission Standards for Hazardous Air Pollutants – National Emission Standard for Asbestos,* 40 CFR Part 61, Subpart M, U.S. Environmental Protection Agency, Washington, D.C., April 6, 1973.

9. AEC, 1970. *Policy Statement Regarding Solid Waste Burial*, Immediate Action Directive, IAD No. 0511-21, U.S. Atomic Energy Commission, Washington, D.C., March 20, 1970.

III. 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.

Objective:

The objective of this requirement is to ensure the development, documentation, and implementation of a complex-wide transuranic waste management program. The complex-wide program and plan establishes the framework within which individual site programs operate.

Discussion:

The Department's management of transuranic waste occurs at over 15 sites that generate and store waste, as well as at the Waste Isolation Pilot Plant which is to serve as the central repository for most of the waste. A complex-wide program and plan establish the overall mission for the Department's management of transuranic waste and to provide a framework within which the individual site programs operate. The *Radioactive Waste Management Manual*, DOE M 435.1-1, Section I.2.B assigns the Assistant Secretary for Environmental Management the responsibility for developing and maintaining complex-wide, waste-type programs. The *Manual*, DOE M 435.1-1, Section I.2.D also assigns the Deputy Assistant Secretary for Waste Management the responsibility for developing and implementing complex-wide, waste-type program plans. The Complex-Wide Transuranic Waste Management Program and Plan are to be developed following the guidance provided for DOE M 435.1-1, Sections I.2.B and I.2.D.

Compliance with this requirement is demonstrated by the presence of a Complex-Wide Transuranic Waste Management Program which includes the appropriate interfaces, technical information, data inputs, and other elements described in Chapter I of this Manual.

Supplemental References:

1. CAO, 1997. *The National TRU Waste Management Plan*, Revision 1, DOE/NTP-96-1204, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, December 18, 1997.

III. 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.

Objective:

The objective of this requirement is to ensure that the hazards associated with transuranic waste management facilities, operations, and activities have been identified, their potential impacts analyzed, and appropriate controls documented, implemented, and maintained for the protection of workers, the public, and the environment.

Discussion:

As described in the guidance for DOE M 435.1-1, Section I.2.F.(2), the Manual requires the radioactive waste management basis to provide for development and documentation of controls to ensure the safe and efficient management of radioactive waste. Requiring an approved radioactive waste management basis for the initiation of new, or continuation of existing, radioactive waste management activities should prevent the operation of facilities without the appropriate controls. The required elements of the radioactive waste management basis vary with the type of waste management operation or facility and the types of hazards associated with the facility. The term "controls," used here and elsewhere in the discussion of a radioactive waste management basis, refers to processes, procedures, equipment, instruments, and other items intended to curb the likelihood of, or consequences from, a problem that could arise from managing radioactive waste. Controls include such things as placards, alarms, tools, shielding, training, checklists, duplication of critical steps, redundant monitoring, analysis, sampling and testing, etc. The items required for a radioactive waste management basis listed above for the four types of transuranic waste management facilities, operations, and activities is not a complete list of those items which should be included in a radioactive waste management basis. Several processes, procedures, and documents that are required by other directives and requirements provide for radioactive waste management controls that should be considered part of the radioactive waste management basis. The guidance on DOE M 435.1-1, Section I.2.F.(2) discusses this aspect of the radioactive waste management basis in detail.

> *Example: Site X has a transuranic waste storage facility in which they store waste to be shipped to the Waste Isolation Pilot Plant. The Field Element Manager is responsible for ensuring that it operates in accordance with an approved radioactive waste management basis. The DOE staff reviews the waste acceptance requirements, the storage facility's waste certification program, plus the facility-specific procedures implementing the site's radiological control program, health and safety plan, training program, quality assurance program, and record-keeping plan. Based on the staff's review, they report to the Field Element Manager that an adequate radioactive waste management basis has been developed and recommend approval.*

Also, as discussed in the Section I.2.F.(2) guidance, if a transuranic waste management facility already operates under an approved Authorization Basis, it may not need any additional controls to demonstrate that it has a radioactive waste management basis. In this case, the Authorization Basis documentation is reviewed and evaluated to determine whether it sufficiently covers the requirements needed for a radioactive waste management basis. The Field Element Manager has the responsibility to ensure the transuranic waste management facilities under his or her authority have a radioactive waste management basis.

> *Example: Site personnel are developing the radioactive waste management basis for the Site Q Transuranic Waste Management Facility which provides non-destructive characterization, selected treatment and repackaging, and storage capabilities for transuranic waste. The site personnel identify the following documents and programs which include descriptions of the controls for safely managing waste at the facility:*
>
> - *Radiological Control Program*
> - *Site Health and Safety Plan*
> - *Safety Analysis Report (SAR)*
> - *Operational Safety Requirements/Technical Safety Requirements*
> - *Basis for Interim Operations*
> - *Technical Standards*
> - *Unreviewed Safety Questions Evaluation*
> - *DOE Safety Evaluation Report*
> - *Listing of documents that are to be Configuration Managed but are not Authorization Basis Documents (including the waste acceptance criteria and certification program documents).*

Following an analysis of the information contained in the above documents, the staff concludes that the complete set of operational requirements relied on by the site to ensure that the public, workers, and the environment are protected from hazards associated with management of transuranic waste at the facility are in place. A statement is prepared that documents that the radioactive waste management basis is covered by the Authorization Basis for the facility.

For a facility that generates transuranic waste, the radioactive waste management basis is to include the program for certifying that waste meets the waste acceptance requirements of the facility(ies) to which the waste will be sent. The waste certification program is reviewed against the applicable requirements of DOE M 435.1-1 and approved in accordance with the Radioactive Waste Generator Requirements (DOE M 435.1-1, Section I.2.F.(7)) before becoming part of the radioactive waste management basis. As discussed in guidance on DOE M 435.1-1, Section I.2.F.(2), several other processes and procedures contribute to a complete radioactive waste management basis at a generating facility.

Example: A small laboratory facility at Site R generates transuranic waste. The radioactive waste management basis for the facility is established through review and approval of the laboratory's waste certification procedure, and a review confirming the adequacy of the following: the Radiological Control Program, the Health and Safety Plan, the Training Program, and the site waste transfer procedure. This is documented in a radioactive waste management basis statement for the laboratory.

Facilities that store or treat transuranic waste are to have approved waste acceptance requirements (see DOE M 435.1-1, Section III.G) prior to the issuance of a radioactive waste management basis. The waste acceptance requirements will usually suffice as documentation of the radiological, physical, and chemical limitations on waste that can be safely received at the facility, provided they are developed correctly with consideration of the hazards of the waste to be managed, and are kept up to date. Controls on the radiological, physical and chemical limitations need to include considerations of the potential effects of radiolysis.

A facility that stores or treats waste is generally expected to have a waste certification program. Waste from these facilities will have to be certified as meeting the waste acceptance requirements of the facility to which it will be transferred and the facilities have the potential for generating radioactive waste (e.g., secondary processing streams from treatment, monitoring and sampling, radioactive release cleanup). Consequently, storage and treatment facilities should also have an approved waste certification program as part of their radioactive waste management basis. An exception to the need for a waste certification program can be justified based on there being no known path to disposal for the waste or based on the expectation that a long time will elapse (e.g., more than a year) before the certification program has been reviewed and accepted by the receiving facility.

> *Example: A transuranic waste storage facility is used for storing defense transuranic waste that will be shipped to the Waste Isolation Pilot Plant and non-defense transuranic waste. According to the schedule for receipt of waste at WIPP, shipments from the site will not occur for six years. The certification program for the defense waste is not scheduled to be reviewed by WIPP for two years. Because there is no disposal facility to which the non-defense waste can be sent, it is not possible for the storage facility to develop a certification program for that waste (i.e., there are no waste acceptance requirements for a disposal facility to which waste can be certified). The Field Element Manager should proceed with ensuring the development of and approving a radioactive waste management basis for the facility even though fully authorized certification programs do not exist. In this case, an interim certification program for the defense waste may be included as part of the radioactive waste management basis (interim because it has not been reviewed by WIPP personnel). The radioactive waste management basis would be updated after the certification program is reviewed and accepted by WIPP personnel.*

The radioactive waste management basis for transuranic waste disposal facilities is to be based on documented controls similar to those discussed for treatment or storage facilities, but with additional limitations based on the performance assessment required by 40 CFR Part 191 and any conditions associated with authorizing operation of the facility (e.g, the conditions of compliance certification resulting from the Environmental Protection Agency review of DOE's compliance certification application per 40 CFR Part 194) and by the disposal authorization statement issued following approval of the performance assessment. In addition, the radioactive waste management basis should include the development and implementation of a monitoring program designed to evaluate performance of the facility (see guidance for DOE M 435.1-1, Section III.Q).

The results of the 40 CFR Part 191 performance assessment and the safety analyses required by DOE 5480.23 provide the basis on which the quantities and concentrations of radionuclides that can be accepted for disposal will be identified and documented in the waste acceptance requirements. The responsibility for the radioactive waste management basis for transuranic waste disposal facilities resides with the Field Element Manager. However, a review may be required by another organization before the issuance and documentation of the radioactive waste management basis. In the case of the Waste Isolation Pilot Plant, the review was performed by the Environmental Protection Agency and was documented in a compliance certification. If another transuranic waste disposal facility is constructed, a performance assessment will need to be prepared. Review of the performance assessment will be in accordance with either external requirements (if regulations similar to those for WIPP certification are promulgated) or a process imposed by the Department.

Staff responsible for establishing a disposal facility radioactive waste management basis should combine the results of the review of the performance assessment (and compliance certification application if applicable) with their own findings on the waste acceptance requirements and monitoring plans as the basis for documenting the radioactive waste management basis for the disposal facility. Guidance for DOE M 435.1-1 Sections III.G (waste acceptance requirements) and III.Q (monitoring) provides details on what information needs to be addressed to meet the requirements and serve as part of the radioactive waste management basis.

For transuranic waste disposal facilities other than WIPP, a disposal authorization statement is to be issued by Headquarters following the review and approval of the performance assessment as required by DOE M 435.1-1, Section I.2.E.(1). The Waste Isolation Pilot Plant met the requirement for a disposal authorization statement when the Secretary of Energy provided notification to Congress that the Department of Energy would open WIPP for disposal operations pursuant to section 7(b)(3) of the *Waste Isolation Pilot Plant Land Withdrawal Act of 1992*, as amended. In the notification, the Secretary determined that the Waste Isolation Pilot Plant was in compliance with all requirements of section 9(a)(1) of the *Waste Isolation Pilot Plant Land Withdrawal Act of 1992*, as amended.

Contents of a Disposal Authorization Statement. The disposal authorization statement will clearly indicate the transuranic waste disposal facility and design that is being authorized to operate. The statement will refer to the performance assessment reviewed as the basis for the authorization and state the primary features of the disposal facility important for understanding the authorization of operations of the facility. Conditions and limitations for operations of the facility are clearly indicated in the disposal authorization statement. These include quantities, limitations, references, or codification of assumptions contained in the performance assessment. The conditions include any limitations or allowances required based on independent analysis of the disposal configuration and conditions being examined in the evaluations. The conditions also include any other limitations, responsibilities, or commitments that were needed to resolve issues during the review of the performance assessment or which will serve to answer questions that need to be resolved during the first years of operation of the disposal facility.

As part of the radioactive waste management basis, site personnel should implement a system or process for tracking the waste inventory at a storage, treatment, or disposal facility. Tracking the waste inventory is a means of ensuring that radionuclide limits established in accordance with a safety analysis or performance assessment will not be exceeded. In addition, a system or process for accurately tracking waste received at a facility can facilitate providing information to the complex-wide management data system (see guidance Section I.2.D.(2)).

Compliance with this requirement is demonstrated if, the radioactive waste management basis is documented and signed by the Field Element manager or a designee (see DOE M 435.1-1, Section I.1.A, Delegation of Authority) for each transuranic waste management facility, operation, or activity. Using a graded approach, it may be possible to include multiple activities under a single radioactive waste management basis, but it should be possible to objectively identify which activities are covered. Further, the radioactive waste management basis includes or references the controls that are established on a facility-specific basis to address the unique waste management requirements and circumstances for each facility, operation, and/or activity.

> *Example: A storage facility that stores mixed and non-mixed transuranic waste has approved waste acceptance requirements and a waste certification program that enables transuranic waste to be shipped to the Waste Isolation Pilot Plant for disposal. The mixed transuranic waste is to remain in storage pending WIPP receiving a RCRA Part B permit. The radioactive waste management basis statement references the waste certification process and the waste acceptance requirement documentation, which in turn invoke the waste acceptance requirements of WIPP. In addition to citing site-wide programs and plans (radiological control, health and safety, training, etc.) the radioactive waste management basis statement also cites the RCRA permit issued for storage of mixed transuranic waste and the facility operating procedure for segregating mixed and non-mixed waste within the facility.*

Supplemental References:

1. EPA. *Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes*, 40 CFR Part 191, U.S. Environmental Protection Agency, Washington D.C.

2. EPA. *Criteria for the Certification or Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations*, 40 CFR Part 194, U.S. Environmental Protection Agency, Washington, D.C.

3. DOE, 1992. *Nuclear Safety Analysis Reports*, DOE 5480.23, U.S. Department of Energy, Washington, D.C., April 10, 1992.

III. 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.

Objective:

The objective of this requirement is to ensure the impacts on the public, workers, or environment are mitigated in the event that a leak develops in a tank storing transuranic waste or in a facility processing transuranic waste. The mitigation is provided by ensuring spare waste storage capacity is a required part of a site's emergency management program. To meet this objective, there needs to be both capacity to handle the largest volume of any single storage tank or liquid waste in process, and the capability to transfer the waste.

Discussion:

This requirement shall be implemented through and included in site emergency management programs that are required by DOE O 151.1, *Comprehensive Emergency Management System.* The directive DOE O 151.1 is referenced in DOE M 435.1-1, Chapter I and considered necessary for the safe management of radioactive waste. The Comprehensive Emergency Management System requires the development of a complex-wide system for preparing for and managing emergencies. At the site level, personnel are to establish an Operational Emergency Base Program that provides the framework for responding to events involving, among other subjects, health and safety, and the environment. The program requires a qualitative hazards survey to identify the emergency conditions, describe the potential impacts, and summarize the planning and preparedness requirements that apply.

During the development of the requirements of DOE M 435.1-1, *Radioactive Waste Management Manual*, a waste management hazard and safety analysis identified the loss of containment of a storage tank or waste processing facility containing radioactive liquids as a hazard requiring mitigation. In addition to requiring facility designs to maintain waste confinement (see DOE M 435.1, Section III.M.(2)), the ability to respond to leaks or other off-normal conditions if they occur was also considered necessary. Consequently, the requirements to have adequate spare capacity and the ability to transfer waste to the spare capacity were established.

Operating procedures are developed and utilized for transfer of liquid transuranic waste to contingency storage. The procedures should address maximum operational capacities and limits for components of the operational system (e.g., spare storage capacity available in tanks). The procedures should define and address all possible emergency transfer scenarios needed to comply with this requirement.

Contingency Storage. Contingency storage is to be provided for both stored liquid transuranic waste and for liquid transuranic waste treatment facilities. In the case of storage tanks, adequate volumetric capacity must be available to receive the largest volume of waste stored in any single tank. In the case of a treatment facility, adequate volumetric capacity must be available to allow all in-process liquids in the facility to be moved into storage in the event of emergency or off-normal conditions.

A number of factors are considered in maintaining spare capacity. First, the requirement includes a provision that the spare capacity has "adequate capabilities." Therefore, the spare capacity must have the necessary features and functionality as dictated by the design and safety analysis for the facility and wastes of concern. Features to be taken into account include appropriate materials of construction, shielding, ventilation and filtration, heat dissipation, liquid level monitoring, and mixing. Similarly, if the waste that may need to be transferred is regulated by some external regulation (e.g., RCRA), the tank(s) that would be used for spare capacity should be properly permitted.

The requirement specifies that the contingency storage provided is to meet the requirements of DOE O 435.1 and DOE M 435.1-1. Of prime interest is the ability of contingency storage and associated facilities to meet the requirements for confinement in Facility Design, DOE M 435.1-1, Section III.M.(2). Additionally, compliance with the requirements for instrumentation and control systems, ventilation, and monitoring systems is very important for tanks or facilities that will be used for contingency storage. Meeting these requirements, in combination, ensures that the use of existing tanks or other facilities for contingency storage minimizes the potential impacts of off-normal or emergency situations involving liquid transuranic waste.

Spare capacity may be provided by a single tank or by the combined available volume in multiple tanks. In cases where radiation fields are sufficiently low, spare capacity could be provided by portable tanks, tankers (i.e,. railroad cars), or tank trucks. Due to the potential for airborne radioactive material, impoundments or bermed areas open to the air should not be used for spare storage capacity unless a safety analysis shows that the risk to workers and the public is low.

> *Example: Liquid radioactive waste is stored in six underground storage tanks with a design capacity of 250,000 gallons each. The waste in the all tanks has the same chemical and radiological characteristics. One tank contains 200,000 gallons and each of the others contain about 100,000 gallons. Capabilities exist to retrieve waste and transfer it among the six tanks. This system meets the requirement because the largest volume of 200,000 gallons can be distributed between any two of the other tanks.*

<u>Transfer Equipment</u>. The ability to perform the transfer is just as important as having the capacity. Equipment necessary to transfer each tank or treatment facility volume of liquid transuranic waste in the event of a leak or other off-normal condition is to be identified and documented.

> *Example: Liquid radioactive waste is stored in six underground tanks with the volumes and characteristics described in the previous example. Although there are transfer lines to any of the tanks from a central diversion box, the tanks were constructed without the capability to retrieve the waste. This situation does not comply with the requirement. Although there is adequate capacity, the ability to transfer the waste does not exist.*

In addition, equipment necessary to transfer the contents of each tank is tested and inspected as part of a routine maintenance program (see DOE M 435.1-1, I.1.E.(9)). Special attention should be given to including in the maintenance program equipment and transfer lines that are not routinely used in managing liquid wastes. Inspection and testing includes the following minimum items:

- leak testing of pipelines;
- ensuring the availability of any jumpers necessary for completing waste transfer;
- confirming that instrument panels, control panels, valves, pumps and any necessary ventilation equipment is supplied with the necessary electrical power, air (for pneumatically-controlled items), steam, and water; and
- performing functional tests of instruments, controls, valves, pumps, and ventilation equipment.

The capability to perform an emergency transfer of liquid transuranic waste is to be maintained at all times. Therefore, every shift must include or have immediate access to qualified individuals and the equipment necessary to perform transfers in a timely manner, unless analysis of the hazards associated with the leaking waste demonstrates that immediate transfer is unnecessary.

> *Example: A large shielding block is in place over a jumper pit that needs to be accessed during an emergency transfer of liquid waste. The block can only be moved by a crane. Therefore, implementation of this requirement entails making sure that the crane is always operationally available (in a matter of hours rather than days) and every shift has a individual qualified to operate the crane and remove the block.*

Spare capacity may be shared by different waste types, however mixing radioactive wastes of different types should be evaluated and is generally not acceptable.

> *Example 1: A tank farm contains both high activity liquid low-level waste and liquid transuranic waste in separate tanks. A spare empty tank is maintained and available for emergency transfers of either waste.*

> *Example 2: A tank farm contains both high-level waste and liquid transuranic waste in separate tanks. If the spare capacity were provided by excess capacity in tanks that contain high-level waste, use of the capacity for transuranic waste would be undesirable. Transferring transuranic waste into a tank containing high-level waste, would result in a mixture that would no longer be eligible for disposal at the Waste Isolation Pilot Plant which, by law, cannot dispose of high-level waste. Therefore, waste managers should identify different spare capacity to accommodate the two different waste* types.

Compliance with these requirements is demonstrated by having adequate spare capacity and transfer equipment exists for emergency transfers of all liquid transuranic waste. In addition, the capability to perform emergency transfers is demonstrated by having waste transfer routings identified, operational procedures to direct transfers, staff trained to the procedures, and records showing that the spare capacity and transfer capability are kept in operating condition.

Supplemental References:

1. DOE, 1995. *Comprehensive Emergency Management System*, DOE O 151.1, U.S. Department of Energy, Washington, D.C., September 25, 1995.

III. 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.

Objective:

The objective of this requirement is to ensure that actions will be taken to preclude, minimize, or mitigate hazards whenever a situation arises at a transuranic waste management facility that could threaten worker or public safety, or the environment.

Discussions:

The *Radioactive Waste Management Manual*, DOE M 435.1-1, Section I.2.G, states that all personnel have a responsibility to identify conditions that require corrective actions to achieve compliance with the Order and Manual requirements or to address health and safety conditions that pose an imminent or possible danger. That responsibility is to ensure that conditions that pose an imminent or potential danger to the environment, or to the health and safety of workers or the public are identified and corrected. If necessary, activities are to be curtailed or shutdown to ensure that the public, workers, and the environment are protected until corrective actions are implemented to mitigate the identified hazard.

Corrective actions are activities which, when implemented, will address and correct noncompliant or hazardous conditions. Corrective actions can include improvements to documentation (e.g., procedures, plans, authorization basis documents), training and qualification programs or procedures, physical and process design changes, changes to operating conditions, or a combination of these activities.

Corrective Action System. A corrective action system exists for addressing noncompliant or hazardous conditions for transuranic waste management facilities, operations, and activities. The system for addressing corrective actions may be an integral portion of the site's quality assurance program. Corrective actions in response to quality assurance program assessments are addressed in the *Implementation Guide for Use with Independent and Management Assessment Requirements of 10 CFR 830.120 and DOE O 414.1 Quality Assurance*. The corrective action system provides for documenting noncompliant or hazardous conditions, identifying the organizations or individuals responsible for developing and implementing corrective action plans, providing corrective action status, and tracking progress through final implementation of the actions. The corrective action system is instituted as a fundamental part of the systematic

evaluation of radioactive waste activities that is implemented by the Site-Wide Radioactive Waste Management Program (see guidance for DOE M 435.1-1, Section I.2.F.(1)).
A problem requiring corrective action could range from a minor deviation from a procedure that has minimal safety or public health implications, to a situation that poses an immediate threat to health and safety from an uncontrolled release of large quantities of radioactive material. For situations where a problem could pose an immediate risk to a worker, member of the public, or damage to the environment, immediate shutdown of the process or facility may be appropriate as the first step in addressing the problem (see guidance for DOE M 435.1-1, Section III.F.(2).

> *Example: An employee performing a routine container inspection in a storage facility notices that there are drums in an area designated for "WIPP-ready packages" that do not have a tamper indicating device on the container closure. The worker records his observation in the inspection log and notifies the building manager. The manager directs that a corrective action plan be prepared. The plan includes an evaluation of the conditions that resulted in the package being improperly controlled and recommends changes in procedures and training to the new procedures to prevent any recurrences. A notice is sent to staff responsible for receiving and handling waste containers and to generator organizations reiterating the requirement for tamper indicating devices. In addition, a follow-up review is schedule for 60 days after the plan is approved.*

If a facility or activity can be allowed to operate while a noncompliant or hazardous condition exists, the allowance and any associated limitations must be defined as part of the facility's or activity's radioactive waste management basis, identified as a configuration controlled item in a configuration management plan or included in a revision or modification to an operating procedure or similar controlled documentation. The corrective action system should provide for preventing the use of systems or facilities (e.g., through lockout), or procedures (through cancellation) in cases where it is determined that use of the system, facility, or procedure impacts safety.

> *Example: In the above example, the facility manager imposes a 2 week moratorium on receiving additional transuranic waste at the facility or certifying transuranic waste as meeting the Waste Acceptance Criteria for the Waste Isolation Pilot Plant. The manager expects that during the two week time period, the underlying problem can be identified and interim measures implemented to prevent a recurrence until the corrective action plan is fully implemented.*

Compliance with this requirement is demonstrated if a corrective action system exists which addresses noncompliant or hazardous situations associated with transuranic waste management and in a systematic fashion, and allows identification of problems by all personnel.

Supplemental References:

1. DOE, 1996. *Implementation Guide for Use with Independent and Management Assessment Requirements of 10 CFR 830.120 and DOE O 414.1 Quality Assurance,* DOE G 414.1-1, U.S. Department of Energy, Washington D.C., August 1996.

III. F.(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.

Objective:

The objective of this requirement is to limit the operation of waste management activities and facilities as necessary to avoid creation of near- or long-term safety or environmental hazards.

Discussion:

The *Radioactive Waste Management Manual,* DOE M 435.1-1, requires that a radioactive waste management basis be established for each transuranic waste management facility, operation, or activity. The radioactive waste management basis documents the conclusion that the potential hazards from management of radioactive waste have been sufficiently evaluated and that adequate controls are in place to provide assurance that the public, workers, and the environment are being protected. Field Element Managers are responsible for ensuring a radioactive waste management basis is developed, reviewed, approved, and maintained for each DOE radioactive waste management facility, operation, or activity (DOE M 435.1-1, Section I.2.F.(2)). The guidance for that requirement should be consulted for additional details on the development, review, and approval of a radioactive waste management basis. Also, additional discussion concerning the radioactive waste management basis for transuranic waste generator, treatment, storage, and disposal facilities is discussed under guidance for DOE M 435.1-1, Section III.D.

As part of his/her responsibilities for maintaining the radioactive waste management basis for transuranic waste management facilities, operations, and activities under his/her authority, the Field Element Manager evaluates the compliance of the facilities, operations, and activities with the constraints and controls documented in the radioactive waste management basis by ensuring that routine assessments are conducted. If the Field Element Manager determines, either through routine assessment or by virtue of an occurrence or off normal event, that an operation, activity, or facility is not operating in compliance with an approved radioactive waste management basis, it must be curtailed or shut down. The action taken is commensurate with the hazards associated with the noncompliance and with the continued operation of the facility.

This requirement is to be implemented in a graded manner. Actions to be taken are based on assessments of adherence to radioactive waste management bases, and can range from shutdown of an operation or facility to placing limits or constraints on what activities can be performed or how the activities are to be performed. Shutdown of a facility involves stopping all operations in the facility except surveillance or monitoring activities necessary to maintain the facility in a safe standby condition. Shutdown is considered appropriate when there is either a potential imminent threat to safety or environmental protection, or a blatant failure to establish or comply with a radioactive waste management basis.

Alternatively, there may be cases where a facility, operation, or activity assessment determines that the radioactive waste management basis is no longer current or has been violated, but there is no imminent threat to public, worker, or environmental protection. In such a case, the Field Element Manager may decide that shutdown of the facility is not necessary. It may be sufficient to impose certain limits until the radioactive waste management basis is made current. The limits imposed may prohibit the generation, receipt, or processing of certain waste streams, or may involve constraints on the processes that may be performed.

The action taken in response to the failure to establish a radioactive waste management basis is to be clearly documented in a formal communication (e.g., letter, memorandum). Such communication needs to identify the reason for the shutdown or curtailment, and identify what is necessary to initiate restart. Generally, development of a corrective action that is implemented through the corrective action system discussed in the preceding section would be appropriate for responding to a shutdown or curtailment of activities.

In concert with Core Requirement #6 of the Integrated Safety Management System, “Feedback and Improvement,” the Field Element Manager should use the audits and assessments to identify opportunities for improvement in the implementation of an activity or facility’s radioactive waste management basis. Identified improvement actions should be shared with like organizations and tracked by management to determine whether they are yielding the anticipated improvements. Communicating the results of assessment upward in the DOE and contractor organization will allow the findings to reach the management level with the authority necessary to effect improvements.

Compliance with this requirement is demonstrated by documented evidence of systematic, routine reviews to determine whether waste management activities and facilities under are operating in accordance with an approved radioactive waste management basis. In addition, the documentation should show that limitations (which may include shutdown) have been placed on activities and operations that do not have or are operating outside the conditions of an approved radioactive waste management basis.

Supplemental References:

1. DOE, 1996. *Safety Management System Policy*, DOE P 450.4, U.S. Department of Energy, Washington, D.C. October 15, 1996.

2. DOE, 1997. *Line Environment, Safety and Health Oversight*, DOE P 450.5, U.S. Department of Energy, Washington, D.C., June 26, 1997.

3. DOE, 1997. *Safety Management Functions, Responsibilities, and Authorities Policy*, DOE P 411.1, U.S. Department of Energy, Washington, D.C., January 1, 1997.

4. DOE, 1997. *Manual of Safety Management Functions, Responsibilities, and Authorities*, DOE M 411.1-1, U.S. Department of Energy, Washington, D.C., October 8, 1997.

III. 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.

Objective:

The objectives of the waste acceptance requirements are to ensure that transuranic waste which is received at a facility contains only the radionuclides that the facility can safely manage, and only in concentrations and/or total activities which are compatible with the work to be undertaken in the facility; ensure that transuranic waste which is to be received at a facility is in a form or package that will maintain its integrity and retain acceptable configuration under the conditions that are expected to be encountered during the management steps the waste will undergo; ensure that no transuranic waste received at a facility contains materials that will compromise the safety or integrity of the facility under the expected operating conditions; and ensure that formal procedures exist and a decision process is clear concerning the granting of exceptions to waste acceptance requirements.

Discussion:

As discussed in the guidance for DOE M 435.1-1, Section I.2.F.(6), the waste acceptance requirements establish the conditions for waste that facilities can safely receive. Therefore, the acceptance requirements for a transuranic waste storage, treatment, or disposal facility include all requirements that transuranic waste must meet to be acceptable for receipt, and for the subsequent storage, treatment, or disposal, as appropriate.

In conducting the analyses for development of the DOE M 435.1-1 requirements, minimum acceptance requirements that must be specified in the waste acceptance documentation for storage, treatment, and disposal facilities in order for transuranic waste to be safely handled were identified. Guidance on subrequirement (a) is provided below under Radionuclide Content or Concentration. Guidance on subrequirements (b) and (c) is provided under Waste Form and Package Criteria and Prohibitions. Guidance on subrequirement (d) is provided under Defense/Non-Defense Waste. Guidance on subrequirement (e) is provided under Exceptions.

Development of Waste Acceptance Requirements. A facility receiving waste for storage, treatment, or disposal is required to document the waste acceptance requirements for the facility. These requirements have their foundation in facility design capabilities such as volume, handling weight, allowable contents, and radiological limits (i.e., criticality, radiation, contamination). Other requirements may include any number of regulations promulgated by the EPA, NRC, DOT, the host state, and DOE itself. The designer and operator of the facility receiving waste are likely to be most knowledgeable and understanding of the requirements and limitations of the facility and, therefore, are in the best position to establish the waste acceptance requirements or criteria that must be met for waste sent to the facility.

Although there are exceptions, most transuranic waste in the Department is to be disposed at WIPP. The exceptions include waste that cannot meet the waste acceptance criteria of WIPP or are otherwise ineligible (e.g., non-defense waste). Personnel responsible for transuranic waste storage or treatment facilities which manage waste destined for WIPP need to consider the WIPP waste acceptance criteria in developing acceptance criteria for their facilities.

A transuranic waste management facility at a site may have its own specific stand-alone waste acceptance requirements. Or a site may have general waste acceptance requirements applicable to all transuranic waste management facilities at the site, with separate facilities adding facility-specific acceptance requirements to the site waste acceptance requirements as necessary. This practice may be particularly effective at sites with many facilities which manage small quantities of waste with multiple locations for staging, storage, and/or central management of waste. At such facilities, most of the process and procedural waste acceptance requirements could be in one document applicable to the whole site, which would be supplemented with specific technical requirements for acceptance at each of the separate management locations. If activities across various facilities are similar, they could share the same supplemental waste acceptance requirements documents. Likewise, if several activities are carried out at locations that are close to one another, or are managed by the same entity, then one supplemental technical document may be prepared to cover those activities.

The waste acceptance requirements and documentation for a facility receiving waste for storage, treatment, or disposal is prepared using a graded approach commensurate with the hazards associated with the management of the waste in the facility and the complexity of the activities to be conducted in the facility. The waste acceptance requirements for a facility which receives large quantities of transuranic waste from many generators, or with highly variable contents, or both, may need to address many hazards and consequently be more detailed. By contrast, a storage facility which will only pass-through properly packaged waste directly to a disposal facility without any additional processing or packaging may only need a minimal set of requirements. Perhaps only a few administrative requirements would be necessary for proper receipt of waste at such a storage facility, along with assurance that waste received at the storage facility meets the disposal facility technical waste acceptance requirements.

> *Example 1: The Waste Isolation Pilot Plant is to receive defense transuranic waste generated by many different processes and from many different sites. In addition, the transportation of contact-handled transuranic waste to WIPP is to be in TRUPACT II containers. The requirements for acceptance of waste at WIPP are extensive and require a high degree of rigor. The waste acceptance requirements are addressed in a number of interrelated documents. These documents include the Waste Acceptance Criteria for the Waste Isolation Pilot Plant, the Generator Site Certification Guide, the Quality Assurance Program Description, and the Transuranic Waste Characterization Quality Assurance Program Plan.*

> *Example 2: At a DOE site, several facilities are used for storage of transuranic waste. A single waste acceptance requirements document which contains the necessary administrative requirements for all of the storage facilities is prepared as an umbrella document at the site. For each storage facility, a supplemental technical procedure which contains the technical criteria specific to the facility (e.g., inventory limits based on safety evaluations) and which invokes the umbrella document for the administrative processes and forms is prepared. This combination of documents provides the necessary waste acceptance criteria for waste to be received at the facilities.*

Legislation, regulations, performance assessments, safety analysis reports, technical safety requirements, criticality analyses, and other appropriate safety or authorization basis documents are to be used to establish the waste acceptance criteria for facilities receiving transuranic waste for storage, treatment, or disposal. These documents and analyses provide the basis for radioactivity (concentration and inventory) limits, waste categories (e.g., contact-handled or remote-handled), waste form and/or packaging stability requirements, allowable chemical content, allowable free liquid content, and any other necessary waste package or form requirements to ensure that the facilities' design, performance, and operating bases are not compromised.

Radionuclide Content or Concentration. Radiological limits for storage, treatment, and disposal facilities may be derived from a number of technical as well as administrative sources. In developing radionuclide limits, personnel need to consider legislative and/or regulatory limitations, the disposal facility performance assessment, safety analysis reports, and criticality analyses. In addition to establishing general radiological limits (e.g., a contact dose rate), these sources identify specific radionuclides whose concentration or total activity must be limited in the waste acceptance criteria in order to remain within the bounds for safe and legal facility operation.

The operating definition of transuranic waste is taken from Federal legislation (see guidance for DOE M 435.1-1, Section III.A). The definition is significant to transuranic waste management because the designated disposal facility for defense transuranic waste, WIPP can only accept waste that meets that definition. Storage and treatment facilities need to include appropriate waste acceptance requirements that require identification of transuranic waste to facilitate its eventual transfer for WIPP disposal.

The results of a long-term performance assessment analysis may provide information on critical radionuclides that are most important to the long-term performance of the disposal facility. The waste acceptance criteria for the disposal facility are to translate the results of the performance assessment analyses into limits on the receipt of waste at the facility or on the operation of the facility.

> *Example: The performance assessment of WIPP is based on an assumed final inventory of transuranic and other radionuclides. Although the performance assessment indicated that facility performance was not sensitive to radionuclide inventory, in the Compliance Certification Application WIPP committed to tracking the cumulative inventory of radionuclides of interest. Therefore, the waste acceptance criteria require sites to report the inventory or concentration of these radionuclides of interest.*

Although performance assessments are not required for storage or treatment facilities, personnel developing waste acceptance criteria for these types of facilities should consider the radiological limits of WIPP. In most cases, transuranic waste will eventually be transferred to WIPP for disposal, so WIPP waste acceptance criteria should be factored into the waste acceptance requirements of the storage or treatment facility to ensure a situation is not created in which the waste does not have a path to disposal.

> *Example: A transuranic storage facility accepts a high dose rate transuranic waste from a generator. Due to the dose rate, the waste is managed and stored as remote-handled*

waste. However, when placed into storage, the waste does not meet the WIPP waste acceptance criteria, thus creating a future management issue. As an alternative, the waste acceptance criteria could be revised to not allow acceptance of transuranic waste that does not meet the WIPP waste acceptance criteria. The generator would be compelled to work with the waste management organizations to determine how to manage or process the waste at the source in order to meet the disposal criteria of available facilities (transuranic and/or low-level waste).

The safety analysis report or safety evaluation prepared for a transuranic waste management facility may identify specific radionuclides that warrant specific attention from a worker safety standpoint, and may require special handling if received and managed at the facility.

Example: A storage facility that manages mixed transuranic waste is subject to RCRA Part B permit requirements for routine inspection of the waste. An analysis of worker radiation exposure associated with inspection of the storage configuration indicates that several radionuclides need to be controlled below certain concentrations to maintain doses to workers as low as reasonably achievable. The waste acceptance requirements for the facility reflect the allowable concentrations from the safety analyses as maxima for waste that can be accepted for storage in the facility.

Any criticality analyses conducted in accordance with the criticality safety program in conformance with DOE M 435.1-1, Section I.1.E.(4) may also result in limitations on acceptance of fissile radionuclides. These limitations need to be included in the waste acceptance requirements, as appropriate. Similarly, for transuranic waste, the *TRUPACT II Safety Analysis Report for Packaging* establishes limits on the amount of fissile material that is allowed to be transported in the TRUPACT II. These limits need to be considered in the development of waste acceptance criteria to avoid the need to repackage waste to transfer it to the next step in the waste management process. These limits are reflected in the *Waste Acceptance Criteria for the Waste Isolation Pilot Plant.*

<u>Waste Form and Package Criteria and Prohibitions</u>. Generally, waste acceptance requirements specify that wastes received at the facility are in a physically/chemically stable form. As used in this requirement, stability refers to the physical and chemical properties of waste that are necessary for it to be handled safely at a facility and to undergo the management steps normally performed at that facility. Such stability is dependent on the waste management steps to be performed with the waste (e.g., treat, store) and the time to complete the management step (e.g., time until treatment or length of expected storage period). Therefore, waste acceptance requirements must specify the physical and chemical stability that correspond to the specific operations and activities of a particular facility. Waste acceptance requirements for a transuranic waste treatment facility need to specify the physical and chemical precautions and conditions under which untreated waste can be received at the facility so that facility safety and effective

operations will not be compromised. Any physical or chemical stabilization of waste prior to transfer to a facility receiving waste for storage, treatment, or disposal needs to be done according to a systematic process that may include consideration of bench-scale testing and verification that the process is producing satisfactory results.

> *Example: A facility that is in the process of cleaning out transuranic radionuclide-contaminated glove boxes determines that operational efficiencies will be realized in the form of fewer drums, less storage space, and fewer transuranic waste shipments if they compact the cleanout waste into 55-gallon drums. The organization responsible for operating the compactor establish a set of waste acceptance criteria for waste that can be received from the cleanout activities. The criteria, based on expected ability to fit 25 boxes in a drum, specify: waste must be packages in 1 cubic foot cardboard boxes; no more than 5% of the volume of a box can be incompressible waste; the long axis of incompressible waste must be oriented in a horizontal plane; boxes must be free of removable external contamination; the dose rate from any box must be less than 10 mrem/hr; there must be less than 8 plutonium-239 fissile-gram equivalents per box; there must be less than 3 plutonium-239 equivalent curies per box; waste must be less than 50 ppm polychlorinated biphenyls, and the waste must be characterized for RCRA constituents. Based on these criteria, the compactor facility can provide 55-gallon drums that meet the on-site storage facility's requirements, and subsequently, the WIPP requirements.*

The waste acceptance requirements are to specify waste streams, classes, or categories of waste requiring application of specific physical, chemical, or structural stabilization methods, as determined by the results of safety analyses or long-term performance assessments. Acceptable waste forms, containers, and packages are specified by the waste acceptance requirements. The waste acceptance requirements need to list any specific packages and containers pre-approved as acceptable for the transuranic waste management facilities, as well as acceptable overpacks. The waste acceptance requirements need to identify any of the following specific technical requirements that must be included to ensure that waste received at any storage, treatment, or disposal facility is consistent with the operating basis of the facility:

- the acceptable limits for waste package external surface dose rate for both contact and remote handled packages;
- the acceptable limits for waste package surface contamination;
- the allowable heat generation rates;
- the acceptable limits for free liquid content, specified on a per package basis;

- the acceptable limits for maximum void space, specified on a per package basis;

- the necessary labeling and marking, including information about bar coding or other tracking system used at the facility receiving the waste and the application of the system by generators;

- any specific radionuclides or chemical or hazardous materials that are prohibited from acceptance at the facility. This may include pyrophoric materials, explosives, or materials that might cause violent reactions during storage, treatment, or disposal;

- any specific requirements associated with acceptance of mixed transuranic waste, including any additional restrictions or limitations on the waste or specifications for handling mixed waste containers;

- any specific requirements associated with acceptance of special transuranic waste needing out-of-the ordinary attention for receipt, handling, storage, treatment, or disposal, (e.g., sealed sources), including any additional restrictions or limitations on the waste or specifications for handling the waste containers;

- any package protection requirements needed for transport and receipt to provide needed physical protection of the packages to prevent breaching and so that the certified status of the waste is preserved; and

- the necessary shipping arrangements for transport to the facility receiving waste, including any electronic data bases or scheduling system used.

Example 1: Waste acceptance criteria for the Waste Isolation Pilot Plant have been developed based on applicable requirements, e.g., statutory requirements, other environmental compliance requirements, operational and safety analysis requirements, and transportation requirements. Development of waste acceptance requirements based on these sources ensures that waste received at WIPP complies with applicable regulations and can be safely managed at the site. The requirements include technical requirements addressing container properties, physical properties, nuclear properties, chemical properties, and gas generation; and administrative requirements for data that need to be provided with waste shipments.

Example 2: A transuranic waste containing spent solvents regulated by RCRA is transferred from a storage facility to a treatment facility for treatment. The treatment facility personnel must establish the limits, if any, on the concentration of solvents for which the treatment process was designed and qualified, and limitations or prohibitions *on other materials that may adversely affect the processing. The waste treatment process is to produce a treated waste product that (1) has been reduced in transuranic contaminant concentrations such that it may be disposed of as mixed low-level waste or (2) is acceptable for disposal at the WIPP as mixed transuranic waste. In either case, the final treated waste form must also meet the disposal facility waste acceptance criteria. In order to ensure that the treatment process product will meet applicable requirements, the treatment facility must document the limitations in the waste acceptance criteria that the organization supplying the waste must meet. By doing so, the treatment facility can safely process the waste, treat it successfully, and produce a product that can be disposed of.*

<u>Defense/Non-Defense Waste</u>. The *WIPP Land Withdrawal Act of 1992*, as amended, limits the waste that can be accepted for disposal at WIPP to transuranic waste generated by atomic energy defense activities. In order to ensure compliance with the statutory constraint, and to facilitate identification of waste that can be disposed of at WIPP, all transuranic waste acceptance criteria must include a requirement for waste to be identified as defense or non-defense. At a minimum, the waste acceptance criteria should require identification of waste as defense or non-defense to be part of the certification program (see Waste Certification guidance for DOE M 435.1-1, Section III.J) and be included in the documentation used to transfer responsibility to personnel at the facility receiving the waste for storage, treatment, or disposal. The requirement applies to all transuranic waste and to all waste management facilities to ensure that the defense or non-defense identity of waste is not lost during waste generation and subsequent processing operations.

Example: The waste acceptance criteria for a transuranic waste storage facility has a waste transfer form that is to be used for each transfer of waste to the facility. The form, which the waste acceptance criteria requires to be used to document the certification that waste meets the waste acceptance criteria, includes identification of the waste as defense or non-defense as a mandatory piece of data. In addition, the waste acceptance criteria require that waste packages be marked to indicate the waste as being defense or non-defense. The waste acceptance criteria identifies three acceptable means of marking waste packages, color of the package, labeling, or through bar coding.

The Departmental interpretation is that the term "atomic energy defense activities" used in the *WIPP Land Withdrawal Act of 1992*, as amended, has the same meaning as the same term used in the *Nuclear Waste Policy Act of 1982*, as amended.

The term "atomic energy defense activities" permits WIPP to dispose of defense transuranic waste resulting from all of the noncivilian activities and programs of DOE, including weapons production, naval reactors, defense research and development, associated defense environmental restoration and waste management and other defense-

> related activities, as defined more specifically in the *Nuclear Waste Policy Act*, from which the term was borrowed. (Nordhaus, 1996)

As the *Nuclear Waste Policy Act of 1982*, as amended, states, the term "atomic energy defense activity" means any activity of the Secretary [of Energy] performed in whole or in part in carrying out any of the following functions:

(a) naval reactors development;
(b) weapons activities, including defense inertial confinement fusion;
(c) verification and control technology;
(d) defense nuclear materials production;
(e) defense nuclear waste and materials by-product management;
(f) defense nuclear materials security and safeguards and security investigations; and
(g) defense research and development.

This definition of atomic energy defense activity does not include transuranic waste generated from DOE's civilian atomic energy activities.

<u>Exceptions</u>. Waste acceptance requirements are established to ensure that facilities can safely manage waste received for storage, treatment, or disposal. Thus, exceptions or deviations to waste acceptance criteria cannot be routine and must be carefully reviewed and documented. The procedures for granting exceptions need to clearly state the entire process for requesting an exception, describe acceptable bases for granting exceptions, and identify any additional information that is needed to supplement the documentation normally provided for waste transfers. The approval process needs to be clearly spelled out including identification of the officials who have the authority to approve the exception.

> *Example: The waste acceptance requirements for a transuranic waste storage facility establishes a per package limit on fissile material. The limit was developed based on criticality and safety analyses which assumed all of the packages in the facility could potentially contain the specified amount of fissile material. A generator has a waste package that slightly exceeds the limit. The waste acceptance requirements specify the that the generator needs to identify the criterion for which an exception is being requested and provide relevant information about the waste package or waste stream for which an exception is being sought. It further identifies to whom the request for an exception is to be submitted. At the storage facility, there are documented procedures indicating the process to be followed for evaluating the exception request and identifying the facility manager as the approval authority. In this case, an analysis is performed indicating that because of the small inventory of fissile material in the facility, an exception can be granted. Documentation supporting this decision includes notification to the generator that the exception is granted, copies of the analyses performed to*

support the decision, and additional controls on waste that can be accepted in the facility during the time the particular waste remains in storage (i.e., limits may have to be placed on the per package content of other waste or on the total number of packages that the facility could accept).

Compliance with these requirements is demonstrated if waste acceptance requirements are documented, contain clear and precise criteria specifying the radionuclide limits in the form of contents or concentrations that can be accepted, the limitations and prohibitions on waste forms and packages that can be received, and the limits, prohibitions, or instructions concerning any other technical information so that the waste is compatible with the safety basis of the facility, and which will result in acceptable waste at subsequent steps in managing the transuranic waste. Waste acceptance requirements are to also contain a clear description of the process and bases for obtaining an exception or deviation to the acceptance criteria for transuranic waste to be received at the facility.

Supplemental References:

1. CAO, 1997. *Generator Site Certification Guide*, Revision 1, DOE/CAO-95-2119, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, August 1997.

2. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 5, DOE/WIPP-069, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

3. CAO, 1996. *Quality Assurance Program Document*, Revision 1, CAO-94-1012, U.S. Department of Energy, Carlsbad Area Office, Carlsbad NM, 1996.

4. CAO, 1998. *U.S. Department of Energy, Transuranic Waste Characterization Quality Assurance Program Plan,* Revision 1, CAO-94-1010, U.S. Department of Energy, Carlsbad Area Office, Carlsbad NM, December 18, 1998.

5. CAO, 1998. *TRUPACT-II Operating and Maintenance Instructions,* Revision 1, DOE/WIPP-93-1001, U.S. Department of Energy, Carlsbad Area Office, Carlsbad NM, May 1998.

6. Nordhaus, 1996. Robert R. Nordhaus, to Al Alm, memorandum, *Interpretation of the Term "Atomic Defense Activities" as Used in the Waste Isolation Pilot Plant Land Withdrawal Act*, U.S. Department of Energy, Washington, D.C., September 9, 1996.

III. G.(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.

Objective:

The objective of this requirement is to establish a process by which personnel at a facility receiving transuranic waste for storage, treatment, or disposal determine that the waste being transferred is acceptable in accordance with the waste acceptance requirements, and for that process to specifically address management of waste that does not conform with all of the requirements when it is received at the facility.

Discussion:

This requirement makes it the responsibility of officials at a facility to which waste is transferred to confirm that waste is in compliance with the established waste acceptance requirements and also provides a mechanism by which the officials confirm that waste can be accepted and safely managed at the facility.

<u>Evaluation and Acceptance</u>. The methodology for implementing the evaluation and acceptance of transuranic waste needs to be flexible and defined on a facility-specific basis. The complete process and procedures, including the responsibilities of generating facilities, need to be clearly documented so that both the generator and the facility receiving the waste understand the process that will be used. As with implementation of other parts of DOE M 435.1-1, this requirement is implemented using the graded approach. Facilities receiving transuranic from many generators and/or offsite generators may need to implement more detailed waste evaluation and acceptance processes than a facility receiving waste from a small number of onsite generators.

The evaluation and confirmation process consists of one or more of the following approaches, and is designed to demonstrate that the waste presented meets the waste acceptance requirements of the facility receiving waste for storage, treatment, or disposal:

- Testing, sampling, and analysis of the contents of a representative sample of waste packages as they are received at the facility;

- Testing and analysis of a number of samples taken at the generator facility;

- Detailed review of sampling and analysis data generated by the sending facility or an independent laboratory employed by the generating facility;

- Audit, review, or surveillance of the sender's waste characterization activities and processes and waste certification programs.

Testing, sampling, and analysis of the contents of a representative sample of waste packages upon receipt is complicated by the fact that additional risk is posed if a technique such as opening of drums and obtaining grab samples is used. Therefore, consideration needs to be given to implementing non-destructive examination technologies if receipt sampling and analysis is the preferred approach. Likewise, analysis of samples taken at the generator's site may involve additional risk, and also may be expensive to implement. If this method is employed, samples which are representative, either statistically or correlated with generator profiles, need to be obtained for analysis to validate this method as accurate. This sampling would include packages from the generators sending the largest volume of waste to the facility or packages containing the critical radionuclides as identified in the waste acceptance requirements.

> *Example: The waste acceptance process for a storage facility that receives waste from multiple generators involves assay to confirm the waste is transuranic, and sample collection and analysis to confirm its RCRA status. The process calls for assaying and sampling one waste package of every 100 from established waste streams and one of every 10 for new waste streams or for waste streams from generators who have a history of poor compliance with the waste acceptance criteria.*

The use of a detailed review of the sampling and analysis data gathered by others would include an evaluation of the methodologies used for collecting the sample, maintaining the integrity of the sample and data (e.g., through a chain of custody), and performing the radioanalyses. As above, the samples collected would need to be representative of the waste, either statistically or with a bias towards large generators or generators of significant radionuclides (i.e., those that are most limiting for the storage, treatment, or disposal facility).

The use of assessments (audits, reviews, or surveillances) to verify compliance of the waste generators' certification programs with acceptance requirements would need to be conducted on a regular schedule commensurate with the frequency of waste generation and shipments. The documentation of the verification process would include organization and authorities; frequency of assessments; methods to be employed; the information that will be documented as a result; and the qualifications of personnel.

> *Example: At the Waste Isolation Pilot Plant, there are no plans for sampling waste packages upon receipt. Instead, WIPP has instituted a program in which generator site waste certification programs are reviewed to determine whether they will produce waste packages meeting the waste acceptance criteria. A Generator Site Certification Guide describes what is entailed in obtaining an approved site certification program. Once a site has developed its program, representatives from WIPP evaluate it, and if determined*

to be acceptable, approve it. After a site's certification program has been approved, WIPP personnel rely on the combination of site certification that waste packages comply with the site's approved program and their own review of transfer documentation and processes to assure that waste meets the waste acceptance criteria. Site certification programs are re-evaluated annually to confirm that they are still adequate.

Non-Conforming Waste. Facilities receiving waste for storage, treatment, or disposal must have a documented process to be used in the event a non-conforming waste is received. A non-conforming waste is a waste container or shipment which is certified by the generator as meeting the waste acceptance requirements of the receiving facility, but which is found to be in violation of the acceptance criteria during the facility's waste receipt and inspection process. Facility procedures need to address how non-conforming waste will be segregated from acceptable waste, the process for notifying the sender of the non-conformance, and the acceptable methods for dispositioning the non-conforming waste. The process includes prior notice to the sender of the actions to be taken by the facility receiving the waste and the sender's obligations, particularly regarding the cost of the actions, to support the disposition of the non-conforming waste.

Example: A transuranic waste storage facility's waste acceptance procedures require that non-conforming waste be segregated from conforming waste and isolated by a rope barrier pending resolution of the non-conformance. The procedures further require notification of the generator of the non-conformance and a resolution to be negotiated with the generator. The process requires consideration of risk and cost in determining the proper resolution.

Compliance with these requirements is demonstrated if there is a procedure or process for evaluating and accepting incoming waste which ensures the acceptance criteria of the facility receiving the waste are met by one or a combination of: (1) testing, sampling, and analysis of representative samples of incoming waste upon receipt; (2) testing, sampling, and analysis of samples of waste taken at the generator facility; (3) evaluation of testing, sampling, and analysis of data provided by the generator; or (4) audits, reviews, or surveillances of generator waste certification programs and characterization activities. Additionally, acceptable waste acceptance requirements for a storage, treatment, or disposal facility will have documented procedures and actions to be taken if a waste that does not conform to the waste acceptance criteria is received at the facility.

Supplemental References:

1. CAO, 1997. *Generator Site Certification Guide*, Revision 1, DOE/CAO-95-2119, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, August 1997.

2. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 5, DOE/WIPP-069, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

III. 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.

Objective:

The objective of this requirement is to provide for the disposal of all transuranic waste that is generated in the future by ensuring that prior to generating a new transuranic waste stream, the specific waste management facilities necessary for safe management of the waste from the time it is generated up to and including its disposal are identified; plans are developed for resolving issues that prevent disposal, and for safe, long-term storage for transuranic waste with no path to disposal; and sites are discouraged from generating transuranic waste that does not have an identified path to disposal.

Discussion:

The Department intends on disposing of stored and future defense transuranic waste (the majority of DOE transuranic waste) that meets waste acceptance requirements at WIPP. The subject requirement is based on a recognition that protection of the public, workers, and the environment is best assured if transuranic waste is generated with cognizance of its final disposition and of the waste management facilities that are needed until the waste is disposed. In developing DOE O 435.1 and DOE M 435.1-1, the safety and hazards analysis identified long-term storage of waste, and potential loss of characterization data from generators and the subsequent need for recharacterization as weaknesses to be mitigated. Therefore, as part of the generator planning requirements in DOE M 435.1-1, Section I.2.F.(7), specific requirements are identified for planning the management of waste prior to its generation, and for approval to generate transuranic waste streams with no identified path to disposal.

Life cycle planning for all transuranic waste. Planning prior to generating transuranic waste is primarily intended to address newly-generated waste streams. Life-cycle planning for waste that has been generated and continues to be generated is documented through the Site-Wide Waste Management Program required in DOE M 435.1-1, Section I.2.F.(1). The following discussion describes the types of life cycle planning need. The information needed is influenced by the fact that, on the implementation date of the Order, the transuranic waste will be in one of three stages of its life-cycle: (1) waste generated in the past (in storage); (2) waste being generated at present; and (3) wastes not yet generated (future wastes); and will either have an identified path to disposal, or will not.

Therefore, from a waste generation planning perspective, there are six different "states" of transuranic waste, depending on when the waste was or is generated and whether it has or will have a path to disposal. The following paragraphs explain the recommended life cycle information for these different transuranic wastes.

Transuranic Waste With a Path to Disposal

Generated currently - The life-cycle information for currently generated transuranic waste with an identified path to disposal includes a description of the management steps for the waste as discussed in guidance for the Site-Wide Radioactive Waste Management Program.

Generated in the future (from a new process) - The life-cycle information for transuranic waste with an identified path to disposal that is generated from a new process includes a description of the management steps for the waste as discussed in guidance for the Site-Wide Radioactive Waste Management Program.

Generated in the past (in storage) - In addition to the basic information on management steps, life cycle information for transuranic waste with a path to disposal that is in storage (due to budget constraints, delays due to regulatory matters or management decisions, or for other reasons) includes a schedule for achieving disposal. For transuranic waste in earthen-covered storage, the retrieval plan required by the storage requirements (DOE M 435.1-1, Section III.N) can be used to meet this requirement provided it has a schedule.

Transuranic Waste Without a Path to Disposal

Generated in the past (in storage) - The life-cycle information for transuranic waste in storage as of the issuance of DOE O 435.1 for which there is not an identified path to disposal includes the basic information on the management steps for the waste which can be identified, a discussion of the issues that hinder disposal of the waste, and the plans and schedule for achieving resolution of the issues.

Generated in the future (from a new process) - The life-cycle information for transuranic waste without an identified path to disposal which is generated from a new process includes the basic information on the management steps for the waste which can be identified, a discussion of the issues that hinder disposal of the waste, and the plans and schedule for achieving resolution of the issues. This information will be assembled in the course of getting the generation of the waste approved in accordance with the process required in DOE M 435.1-1, Section I.2.F.(19), and is also discussed in the next section of this guidance.

Generated currently - The life-cycle information for transuranic waste without an identified path to disposal includes the basic information on the management steps for the waste which can be identified, a discussion of the issues that hinder disposal of the waste, and the plans and schedule for achieving resolution of the issues. The intent of the requirement is not to ensure that these waste streams receive approval for generation in accordance with General Requirement I.2.F.(19). However, the life-cycle planning information needs to address the continued generation of this waste. The life-cycle planning information for continuing to generate a no path forward waste needs to include consideration of the necessity to generate the waste, an understanding of what prevents disposal of the waste, the needed capacity and capabilities for continued storage of the waste, and the plans for future disposal of the waste. Discussions would also be included on any alternatives to the process that generates the no path forward waste that have been considered.

Providing the life cycle information discussed above for waste streams already being generated is relatively straightforward. For most transuranic wastes, the information already exists and has been utilized for other documents such as the Programmatic Environmental Impact Statement and the Baseline Disposition Maps. To the extent that existing documentation includes the specified information, they may be used to meet the life cycle planning requirement.

Example: A transuranic waste generating facility operating at Site A continues to operate with no alterations. The facility generates the same transuranic waste streams it has been generating for years, and none of them are waste streams without a path to disposal. The life-cycle information about transuranic waste generated at this facility is included in the current waste inventories and capacities section of the Site A Radioactive Waste Management Plan, and no technical or programmatic issues are included in the Plan concerning these waste streams.

Waste generator planning prior to generation. Planning, prior to generating transuranic waste (subrequirement H.(1)), is intended to address transuranic waste streams that do not already exist. Transuranic waste streams that are first generated after issuance of the Order are subject to this requirement. Waste generator planning is a component of the waste generator program required in I.2.F.(7) of the General Requirements Chapter of DOE M 435.1-1. Waste generator planning activities need to be integrated in the generator program with waste characterization, certification, and transfer activities.

Example: A previously operating high-level waste treatment facility has been shut down for eighteen months and is to be restarted. Based on past experience, it is known that contamination control activities in the building will result in the generation of a transuranic waste stream. As part of the generation planning in support of the restart, plant personnel must evaluate the life-cycle of all of the waste streams (high-level, *transuranic and low-level) that will come from the facility. For the transuranic waste, personnel confirm that there is a facility that can accept the waste for storage and that because the waste is from a defense-related activity, it is eligible for disposal at the Waste Isolation Pilot Plant. Based on the WIPP waste acceptance criteria and communications with WIPP personnel, the determination is made that the waste will meet the waste acceptance criteria and that adequate capacity will be available. From the perspective of transuranic waste life-cycle planning there are no issues associated with the restart.*

Generator planning addresses the life-cycle of the waste to disposal, including all interim steps of waste management. This can be accomplished by preparing a waste stream profile and reviewing it with the facility(ies) that will manage the waste. The waste stream profile format used needs to be consistent with the needs of the storage, treatment, and/or disposal facilities that will be involved in managing the waste stream. An example of a waste stream profile form is included as Figure III.H.1 at the end of this section of guidance. The waste generator confirms with each storage, treatment, and disposal facility that will be used, that based on the current knowledge of the waste stream characteristics, and planned facility capacity, the waste stream can be managed by the facility. It is therefore conceivable that a generator may have to interface with multiple facilities (e.g., a storage and/or treatment facility in addition to the disposal facility) to ensure that the waste can be managed.

Example: In the previous example, the treatment facility confirmed with the storage facility that based on the expected generation rate of the transuranic waste and the expected commencement of shipments of waste to WIPP that there was sufficient storage capacity to handle the transuranic waste stream.

The determination of whether a transuranic waste stream has an identified path to disposal is based on the availability and capacity of existing or planned facilities and operations. A planned facility is considered to be available if it has been authorized (e.g., a line item in a Congressional appropriation or equivalent approval for design and construction). A facility is not considered available if it is not authorized to accept or manage a particular waste type or concentration. If a planned facility is designated in the planning information, then the planning information also needs to address the schedule for when the facility will be operational, and the management steps that will be taken for waste designated for that facility until it becomes operational.

For purposes of planning for disposal of a transuranic waste stream, a facility or capabilities that are part of a program or strategic plan, but have not been authorized are not considered available. If a planned or available facility is canceled, the generator site needs to revise the planning for the life-cycle of the transuranic waste, an alternate path to disposal needs to be identified and documented, or approval to generate the transuranic waste needs to be obtained from the cognizant Field Element Manager as required by DOE M 435.1-1, Section I.2.F.(19).

The generator is responsible for ensuring that transuranic waste is not generated unless the life-cycle management, including disposal of the waste, has been considered. However, as discussed below, it is not the objective of this requirement to prohibit, under all conditions, the generation of transuranic waste that does not have an identified path to disposal. In meeting the DOE O 435.1 planning requirements, it is appropriate for waste management organizations to provide assistance to the generator in determining the waste management path, particularly in cases where the waste management organization may utilize offsite treatment, storage, or disposal facilities.

Compliance with this planning requirement is demonstrated by the individual sites establishing a process for evaluating the life-cycle of low-level waste prior to its generation, including the identification of low-level wastes with no path to disposal and appropriate records justifying the newly generated low-level waste stream(s), and site personnel possessing planning information showing the location(s) where low-level waste will be stored, treated, and/or disposed along with a confirmation that the personnel managing the facilities agree that the low-level waste may be managed at those facilities.

Supplemental References:

1. DOE, 1998. *Accelerating Cleanup: Paths to Closure*, DOE/EM-0362, U.S. Department of Energy, Washington, D.C., June 1998.

III. H.(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.

Objective:

The objective of this requirement is to ensure that prior to generation of a new transuranic waste streams with no path to disposal, the need to generate the waste is carefully considered and plans for safe long-term storage and for resolving issues that prevent disposal of the wastes are developed.

Discussion:

There are instances where programmatic needs may necessitate the generation of transuranic waste without an identified path to disposal. In these instances, the Field Element Manager must ensure development of a process for identifying generation of transuranic waste with no path to disposal and approving the conditions under which such transuranic waste can be generated (DOE M 435.1-1, Section 1.2.F.(19)). The process of identifying waste with no path to disposal and establishing conditions for its generation is intended to raise to the attention of DOE management that a long-term commitment is being made with the generation of such a waste, including prolonged storage of this waste and resolving those issues that prevent the waste from being disposed.

> *Example: Through generation planning it is determined that an Office of Science project will generate a small volume of non-defense transuranic waste. The generator contacts the waste management organization and learns that because the waste is non-defense it is not eligible for WIPP disposal. Working together, generator and waste management personnel determine there is no way to avoid creating the waste if the project proceeds, however, the waste management organization does have long-term storage capacity available. The Field Element Manager determines that due to the importance of the project, and based on plans that the Department is pursuing to resolve disposal of non-defense transuranic waste that generating the transuranic waste is acceptable.*

The minimum conditions for generating a waste without an identified path to disposal are identified in this requirement. They include various evaluations and considerations that involve both the waste generating and waste management organizations. The decision to proceed with the activity generating the wastes is made considering the factors discussed below.

<u>Programmatic need to generate the waste</u>. There must be a clear identification of the programmatic mission being served that results in the generation of transuranic waste with no identified path to disposal. Alternate means of accomplishing the mission without generating the waste should be discussed. These could include use of alternative materials to achieve the mission, use of different processes, or substitution of chemicals other than the ones originally to be used.

<u>Characteristics and issues preventing the disposal of the waste</u>. The reasons that the transuranic waste cannot be disposed of must be identified. These may be technical or programmatic reasons. For example, if a waste needs to be treated in order to meet a disposal facility waste acceptance criteria and an appropriate treatment facility is not available, the lack of treatment would be

identified as the reason the waste does not have a path to disposal. Identifying the characteristics and issues preventing disposal is necessary to support the development of plans for achieving disposal.

Safe storage of the waste until disposal can be achieved. Since the waste cannot be disposed of pending the resolution of programmatic or technical issues, facilities must be available for safe storage. In order to evaluate the ability to provide for the storage of the waste, there needs to be an estimate of the amount of the waste that will be generated, as well as an estimate of the time necessary to keep the waste in storage. Identification of the requirements for safe storage and acceptable storage facilities is a prerequisite to generating the waste so that unique or risky aspects that may make long-term storage problematic can be identified. In addition, treatment necessary to comply with RCRA, if applicable, should be identified.

Activities and plans for achieving final disposal of the waste. The decision to generate waste with no identified path to disposal must be based on a plan to eventually achieve disposal. The plan to achieve disposal of the waste needs to identify the activities being pursued to resolve issues preventing disposal and a schedule for their resolution. The activities described may be fairly detailed if the problems are technical and involve only one waste stream at a site. In other cases involving programmatic issues, or which involve several waste streams at several sites, the activities and schedules to resolve issues may be less certain because they are dependent on other internal or external organizations. For example, resolution of the issue of disposal of non-defense transuranic waste may require action external to DOE (e.g., legislation). Sites should defer to the complex-wide plans for addressing disposal of non-defense transuranic waste in lieu of developing individual plans and schedules.

Example 1: Approval is given to generate transuranic waste with no path to disposal. The waste is not acceptable for disposal at WIPP because it is reactive (EPA hazardous waste code D003). The approval to generate the waste is based on the generator providing plans to develop the treatment capabilities necessary to make the waste acceptable for WIPP disposal. These plans should be detailed, identifying the schedule for conducting the studies, tests, and engineering, as well as regulatory activities, necessary to allow the waste to be treated.

Example 2: A non-defense transuranic waste which is otherwise acceptable for WIPP disposal may require a programmatic decision by DOE Headquarters and legislative action to resolve disposal issues. The site plan for addressing this issue should identify the data collection and options analyses to be performed by the site and address how they fit with the actions being taken by the Complex-Wide Transuranic Waste Management Program (see DOE M 435.1-1, Section III.C).

If the assumptions for the planned management of the waste are adversely impacted (e.g., as a result of testing, design, funding profile, DOE policy) they should be updated. Minor updates to the assumptions and changes to the planned management of the waste would not be a basis for re-evaluating the generation of the waste as long as the overall plan remains essentially unchanged. However, major changes to the plan (e.g., changes in decisions for developing a treatment facility or disposal facility to handle the waste) must result in a re-evaluation of the acceptability of continuing to generate the transuranic waste. All changes in plans for resolving issues preventing disposal should be forwarded to the Headquarters Office of Waste Management so their impact on the Complex-Wide Transuranic Waste Management Program can reflected in the program plan (see DOE M 435.1-1, Section I.2.D.(1)).

Compliance with requirement is demonstrated by the waste generation organization having documentation concerning the decision to generate a transuranic waste stream that does not have an identified path to disposal. This documentation needs to include the cognizant Field Element Manager or designee approval to generate the waste, an explanation of the need for the process that generates the transuranic waste, a discussion of the reason it cannot be disposed of, the proposed management plan for the waste, and an up-to-date schedule of activities being pursued to resolve constraints to the disposal of the subject waste. Consistent with the use of a graded approach for applying DOE M 435.1-1 requirements, the schedule and plans for disposing of non-defense waste can defer to the complex-wide resolution of the issue.

Supplemental References:

1. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* DOE/WIPP-069, Revision 5, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

WASTE STREAM PROFILE FORM **Page 1 of 3**

Waste Stream Profile Number: ________________ Generator site name: ________________

Technical contact: ________________________ Generator site EPA ID : ______

Technical contact phone number: ________________

Did your facility generate this waste? Yes No

If no, provide the name and EPA ID of the original generator:

____

Waste Stream Information

ID: ________________________ Summary Category: ___________________

Waste Stream Name : ________________________________

Description from the TWBIR (if available): _________________________________

Defense TRU Waste?: Yes No CH-TRU or RH-TRU?: CH RH

Concentration of PCBs: ____

Number of SWBs _______ Number of Drums________ Number of Canisters ___

Data package numbers supporting this waste stream characterization: __________________

List applicable EPA Hazardous Waste Numbers: ______________________________

List the concentrations of VOCs listed in Table 4-2: ________________________

List average isotope ratios: ____

List the weight fraction of CRP: _____________________________________

Acceptable Knowledge Information

For the following, enter supporting documentation used (i.e., references and dates)

Required Program Information

- Map of site: ____
- Facility mission description: ____
- Description of operations that generate waste: ______________________________
- Waste identification/categorization schemes: ______________________________
- Types and quantities of waste generated: _________________________________
- Correlation of waste streams generated from the same building and process, as appropriate: ____
- Waste certification procedures: _______________________________________

Figure III.H.1. Example Transuranic Waste Stream Profile Form

WASTE STREAM PROFILE FORM **Page 2 of 3**

Required Waste Stream Information

- Area(s) and building(s) from which the waste stream was generated: ________________
- Waste stream volume and time period of generation: ________________________
- Waste generating process description for each building: _______________________
- Process flow diagrams: ____
- Material inputs or other information identifying chemical/radionuclide content and physical waste form: ____
- Which Defense Activity generated the waste: (check one)
    - Weapons activities including defense inertial confinement fusion
    - Naval Reactors development
    - Verification and control technology
    - Defense research and development
    - Defense nuclear waste and material by products management
    - Defense nuclear materials production
    - Defense nuclear waste and materials security and safeguards and security investigations

Supplemental Documentation

- Process design documents: ____
- Standard operating procedures: ______________________________________
- Safety Analysis Reports: ____
- Waste packaging logs: ____
- Test plans/research project reports: ________________________________
- Site data bases: ____
- Information from site personnel: _____________________________________
- Standard industry documents: _______________________________________
- Previous analytical data: ____
- Material safety data sheets: ____
- Sampling and analysis data from comparable/surrogate Waste: ____________________
- Laboratory notebooks: ____

Figure III.H.1. Example Transuranic Waste Stream Profile Form (cont.)

WASTE STREAM PROFILE FORM **Page 3 of 3**

Sampling and Analysis Information [(1)]

For the following, when applicable, enter procedure title(s), number(s) and date(s).

- Radiography: ____
- Visual Examination: ____
- Headspace Gas Analysis
  VOCs: ____

Homogeneous Solids/Soils/Gravel Sample Analysis

Metals: ____
PCBs: ____
VOCs: ____
Nonhalogenated VOCs: _____________________________________
Semi-VOCs: ____
Other (specify): ____

Waste Stream Profile Form certification:

I hereby certify that I have reviewed the information in this Waste Stream Profile Form and it is complete and accurate to the best of my knowledge. I understand that this information will be made available to regulatory agencies and that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

______________________ ______________________ __________
Signature of site project manager Printed name and title Date

Note: (1) If radiography, visual examination, headspace gas analysis, and/or homogeneous solids/soils/gravel sample analysis were used to determine EPA Hazardous Waste Codes attach signed summary reports documenting this determination.

Figure III.H.1. Example Transuranic Waste Stream Profile Form (cont.)

III. 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.

Objective:

The objective of this requirement is to ensure that sufficient knowledge of transuranic waste's characteristics (e.g., chemical, physical, radiological) is available to protect workers handling the waste and to support effective decision-making for its management. This information is to be maintained from generation, through storage and treatment in sufficient detail to ensure that the requirements of subsequent treatment and storage facilities, transportation regulations, and the disposal requirements for transuranic waste will be met.

Discussion:

The *Radioactive Waste Management Manual* assigns the Field Element Manager the responsibility of ensuring development, approval, and implementation of a program that addresses the responsibilities of waste generators, including waste characterization (DOE M 435.1-1, Section I.2.F.(7)). The characterization data acquired during generation, storage, and after treatment of transuranic waste need to be reliable and in sufficient detail to ensure subsequent management can be conducted safely and to meet the waste acceptance requirements of all subsequent receiving facilities. Accurate characterization of transuranic waste is essential to: 1) waste planning by generators, as required by DOE M 435.1-1, Section III.H; 2) waste certification by generators and other senders of waste, as required by DOE M 435.1-1, Section III.J; 3) waste transfers by generators and other senders of waste, as required by DOE M 435.1 Section III.K; and; 4) waste evaluation and acceptance by receivers of waste, as required by DOE M 435.1-1, Section III.G.

In conducting the analyses for development of the DOE M 435.1-1, characterization was identified as necessary to ensuring the safe management of waste from generation through disposal. Waste characterization is defined (DOE M 435.1-1, Definitions) as:

> "The identification of waste composition and properties, such as 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."

Accurate waste characterization is necessary so that the waste and waste containers are compatible and worker handling of waste containers can be performed safely. All information necessary for personnel to safely handle a container of transuranic waste needs to be known at all times during the life-cycle of the waste.

Waste characterization is a tool for gathering information that supports defensible decisions regarding safety, process, environmental and compliance matters in the management of transuranic waste. The significance of the waste management decision will guide the graded application of this requirement, as well as the more detailed characterization requirements addressed in subsequent sections of this guidance. These subsequent sections address application of a data quality objectives process to guide characterization (Section III.I.(1)) and minimum characterization requirements (Section III.I.(2)).

Use of Direct and Indirect Methods. Waste managers are to characterize transuranic waste using an appropriate combination of direct and indirect methods. The appropriate method for characterizing waste depends on the parameter being measured, the hazards associated with acquiring the information, and the amount and quality of the data needed as determined through a data quality objectives or similar process.

Direct methods of characterizing waste can be used to established certain physical and chemical attributes as well as radiological characteristics. The most common direct methods for characterizing the chemical and/or radiological characteristics are sampling and laboratory analyses and certain nondestructive evaluation techniques (e.g., real-time radiography). Direct characterization methods are conducted in accordance with the quality assurance program and plan governing the site and laboratory facilities.

Indirect methods of characterization use non-destructive examination techniques and acceptable knowledge to replace, supplement, and/or initially provide data that might otherwise be collected by direct, intrusive characterization of the waste. In the safety and hazard analysis performed in support of development of DOE M 435.1-1, the use of indirect methods was identified as an appropriate means of characterizing waste and at the same time complying with the as low as reasonably achievable (ALARA) principle for keeping radiation exposures to a minimum. An additional benefit of characterizing transuranic waste by the use of indirect methods is the avoidance of the generation of waste associated with sample materials, and laboratory equipment and expendables.

In order for indirect methods of transuranic waste characterization to serve their purpose of providing information necessary for the safe management of waste, the data need to be sufficiently accurate. The level of accuracy is determined through application of data quality objectives, or comparable process. Consistent with the data quality objectives, correlations demonstrating that data provided by indirect methods are representative of the actual waste may need to be supported through the application of direct methods. The methodology could employ a number of techniques, some of which involve some direct sampling and analysis of the waste stream. The following guidance paragraphs discuss different indirect methods.

Similar to the EPA and NRC guidance on characterizing mixed waste, DOE endorses the use of indirect methods such as the use of “acceptable” or “waste knowledge” for characterizing physical, chemical, RCRA-regulated, and radioactive components of waste. The term “acceptable knowledge” (or “waste knowledge”) includes process knowledge; records of analyses performed prior to the effective date of a requirement; or a combination of process knowledge and previous records, supplemented with chemical analyses (NRC/EPA, 1997). Process knowledge refers to detailed information on processes that generate waste subject to this requirement or information on processes similar to those which generated the waste being characterized.

Acceptable knowledge characterization of transuranic waste is based on an understanding of the materials and processes used to generate the waste, or analytical data obtained from the process or waste stream or both. Acceptable knowledge also includes information regarding the source of the waste stream, the physical form and materials comprising the waste, the chemical constituents of the waste, and the nature of the radioactivity present. Acceptable knowledge may be used to describe transuranic waste if the source information is consistent, defensible, and auditable.

While the development of a process for identifying and documenting transuranic waste acceptable knowledge is not dictated by this requirement, the following guidance provides an overview of elements of an acceptable process for assembling acceptable knowledge documentation:

- Acceptable knowledge is compiled in an auditable record.

- Correlations within waste streams in terms of time of generation, waste generating processes, analytical data, and site-specific facilities are clearly described.

- A reference list of applicable documents, databases, quality control protocols, and other sources of information that support the acceptable knowledge information is prepared.

- Procedures which outline the methodology that is to be used to identify and assemble auditable acceptable knowledge records, including the origin of the documentation, how the assembled information was or will be used, and any limitations associated with the information.

Characterization data gained through acceptable knowledge must be within the acceptable range of certainty and precision identified by the data quality objectives or similar process. Additionally, the effects of time-dependent processes must either be negligible or predictable. If acceptable knowledge is supported by the collection, analysis, and comparison of statistically valid samples with the acceptable knowledge records, periodicity of sampling and analysis should correlate with the nature of any changes in the process creating the waste or with changes that are being documented in characterization data.

Non-destructive examination and assay techniques use methods such as passive-active neutron assay, high resolution gamma ray spectroscopy, and thermal neutron capture to non-destructively collect data relating to the radionuclide constituents in the waste. Acceptable performance of assay techniques is determined through measurement of known standards and comparison to established quality assurance objectives of the applicable characterization program. A process, similar to the one discussed above regarding acceptable knowledge, needs to be established and documented in site procedures that outline the exact nature of the acceptable use of non-destructive examination techniques for providing characterization information on waste.

Another indirect method of providing radionuclide characterization data is through the use of a known relationship, or scaling factors, between a measured radionuclide or a dose rate and the radionuclide(s) of interest. As discussed above for acceptable knowledge and non-destructive examination techniques, use of scaling factors must be correlated with actual data.

The use of scaling factors is generally established by an initial characterization that provides a statistical basis for use of the scaling factors. As with any indirect method, the characterization program needs to include confirmatory measurements. The frequency of the confirmatory measurements is to be based on the consistency of the process generating the waste. Additionally, the history of previous confirmatory measurements may also influence the frequency of future confirmatory measurements with results that are very consistent providing justification for less frequent confirmatory measurements.

> *Example: A waste stream from an actinide processing building is sampled and analyzed and determined to be composed of three primary nuclides: Pu-239, Am-241, and Pu-238. The samples are found to contain the three radionuclides in essentially the same ratio. The process is known to be uniform and is therefore expected to generate similar concentrations in the waste stream as the facility is operated. Therefore, the contents of future waste containers are routinely characterized based on a gamma energy analysis which detects gamma radiation from the Am-241 and Pu-238. The characterization program requires the collection and full analysis of samples once a month to confirm that the ratio of the three radionuclides falls within an acceptable range (based on application of the data quality objectives process).*

<u>Characterization Documentation</u>. The requirement states that characterization data shall be documented in sufficient detail to enable the waste acceptance requirements of the receiving

facility to be met. The following elements are considered essential to this process for acquiring and controlling characterization data:

Organization(s) and Responsibilities - Identification of the organizations involved and responsible for characterization of transuranic waste.

Quality Assurance - Characterization data need to be subjected to a quality assurance program and the program that applies needs to be identified and documented.

Procedures - The process for obtaining waste characterization data is formalized in procedures which describe to the user the steps that are to be followed and the administrative process for ensuring the data are of the quality needed. Topics that need to be proceduralized include the processes for sampling, packaging, transportation, laboratory analysis, and data control.

Procurement/Purchasing Controls - The procurement and/or purchasing of items or services that are significant to characterizing transuranic waste are controlled and documented. Such procurement includes the purchase of sampling equipment and sample transport containers, as well as services such as laboratory analyses (onsite or offsite). As dictated by the type of procurement, the documentation needs to include (or reference) the technical specifications for the item/service being procured, identification of quality assurance requirements including any required inspections, specifications of documentation requirements (e.g., certification of compliance or conformance, laboratory analytical results), and a statement ensuring access to the provider’s facilities as necessary to perform audits and inspections. The characterization data need to be traceable through the provider’s process of generating them and verifying their accuracy.

Document/Data Change Control - Records that contain characterization data, whether they have been generated through sampling and analysis, nondestructive assay, or acceptable knowledge, need to be controlled. In addition, the waste characterization procedures and quality assurance program documentation are subject to document control. Document and data control need to include review, approval, and distribution to designated recipients (users), and a controlled process for making revisions to documents or data. Existing document and data control programs at a site may be adequate to provide the necessary controls for documents related to transuranic waste characterization data, but will need to be reviewed to ensure the objectives of DOE M 435.1-1 requirements are met.

Training - Characterization data are generated and managed only by personnel that are properly trained to recognize the significance of the data. Generally, training of laboratory personnel will be adequate to support transuranic waste characterization, but needs to be reviewed versus the goals of the characterization. Other staff managing and using characterization data need to understand what is to be done with the data (i.e., what decisions are to be made) once data are collected.

Records - Waste characterization records include those that are necessary to meet the waste acceptance requirements of receiving facilities, and as specified by the waste certification program DOE M 435.1-1, Section III.J.

As noted above, existing programs at a site may provide the framework within which the elements of waste characterization can be addressed (e.g., quality assurance, training, document control).

The waste acceptance requirements of a facility to which the waste is sent also may impose additional requirements on what is to be included in the waste characterization data. The waste acceptance requirements for the receiving facility include specific quality assurance, administrative, or documentation requirements so that waste characterization data are acceptable to the facility.

Example: A site is preparing to transfer waste to WIPP for disposal. The waste characterization program at the site normally generates data on the physical, chemical, and radiological characteristics of the waste. However, additional requirements have been established for the characterization of transuranic waste in order to transfer it to the WIPP for disposal. In addition to what is normally thought of as characterization data (chemical and radiological), the waste acceptance criteria require, among other information, the waste packages to be characterized in terms of their thermal power and decay heat.

Compliance with this requirement is demonstrated by a program for documenting and the existence of records that document the process for acquiring and verifying the validity of transuranic waste characterization data acquired through the use of direct or indirect methods.

Supplemental References:

1. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* DOE/WIPP-069, Revision 5, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

2. EPA, 1994. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, U.S. Environmental Protection Agency, Washington, D.C., September 1994.

3. NRC/EPA, 1997. "Joint NRC/EPA Guidance on Testing Requirements for Mixed Radioactive and Hazardous Waste," *Federal Register*, Vol. 62, No. 224, U.S.

Environmental Protection Agency and U.S. Nuclear Regulatory Commission, November 20, 1997.

III. I.(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.

Objective:

The objective of this requirement is to invoke a process for determining the type, quantity, and quality of characterization data needed to support the safe management of transuranic waste so as to ensure that needed data are acquired, the data meet the objectives they are being collected for, and resources are not wasted on unnecessary, incomplete or unusable data collection efforts.

Discussion:

The type, quantity, and quality of characterization data obtained for the safe management of transuranic waste need to be consistent with the purpose for which the characterization information will be used. The uses of transuranic waste characterization data include complying with storage, treatment, and disposal facilities' waste acceptance requirements; determining radiation shielding and other protective measures; evaluating compliance with processing requirements; and meeting legislative or regulatory commitments. This requirement is included in DOE M 435.1 to ensure that the appropriate characterization data to support the safe management of transuranic waste are generated. The requirement is intended to promote a structured process for the collection and use of transuranic waste characterization data and to avoid the collection of data that is neither necessary nor defensible.

Input from various waste management organizations and interested groups is necessary to establish a clear understanding of the characterization data needs and the level of data quality that is acceptable for making transuranic waste management decisions. The current requirement invokes the use of a structured process for determining the type, quantity, and quality of characterization data needed. Such a process, called a data quality objectives process, has been developed by the Environmental Protection Agency and is documented in *Guidance for the Data Quality Objectives Process*. Application of the EPA process and use of the guidance for the use of the data quality objectives process is an acceptable method of meeting this requirement. However, use of other comparable processes that employ a structured approach to yield similar results is also acceptable.

The objectives of applying a structured process such as the data quality objectives process are to:

- manage and control the risks of making incorrect decisions;
- determine the data required to support making specific decisions;
- determine the type and quality of required data;
- allow stakeholders, decision makers, data users, and relevant technical experts to participate in planning and assessment;
- determine the quantity, location, and type of samples required;
- quantify the uncertainty in data through development of statistical sampling plans; and
- reduce overall costs by identifying resource-efficient sample collection and analytical methods by optimizing the sample and analysis plans.

The data quality objective process is a strategic planning approach based on the scientific method that is used to prepare for a data collection activity. The value of using this process to develop transuranic waste characterization parameters is that it reduces radiation exposure and saves resources by making characterization data collection operations more resource-effective; enables characterization data users and others to participate in characterization data planning; and provides a structured method for defining characterization data performance requirements, i.e., quality.

To foster the development and implementation of an effective data quality objectives or similar process, individuals are assigned responsibility for specific activities for each application of the process. Key activities of the process include:

- preparing the data quality objectives documentation;
- identifying stakeholders;
- identifying technical experts;
- ensuring opportunities for input and coordinating stakeholder and technical experts into the data quality objective process;
- reviewing and commenting on the developed data quality objectives; and

- approving the data quality objectives documents.

A more detailed description of the assignment of specific responsibilities for implementing a data quality objectives or similar process is presented in the Hanford "Data Quality Objectives Procedure" (see reference 2).

The data quality objectives process consists of seven steps. The output from each step influences the choices that will be made later in the process. Even though the data quality objectives process is depicted as a linear sequence of steps, in practice it is iterative; the outputs from one step may lead to a reconsideration of prior steps. This iteration is encouraged since it will ultimately lead to a more efficient data collection design. During the first six steps of the process, a team of process-cognizant personnel develop decision performance criteria (i.e., data quality objectives) that will be used to develop the data collection design.

The final step of the process involves developing the data collection design based on the data quality objectives developed in the first six steps. The first six steps need to be completed before the team attempts to develop the data collection design because the design is dependent on a clear understanding of the first six steps taken as a whole.

Following is a listing and brief description of each of the seven steps. This is followed by an example of how the data quality objectives process can be applied to transuranic waste characterization.

> *1.* *State the Problem* – Concisely describe the problem to be studied. Review prior studies and existing information to gain a sufficient understanding to define the problem.
>
> *2.* *Identify the Decision* – Identify what questions the study will attempt to resolve, and what actions may result.
>
> *3.* *Identify the Inputs to the Decision* – Identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement.
>
> *4.* *Define the Study Boundaries* – Specify the time periods and spatial area to which decisions will apply. Determine when and where data should be collected.
>
> *5.* *Develop a Decision Rule* – Define the statistical parameter of interest, specify the action level, and integrate the previous data quality objective outputs into a single statement that describes the logical basis for choosing among alternative actions.

6. <u>Specify Tolerable Limits on Decision Errors</u> – Define the decision maker's tolerable decision error rates based on a consideration of the consequences of making an incorrect decision.

7. <u>Optimize the Design</u> – Evaluate information from the previous steps and generate alternative data collection designs. Choose the most resource-effective design that meets all data quality objectives.

Example: In order to comply with current legislation, the Waste Isolation Pilot Plant has established a waste acceptance criterion that transuranic waste must exceed 100 nCi (3700 Bq) of alpha-emitting transuranic nuclides per gram of waste. At the CST Site waste management personnel worked with the WIPP staff, site laboratory personnel, and members of the local citizens advisory board to address the transuranic waste determination issue. The question is formulated as, what are the analytical criteria waste must meet in order to be categorized as transuranic waste? The answer to this question makes a significant difference in cost and in the amount of waste that will be shipped to WIPP, and conversely, the amount of waste that will be designated as low-level waste and disposed of near surface. From the perspective of worker protection, it was recognized that a non-intrusive analysis technique was preferred. The CST Site personnel anticipated that most of the waste would be around 200 nCi/g (7400 Bq/g) so they opted for a two-tiered characterization approach which employs a fast, inexpensive protocol to make an initial screening of waste and a slower, more expensive protocol to characterize waste that fails the initial screening. The data quality objective is:

> *Waste containers will be categorized as transuranic waste if the results of the non-destructive analysis exceed the minimum detectable concentration for a particular assay system and protocol, and the results exceed 100 nCi/g. Waste containers will be initially analyzed using a system and protocol that has a minimum detectable concentration of 150 nCi/g. If the result does not exceed 150 nCi/g, the waste container will be analyzed using a system and protocol with a minimum detectable concentration of no more than 50 nCi/g.*

Applying this data quality objective, a waste container is assayed as having 175 nCi/g using the first system (150 nCi/g minimum detectable concentration) and categorized as transuranic waste. Another waste container assayed as having 125 nCi/g using the first system. Even though the assay exceeds 100 nCi/g, the categorization would be indeterminate because the assayed value is less than the minimum detectable concentration. An assay of the container using the second system (50 nCi/g minimum detectable concentration) yields a result of 110 nCi/g. Based on the second measurement the waste is categorized as transuranic.

The above description of the use of the data quality objectives process, and the example, are provided as an introduction to the process. A more detailed description of the process can be found in the referenced EPA guide. The data quality objectives process is most useful during the planning stages of identifying transuranic waste characterization and uncertainty parameters, i.e., before the data are needed and collected. The value of the process is diminished significantly if the characterization data have already been collected because there is a tendency to make the questions that need to be answered fit the available data. The application of the data quality objectives process is applied in a graded manner, i.e., the depth of detail and the magnitude of the resources expended in implementing the process should be commensurate with the relative importance of the characterization data in terms of the decisions to be made and protection of the public, workers and the environment.

The intent of this requirement is not that waste streams with characterization processes already in place and accepted by storage, treatment, and disposal facilities be recharacterized using the Data Quality Objectives Process, or a comparable process, or that the characterization processes be revised using the Data Quality Objectives Process, or a comparable process. The intent is that, as new waste streams are identified and generated, the Data Quality Objectives Process, or a comparable process, be used for identifying characterization parameters and acceptable uncertainty in characterization data. If the characterization parameters of an existing waste stream characterization process are to be significantly modified, then the Data Quality Objectives Process, or a comparable process, should be used.

Compliance with this requirement is demonstrated by the documented use of a data quality objectives or a comparable process for determining the type, quantity, and quality of characterization data needed to safely manage transuranic waste.

Supplemental References:

1. EPA, 1994. *Guidance for the Data Quality Objectives Process,* EPA QA/G-4, U.S. Environmental Protection Agency, Washington, D.C., September 1994.

2. WHC, 1996. *Data Quality Objectives Procedure*, WHC-IP-1216, Revision 1, Westinghouse Hanford Company, January 31, 1996, (included as Appendix A in draft Manual HNF-SD-WM-PROC-021, Revision 0, Lockheed Martin Hanford Corporation, January 2, 1997).

III. I.(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.

Objective:

The objective of this requirement is to establish minimum transuranic waste data that have been determined to be necessary for safe and effective management during the life cycle of the waste.

Discussion:

In the process of developing DOE O 435.1 and DOE M 435.1-1, the safety and hazard analysis indicated that certain characterization data were critical because several consequences could be avoided or minimized if certain basic information was accurately known about transuranic waste. This requirement identifies those critical characterization data points that must be known for safe handling and proper management. The sections below provide guidance on each of these specific characteristics.

<u>Physical and Chemical Characteristics</u>. Physical characteristics support handling and packaging activities. Parameters include a description of the material, its density, consistency, and appearance. Chemical characteristics impact handling, storage, containment, and can impact treatment processes. These characteristics determine the compatibility of the waste with other waste and the waste container, as well as its compatibility with proposed treatment processes. Parameters include pH, reactivity, chemical compounds present, and the presence of hazardous

and/or toxic constituents. Physical and chemical characteristics can be determined directly by visual examination and/or sampling and analysis. Physical characteristics can be determined directly, indirectly by use of acceptable knowledge and/or by non-destructive examination techniques such as computer tomography or real-time radiography. Chemical characteristics can also be determined by use of acceptable knowledge.

Volume and Weight. Volume and weight information is necessary for proper control of storage and disposal facility capacities as well as proper payload control for transportation and handling systems. Typical parameters include:

- container volume, measured as the external volume of the waste container which represents the volume that will be occupied in a storage or disposal facility (e.g., 55 gallon drum or 120 cu ft (for a 4 x 5 x 6 box));

- actual waste volume, including stabilization media;

- container weight; i.e., the total weight of the container and all of its contents (waste, shielding, stabilization media) that would have to be handled;

- identification of the stabilization medium, if used; and

- waste container utilization factor, measured as the percentage of the packaging volume that is filled with waste, including stabilization media. This parameter does not require an individual calculation be made of stabilization or absorbent media volume, but that those media be included in the total waste volume calculation.

These characteristics are generally determined by acceptable knowledge (e.g., container size, stabilization medium) or by measurement (e.g., weight).

Radionuclide Data. Radionuclide information allows for proper control of thermal loads for storage and disposal facilities, determination of personnel safety procedures, control of total activity limits for transportation, storage, and disposal, and also determination of the waste type. Parameters which constitute radionuclide information may include the following:

- total activity in the container, in curies;

- identity and activity per unit mass of the major radionuclides. For purposes of this guidance, major radionuclides are those which affect the determination that a waste is transuranic waste and any others determined to be of importance to the receiving facility (e.g., by safety analysis, performance assessment, etc.);

- radiation dose levels at the surface of the container; and
- container external surface contamination levels.

These characteristics can be determined directly by smear survey or radiochemical analysis of the waste, or indirectly by waste package non-destructive assay, radiation survey, and/or by documentation of nuclear materials accountability information or individual assays performed on components contained in the container.

Date and Generating Source. Date and generating source information helps to determine the validity of currently held documentation on the waste, which, in turn, will determine the need for additional sampling or analysis. Parameters include characterization date, packaging date, DOE site, building location of the process which generated the waste, and the generating process, if available.

Performance Assessment and Compliance Data. Additional data about waste that are important to performance or evaluating performance of the disposal facility, or to complying with laws, applicable regulations, or authorizing conditions (e.g., of a permit) may also need to be collected. The specific data needed will, by necessity, be identified by the disposal facility operator. Parameters which need to be included with waste characterization data may be identified by the analysts developing the disposal facility performance assessment, specified through conditions imposed on the site through the review and approval of the performance assessment, or derived from internal regulatory compliance evaluations. Examples of the types of data that may be needed are the presence and amounts of chelating agents which can enhance the transport of radionuclides from the disposal facility, or the presence and concentrations of specific chemicals which are not acceptable above specific limits (e.g., reporting polychlorinated biphenyls concentrations versus a limit of 50 ppm).

All of these data may not be required for a particular phase in the management of the waste's life cycle. The specific data needed will be determined by the waste acceptance criteria of a particular receiving facility.

> *Example: Experimental work in a laboratory generates a liquid transuranic waste stream that is transferred via a pipeline to a central storage tank. Although the minimum characterization requirements include "weight of the container and contents," this is not relevant to this waste stream and the characterization data in the waste acceptance requirements for the central storage tank do not include packaging weight.*

Compliance with this requirement is demonstrated by the existence of a program or procedures for determining and records that document characterization of transuranic waste consistent with the minimum characterization data requirements.

Supplemental References: None.

III. J. <u>Waste Certification</u>.

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.

Objective:

The objective of this requirement is to ensure that waste transferred to a facility for storage, treatment, or disposal meets the receiving facility's waste acceptance requirements, to reduce the likelihood that transferred wastes contain unacceptable materials or characteristics, and to avoid hazards that would occur from the transportation and handling of waste packages which do not meet acceptance requirements. Certification also ensures that the storage, treatment, or disposal facilities receiving the waste operate within limits established through safety analyses and/or performance assessments.

Discussion:

The *Radioactive Waste Management Manual*, General Requirements, assigns the Field Element Manager the responsibility of ensuring development and approval of a program that addresses the responsibilities of waste generators (DOE M 435.1-1, Section I.2.F.(7)). The generator requirements are to address hazards associated with a waste management facility receiving unexpected volumes or types of waste, or receiving waste that may not meet the waste acceptance requirements of the facility to which it is transferred. The generator requirements address generation planning, waste characterization, waste certification, and waste transfer. As discussed in this guidance, a certification program is to be established by generators of radioactive waste to provide a mechanism for confirming that waste is in compliance with the waste acceptance criteria of the facility to which the waste is being transferred. The certification program is required by any organization or facility that transfers waste to another facility.

Example: The Transuranic Waste Storage Facility has transuranic waste that it has received for storage over the last 10 years. Facility personnel plan to continue to receive transuranic waste and store it until it can be transferred to WIPP. The organization responsible for the storage facility must have a certification program through which facility personnel confirm the waste meets the acceptance criteria for WIPP . Since the storage facility does not change the characteristics of the waste package, the facility waste acceptance requirement should ensure that the waste they receive is acceptable for WIPP disposal. In this particular example, the certification program would have to be in accordance with the Generator Site Certification Guide (CAO, 1997).

The certification program is part of the waste generator program that is approved by the Field Element Manager or designee. The certification program requires that an authorized official confirms compliance with the waste acceptance requirements of the facility to which waste is being transferred. Additional guidance correlated to the specific waste certification requirements of the Transuranic Waste Requirements Chapter is provided below.

Program Development and Documentation. The waste certification program should consist of a documented, structured process that works in concert with the DOE M 435.1 requirements for waste acceptance (Section III.G) and waste transfer (Section III.K) to control the transfer of waste to a storage, treatment, or disposal facility. Development of the waste certification program involves defining and documenting controls for those items and activities that affect certifying that a waste and its packaging meets the waste acceptance criteria of the receiving facility. The documentation should include the following:

Organizations and Responsibilities - Certification program documentation needs to identify the organizations and officials involved in the certification process and the responsibilities of each. Officials who are authorized to certify waste are identified in the documentation.

Quality Assurance - The certification program is subject to quality assurance. The quality assurance controls that apply to waste certification activities needs to be identified and documented. The use of an existing quality assurance program under which the certification activities will be performed is acceptable and appropriate.

Procedures - The process for certifying waste is formalized in procedures. The procedures need to describe to the user the steps that are to be followed and the administrative process for ensuring waste containers are certified. The procedures require a signed statement certifying waste meets the appropriate criteria. The procedures also document the steps necessary for complying with the applicable transportation requirements (e.g., requirements from a safety analysis report for packaging and/or from Title 49, Code of Federal Regulations).

Procurement/Purchasing Controls - The procurement and/or purchase of items or services that are significant to certifying that waste meets the waste acceptance criteria of a receiving facility need to be documented. Such procurement may include the purchase of materials such as waste containers or laboratory services (onsite or offsite). As dictated by the type of procurement, the documentation should include (or reference) the technical specifications for the item/service being procured; identification of quality assurance requirements including any required testing or inspections; specification of documentation to be provided on delivery (e.g., fabrication inspection and/or test records; a certificate of compliance or conformance, laboratory analytical results); and a statement ensuring access to the provider's facilities as necessary to perform audits and inspections. The certification program ensures that the procurement documentation is reviewed and approved by an official with knowledge of the need, intent, and requirements for the procurement. The program also provides for documented verification commensurate with the relative importance and complexity of the items or services being procured.

Document Control - The principal documents that constitute the certification program needs to be subject to document control. Program documentation will identify which documents are to be controlled. The waste certification program description, waste certification procedures, and quality assurance program documentation need to all be subject to document control. Document control includes review and approval, distribution to designated recipients (users), and a controlled process for making changes to the documents. Existing document control programs at a site may provide the necessary controls for documents that are part of the waste certification program.

Training - The certification program needs to identify the training requirements for the various individuals who are involved in the program. At a minimum, the program will require training of the official who certifies that the waste meets the waste acceptance criteria of the facility(ies) to which it is being transferred. In addition, individuals will need to be trained in the procedures that control the part of the certification process with which they are involved.

Records - The certification program documentation needs to describe the management of certification records (see guidance for subparagraph (1) of this Waste Certification requirement).

Example: A site generates a small amount of transuranic waste that is sent to a central facility managed by a waste management organization. The generating organization works with the receiving facility to define the waste certification program for the site. Through a review of the existing site procedures, site personnel determine that the waste certification program can operate under the existing site quality assurance program, document control program, procurement process, and records management program. However, they determine that the site training program does not adequately address the certification process. Consequently, the waste managers work with the training department to develop a training module that explains the purpose and process of waste certification. The certification program documentation would identify these other programs as applicable, specify the facilities from which waste would be transferred, designate the officials responsible for waste certification at those facilities and their training requirements, and develop procedures (within the document control program) that ensure compliance with the waste acceptance criteria. Within the

> *existing programs, site personnel would identify the records to be maintained and retention times, technical specifications and receipt requirements for obtaining waste packaging materials, and requirements for analytical data. Operating within the parameters defined by the program, the waste generators would be able to certify waste for transfer to the onsite receiving facility.*

As noted in the preceding example, existing programs at a site may provide the framework within which elements of the waste certification program can be addressed (e.g., quality assurance, training, document control). The waste acceptance requirements of the facility to which the waste is to be sent may impose additional requirements on what is to be included in the waste certification program. Whether the waste acceptance requirements of the facility to which waste is transferred mandate a waste certification program (e.g., a commercial facility), the organization transferring the waste is responsible for developing and implementing a certification program to provide internal assurance that the waste acceptance requirements will be met.

Implementation. The waste certification program is implemented through the use of the documented controls, processes, and procedures. The key document in a waste certification program is the certification statement or equivalent. The certification statement is the documentation signed by a designated official that certifies that the waste meets the appropriate requirements. The list below, derived from the *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, is a generic listing of the topics that are recommended for consideration in development of certification statements.

1. Container and Physical Properties

   - container type or description
   - labeling/markings
   - weight
   - vents
   - liquids

2. Nuclear/Radiological Properties

   - fissile content
   - transuranic activity
   - other radioactivity
   - dose rate
   - surface contamination
   - thermal power

3. Chemical Properties

- mixed waste
- polychlorinated biphenyls
- other hazardous constituents
- pyrophorics
- explosives
- corrosives
- compressed gases
- volatile organic compounds

4. Packaging/Shipping Data

- packaging
- shipping information

Graded Approach. A graded approach is used in implementing the waste certification program. The above list is recommended for the intersite transfer of transuranic waste. Intersite transfers involve certifying that the waste is in compliance with the requirements for the receiving facility itself, and also in compliance with Department of Transportation requirements. However, even though the above list should be considered, it may be shortened and simplified for onsite transfers where the organizational relationships and knowledge of waste and waste generating activities may reduce the information that needs to be documented and transferred with each individual waste container or shipment. For onsite transfers, much of the information may already be available to the receiving facility. Onsite transportation of waste should be certified as meeting Department of Transportation requirements or site-specific requirements for transportation.

Example: For onsite transfers the receiving facility/organization may already have a waste stream profile provided by the generator facility/organization. Because of the existence of the waste stream profile, the certification may be as simple as an individual trained to the waste packaging and certification procedures signing a waste pick-up request that provides the radionuclide inventory of the waste packages being transferred and the waste stream identification number.

The waste acceptance requirements of the facility receiving the waste (see DOE M 435.1-1, Section III.G) may dictate additional items which must be part of the certification statement. Even if such information is not dictated by the receiving facility, the waste acceptance criteria should be used to identify key elements to include on the waste certification statement.

Compliance with the development and documentation portion of the certification requirement is demonstrated by a waste certification plan that identifies the organizations involved, assigns responsibilities for implementing the program, and describes or references the quality assurance, training, procurement controls, records management, and procedures to be used by the program. Acceptable performance for implementing the program is demonstrated when the appropriate personnel are trained, and have and follow the procedures that govern their part of the waste certification process. Acceptable performance also requires that the waste certification plan and procedures are current and controlled in accordance with a document control program, and records related to certification (e.g., certification statements, training records, procurement records, characterization records, container records) are generated and managed in accordance with the established site program.

Supplemental References:

1. CAO, 1997. *Generator Site Certification Guide*, Revision 1, DOE/CAO-95-2119, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1997.

2. DOT. *Shippers-General Requirements for Shipments and Packagings*, 49 CFR Part 173, U.S. Department of Transportation, Washington, D.C.

3. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 5, DOE/WIPP-069, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

III. J.(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.

Objective:

The objective of this requirement is to ensure waste certification programs are developed that clearly identify the documentation required for certifying waste, specify personnel with the authority to make the certification, and provide a traceable and verifiable record of and basis for certification.

Discussion:

Officials who have the authority to certify that waste meets the waste acceptance requirements of the receiving facility must be designated by a cognizant manager. To avoid having personnel who are not knowledgeable of waste acceptance and transfer requirements authorizing the release of waste, the program needs to identify, by title or name, the officials who are authorized to certify. The official(s) are qualified by virtue of position, responsibilities, and training to make this certification. The official(s) have sufficient familiarity with the waste being generated and have been trained relative to the acceptance criteria of the facility receiving the waste for storage, treatment or disposal (and applicable transportation requirements) to be able to certify in writing that the waste is acceptable for transfer. The official(s) need to also have authorization from the facility receiving the waste to transfer the waste (see DOE M 435.1-1, Section III.K). Implementation of this element should be tailored to specific site needs and situations.

> *Example: Onsite transfers from multiple laboratories or processes to a central waste management facility may involve training multiple personnel (e.g., one for each laboratory or process) who have the authority to certify waste as meeting the onsite waste acceptance requirements. However, for the transfer of waste from the central waste management facility to an offsite facility, there may be a designated official at the site who has been trained relative to the acceptance criteria of the offsite storage, treatment, or disposal facility waste acceptance criteria and transportation requirements that is authorized to certify the waste as ready for shipment.*

The waste certification program needs to specifically identify the documentation to be produced to support the certification that waste meets the waste acceptance criteria of the receiving facility. The required documentation may include the following:

<u>Waste Stream Profile</u> (or record relating the waste to a previous profile). The waste stream profile is a description of the waste stream, generally identifying the source, physical and chemical description, and upper limits on radionuclides.

<u>Radionuclide Characterization Data</u>. Radionuclide characterization data include the concentration and/or inventory of radionuclides as determined by characterization (see guidance for DOE M 435.1-1, Section III.I, Waste Characterization).

<u>EPA Uniform Hazardous Waste Manifest</u>. The EPA manifest is required by 40 CFR Part 262 for the transfer of a hazardous or mixed waste.

<u>Waste Container Data and Integrity Maintenance Documentation</u>. Container data include information about the container dimensions, other physical attributes, and

procurement information. Integrity documentation includes the records of ownership and transfer of waste containers and data. (See guidance for Waste Transfer, DOE M 435.1-1, Section III.K).

Radiological Survey Results (or documentation referencing a survey record). Survey results include the determination of the surface contamination of the waste container and the external dose rate.

Bill of Lading. A document indicating the contents of a shipment.

Real-Time Radiography Results. The results of radiography performed to detect unallowed material in the waste package (e.g., liquids, compressed gas cylinders).

Certification Statement. The statement required by DOE M 435.1-1 to document that waste is in compliance with the acceptance criteria of the facility to which the waste is being transferred.

Authorization to Transfer. Documentation indicating that an official from the facility to which the waste is to be transferred has authorized transfer of the waste to the facility.

As noted for other elements of this requirement, the organization developing the certification program uses a graded approach in determining which of these documents are needed. Regardless of the extent of the required documentation, the certification statement can serve as a checklist that all of the waste acceptance criteria have been considered and the waste is in compliance. An example of a certification statement for waste to be shipped to WIPP is provided at the end of this section of guidance (Figure III.J.1).

In order to ensure that information is available if or when it is needed in the future, the waste certification program should identify which records are to be maintained and how they are to be maintained. The certification program documentation may include specific records management requirements, or may simply invoke an existing acceptable records management program. Although no minimum record retention times are established in DOE M 435.1-1, certain records may need to be maintained indefinitely. Whereas hazardous waste regulations require only a three-year retention period, DOE disposal facilities should plan on maintaining pertinent records at least through the operations, closure, and post-closure monitoring periods, and consider making them part of any local land use records. The pertinent records would be those which identify physical, chemical, and radiological characteristics of the waste and the certification of that information. Generating, storage, or treatment facility waste management records may not be required beyond the life of the facility or operation, provided pertinent information has been supplied to the facility where the waste will be disposed.

Example: Personnel at a storage facility maintain records describing when they received waste, what the waste was (characterization and container data provided by the generator), and to whom the waste was eventually transferred. Once the waste is disposed of and the waste characterization and container information is in the possession of the organization responsible for the disposal facility, the organization responsible for the storage facility disposes of its records.

To meet the requirement for auditability and retrievability, the method of records storage and retention needs to allow a person to trace shipment or waste container information back to the generator certification data (e.g., characterization data, source data, container data). In accordance with the DOE M 435.1-1, Section III.K Transfer Requirements, information on the source and characteristics of the waste are to be transferred when waste is transferred. It is not the intent of this requirement that a certification statement be generated for existing waste that was received without such information (i.e., waste in storage as of the issuance of DOE O 435.1). However, such documents must be created for any subsequent transfers of waste.

Example: A site should be able to provide the characterization, container, and certification information for any waste container within a storage, treatment, or disposal facility if that waste container is transferred after issuance of DOE O 435.1.

Compliance with this requirement is demonstrated by a program or procedure for record keeping and records showing that each container of waste is certified as having met the waste acceptance criteria of the facility to which it was transferred and the certification statement is supported by additional records regarding the waste source, characterization, and container.

Supplemental References:

1. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 5, DOE/WIPP-069, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

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

Objective:

The objective of this requirement is to ensure that waste meets the acceptance requirements of the storage, treatment, or disposal facility before it is transferred to prevent transferring waste that could endanger receiving facility personnel, and to avoid the delay and potential hazards associated with corrective actions taken to remedy non-compliant conditions.

Discussion:

The waste certification requirements above address development, implementation, and content of a waste certification program. The requirement that waste be certified before transfer ensures that the program is effective in preventing the transfer of waste that does not meet the waste acceptance criteria of the facility receiving the waste for storage, treatment, or disposal. In accordance with this requirement, waste should be released for transfer to another facility only after there is a certification by an authorized official that the waste acceptance requirements have been met. Ensuring certification occurs prior to allowing the physical transfer of waste prevents potential hazards associated with managing waste rejected by the facility to which it is transferred. Requiring certification before waste is transferred also reduces the likelihood of having to recall a waste shipment due to a discovery by the certification official, after the waste is in transit, that the waste does not comply with the waste acceptance requirements. Guidance on DOE M 435.1-1, Section III.K discusses what constitutes a transfer, and can be consulted to determine when this requirement needs to be met.

Certification that the waste is ready for transfer and meets the waste acceptance criteria and the applicable transportation requirements, is a control point in the transfer process. The procedures controlling waste transfer should not allow the transfer to occur unless the certification statement has been signed. Once signed, the certification statement becomes part of the record for the transfer of the waste (see Waste Transfer, Section III.K). An example of a certification statement for shipment of contact-handled waste to WIPP is included as Figure III.J.1. As can be seen from examination of the certification statement in Figure III.J.1, the signature on the certification statement is confirming that the waste has been characterized for physical, chemical, and radiological characteristics, properly packaged, and necessary container markings and shipping data have been prepared.

> *Example: Central Waste Management Facility personnel are responsible for receiving waste, providing interim storage, and making transfers to an offsite transuranic waste storage facility. In order for the workers at the Central Waste Management Facility to place a waste container on a truck for transfer, the operating procedures for the facility require that they have a signed certification statement that correlates to the container(s) (either bar coded or numbered). Once a waste container is loaded, a copy of the certification statement is included in the waste transfer papers and another is included in the Central Waste Management Facility files.*

Compliance with this requirement is demonstrated by the presence of a certification program which includes procedures requiring a signed certification statement prior to the release of waste for transfer, and by dated records showing that waste was certified before being transferred.

Supplemental References: None.

III. J.(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.

Objective:

The objective of this requirement is to ensure that certified waste is managed to maintain the certification status and avoid the unnecessary handling of waste containers that would be necessary for recertifying waste.

Discussion:

There may be instances where waste must be stored before being transferred to the next stage in the waste management process. If waste is certified as meeting the waste acceptance criteria of the receiving facility prior to, or during storage, it needs to be stored and controlled so that the certification remains valid until the waste can be transferred. For instance, many DOE sites will send transuranic waste to WIPP for disposal. If a facility certifies waste in accordance with a program authorized by the Carlsbad Area Office, the waste needs to be stored under conditions and with controls to protect it from physical damage, and to prevent tampering (i.e., placement of unallowed materials into the container) so it can be transferred for disposal without re-certification.

> *Example: A facility generates transuranic waste which is sent to an onsite storage facility. An inventory of everything put into the waste container is maintained while the container is being filled. Once filled, the container is closed and a numbered tamper-indicating device is put on the container closing band. The facility's authorized waste certification official confirms that the waste has been properly characterized and meets the storage facility's waste acceptance criteria. When the authorized waste certification official fills out the waste certification statement, the number of the tamper-indicating device is also entered on the form. Facility procedures require closed, certified waste packages to be staged in an indoor area adjacent to the loading dock. Thus, at the time of transfer, the generating and receiving facility personnel are assured that the certification is valid because environmental conditions have not affected the*

package (it has not been exposed to precipitation, freezing, or extreme heat/sunlight) and because the tamper indicating device indicates that the container has not be opened since it was certified.

Also, certifying officials need to be aware of any limitations on the amount of time a waste can be stored without invalidating the certification. Actions necessary to certify a waste that involve potential radiation exposure of workers are deferred, if possible, until there is a reasonable expectation that the waste can be transferred to the receiving facility within the time that the certification is valid. Routine monitoring required for waste in storage may not allow all activities that could result in worker exposure to be deferred.

This requirement is not to be interpreted in a manner that interferes with a facility performing a normal acceptable waste management function. Therefore, if a waste is certified as meeting the waste acceptance criteria of a treatment facility, the requirement to maintain the certification of the waste is not intended to prevent the treatment facility from treating the waste. Even though, treating the waste will not "maintain" the certification, the purpose of the certification is to ensure the waste can be safely accepted for treatment. Maintenance of the certification status is intended to cause the waste to be stored, transported, and staged at the treatment facility in a manner that will allow personnel to treat the waste without concern that it no longer meets the acceptance criteria. In addition, despite the protection provided for the waste, sampling prior to treatment may still be a necessary process control step.

Specific requirements for protecting the certification status of a container of waste are generally negotiated with the receiving facility. Requirements to be considered include protecting the waste container, preventing unauthorized introduction of material into the waste, and protecting the data about the waste container. The Waste Transfer requirements (DOE M 435.1-1, Section III.K) also address protecting waste containers and data to ensure that characterization and packaging data remain accurate and useable by waste managers. Waste containers need to be provided with sufficient protection from the elements (e.g., precipitation, wind, flooding, excessive heat) such that the character of the waste and container, and therefore the certification are not altered. Containers of waste also need to be stored in a manner that prevents modifying their contents (e.g, under lock and key or with a tamper indicating device) and in a location where the container will not be damaged (away from equipment high traffic areas where there is the possibility of damage). In addition, it is necessary to be able to relate each container of waste to information about the contents of the container. Container markings must be protected from defacement or removal, and records regarding container identification and contents must be safely stored.

Example: Department personnel have learned from experience that below-ground storage does not provide the type of protection that could be relied on to protect the certification status of the waste. Although the below-ground environment maintains waste packages within a reasonable temperature range, it also subjects them to *environmental conditions that can be detrimental to packaging and marking. Condensation collecting under plastic has been shown to lead to rust of waste containers making markings illegible and the container no longer suitable for performing its containment function.*

Compliance with this requirement is demonstrated by the existence of a program or procedure reflecting this requirement and site personnel able to show that the storage of containers of waste is in a facility or manner where the containers are not damaged by normal weather events, and cannot be accessed by unauthorized personnel. Further, each container can be traced to its certification and the information supporting that certification.

Supplemental References:

1. CAO, 1997. *Generator Site Certification Guide*, Revision 1, DOE/CAO-95-2119, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1997.

2. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 5, DOE/WIPP-069, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

CH-TRU WASTE CERTIFICATION STATEMENT

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Container ID Number: ________________________

CRITERIA	LIMITS	INITIALS
Container Description	• DOT Type A 55-gallon drums or solid waste boxes (SWBs)	
Container/Assembly Weight	• 1000 lbs/55-gallon drum • 4000 lbs/SWB • TRUPACT-II weight limits	
Removable Surface Contamination	• 20 dpm/100 cm^2 alpha • 200 dpm/100 cm^2 beta-gamma [4]	
Container Marking	• Bar code • Shipping category [1]	
Filter Vents	• Payload containers vented	
Liquids	• No liquid wastes • < 2 liters total residual liquid per 55-gallon drum • < 8 liters per SWB • < 1 in. (2.5 cm) in the bottom of any container	
Pu-239 FGE	• < 200 g/55-gallon drum • < 325 g/SWB • < TRUPACT-II limits	
Pu-239 Equivalent Activity	Untreated Waste • 80 PE-Ci/55-gallon drum • 130 PE-Ci/SWB • 1800 PE-Ci/55-gallon. Drum overpacked in SWB or TDOP Solidified/Vitrified Waste • 1800 PE-Ci/55-gallon drum	
Contract Dose Rate	• 200 mrem/hr	
Thermal Power	• Reported if > 0.1 watts/ft^3 • < 40 watts per TRUPACT-II	
TRU Alpha Activity	• > 100 nCi/g of waste matrix	
Pyrophoric Materials	• < 1% Radionuclide pyrophorics • No non-radionuclide pyrophorics	
Mixed Waste	• Characterization per QAPP • Limited to EPA waste codes listed in WAC	
Chemical Compatibility	• Chemicals allowed by the CH-TRAMPAC	

Figure III.J.1. Example Waste Certification Statement

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CRITERIA	LIMITS	INITIALS
Hazardous Constituents	• Target analytes and TICs reported per QAPP	
Explosives, Corrosives and Compressed Gasses	• None present	
PCBs Concentration	• < 50 ppm	
Decay Heat(1)	• Wattages listed in CH-TRUCON	
Flammable VOCs	• 500 ppm in container headspace	
VOC Concentration	• Limits shown in WAC Table 3.5.3.3	
Aspiration(1)	• Times shown in CH-TRUCON tables	
Shipping Category(1)	• Content codes listed in CH-TRUCON • One category per TRUPACT-II	
Confinement Layers(1)	• Liner punctured/vented • Number of layers known • Bags closed by approved methods • Sealed containers > 4 liters prohibited (except for waste material Type II.2)	
Acceptance Data	• Auditable package of data with signed Certification Statement on file • WWIS data transmitted	
RCRA Data	• Waste Stream Profile Form • Uniform Hazardous Waste Manifest(2) • Land Disposal Restriction notification(2)	
Shipping Data	• TRUPACT-II Payload Container Transportation Certification Documents • Bill of lading(3)	

NOTES: (1) Applies to TRUPACT-II payload control only
(2) Applies to mixed wastes only
(3) A Uniform Hazardous Waste Manifest may be substituted
(4) May be 1000 dpm/100 cm^2 for certain isotopes

I hereby certify that I have reviewed the data for this waste container and that it is complete and accurate to the best of my knowledge. I have determined that it meets the requirements stated in the current revision of the WIPP Waste Acceptance Criteria. I understand that this information will be made available to regulatory agencies and that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

______________________________ ________ ________
Waste Certification Official Signature Date Initials

Figure III.J.1. Example Waste Certification Statement (cont.)

III. 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.

Objective:

The objective of this requirement is to ensure that the responsibility for transuranic waste containers is established, maintained, properly transferred, and adequately documented so that ownership, and therefore responsibility for safe management, of waste is clear. This responsibility includes maintaining the waste characterization information, the container information, and information about the treatment, storage, transportation and disposal status of containers of waste. This responsibility also includes an assurance that the container of waste has not been altered in a manner that affects its certification status or the ability of the waste to be properly managed.

Discussion:

As discussed in Section I.2.F.(7) of the guidance for DOE M 435.1-1 Chapter I, the radioactive waste generator program includes consideration of the generation planning, characterization, certification, and transfer of transuranic waste. In the generator's program, initial responsibility is assigned for containers of transuranic waste and a documented process for transferring the responsibility is established.

In the development of DOE O 435.1 and DOE M 435.1-1, maintaining the integrity of waste containers was identified as necessary for the proper control and safe management of transuranic waste. Similarly, maintaining information about containers of transuranic waste (characterization and container data) was recognized as vital to making and executing safe management decisions. In order to ensure that it is clear who has the responsibility for protecting the integrity of each container of transuranic waste and associated waste and container data, there needs to be one person who is identified as being responsible for the waste at any time. Confusion over who is responsible for specific waste containers is avoided by documenting the transfer of responsibility.

This requirement is similar to the concept of "chain of custody" used in sample management. As with samples, transuranic waste containers may be the responsibility of many different organizations during their management life cycle. At any point during the life cycle management of the waste, the identity of the individual responsible for each container of waste needs to be explicit. By clearly identifying the "owner" of each container of waste, there is no question regarding who is responsible for protecting the waste container and the waste characterization and container data, and for moving the waste to the next phase of waste management (i.e., storage, treatment, or disposal).

Maintaining Waste Container and Data Integrity. The individual responsible for a container of waste is responsible for maintaining and protecting both the integrity of the container of waste and the data about the container of waste. Protecting the integrity of the waste container is the same as protecting the certification status of a waste container as discussed in the Waste Certification guidance. Essentially it involves managing the container of waste so that it is not damaged or does not degrade because of the conditions under which it is managed.

Maintaining the data about the container of waste involves ensuring receipt or traceability, or developing (as discussed below) information necessary to support subsequent waste management activities, or clearly documenting and ensuring that the information is stored and updated so that full and accurate information is available to the next individual to whom the waste is transferred.

Transferring Responsibility. The transfer of responsibility for containers of waste and the associated waste and container data is to be done in accordance with procedures at each of the facilities involved. The facility from which the waste is transferred, typically establishes (for newly-generated waste) or possesses (for stored wastes) a record or data package about the waste and its container. The facility operating procedures should require the development of an ownership log sheet similar to a “chain-of-custody” log. This log becomes part of the data package that is transferred with the container of waste. Upon transfer, the facility transferring the waste is responsible for ensuring personnel at the facility to which the waste is being transferred have assumed responsibility for the waste. A signed and dated copy of the ownership log sheet can serve this purpose. All subsequent transfers, e.g., from storage or treatment facilities, are to be in accordance with procedures requiring the transfer of the data package and documentation of the transfer of responsibility for the waste.

Procedures at the storage, treatment, or disposal facility should require the receipt of certain information about any waste which is received. To ensure that they have sufficient information to safely manage the waste and to transfer the waste to a subsequent waste management facility (if appropriate), it is important for storage, treatment, and disposal facility personnel to ensure they are provided information about the containers of waste for which they become responsible. The receiving facility requires the following documented information be available for all waste they expect to receive:

- Responsible individual. The name, title, affiliation, and phone number of each person who has held responsibility for the waste, starting with the generator. This listing can serve as the ownership log with each person signing the log upon accepting responsibility for the waste.

- Transfer dates. The date the transfer was accepted by each new "owner" of the waste.

- Waste container information. Information about the container (see guidance for III.K.(2) in this section).

- Characterization information. Information about the waste. See guidance on Waste Characterization.

- Physical location. The site and name (e.g., unique identifier such as a building number) of each location where the waste was managed.

- Previous transportation. Dates of transportation and names of carriers.

- Certification status. A signed certification statement or equivalent (see guidance on Waste Certification). Only the certification statement for the facility to which the waste is being transferred must be part of the waste package data. Previous certification statements may be included if they serve the purpose of documenting other data that should be part of the data package (e.g.,container or characterization data).

- The planned disposition of the waste. Expected storage, treatment, and disposal. See guidance on Generation Planning and Site-Wide Radioactive Waste Management Program.

For each transfer of waste, beginning with the generator, the receiver of the waste is responsible for obtaining the proper information from the sender of the waste. The receiver is responsible for ensuring receipt or availability of complete and accurate information concerning containers of waste. The information needs to be reviewed prior to actual transfer and is a condition of acceptance by the receiver.

> *Example: A treatment facility receives transuranic waste for processing. Upon signing for receipt of the waste, the facility manager becomes the individual responsible for the waste. Facility procedures require that a copy of the data received from the generator be kept in a file cabinet which is accessible only to one individual on each shift. As the containers of waste are processed in the facility, information is recorded in a log and the data package is updated to reflect the change in status of the waste. Upon completion of the processing, the treated waste is packaged in new waste containers and a certification statement is generated indicating that the treated waste meets the waste acceptance criteria for the storage facility to which it will be shipped. Before the waste is transferred, the treatment facility personnel provide a complete set of data to the storage*

facility personnel. The data package reflects the new container numbers for the treated waste, but includes the data on the original containers received at the treatment facility. The treatment facility also keeps a duplicate copy of the data package which includes a copy of a waste log indicating transfer of ownership to the storage facility.

The responsibility for ownership of the waste can be different than that for waste certification. The individual responsible for the waste does not necessarily have to be the same individual that certifies the waste is ready to be transferred (see guidance on Waste Certification). As indicated above, the certification status is one piece of information that is transferred with the waste.

Compliance with this requirement is demonstrated if facilities have procedures for the receipt of waste and the transfer of waste, as appropriate, which address the acquisition of waste and container data and the transfer of ownership, respectively. Further evidence of acceptable performance is facility records showing that data on the waste containers are available and accurate, and that documented transfer of responsibility occurs.

Supplemental References:

1. EPA 1997. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, 3rd Edition, U.S. Environmental Protection Agency, Washington D.C., June 1997.

III. K.(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.

Objective:

The objective of this requirement is to ensure that shipments or transfers of transuranic waste are made only with the cognizance and approval of personnel at the facility receiving waste so that preparations can be assured for its safe management.

Discussion:

As discussed in the guidance for DOE M 435.1-1, Section I.2.F.(7), the radioactive waste generator program includes consideration of the generation planning, characterization, certification, and transfer of transuranic waste. During the development of DOE O 435.1 and DOE M 435.1-1, a review of waste management functions indicated that the receipt of waste without personnel at the facility receiving the waste having knowledge of what was sent presented a potential hazard. If waste is transferred to a facility without prior authorization, the controls necessary for the proper and safe management of the waste may not be in place. As a consequence, the waste may be rejected and returned to the sender. This requirement represents a control to minimize the potential for exposures and releases during the handling and transfer of transuranic waste.

Safe transfer of the waste can only be assured if the facility receiving the waste for storage, treatment, or disposal has considered the acceptability of the waste versus its safety operating constraints. Personnel at a storage, treatment, or disposal facility who authorize the transfer of waste are indicating that they have the capability to receive the waste and manage it in a manner that is protective of workers, the public, and the environment. Therefore an essential component to safe life-cycle management is that authorization be received before transfer of transuranic waste to a storage, treatment, or disposal facility. Meeting this requirement is the responsibility of the organization or individual transferring (sending) the waste. The following are considered transfers:

(1) Waste is physically moved from one location to another, even if ownership does not change.

(2) Waste is physically moved from one location to another and ownership changes.

(3) Waste is not physically moved, but ownership changes.

The actions and documentation necessary to obtain authorization will depend on the specific storage, treatment, or disposal facility to which waste is to be transferred. In some cases, the submittal of a waste stream profile which provides a description of the waste and a range of the waste characteristics, augmented by conversations with the generator, may provide enough information for the storage, treatment, or disposal facility staff to be confident that they can safely manage the waste. In other cases, the waste acceptance requirements of the storage, treatment, or disposal facility may dictate that an onsite visit and review of the generator's waste certification program be performed. In order to expedite the transfer of waste, staff responsible for sending the waste need to ensure they understand what information and activities need to be completed in order to receive transfer authorization.

Authorization to transfer waste is received in writing and states the scope of the authorization. The authorization may specify a specific group of waste packages or specific number of shipments of a particular waste type. However, it is acceptable for the written authorization to specify a waste stream(s) which the generator can send on a routine basis. Any additional conditions or notification requirements can be included in the written authorization. Whereas it is the responsibility of the storage, treatment, or disposal facility to prepare the written authorization, the organization sending the waste must not transfer waste until they have authorization and understand which waste is included in the authorization.

Example 1: An activity at Site X results in the routine generation of transuranic waste in the form of contaminated personnel protective equipment, swipes, plastic sheeting, and paper waste. The waste stream is designated by the number X-2156. Consistent with site procedures, the generator prepares a waste stream profile which describes the characteristics, packaging, and projected generation rate of the waste stream and provides it to the waste management organization. The waste management organization reviews the waste stream profile and calls the generator facility representative to clarify the information on the waste stream profile. The waste management organization has previously reviewed the generator's certification program. Based on the certification program and the waste stream profile, the waste management organization prepares a letter authorizing the generator to transfer any waste that meets the X-2156 profile until further notice. The authorization letter also states that the generator must provide the waste management organization notice of the number of waste containers to be transferred 48 hours before a transfer occurs.

Example 2: A site plans to ship transuranic waste to WIPP for disposal. A Generator Site Certification Guide (DOE/CAO-95-2119) has been prepared to aid individual sites in their preparation to become authorized certifiers of waste destined for WIPP. Generator sites are authorized by WIPP to certify waste for transfer following an audit confirming satisfactory implementation of certification requirements. The authorization is typically good for one year, at which time the transferring facility must be re-authorized through an audit. Once the generator's certification program has been audited and found to be acceptable, day-to-day authorization of waste transfers is accomplished by review and approval of data packages describing planned waste transfers.

When transuranic waste is transferred (moved from one location to another), but the ownership of the waste does not change (i.e., the same individual is responsible for both facilities), a separate authorization may not be required. Recognizing that the intent of this requirement is to ensure that the waste is expected and can be safely managed at the facility to which it is being transferred, other documentation can serve as the written authorization.

Example: The manager of the waste management organization is the official responsible for authorizing transfer of waste to either of two separate storage facilities, Building A and Building B. Even though the waste acceptance criteria are the same for the two facilities, waste is accepted and logged into each facility separately. The manager decides to consolidate all of the waste into Building A for more efficient management. The authorization to transfer is provided by the certification statement indicating that the waste meets the Building A waste acceptance requirements, and the documentation of the new storage location on the waste characterization and container data.

Compliance with this requirement is demonstrated by sites having procedures that require a confirmation of authorization before releasing waste for transfer, and records showing that transfers are made in accordance with written authorizations.

Supplemental References:

1. DOE/CAO, 1995. *Generator Site Certification Guide*, DOE/CAO-95-2119, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, 1995.

III. K.(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.

Objective:

The objective of this requirement is to ensure establishment and maintenance of information about the characteristics of waste and the waste containers to ensure that sufficient information to support management of waste in a manner that is protective of workers, the public, and the environment is always available.

Discussion:

The *Radioactive Waste Management Manual*, assigns the Field Element Manager the responsibility of ensuring development and approval of a program that addresses the responsibilities of waste generators (DOE M 435.1-1, Section I.2.F.(7)). The generator requirements are to address hazards associated with a waste management facility receiving unexpected volumes or types of waste, or receiving waste that may not meet the applicable waste acceptance requirements. Generator requirements address generation planning, waste characterization, waste certification, and waste transfer. The requirement for traceability of data addresses the hazards associated with transferring waste without providing or maintaining adequate information about the container and its content. Establishing and maintaining the identity of the waste, as well as maintaining controls based on the waste's hazards, are necessary for its safe transfer and subsequent management. Acquisition of information about the waste is addressed in the guidance on Waste Characterization (DOE M 435.1-1, Section III.I). Certification that waste is ready for transfer (i.e., meets the waste acceptance requirements and transportation requirements) is discussed in the guidance on Waste Certification (DOE M 435.1-1, Section III.J). Maintenance of documentation regarding transfer of waste is discussed later in this section of guidance.

In the process of developing DOE O 435.1 and DOE M 435.1-1, transfer was identified as the activity in the life-cycle management of waste with the greatest potential for loss of information about containers of waste, and the associated loss of adequate waste management controls needed to avoid exposure or release of radioactivity. Therefore, when waste is transferred, the waste characterization and container data must be transferred or available to the new "owner" (i.e., responsible waste manager) of the waste.

> *Example: A liquid transuranic waste is being transferred to a treatment facility for solidification. The waste was characterized and the waste characterization information listed on the waste certification statement. Although the waste met the waste acceptance criteria for the treatment facility and an authorization to make the transfer was granted, the characterization information was not transmitted before or in conjunction with the waste transfer. Due to storage limitations at the treatment facility, the drums of waste were placed in an unheated staging area. After a three days of below freezing weather, it was noted that the drums were bulging and split. Had the characterization information been documented and transferred with the waste, treatment facility personnel would have known it was an aqueous waste and would have imposed controls on the waste to protect it from freezing conditions.*

Sufficient information about the container in which waste is packaged needs to be provided to the storage, treatment, or disposal organization to which waste is transferred to ensure that the containers are handled safely.

The information about the container is supported by and traceable to the more detailed container procurement information. The organization that procures the container is responsible for properly documenting the essential information regarding the procurement. The information needs to be maintained so questions about adequacy of the container for its originally intended or alternate uses can be assessed and to answer questions about subsequent procurements. Information documented concerning the procurement of waste containers includes:

- Purpose of the container;
- Container performance requirements;
- Purchase specifications; and
- Manufacturer certifications verifying performance to purchase.

The information concerning the purpose of the container should include the designed service life, the environments for which the container was designed and is compatible with, and other information necessary to allow proper use of the container. The procurement information includes vendor information, product specifications, lot or serial number information, and other procurement information necessary to document the container purchased.

The detailed procurement data about containers can be, but does not have to be, transferred at the time waste is transferred. An acceptable practice for the organization transferring the waste would be to maintain the records for as long as they are retrievable and can be correlated to the waste containers.

The type of container information that should be provided upon transfer of containers of waste will depend on the type of waste and subsequent waste management steps. Typically, the information includes the following:

- container size and type - generally this would be the container that is providing the primary containment of the waste (e.g., DOT 7A 55-gallon drum, standard waste box, or DOT 7A 80-gallon overpack);
- container enhancements - additional items that have been added to the primary container to facilitate container performance (e.g., shielding, liners, plastic bags, absorbents);
- lifting limitations - allowable and/or unallowable lifting points and methods; and
- load limitations - based on the physical characteristics, the maximum number of containers or weight that can be placed on top of the waste container.

When waste is initially placed in the container, the organization packaging the waste is to document and manage the information regarding its characteristics (e.g., radioisotopic inventory, total activity, radiation dose, waste form). When the container of waste is physically transferred or the ownership has changed, the information regarding the waste and container must be provided or made available to the organization that acquires responsibility for the waste. A transfer is considered to have occurred if the waste is physically moved from one location to another or if there is a change in responsibility for the waste.

The following waste container characterization data are typically provided with the transfer of transuranic waste:

- physical and chemical description of waste (use of item description code or waste stream identifier, if applicable);
- radiological inventory (see guidance on Waste Characterization);

- gross weight;
- volume percent utilized;
- fissile gram equivalent;
- fixed and removable surface contamination (alpha and beta/gamma);
- surface dose rate;
- seal number;
- TRUCON Code;
- thermal power; and
- shipping category.

Example: Building 2000 is undergoing a facility cleanout that involves the decontamination of building surfaces and the removal of excess processing equipment. The organization responsible for the facility identifies two types of waste containers to be used, 55-gallon drums for small items, personnel-protective clothing, and contamination control waste, and standard waste boxes for larger pieces of equipment. The job is managed such that one operator is responsible for logging each piece of waste put into the containers. Upon filling a waste drum or box, the container is closed, and a tamper-indicating device is installed. Radiological Services personnel perform radiological surveys of each container of waste and record the data. The authorized waste certification official uses the data recorded on the waste log and survey sheets, supplemented with radiological characterization data, weight data, and other information to fill out a waste certification checklist. The checklist requires identification of waste container data as discussed above. In accordance with site procedures, the checklist is a piece of required paperwork that is to be provided to the storage, treatment, or storage facility to which the waste is transferred.

This requirement needs to be implemented with consideration given to documentation requirements imposed by other internal programs or external organizations such as the Environmental Protection Agency or Department of Transportation. These other documentation requirements, such as an EPA Uniform Hazardous Waste Manifest or a transportation bill of lading, may include much of the waste container information that is provided to the storage, treatment or disposal facility to which waste is transferred. Therefore, to the extent these other documents have the appropriate information, they may be used to meet the requirement to convey information about the waste being transferred to a subsequent waste management facility. If documentation prepared to meet requirements of other programs or organizations is used, it may need to be supplemented to provide any additional data on waste characterization and packaging addressed in this guidance.

> *Example: Transuranic mixed waste is being sent from one site to another for storage. Since the waste is regulated under RCRA, a Uniform Hazardous Waste Manifest is prepared as required by 40 CFR Part 262. The manifest includes information about the physical and chemical characteristics of the waste, the container type, and container weight. The site has developed a 'Radiological and Supplemental Characteristics Data Sheet' to provide additional information about the containers of mixed waste. The data sheet provides additional information about the radiological inventory, surface dose rate, surface contamination, fissile material content, number of the tamper-indicating device installed on the waste containers, load limitations, and handling limitations. Between the two documents the storage facility is provided enough information so they can safely manage the waste.*

Compliance with this requirement is demonstrated if there are procedures requiring that characterization and container data be provided and maintained for each waste transfer and documented records of transfers show that the information is being provided.

Supplemental References:

1. EPA. *Standards Applicable to Generators of Hazardous Waste,* 40 CFR Part 262, U.S. Environmental Protection Agency, Washington, D.C.

III. L. <u>Packaging and Transportation</u>.

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.

Objective:

The objective of these requirements is to ensure that when waste is packaged, the container selected is adequate to contain the waste and limit radiation exposure for the entire time the waste is in storage, to reduce future exposure by segregating defense and non-defense wastes, and to ensure that the container can be correlated to necessary information on its contents. The first subrequirement is to ensure the selection of a container for waste based on the life cycle of the waste so that there will not be unnecessary repackaging of waste. The second sub-requirement is to prevent the build-up of pressure or concentrations of gases that could cause a loss of waste confinement. The third subrequirement is to ensure the segregation of defense waste that can be accepted for disposal at WIPP from other waste in order to facilitate compliance with the *Waste Isolation Pilot Plant Land Withdrawal Act of 1992,* as amended. The last subrequirement is to ensure that it is possible to identify the contents of the container of waste during storage and when the waste is removed from storage for treatment or disposal without having to open the container.

Discussion:

The need for packaging requirements specific to waste management evolved from the development of DOE O 435.1, and past experience in transuranic waste transportation. The safety and hazards analysis conducted in support of the Order and Manual development identified loss of confinement of a waste container as a potential hazard affecting worker safety and releases to the environment. In addition, the inability to associate a container with data on the contents was identified as a situation that would result in unnecessary worker exposure due to the need to re-characterize the waste. Mitigation of each of these concerns can be achieved through proper packaging and compliance with the requirements of this section. The safety analysis supporting use of the TRUPACT II for transportation of transuranic waste has identified the build up of explosive gases as a potential problem.

An analysis of existing requirements affecting the packaging of waste identified the Department of Transportation (DOT) regulations and the DOE Orders, DOE O 460.1A and DOE O 460.2, as sources of packaging requirements (see DOE M 435.1-1, Section I.D.(12)). Generally, the DOT requirements apply to offsite shipments. *Packaging and Transportation Safety* (DOE O 460.1A) invokes the DOT requirements, or documented requirements providing equivalent safety, for onsite shipments. These regulations require the use of DOT Type A or Type B packaging (depending on radionuclide content) for DOE waste shipments. The DOE O 460.1A also establishes the means and approval authority for qualifying packaging as Type A or Type B. *Departmental Materials Transportation and Packaging Management* (DOE O 460.2) includes DOE policies and requirements that supplement the DOT regulations. Requirements from DOE O 460.2 relevant to waste packaging include the inspection of waste shipments upon receipt, provision of data to the Department's Packaging Management Plan, and performance of routine assessments of transportation and packaging operations.

While the DOT regulations and DOE packaging and transportation requirements were considered adequate for shipping waste, they were not considered sufficient to address the other transuranic waste management concerns associated with long-term storage or with selecting and packaging waste based on the entire waste management life cycle.

The life-cycle management of transuranic waste has historically involved the packaging of transuranic waste followed by a protracted storage period while awaiting disposal. Selection of a container (i.e., a receptacle and any other components or materials necessary for the receptacle to perform its required containment function) needs to account for all waste management steps expected prior to and including disposal. Therefore, the container needs to meet the requirements for transportation, storage, and eventual disposal (to the extent the disposal requirements are known). Alternatively, if waste treatment is required, the container needs to be adequate to contain the waste during storage and allow the waste to be transferred to the treatment facility where it may be removed from the container prior to treatment. Subsequent to treatment, packaging of the treated residues is based on meeting all of the requirements of the remaining waste management steps. Selection of a container that fulfills the needs of all subsequent waste management actions ensures waste confinement and eliminates the need to repackage the waste, thus avoiding potential exposure to workers.

> *Example: The Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069) identifies the container, packaging, and transportation requirements that must be met before transuranic waste may be shipped to and disposed in WIPP. The requirements are derived from several sources which include: the WIPP Safety Analysis Report, the TRUPACT-II Safety Analysis Report for Packaging, the RH-TRU 72-B Cask Safety Analysis Report for Packaging, and the WIPP Land Withdrawal Act of 1992, as amended. Containers that meet the WIPP Waste Acceptance Criteria and the acceptance criteria for storage would be acceptable since the waste would likely not require repackaging for any of the expected waste management steps.*

<u>Containment and Protection</u>. Transuranic waste must be adequately contained, and the container protected from conditions that could cause container degradation. Inadequate containers or container degradation could lead to failure and result in the spread of contaminated materials, worker exposure, or the non-acceptance by a receiving facility. When selecting transuranic waste containers, consideration must be given to the conditions to which the container will be subjected. If waste is to be stored outside for an extended period and subjected to the natural environment, the container must be made of materials that have been demonstrated to maintain integrity during these conditions.

> *Example: Contaminated soil and debris were packaged in wooden boxes or carbon steel 55-gallon drums which were stored in earthen berms for many years. The boxes and drums degraded to the point that they no longer served as containment and were literally falling apart. Due to the selection of inadequate containers (for the storage conditions and duration), the waste had to be repackaged prior to transfer and the used wooden boxes and drums also managed as transuranic waste.*

Transuranic waste must not be incompatible with the container in which it is placed. The physical, chemical, and radiological attributes of the waste need to be considered when selecting a container. Container integrity must not be jeopardized due to the size, shape, or weight of objects contained in the waste. Containers need to be compatible with any unusual chemical characteristics, water content, and pH of the waste. If absorbent or other materials are used to bind liquids contained in the waste, the resultant waste matrix must not be capable of spontaneous combustion, decomposition, explosion, liquid desorption, or otherwise have the ability to affect the integrity of the containers in any way (see Storage guidance III.N).
Shielding may also be required to provide protection to workers who handle the waste containers or who are responsible for monitoring waste in storage. The necessity for shielding should be

considered at the time of packaging so that the shielding can be integrated into the waste container before waste is present if internal shielding is acceptable to the storage, treatment, or disposal facility. Alternatively, the storage configuration may be designed to provide the necessary shielding. If shielding is required, consideration needs to be given to the use of materials that do not have the possibility of becoming a mixed waste if contaminated by the radiological constituents. Guidance for DOE M 435.1-1, Section III.K discusses the selection and procurement of waste containers and the necessary information that is documented.

> *Example: A new facility generates remote-handled transuranic waste sludges with caustic properties and multiple fission products species. The container selected has been designed to withstand chemical attack from the sludge, includes sufficient absorbent to ensure there are no free liquids, and incorporates shielding. The container provides protection of workers, the public, and the environment during its intended service life.*

The anticipated service life needs to be considered when selecting a container for transuranic waste. A determination of the anticipated storage time, environment, and location (waste acceptance criteria) is essential to selecting the proper waste container. For waste that does not have an identified path to disposal, the waste container may need to be designed to remain effective for an extended and/or indefinite storage period.

> *Example: A site needs to repackage a small quantity of non-defense transuranic waste with no identified path to disposal. A policy and plan have not yet been completed for resolving the disposal issues. The selected container has been designed to last a minimum of 50 years, if stored indoors.*

When selecting containers for transuranic waste, consideration needs to be given to the full life cycle of the waste, with a goal of packaging the waste only once. The selected waste container needs to be compatible with transportation requirements and the waste acceptance criteria of the facilities expected to manage the waste. Sites have generally identified the use of the DOT-certified 55-gallon drum as the container of choice for all sized, newly-generated waste. An alternative container is the standard waste box (3.1 x 4.5 x 5.9 ft). Both 55-gallon drums and the standard waste box will fit in the TRUPACT II used to transport transuranic waste to WIPP for disposal. Sites should avoid selecting containers which allow quick containment of the waste, but are not amenable to subsequent waste management steps.

> *Example 1: A site selected a 4 x 4 x 8-ft box as the container for high volumes of miscellaneous contact-handled waste because it accommodates large amounts of waste without the need for any size-reduction. However, because consideration was not given to the entire life cycle for management of the waste, site personnel did not take into account that the box was not compatible with any approved transuranic waste disposal facility or transportation system. Consequently, in order to make the waste acceptable*

for transport and disposal at WIPP, site personnel will have to repackage the waste and may have to treat the 4 x 4 x 8-ft box as transuranic waste also.

Example 2: A requirements analysis was performed on the life-cycle plan for a specific transuranic waste stream that will generate odd-sized solid debris. The analysis indicated that a standard waste box could be used to meet all the requirements for transportation, as well as satisfy the storage and disposal facilities waste acceptance requirements.

To ensure that the waste container performs as expected, the following need to be considered when placing waste in the packaging:

- Container free of deformations or imperfections that may cause a loss of container integrity before the designed lifetime.
- Waste placement in a manner that does not adversely affect the integrity of the waste container.
- Containers utilized such that void space within the container is minimized, although care should be taken to avoid exceeding weight or other limitations identified through consideration of the life-cycle management process.
- Waste container labels and markings permanently applied.

The selection of the container is influenced by the storage conditions, storage duration, and the monitoring expected for the waste container. Ensuring waste containers provide confinement for their expected storage life is therefore dependent on ensuring an appropriate storage environment consistent with the container characteristics. Storage of waste containers is addressed in the guidance for DOE M 435.1-1, Section III.N.

Vents. Because of the relatively large flux of alpha particles associated with transuranic waste, there is a potential for radiolysis of hydrogen containing materials and the generation of hydrogen gases within transuranic waste containers. In addition, depending on the waste contents and/or the storage conditions, other gases, some of which are potentially flammable or explosive, may be created. To address this issue, containers of newly generated waste shall be equipped with vents or other mechanisms to mitigate the hazards associated with the evolution and accumulation of gases within a waste container. Implementing this requirement includes taking actions to address the accumulation of gases in inner containers such as bags, paint cans, and drum liners, in addition to addressing the outer container. Inner containers may be punctured, vented, or provided with products which have been proven to prevent the accumulation of dangerous quantities of gases. Outer containers can be provided with filtered vents or products which have been proven to prevent the accumulation of gases. The installation of vents or other mechanisms on transuranic waste containers must not interfere with the container's ability to maintain waste containment until the waste is properly dispositioned (treated or disposed).

Waste currently in storage is to be provided with vents or other mitigating mechanisms at the soonest practical time unless it can be shown that vents are not needed. Implementation of this requirement does not require waste to be removed from storage solely for the purpose of installing vents since this would result in exposure which could otherwise be avoided. Instead, the intent is for site waste managers to install vents the next time the waste containers are accessed for some other purpose such as assaying, reconfiguring storage, recovering waste from earthen-covered storage, or preparing for transportation to the Waste Isolation Pilot Plant. The *Waste Acceptance Criteria for the Waste Isolation Pilot Plant* requires the installation of vents on containers so they can be transported in the TRUPACT II.

The installation of vents on containers of transuranic waste in storage is not necessary if an appropriate analysis has been prepared that demonstrates that the unvented containers do not pose an unacceptable hazard. Application of this allowance within the requirement is dependent on an approved safety analysis report or equivalent which shows that gas generation is not credible or that the consequences are acceptable. An acceptable method of demonstrating that venting is not required is to show that, based on the waste container contents, radiological characteristics, and/or environmental factors, it is not credible to generate gases which pose a fire or explosion hazard or create conditions which would otherwise breach the containers, such as over-pressurization. In this usage, credible has the same meaning as used in safety analysis reports. If over-pressurization or generation of ignitable or explosive gases is credible or assumed to be credible, the analysis must show that the consequences of an accident are within established limits for radiation dose to workers (10 CFR Part 835) and to the public (DOE 5400.5).

The *Radioactive Waste Management Manual*, Section III.D requires the development of a radioactive waste management basis for transuranic waste management facilities, operations, and activities; this includes transuranic waste in storage as of the issuance of DOE O 435.1. In developing the radioactive waste management basis, site personnel need to consider the hazards associated with drums of transuranic waste which have not been provided with vents or been proven to not need vents through an approved safety analysis. For unvented containers in earthen-covered storage, the facility itself may mitigate the hazards associated with the accumulation of gases. For above-grade storage of transuranic waste containers, the radioactive waste management basis needs to include controls which mitigate the hazards associated with the accumulation of gases by restricting access to the storage area and providing equipment to protect against fire or explosion. Waste managers should evaluate unvented containers in storage and determine if it is appropriate to take prompt action to install vents rather than wait until the next time the waste is actively managed. Immediate action may be warranted if drums show signs of gas accumulation (bulging) or if the waste and radiological characteristics are similar to other containers which contain waste which is known to evolve gases.

Segregating Defense Waste. Consistent with current legislation, the Department plans to dispose of defense transuranic waste at WIPP. Disposal at WIPP of only defense waste is a constraint in the *WIPP Land Withdrawal Act of 1992*, as amended. In contrast to defense waste, there are currently no planned facilities for the disposal of non-defense waste. The intermixing of defense and non-defense transuranic waste is therefore a practice that must be avoided, if feasible, so waste can be accepted for disposal at WIPP. The *Radioactive Waste Management Manual*, DOE M 435.1-1, includes a requirement (DOE M 435.1-1, Section III.G) that identification of waste as defense or non-defense must be included in facility waste acceptance requirements. Additional discussion of what qualifies as defense waste is included in the guidance for Section III.G of this document.

The language in the *Nuclear Waste Policy Act of 1982,* as amended, defines “atomic energy defense activity” to include “any activity...performed in whole or in part in carrying out...defense nuclear waste and materials by-products management” (Nordhaus). Based on this definition, the disposal of commingled defense and non-defense transuranic waste at WIPP is permissible in those cases where it is not feasible to segregate the waste. This is a result of the source of the waste being “in part” from defense nuclear waste management. The feasibility of segregating and packaging defense waste separate from non-defense waste needs to be made at the time the waste is packaged, and needs to be based on consideration of the cost and risk associated with performing the waste packaging. Waste managers must make a good faith effort to evaluate whether there is the potential for commingling defense and non-defense waste streams and whether it is feasible to segregate them prior to generating and packaging the wastes. It is inappropriate to generate and package waste without regard to the source being a defense or non-defense activity then claim that it is not feasible to segregate waste once it is commingled in a container. If the actions necessary to segregate defense waste from non-defense waste would not normally be performed and performing them would result in undue costs or risk (radiation exposure), then segregation would not be considered feasible.

> *Example: Site A has an examination and experimental facility which has a series of gloveboxes used for performing work on materials containing transuranic isotopes. Both defense and non-defense experiments are performed in the gloveboxes, however, generally they are not performed at the same time. A project involving the examination of materials in support of the Office of Science has been completed. Prior to commencing the next project, a general clean-out of the gloveboxes is performed in which material associated with the project, e.g., unused specimens and one-time use materials (swipes, etc.), are removed from the gloveboxes. These waste materials are packaged as non-defense waste. Various equipment and tools remain in the gloveboxes for use in subsequent experiments. Whenever there is a more thorough cleanout of the*

gloveboxes, when maintenance (change-out of gloves or HEPA filters) is performed, or when failed equipment is removed, it is recognized that there is a commingling of contamination from defense and non-defense activities. However, because the waste is in part from defense activities, it is packaged and disposed of as defense transuranic waste. Similarly, when the gloveboxes are decommissioned and removed, the fact that they were used for defense program activities makes them eligible for disposal as defense waste.

Waste that is generated after issuance of DOE O 435.1 is to be identified as either defense or non-defense waste. In this usage, generated means any waste that is packaged after issuance of DOE O 435.1, including waste from processing plants, treatment plants, cleanup activities, and retrieval activities. Once identified, if feasible, the waste must be packaged separately and the containers clearly marked as to whether they contain defense or non-defense transuranic waste. Identification of waste containers as defense or non-defense can be included in machine-readable code on the container, but should also be human readable. Different categories can be distinguished through markings or labeling of waste packages or through color coding. This provides a ready indication that a waste package is eligible for disposal at WIPP because personnel involved in the transfer operation can easily see that waste containers are of the correct category in addition to having the information on records.

Example: A site that stores transuranic waste uses color coding to distinguish defense from non-defense transuranic waste. The site already uses white drums for the storage of transuranic waste, so opts to have non-defense transuranic waste drums painted with 2-inch red stripes around the drum about 12 inches from each end. In addition to the characterization documentation indicating the type of waste, the red-striped drums are easy to distinguish from the plain white drums that contain defense transuranic waste.

The Manual does not require waste containers that were previously (e.g., prior to issuance of DOE O 435.1) placed in storage in buildings or other accessible above-ground configurations to be removed from storage so they can be marked or labeled to distinguish those containing defense waste from those containing non-defense waste. In fact, such an action would be counter to one of the purposes of these requirements, namely to avoid personnel exposure attributable to unnecessary handling of waste containers. Also, it is not the intent of this requirement to segregate defense and non-defense waste that was previously commingled in a waste container. Such waste is to be considered defense waste. However, when waste containers are removed from storage for some other reason, such as preparation for transfer to WIPP, waste managers are to label or mark them as defense or non-defense and/or segregate them to facilitate future waste handling. Similarly, waste containers in earthen-covered retrievable storage configurations must be marked or labeled during the time they are recovered, assayed, and transferred to another waste management activity. If the containers of waste in earthen-covered retrievable storage have failed and the waste is determined to be transuranic, the new container provided for repackaging the waste must be marked, labeled, or color coded as discussed above.

Example: Transuranic waste is stored in drums in a dense-pack array in a storage facility. Records indicate that most of the waste is defense waste. In the process of certifying the waste for transfer to WIPP in accordance with the approved certification program, each waste container is being assayed to determine its transuranic isotope concentration. As personnel remove and assay each drum, they also apply stickers in three locations on each drum that indicate whether the waste is defense or non-defense. This determination is made based on a review of records of the programs that generated the waste. Those drums identified as containing both defense and non-defense waste are labeled as defense waste and are eligible for disposal at WIPP. When the waste containers are returned to storage, personnel segregate the containers of defense waste from those of non-defense waste.

Containers of non-defense transuranic waste are to be segregated from containers of defense waste in storage facilities in a manner that minimizes and simplifies future waste container handling. In placing waste into storage, consideration needs to be given to the timing of transferring waste containers to a subsequent waste management step. Segregation within a storage facility does not require construction of separate facilities for storing waste or even providing separate bays within a facility. Segregation can be provided by how and where the waste is placed in the storage facility and it can be delineated by lines painted on the floor, by rope barriers, or similar means. The principal concern to consider in storing waste that has been segregated as defense or non-defense is the ability to access waste for future management without having to handle other waste. Since WIPP has been identified as the defense transuranic waste repository, it is likely that waste management steps leading to transfer to WIPP will occur with defense waste on a schedule separate from actions to be taken with non-defense waste. Therefore, to the extent practical, waste should be placed in storage to allow access of the WIPP-bound waste without having to move the non-defense waste.

Marking and Labeling. The marking and labeling of waste containers need to be done in a manner that allows traceability to the documentation of the waste characteristics and container information. The marking or labeling needs to be applied such that it will be visible if the waste package is on the outside of a storage or transportation array. For a 55-gallon drum, this is generally accomplished by placing the marking or labeling about every 120 degrees around the outside of the drum. For a waste box, acceptable labeling can be accomplished by placing labels on each side of the box. Waste package identification should be in medium to low density Code 39 bar code symbology in accordance with ANSI/AIM-BC1-1195. Bar coding is to be a minimum of 1 inch high and should be accompanied by human-readable alphanumeric characters at least ½ inch high. Durability and readability of marking and labeling is one of the items included in the inspection program for waste in storage (see guidance for DOE M 435.1-1, Sections III.N and III.Q).

Example: A transuranic waste generator is packaging waste in accordance with the site certification program that successfully passed a Waste Isolation Pilot Plant Waste Certification Program audit. In accordance with the site certification procedures, labels meeting ANSI/AIM-BC1-1995 that contain the site identifier and unique identifier are placed in three locations equally spaced around each drum. This satisfies the marking and labeling requirement.

Waste characterization and the container documentation is to be associated with each individual container of waste. Guidance related to documentation is discussed in guidance for Waste Transfer (DOE M 435.1-1, Section III.K). The documentation needs to include the aspects relative to container selection including the designed service life, the environments that the container was designed for and is compatible with, and other information necessary to allow proper use of the container.

Compliance with the packaging requirement is demonstrated by procedures which document proper packaging protocols, including documented evidence that, where feasible, non-defense transuranic waste has been packaged separately from defense transuranic waste and by never having to repackage transuranic waste that is packaged after issuance of DOE O 435.1 in order to maintain containment. However, the above protocol may not be satisfied by containers that were placed in storage prior to issuance of the DOE O 435.1. For those containers, the goal is to only have to repackage the waste one time after it is retrieved and characterized. Further, acceptable performance is demonstrated by containers of waste having marking and labeling that allows correlation with waste characterization data and container information. Successful performance of this requirement is also demonstrated by a record of container performance in which failure has not routinely occurred.

Supplemental References:

1. DOE, 1995. *Departmental Materials Transportation and Packaging Management,* DOE O 460.2, U.S. Department of Energy, Washington, D.C., September 7, 1995.

2. DOE, 1996. *Packaging and Transportation Safety,* DOE O 460.1A , U.S. Department of Energy, Washington, D.C., October 2, 1996.

3. DOT. *Shippers-General Requirements for Shipments and Packagings*, 49 CFR Part 173, U.S. Department of Transportation, Washington, DC.

4. ANSI, 1995. *Uniform Symbology Specification,* ANSI/AIM-BC1-1995, American National Standards Institute, Automatic Identification Manufacturers, August 16, 1995.

5. CAO, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant,* Revision 5, DOE/WIPP-069, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

6. Nordhaus, 1996. Robert R. Nordhaus to Al Alm, memorandum, *Interpretation of the Term "Atomic Defense Activities" as Used in the Waste Isolation Pilot Plant Land Withdrawal Act,* U.S. Department of Energy, Washington, D.C., September 9, 1996.

7. Dials, 1997. G.E. Dials to Distribution, memorandum, *Carlsbad Area Office Interim Guidance on Ensuring that Waste Qualifies for Disposal at the Waste Isolation Pilot Plant,* Carlsbad Area Office, U.S. Department of Energy, Carlsbad, NM, February 18, 1997.

8. *Waste Isolation Pilot Plant Land Withdrawal Act of 1992,* as amended, October 30, 1992.

9. *Nuclear Waste Policy Act of 1982,* as amended, January 7, 1983.

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

Objective:

The objective of this requirement is to reduce the risk associated with transuranic waste management by reducing the number of miles traveled transporting waste. This is to be done by the efficient use of waste containers, minimizing the volume of waste which requires shipment, and optimizing shipping plans and schedules.

Discussion:

The need for transportation requirements specific to waste management concerns was evaluated in the development of DOE O 435.1, *Radioactive Waste Management*, and DOE M 435.1-1 the *Radioactive Waste Management Manual*. An analysis of existing requirements affecting waste transportation identified the Department of Transportation (DOT) regulations and the DOE Orders, DOE O 460.1A and DOE O 460.2 (see DOE M 435.1-1, Section I.1.E.(11)), as sources of applicable requirements. Generally, the DOT requirements apply to offsite shipments. *Packaging and Transportation Safety* (DOE O 460.1A) invokes the DOT requirements, or documented requirements providing equivalent safety, for onsite shipments. *Departmental Materials Transportation and Packaging Management* (DOE O 460.2) includes DOE policies and requirements specific to DOE that supplement the DOT regulations. Requirements from DOE O 460.2 relevant to transuranic waste transportation address development of a

Transportation Plan for high-visibility shipment campaigns (e.g., shipments to WIPP), use of the Department's Transportation Tracking and Communications System, and administrative requirements. Additionally, for waste exceeding Type A quantities of radioactive material per DOT regulations, notification of the expected date of arrival is to be given to the site to which the waste is being shipped, and if the waste is not received on the expected day, notification of the shipper is mandated.

The DOT regulations and DOE packaging and transportation requirements were considered adequate for ensuring safe transportation of the waste. However, recognizing that one of the higher risks associated with waste management is from the number of miles traveled in transporting waste, transuranic waste shipments should be minimized to reduce worker exposure, risk, and cost. This can be achieved, in part, by ensuring that all containers or primary packagings (e.g., drum or waste box) are used to capacity, and that transportation systems are efficiently utilized. Reaching the capacity (volume or weight) of the waste container should be a goal of every waste packaging operation. Containers should be filled so as to minimize headspace volume and allow closure, without exceeding its weight capacity or compromising its integrity.

> *Example 1: Miscellaneous defense transuranic waste such as personnel protective equipment, contaminated tools, and paper and plastic sheeting are being packaged in 55-gallon drums for disposal at WIPP. Site personnel use a compactor to maximize the amount of waste placed in the drum. Administrative controls ensure that drum weight limits are not exceeded.*

> *Example 2: Defense transuranic waste is being thermally treated and packaged in 55-gallon drums for disposal at WIPP. Because of the density of thermally treated waste, site personnel fill each drum to its maximum weight capacity, 1000 pounds, although excess headspace remains.*

There may be circumstances that require the use of dunnage in the form of empty drums when transporting transuranic waste. Due to TRUPACT II limits on weight, wattage, curies or dose rate, it may not be possible to include a full complement of containers with waste in a shipment. Some empty containers may have to be included in the normal 14 drums (or 7 for a half pack) which constitutes a shipment. In optimizing shipments, the amount of dunnage used is to be minimized to the extent practical.

The same goal applies to transport systems. Containers of waste should be held and accumulated until a sufficient number of packages is available to make cost-effective use of the transportation system.

> *Example: Defense transuranic waste is being thermally treated and packaged in 55-gallon drums for disposal at the WIPP. Because of the density of thermally treated*

waste, each drum is filled to its maximum weight capacity of 1000 pounds. A sufficient number of drums (7) is then accumulated at a staging area to enable full and efficient use of the Halfpack packaging for shipment to the WIPP.

The distance transuranic waste is transported, and the number of times waste is physically handled is directly related to the risk of release or exposure. As part of the planning and documentation concerning the life-cycle management of transuranic waste, the Site-Wide Waste Management Program should seek to reduce the number of times the waste is handled or otherwise transported. Site transuranic waste management programs need to ensure that both on-site and off-site transport and handling is minimized.

Example 1: A small quantity site performed an optimization study and determined the nominal volume of transuranic waste that needed to be shipped off-site for the year. Staging the waste prior to transport reduced the number of shipments and allowed the transfer of the waste to occur during the summer when road conditions were best.

Example 2: A waste management operation on a large DOE reservation generates transuranic waste that can only be fully characterized by facilities located elsewhere on the reservation. Staging the waste and transferring it during off-peak traffic hours reduced the number of shipments across publicly-traversed roads on the reservation, and helped minimize the risk to the public.

Transuranic waste transportation needs will be specific to each site. Availability of treatment, storage, and disposal capabilities, as well as funding profiles, will influence the need to ship transuranic waste. In this requirement, the term, “to the extent practical” means that site personnel have latitude in making decisions regarding what is practical for their particular situation. This requirement is not intended to force decisions that are contrary to safe waste management, regulatory compliance, or cost-effectiveness. Detailed and documented planning that provides the rationale for a waste shipment regimen is the best way to balance this requirement with site-specific realities.

Example: A site-specific evaluation was performed to support a recommendation on either building transuranic waste storage capacity or maintaining the current number of small off-site shipments. The evaluation indicated that concerns over building the storage facility outweighed the benefits of minimizing shipments and the current shipment regimen was continued. The evaluation was included as part of the Site-Wide Waste Management Program documentation.

Transportation over the nation's highways and railways results in the most direct contact between the Department’s radioactive waste and the general public, stakeholders, and representatives of States, Tribes, and local government organizations. These groups are primarily concerned with the shipment of these materials through states, cities, and neighborhoods. Efforts to minimize the volume and number of transuranic waste shipments will help alleviate their concerns.

Compliance with this requirement can be demonstrated by a combination of site procedures directing the efficient use of waste container capacity and documentation showing that transuranic waste shipments are systematically planned and make optimal use of the shipment system (e.g., TRUPACT II) to the extent practical.

Supplemental References:

1. DOE, 1995. *Departmental Materials Transportation and Packaging Management,* DOE O 460.2, U.S. Department of Energy, Washington, D.C., September 7, 1995.

2. DOE, 1996. *Packaging and Transportation Safety*, DOE O 460.1A , U.S. Department of Energy, Washington, D.C., October 2, 1996.

3. DOT. *Shippers-General Requirements for Shipments and Packagings*, 49 CFR Part 173, U.S. Department of Transportation, Washington, D.C.

III. M. <u>Site Evaluation and Facility Design</u>.

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.

Objective:

The objective of this requirement is to ensure that natural and human environmental factors and geotechnical characteristics of proposed sites are accounted for in selecting the location and design features of new transuranic waste management facilities or significant modifications of existing facilities, and that locations are avoided if facility design cannot compensate for negative site characteristics or environmental conditions.

Discussion:

The *Radioactive Waste Management Manual* (DOE M 435.1-1, Section I.1.E.(18)) invokes the requirements of DOE O 420.1, *Facility Safety,* and DOE O 430.1A, *Life Cycle Asset Management* in site evaluation and facility design. In the development of DOE M 435.1-1, it was determined that specific attention should be given to selection of a waste management facility location with consideration given to the beneficial and detrimental aspects of the site.

Site evaluation includes the identification and characterization of potential sites (locations within a DOE reservation) for new transuranic waste management facilities or significant modifications of existing facilities. Selection of sites for DOE facilities is generally constrained to those federal lands owned and managed by DOE. Within DOE reservations, the process of selecting sites has the purpose of identifying the best location with consideration of features which are desirable for a facility.

In the context of this requirement, the environmental and geotechnical characteristics include:

- ecology - the flora and fauna that have evolved and adapted to the other environmental characteristics of the site;
- topography - the physical features of the ground surface at and around the site;
- meteorology - the normal and extreme weather events of the site;
- hydrology - the surface and ground water at the site;
- geology - the sediment and structural features of the earths crust at the site;
- seismology - the earthquake potential of the area;
- soil characteristics - characteristics of the soil that affect its load-bearing, water infiltration, and percolation;
- human activities - proximity of the public and human-induced events or feature;
- emergency services and response - proximity of services and population sheltering; and
- hazards to other facilities - proximity of existing facilities and proposed facility.

Characterization of a site is to result in collection of the data necessary to support a decision on acceptability of a site and for use in site-specific design of a facility. The site characterization and selection process will vary from one DOE site (reservation) to the next because of substantial differences in their environmental and geotechnical characteristics. Similarly, the interests of stakeholders which vary from site to site are likely to influence the issues to be addressed in site characterization and selection. The level of characterization needs to reflect application of a data quality objective-type process where the type and amount of information to be collected is commensurate with the hazards and the decisions which have to be made based on the data. The resulting site characterization program needs to include the investigations and studies needed to evaluate site and facility performance.

Natural Phenomena Hazards. The characterization of a site for natural phenomena hazards is to identify the range of normal and extreme natural events that should be taken into account in the siting and design of the facility. The amount of characterization necessary will be influenced by the hazard associated with the facility and release of the radionuclide inventory. Guidance on characterization and consideration of natural phenomena hazard in the design of DOE facilities is contained in the following standards supporting implementation of *Facility Safety* (DOE O 420.1):

- *Natural Phenomena Hazards Characterization Criteria*;
- *Natural Phenomena Hazards Assessment Criteria*;
- *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components*;
- *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*; and
- *Guidelines for Use of Probabilistic Seismic Hazard Curves at Department of Energy Sites for Department of Energy Facilities*.

Example: A new storage facility is being considered at the Hanford Site. Due to the environmental setting, wind effects and seismic activity are factors that have to be considered in the design regardless of the location selected at the Site. However, due to the local topography, concerns about flooding can be addressed by selecting a location on the Site's central plateau. A similar facility is being considered at the Savannah River Site. The Savannah River Site evaluation includes the consideration of flooding and high winds in the design regardless of location. However, seismic concerns are minimal because of the region of the country; also flooding impacts can be mitigated by selecting an appropriate area of the Site.

In carrying out characterization activities, field studies need to be performed so as to not compromise the integrity of the land to be dedicated to waste management activities. This is particularly relevant to disposal facilities where improper design or installation of core sampling or groundwater sampling wells can lead to a preferential path for the migration of contaminants from a facility. Also, the characterization is to be carried out in accordance with the site's quality assurance program, including maintaining records of data collected. Documentation of the results of the site characterization program is not only needed for use in design, but may also provide information necessary for complying with requirements of the NEPA process.

<u>Human Activities</u>. The site of a proposed transuranic waste management facility needs to be evaluated with respect to the effects of the facility on human activities and the effect of human activities on the facility. Effects of the facility location on human activity includes consideration of:

- transportation routes;
- present and future population distribution (future population considerations should be constrained to reasonable time frames consistent with regional land use planning, not thousands of years);
- present and proposed land and water uses in the region; and
- any special characteristics that would influence the consequences of releases of radioactive material during the life cycle of the facility.

The potential impact of the waste management facility construction, operation, and decommissioning need to be evaluated, considering current and future land use plans and population distribution. Evaluation and selection of the location for a facility should ensure that there is and will remain a buffer between the facility and the public. Such considerations in site selection provide defense in depth by ensuring there is space for corrective actions to be taken if there are unplanned releases and by establishing distance for attenuation of such releases so that impacts are minimized.

> *Example: Site Z is going to construct a facility to treat remote-handled transuranic waste to make it acceptable for disposal. There are no natural environmental characteristics that make any of the proposed locations superior to others. However, one location is in the center of the site and the others are either near the current site boundary or in areas being cleaned up so they can be released from DOE control. Because the criteria for selecting a site include consideration of the proximity to current and future populations, the location near the center of Site Z is preferred.*

Another aspect of human activities is the effect that they may have on the waste management facility. Locating a facility near other facilities on or near the DOE site may impact the design or performance of the facility. For instance, a tall building may create a wake on its downwind side that would cause the exhaust effluent from a nearby, downwind facility to be dragged down to ground surface in a short distance with the potential of impacting workers or nearby members of the public. To counteract this effect, the waste management facility would have to extend its stack higher than the wake effect, or an alternative location for the facility should be considered.

Compliance with this requirement is demonstrated by performing an appropriate site evaluation for new facilities or expansions of existing facilities, and by the ensuring that the environmental and geotechnical characteristics of the site which are significant to protection of workers, the public or the environment are accounted for in selection of the site or through facility design.

Supplemental References:

1. DOE, 1989. *General Design Criteria*, DOE 6430.1A, U.S. Department of Energy, Washington, D.C., April 6, 1989 (canceled).

2. DOE 1992. *Guidelines for Use of Probabilistic Seismic Hazard Curves at Department of Energy Sites for Department of Energy Facilities*, DOE-STD-1024-92, Change 1, U.S. Department of Energy, Washington, D.C., 1992.

3. DOE, 1993. *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components*, DOE-STD-1021-93, Change 1, U.S. Department of Energy, Washington, D.C., 1993.

4. DOE, 1994a. *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, DOE-STD-1020-94, Change 1, U.S. Department of Energy, Washington, D.C., 1994.

5. DOE, 1994b. *Natural Phenomena Hazards Characterization Criteria*, DOE-STD-1022-94, Change 1, U.S. Department of Energy, Washington, D.C., 1994.

6. DOE, 1995. *Natural Phenomena Hazards Assessment Criteria*, DOE-STD-1023-95 Change 1, U.S. Department of Energy, Washington, D.C., 1995.

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

Objective:

The objective of this requirement is to ensure that a minimum set of facility requirements and general design requirements determined from hazards analyses or policy considerations are applied to transuranic waste management facilities.

Discussion:

The facility requirements and general design criteria included in DOE M 435.1-1, Sections III.M.(2) (a) through (e), are included as requirements to ensure adequate protection of the public, workers, and the environment from nuclear hazards. The requirements contained in these sections apply to new and existing transuranic waste management facilities, unless the requirement specifies otherwise.

During the development of DOE O 435.1 and DOE M 435.1-1 an analysis of the hazards associated with the management of waste indicated that appropriate facility safety requirements and general design requirements are essential to ensuring the protection of the public, workers, and the environment. Therefore the intent is to apply these requirements to all transuranic waste management facilities, both existing and new. However, it is recognized that in some cases it may not be practical, or possible, to apply these requirements to existing transuranic waste facilities or operations. Such conditions as limited programmatic usage, expected short service life of the operation, or factors that make long-term, capital-intensive upgrades unreasonable may be bases for not applying the requirements. In such cases, an exemption to the requirement may be warranted. The Implementation paragraph of DOE M 435.1-1 provides for an exemption to a requirement provided it is processed in accordance with the requirements of DOE M 251.1-1A, *Directives System Manual.*

> *Example: At Site Z it is determined that the requirement in DOE M 435.1-1, Section III. M.(2)(e), Monitoring, for an existing transuranic waste tank is unreasonable due to the planned short service life of the tank. The existing tank is not routinely being used and would only be used over the next 18 months for emergency storage of liquid transuranic waste. A replacement for the tank is under construction. In accordance with DOE M 251.1-1A, Chapter VII, "Exemptions," an Exemption Request is prepared that supports the position that application of the requirement is not justified by any safety and health benefit. The exemption request also notes that procedures will be implemented to ensure a once per shift visual check to ensure no waste is inadvertently transferred to the tank. The Exemption Request is processed in accordance with the requirements contained in paragraph 4, Exemption Process, in Chapter VII.*

DOE M 435.1-1 also allows for the use of the "Necessary and Sufficient Closure Process" or the integrated "Safety Management System." Use of these processes for deriving facility design requirements that provide protection comparable to the requirements contained in DOE M 435.1-1, Sections III.M.(2) (a) through (e) is also acceptable at sites where these processes are invoked by contract.

Application of these requirements to all existing transuranic waste facilities may appear to contradict the direction or guidance provided by some other DOE Orders that are invoked by DOE M 435.1-1, Section I.1.E., *Requirements of Other Regulations and DOE Directives*. In such cases the requirements contained in DOE M 435.1-1 do apply.

> *Example: Section I.1.E.(18), Site-Evaluation and Facility Design, invokes DOE O 420.1, Facility Safety. Guidance to DOE O 420.1 states that the design criteria included in the Order are "applicable to the design and construction of new nonreactor nuclear facilities and for modifications to existing nonreactor nuclear facilities when modifications significantly increase the probability or consequences of a nuclear accident or require a*

change in the Technical Safety Requirements (TSRs) of a facility. The definition of 'significant' is intentionally left to the judgment of the proposing contractor and the approving DOE authority. In part, this is intended to allow upgrading of existing safety equipment or installation of minor new improvements without subjecting the process to onerous procedural requirements and thus discouraging improvements." Thus, under DOE O 420.1 an existing transuranic waste management facility that is to be "insignificantly" modified does not have to meet the design requirements of DOE O 420.1. However, under DOE M 435.1-1, the same facility must meet the design requirements of DOE M 435.1-1, Section III.M.(2) (a) through (e), or follow the DOE M 251.1-1A exemption process. The requirements contained in DOE M 435.1-1 have precedence, and should be implemented.

A "backfit" process has been discussed by the Department in the past to address changes that may be required through the imposition of a new DOE safety requirement. Such changes may be problematic for transuranic waste facilities and systems that have been in existence for over 20 years. It is not the purpose of DOE O 435.1 and DOE M 435.1-1 to create such a process for the Department; however an existing or new field-office or Program Secretarial Office backfit analysis and review process may be applied to determine whether implementation of a proposed backfit could be justified on the basis of a substantial safety improvement or on a cost-benefit basis. One example of a candidate process is contained in expired DOE N 5480.5, *Imposition of Proposed Nuclear Safety Requirements*, which expired in 1993 because of an administrative provision. Another candidate process is described Draft DPOM-FS-300, "Treatment of Proposed Backfits," which was developed for the Office of Defense Programs, but not formally adopted. A third candidate process is documented in Westinghouse Savannah River Company, High Level Waste Management Engineering Procedure, ENG. 12, "HLWMD Backfit Analysis Procedure." For development of new backfit processes Nuclear Regulatory Commission requirements in 10 CFR 50.109 and 10 CFR 76.76 should be consulted.

Compliance with this requirement is demonstrated by documentation that supports the implementation of the requirements at DOE M 435.1-1, Section III.M.2. (a) through (e), or documentation that supports the "Necessary and Sufficient Closure Process" or integrated "Safety Management System," or the DOE M 251.1-1A exemption process.

Supplemental References:

1. DOE, 1995. *Implementation Guide for Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria*, Revision G, Draft DOE G 420.1-X, September 1995.

2. DOE, 1993. *Defense Programs Operations Manual, "Treatment of Proposed Backfits,"* Revision 0, Draft DPOM-FS-300, U.S. Department of Energy, Washington, D.C., February 5, 1993.

3. DOE, 1998. *Directives System*, DOE O 251.1A, U.S. Department of Energy, Washington, D.C., January 30, 1998.

4. DOE, 1998. *Directives System Manual*, DOE M 251.1-1A, U.S. Department of Energy, Washington, D.C., January 30, 1998.

III. M.(2) Facility Design. The following facility requirements and general design criteria, as a minimum, apply:

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

Objective:

The objective of this requirement is to ensure that the design of transuranic waste management facilities and equipment include features necessary to prevent the uncontrolled releases of radioactive materials.

Discussion:

During the development of DOE O 435.1 and DOE M 435.1-1, the unexpected or uncontrolled release of radioactive materials at different stages of waste management were identified as potential hazards that could impact workers, the public, or the environment. The DOE M 435.1-1, Section I.1.E.(18) invokes the *Facility Safety* and *Life Cycle Asset Management* Orders, DOE O 420.1 and DOE O 430.1A, respectively, as directives applicable to the design of radioactive waste management facilities. The current requirement supplements those directives by specifically requiring that waste management systems and components of those systems be designed to maintain waste confinement.

The term "confinement" is defined as:

> "An area having structures or systems from which releases of hazardous materials are controlled. Primary confinement systems are process enclosures (gloveboxes, conveyors, transfer boxes, and other spaces normally containing hazardous materials). Secondary confinement areas surround one or more primary confinement systems (operating area compartments)."

In broad terms the purpose of waste confinement is to minimize the spread of radioactive and/or hazardous materials during normal operations, abnormal operations, and potential accidents. The

Packaging and Transportation requirements (DOE M 435.1-1, Section III.L) address confinement of solid transuranic waste in packaging. The Disposal requirements (DOE M 435.1-1, Section III.P) invoke performance-based requirements for confinement of transuranic waste disposal facilities. Therefore, the focus of the following guidance is on incorporating confinement features into the design of treatment or liquid storage systems.

The designs of confinement features should be tailored on a case-by-case basis (i.e., graded approach) based on a consideration of the quantity and form of the transuranic waste and on the conditions for potentially dispersing the contamination. For liquid waste storage or treatment, the vessels, piping, pumps, valves, etc. must provide the primary confinement. Similarly, in treatment systems for solid transuranic waste, hoods, gloveboxes, and process equipment must be designed to control the spread of contamination. Design of these systems should take into account the chemical characteristics of the materials to be managed so that appropriate materials of construction can be selected. Engineering evaluations, trade-offs, and experience should be used to develop practical designs that achieve the confinement objective. The adequacy of confinement systems to effectively perform the needed functions needs to be documented and accepted through the facility or operation safety analysis report or similar documentation.

> *Example: A treatment system for transuranic waste generates an acidic by-product waste stream. The facility is designed so that the liquid waste stream is collected in tanks in the facility, then is batch processed to meet the disposal facility's waste acceptance criteria. The design requires the storage vessel, piping, and valves to be constructed of stainless steel rather than carbon steel because of the pH of the waste stream. In addition, all of the piping and connections are to be welded construction to prevent the potential for leaks developing at threaded or flanged fittings.*

The need to design secondary confinement into the waste management systems or components needs to be based on the analysis of the hazards associated with the potential failure of the primary systems. However, it is generally expected that systems handling liquid wastes will have secondary confinement to minimize the impacts of leaks, spills, or overflows. The secondary level of confinement may be provided by use of double-walled equipment, e.g., double-walled vessels or pipelines, or by using catchments, e.g., diked or bermed areas, or drip pans.

Designs must also account for the flow of air necessary to maintain waste confinement. Air flow is to be from areas of lesser contamination to areas of greater contamination. To ensure that proper airflow is maintained, the ventilation system design includes equipment which monitors air pressure between different levels of confinement and provides alarms if an adequate pressure differential is not maintained. From the area of highest contamination the air needs to be exhausted through an appropriate filtration system (see guidance below on ventilation).

Example: A treatment facility is designed for processing remote-handled transuranic waste in a process cell. The process cell is in a room which serves as a secondary confinement. The building ventilation system is designed so that the air flows from the nonradiological portions of the building, into the process room, and from the process room into the process cell. The ventilation system is also designed to measure the relative pressure between adjacent confinement layers. If the pressure within the process cell is not negative relative to the pressure in the process room, or if the pressure in the process room is not negative relative to the pressure in the rest of the building an alarm sounds to indicate that confinement has been compromised.

Compliance with this requirement is demonstrated by transuranic waste treatment and storage facilities providing primary and secondary confinement commensurate with hazards identified in a safety analysis or similar documentation.

Supplemental References: None.

III. M.(2) Facility Design. The following facility requirements and general design criteria, as a minimum, apply:

(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.

Objective:

The objective of this requirement is to ensure that airborne effluents released from transuranic waste management facilities are in accordance with applicable DOE Orders and external regulations, and to preclude or mitigate the accumulation of flammable or explosive gases which could lead to fire or explosion and the uncontrolled release of radioactive material.

Discussion:

This requirement is based on a similar requirement developed to address a group of hazards that was identified during the development of the high-level waste chapter of the *Radioactive Waste Management Manual*, DOE M 435.1-1. During the development of the Manual, it was determined that hazardous conditions can result from the unexpected or uncontrolled release of radioactive material that could result from poorly designed ventilation systems or due to the accumulation and ignition of flammable or explosive gases. Similar situations could occur at a transuranic waste management facility and should be addressed to prevent uncontrolled airborne releases of radioactivity that could endanger workers, the public, or the environment. Subrequirement III.M.(2)(b)1 is discussed below under Airborne Effluent Filtration Systems and subrequirement III.M.(2)(b)2 is discussed under Flammable and Explosive Gases.

Airborne Effluent Filtration Systems. The subrequirement to maintain radioactive material in airborne effluents from transuranic waste management facilities to appropriate levels through the use of filtration systems is to be implemented using the graded approach. This requirement is intended to ensure that transuranic waste management facilities have adequate filtration where necessary, not to dictate that each facility must have a particular type of air filtration or removal efficiency. Therefore, the safety analysis or assessment for each facility will provide the basis for determining the level of filtration required.

> *Example 1: A transuranic waste treatment facility is constructed so transuranic waste packages can be opened, the waste sorted, and the appropriate waste thermally treated. In order to ensure worker protection, the building ventilation system is constructed to draw air from radiologically clean areas, to radiologically-controlled areas and finally to airborne contamination areas such as glove boxes and thermal treatment equipment. Through the auditable safety assessment, it is determined that the potential exists for releases of radioactive materials through the exhaust system. The building exhaust system is therefore equipped with high-efficiency particulate air filters to ensure that releases are controlled to within limits. Monitoring is used to ensure the necessary removal efficiency is maintained by the air filter system.*

> *Example 2: A storage building is designed and operated to receive only closed containers of transuranic waste and to perform nondestructive testing. Through the preparation of an auditable safety assessment it is determined that the potential for release of radioactivity in the building is very low. Consequently, the ventilation system provided for the building is only for climate control and not for contamination control. The building exhaust system is determined to need no extra filtration to comply with the*

requirements to meet applicable release standards, and the rationale and basis of the analysis is incorporated into the facility safety documentation.

Standards for DOE compliance with airborne releases are contained in DOE 5400.5, *Radiation Protection of the Public and the Environment*, and 40 CFR Part 61. The limits for release cited in these documents are for the DOE site (i.e., all the activities of the Department), not for individual facilities. Therefore, the operational limits for any individual facility need to be established based on the potential impacts from all facilities on the site. Consistent with Departmental practices and an underlying principle in development of the *Radioactive Waste Management Manual*, airborne effluent releases need to be kept as low as reasonably achievable.

The number, size, and design of air filtration equipment need to meet the performance requirements dictated by the safety analysis or assessment. The location of air filtration units in the ventilation system is established as close as practical to the source of contamination so as to minimize spread to the remainder of the ventilation system. The system is designed for ease of maintenance and periodic inspection and has provisions (test ports) to facilitate insertion of measuring devices for testing filter performance. Where larger loads are expected or predicted on the filtration systems (e.g., dusty condition), pre-filters need to be considered to extend the life of the main filter and reduce maintenance.

Flammable and Explosive Gases. The subrequirement addressing explosive or flammable concentrations of gases is intended to ensure that the design of facilities and equipment includes consideration of the potential for generating these types of gases. Generation of flammable or explosive gases has been a concern in the storage of liquid waste (e.g., high-level waste tanks), but also needs to be recognized as a potential problem in other situations, such as in treatment systems.

Where sampling data and safety analyses indicate a potential for accumulating gases in concentrations approaching the lower flammability limit, facilities and equipment shall be provided to prevent the conditions which could lead to fire or explosion. This is normally accomplished by the design and installation of ventilation equipment which provides enough air flow to maintain gases below flammable or explosive concentrations. In situations where gas evolution is episodic and the concentration of gases approaches the lower flammability limit for short periods of time in spite of the ventilation system, spark-proof technology needs to be employed in the design of ventilation equipment so that the equipment itself does not become a source of ignition.

Attention to fire protection for the filtration system also needs to be considered to ensure the facility can perform under off-normal conditions. Guidance for protection of filtration systems in ventilation plenums for nuclear facilities is provided in the *Fire Protection Design Criteria* (DOE-STD-1066-97). This guidance addresses materials of construction, location of filters, fire ratings of protective walls, and internal detectors for fire and heat.

Other methods can be employed to prevent conditions which could lead to ignition of flammable or explosive gases. One such method is the introduction of a sufficient flow of inert gases into the headspace where flammable or explosive gases would accumulate. The inert gases need to be supplied at a rate that keeps the concentration of the flammable or explosive gases and of available oxygen/oxidants below levels that could result in deflagration or detonation. As with ventilation equipment, the specific conditions of gas generation and of providing an inert atmosphere in the headspace must be evaluated and a decision made as to whether spark-proof technology should be included in the design of the system.

Compliance with this requirement is demonstrated by analyses that support the level of filtration provided on a transuranic waste management facility, and if airborne effluent monitoring data are available, a demonstration of compliance with the site-established operational guidelines for the facility. In addition, acceptable implementation is demonstrated by analyses, monitoring data, or both showing that the potential for generation of explosive or flammable concentrations of gases has been considered and where the potential exists, the presence of ventilation equipment or other means that prevent deflagration or detonation. The analysis and rationale for the selected controls must be documented in the radioactive waste management basis.

Supplemental References:

1. DOE, 1990. *Radiation Protection of the Public and the Environment*, DOE 5400.5, U.S. Department of Energy, Washington, D.C., February 8, 1990.

2. DOE, 1997. *Fire Protection Design Criteria*, DOE-STD-1066-97, U.S. Department of Energy, Washington, D.C., 1997.

3. EPA. *National Emission Standards for Hazardous Air Pollutants*, 40 CFR Part 61, U.S. Environmental Protection Agency, Washington, D.C.

III. M.(2) Facility Design. The following facility requirements and general design criteria, as a minimum, apply:

(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.

Objective:

The objective of this requirement is to ensure the incorporation of the concept of life-cycle waste management into the design and construction of radioactive waste management facilities to minimize the amount of radioactive waste that must be managed in the future from decontamination and decommissioning activities, and to reduce the number of facilities that must be dismantled due to contamination rather than re-used for another beneficial purpose.

Discussion:

During the development of DOE O 435.1 and DOE M 435.1-1, the concept of life-cycle management of waste was identified as a key theme that would promote safety and provide a long-term benefit in reducing hazards associated with radioactive waste management. This requirement was developed to extend the life-cycle management concept to the design of facilities used for the management of radioactive waste. The goals of applying this concept at the design stage are to minimize the future generation of waste and to promote the planning for subsequent beneficial use or decommissioning of a facility at the end of its original mission. Decontamination and decommissioning activities also becoming a significant part of the life-cycle costs for transuranic waste facilities. This requirement addresses this situation by promoting proactive consideration of design features that facilitate decontamination and dismantlement activities that will lead to a beneficial use or decommissioning.

New transuranic waste facilities are defined as those whose design basis was not approved prior to the implementation date of DOE O 435.1. The term design basis is defined in the Manual Definitions. If a transuranic waste facility's design basis is defined after the issuance date of DOE O 435.1, the requirements of this section are applicable. Similarly, if a significant modification to an existing facility is made after the implementation date of DOE O 435.1, this requirement to incorporate features that facilitate decontamination and to consider eventual facility decommissioning or reuse applies. Application of these requirements to existing facilities should be considered and applied on a case-by-case basis. To support this decision, an analysis needs to be conducted comparing the expected benefits by the application of these requirements to the costs of implementing such measures. These costs include programmatic impacts, resource and schedule impacts, as well as potential impacts such as additional worker exposures due to radiation and chemical hazards, and future costs.

Design to Facilitate Decontamination. Decontamination is defined by the Implementation Guide to DOE O 420.1, *Facility Design*, as "the act of removing a chemical, biological, or radiological contaminant from or neutralizing its potential effect on a person, object, or environment by washing, chemical action, mechanical cleaning, or other techniques." In conjunction with DOE O 420.1, DOE M 435.1-1 requires that transuranic waste facilities incorporate measures to reduce areas of contamination or to simplify decontamination of areas that may become contaminated with radioactive or hazardous materials to facilitate either decommissioning or reuse of the facility. Following are design features that need to be considered:

- Service piping, conduits, and ductwork kept to a minimum in areas that could be potentially contaminated and, if included in such areas, their design arranged to facilitate decontamination.

- Cracks, crevices, and joints filled and finished smooth to prevent accumulation of contaminated material.

- Walls, ceiling, and floors in areas vulnerable to contamination finished with washable or strippable coverings.

- Metal liners, e.g., stainless steel cell lining, used in areas that have the potential to become highly contaminated with radioactive materials.

- Contaminated or potentially contaminated piping systems have provisions for flushing and/or cleaning.

- Accessible, removable covers for inspection and cleanouts provided.

- Construction materials that reduce the amount of radioactive materials requiring disposal and that are easily decontaminated.

Example: A transuranic waste thermal treatment facility is being planned. The facility design is reviewed to determine the ease with which the constructed treatment facility could be decontaminated following its operational life. The evaluation finds that transuranic waste transfer lines can be modified by including liners, and certain areas are found to be amenable to the use of strippable coverings. The design is modified to incorporate these changes and improve the ability to decontaminate the facility.

<u>Design to Support Decommissioning</u>. Decommissioning, also defined in DOE O 420.1, is “the process of closing and securing a nuclear facility or nuclear materials storage facility to provide adequate protection from radiation exposure and to isolate radioactive contamination from the human environment.” Design features that need to be considered to support decommissioning or a reuse of the facility include:

- Use of modular radiation shielding, in lieu of or in addition to, monolithic shielding walls.

- Use of modular, separable confinements to preclude contamination of fixed portions of the structure.

- Designs that ease cut-up, dismantlement, removal, and packaging of contaminated equipment, such as glove boxes, air filtration equipment, large tanks, vessels, and ductwork, from the facility.

- Use of localized liquid transfer systems that avoid long runs of buried, contaminated piping; emphasis on localized batch solidification of liquid waste. Special provisions may also be included in the design to ensure the integrity of joints in buried pipelines.

- Piping systems that carry contaminated or potentially contaminated liquid that free drain by gravity.

- Location of exhaust filtration components of ventilation systems at or near individual enclosures to minimize long runs of internally contaminated ductwork.

- Equipment, including effluent decontamination equipment, that precludes to the extent practicable, the accumulation of radioactive or other hazardous materials in relatively inaccessible areas, including turns in piping and ductwork.

- Provisions for suitable clearances, where practical, to accommodate remote handling and safety surveillance equipment required for future decontamination and decommissioning.

- Use of lifting lugs on large tanks and equipment.

Decommissioning and Reuse Planning. Due to the high life-cycle costs of transuranic waste facilities, this subrequirement is also intended to promote post-mission planning of transuranic waste facilities by requiring the identification of possible decommissioning methods or reuses of transuranic waste facilities as early as possible. To meet this requirement transuranic waste facility designs, or significant modification efforts, need to include analysis to determine the best decommissioning methods, using currently available technologies, and factor the results of this analysis into the facility's design. Likewise, if a reuse of the facility is envisioned, any features that can support this reuse mission need to be considered in the design effort.

Life-Cycle Asset Management, DOE O 430.1A, addresses deactivation and decommissioning requirements of DOE facilities. Refer to DOE O 430.1A and its Guides for further information on additional information on deactivation and decommissioning activities. Refer also to a new

DOE Standard, listed below, on the integration of safety and health requirements into facility disposition activities.

Compliance with this requirement is demonstrated by the existence of design documentation that indicates decontamination was considered during the design of new transuranic waste facilities or significant modifications to transuranic waste facilities. Additionally, Site-Wide Radioactive Waste Management Program documentation demonstrates that post-mission planning was considered, as early as possible in the life of a facility, to assist in the identification of possible decommissioning methods or facility reuse.

Supplemental References:

1. DOE, 1995. *Implementation Guide for Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria*, Revision G, Draft G 420.1-X, U.S. Department of Energy, Washington, D.C., September 1995.

2. DOE, 1997. *Decommissioning Implementation Guide*, Draft G 430.1-4, U.S. Department of Energy, Washington, D.C., October 1, 1997.

3. DOE, 1997. *Integration of Safety and Health into Facility Disposition Activities*, Draft for DOE Complex Wide Review 9/26/97, DOE-STD-1120-98, U.S. Department of Energy, Washington, D.C., September 26, 1997.

4. DOE, 1998. *Life-Cycle Asset Management*, DOE O 430.1A, U.S. Department of Energy, Washington, D.C., October 14, 1998.

III. M.(2) Facility Design. The following facility requirements and general design criteria, as a minimum, apply:

(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.

Objective:

The objective of this requirement is to ensure that engineered controls are included in the design of transuranic waste storage and treatment facilities to minimize the likelihood of release of radionuclides that could lead to exposures or contamination of the environment.

Discussion:

This requirement for instrumentation and engineering controls is invoked to address a group of hazards that was identified during the development of DOE O 435.1 and DOE M 435.1-1 -- the failure to promptly detect and prevent conditions which could lead to a release of radioactive material from transuranic waste storage or treatment facilities that could impact workers, the public, or the environment. This requirement is closely related to the previous design requirement for monitoring systems. However, this requirement focuses on controls to prevent the loss of containment.

The engineered controls referred to in this requirement are those systems or design features that are provided to detect and prevent the loss of containment of transuranic wastes volumes in treatment or storage facilities, and to provide volume inventory data, where appropriate. During the design of storage or treatment systems, the flow of waste material through the system should be evaluated to determine where there is a potential for the loss of containment by overfilling or spilling. Examples of engineering controls include flowmeters and level-sensing devices coupled with anti-siphon devices or shut-off valves, and any other instrumentation and controls that maintain sufficient freeboard within a storage vessel or unit. Other instruments and controls include devices that measure changes in characteristics of liquid waste, e.g., temperature, pressure, pH, and/or other characteristics providing a measure of a materials stability, that are combined with shutoff or diversion routing devices. Although this requirement most obviously applies to management of liquid wastes, it also needs to be considered and applied, as appropriate, to solid transuranic waste.

> *Example 1: A tank system has been installed to receive and store transuranic wastes pending treatment. The wastes are transferred by pipeline to the tanks. The design of each tank includes a liquid level sensor which is coupled to an alarm and diversion valve. When the liquid level is at 88% of the tank depth an alarm sounds on the control room annunciator panel. When the liquid level reaches 92% of the tank depth the diversion valve is automatically actuated and the liquid level is transferred to a spare tank.*

> *Example 2: A facility is being designed to provide thermal treatment of transuranic waste. The thermal treatment unit is designed for continuous feed and continuous discharge of the ash and slag to a disposal container. To avoid the loss of containment, an interlock is included in the design which prevents feed from entering the combustion chamber and waste product from leaving the chamber if a disposal container is not in place at the discharge of the thermal treatment unit.*

The graded approach is used in determining the appropriate level of engineering controls to incorporate into the design of transuranic waste management facilities. As indicated in the preceding examples, sensing devices, alarms, and spill or overflow prevention features are most appropriate in facilities storing liquids or with continuous, automatic processes. Other instances involving bulk or solid transuranic waste may need to invoke these controls as well, where a simple shutoff of the equipment could prevent overfilling or other hazardous conditions.

The design of engineering controls to meet this requirement will most likely be directed by the facility-specific safety analysis or safety assessment prepared for the waste management facility. Such safety analyses or assessments may dictate that certain engineering controls be designed as safety-class or safety-significant systems, structures, or components (SSC) to ensure they survive design-basis accidents. Use of the safety analysis process, as prescribed by DOE 5480.23, *Nuclear Safety Analysis Reports*, to identify the necessary engineering controls to meet this requirement for both new and upgrades to existing transuranic waste treatment and storage facilities, is considered appropriate and encouraged.

Loss of containment at a waste storage or treatment facility can result from overflows, spills, leaks, or siphoning of waste from a storage vessel. Incorporation of design measures at these facilities to prevent such loss of containment is necessary, but is not necessarily sufficient to adequately control the hazards associated with release of radioactive materials. Equipment of this nature, in spite of rigorous maintenance, can fail over its expected service life. Therefore, as discussed in the above guidance on confinement, an engineered barrier to fully contain the spilled waste or a diversion mechanism to channel the waste to a desired location provides defense-in-depth for the circumstances where the engineering controls do not function.

> *Example: At the Liquid Transuranic Waste Storage Facility, the engineering controls on the liquid transuranic waste storage tanks include a waste feed line shut-off valve, activated by a tank liquid level-sensing device, to prevent overflow of waste from the tank. In addition, the tank is designed with an overflow line so that if the valve malfunctions and the tank is overfilled, the overflow is routed to another waste tank that is maintained as a spare at the storage facility.*

Compliance with this requirement is demonstrated by the incorporation of engineering controls in storage facilities or treatment processes that provide detection and automatic shutoff or diversion of the flow of waste materials that could otherwise spill or overflow the system as documented in the facility's safety documentation.

Supplemental References:

1. DOE, 1995. *Implementation Guide for Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria*, Revision G, Draft DOE G 420.1-X, U.S. Department of Energy, Washington, D.C., September 1995.

2. DOE, 1992. *Nuclear Safety Analysis Reports,* DOE 5480.23, U.S. Department of Energy, Washington, D.C., April 10, 1992.

III. M.(2) Facility Design. The following facility requirements and general design criteria, as a minimum, apply:

(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.

Objective:

The objective of this requirement is to ensure the design and installation of equipment capable of identifying failures in containing transuranic waste and other conditions that could result in exposure of the public, workers or releases to the environment.

Discussion:

During the development of DOE O 435.1 and DOE M 435.1-1, the hazards analysis identified releases resulting from confinement failure of a component or from failure to stop transfer of waste when the receiving vessel (e.g., tank or bin) is full as a hazard that needs to be mitigated. The requirement discussed here is generally directed toward prompt detection of acute releases (releases that are detectable visually or by some other gross indicator) that become apparent over a time frame of hours or days. In contrast, the requirements for monitoring (see DOE M 435.1-1, Section III.Q) for compliance with release limits is directed toward detection of releases that generally evolve slowly and may be detected by low threshold environmental monitoring devices weeks, months, or longer after the release begins.

As in implementation of all of the requirements of DOE O 435.1 and DOE M 435.1-1, the graded approach is used for determining the appropriate level of rigor in applying this control to the management systems employed at a particular waste management facility. Also, monitoring for leakage and contamination spread needs to be performed by means appropriate for the type and character of radioactive waste being managed at the facility. Rigorous application of this requirement may be most appropriate for circumstances involving storage or treatment of liquid transuranic waste, for example, highly acidic liquid waste in a single-walled, mild steel tank may require continuous monitoring coupled with alarms and transfer equipment. A treatment facility involving solid waste may need to implement monitoring systems such as portable constant air monitoring systems designed to detect airborne contamination spread from dry processes. A facility storing containerized waste may rely on a program of container inspections to meet the needs for monitoring for leaks and abnormal conditions.

For transfer systems, designers may need to consider the use of continuous flow monitors to allow comparisons of total volume input to total volume output as an indicator of the integrity of the transfer system. The containment integrity of waste transfer systems can also be monitored for radiation levels in excess of those expected from residual waste in the transfer system.

A highly reliable means of monitoring for releases is the use of secondary confinement which is then checked for waste. It also offers the benefit of providing defense-in-depth in containment of releases of transuranic waste.

> *Example: A liquid transuranic waste transfer line from a storage tank to a treatment facility is enclosed in a larger diameter secondary containment tube. The transfer line and containment tube were constructed with sufficient pitch to cause any leakage into the containment tube to flow back to the storage tank area. The transfer line developed a leak at a coupling which was discovered when waste was found in the secondary containment at the storage tank area.*

What constitutes rapid detection of failed confinement or abnormal conditions needs to be established for each facility, operation, or activity. Monitoring design requirements and engineering controls to address catastrophic failures will be established through the conduct of safety analyses. The failures and conditions being addressed by this requirement are those that are not catastrophic, but could result in releases of radioactivity or doses to workers or the public in excess of established limits if they were allowed to continue over a period of hours or days. Detection equipment needs to be designed to detect confinement failures or abnormal conditions rapidly enough that action can be taken before the situation degrades to the point that response and recovery would result in doses to workers that approach the dose limits for radiation protection of workers (10 CFR Part 835). Similarly if the failure releases radioactivity to a air or liquid effluent stream, detection needs to occur rapidly enough to prevent environmental releases from exceeding annual limits.

Compliance with this requirement is demonstrated by a documented basis for the design of monitoring for transuranic waste systems and the capability to monitor waste volume and detect volume changes in a time frame that will allow implementation of corrective measures to limit public and worker doses to allowable levels and to limit releases to the environment.

Supplemental References:

1. DOE. *Occupational Radiation Protection,* 10 CFR Part 835, U.S. Department of Energy, Washington, D.C.

III. 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.

Objective:

The objective of this requirement is to promote safe storage of transuranic waste by eliminating from storage materials which could result in fires or explosions due to their reactivity or ignitability.

Discussion:

The safe storage of transuranic waste can be jeopardized by the presence of materials which may ignite or explode. To avoid the potential for accidental releases from stored wastes, this requirement prohibits storage of materials that are known to be readily capable of ignition or explosion, or which may degrade over time to be ignitable or explosive. In establishing waste acceptance criteria for storage, waste managers must prohibit the acceptance of materials which have the potential of igniting or exploding. The following materials are not to be stored:

- Reactive metals - metals that can react violently with water, form potentially explosive mixtures with water, or ignite when exposed to air; e.g., uranium or plutonium metal turnings are reactive metals.

- Certain dried ion exchange resins - organic ion exchange resins which have been used for treating solutions containing nitrates have the potential of igniting or exploding if they are allowed to dry out.

- Cellulosic materials contaminated with strong oxidizers - cellulosic materials can spontaneously ignite due to the presence of strong oxidizers, e.g., concentrated nitric acid.

- Volatile materials if stored in areas of high temperatures - storage of volatile materials in closed containers subject to high temperature can result in pressurization of the container and, depending on the waste materials, evolution of flammable gases.

- Pyrophoric materials - nonradioactive materials which can ignite spontaneously are not to be packaged for storage. Radionuclides which may be pyrophoric are to constitute less than 1% by weight of the container contents unless they are treated to eliminate the pyrophoric characteristic.

When waste with the characteristics described above have been generated, it is necessary to treat them prior to placing them into storage. The treatment may consist of causing the reaction to occur under controlled conditions, e.g., oxidation of pyrophoric metals such as uranium fines, or may involve the stabilization of waste materials so that they are no longer flammable or explosive.

> *Example 1: In the process of cleaning out a glovebox, paper absorbent was used to clean up an acid spill. Prior to placing the absorbent material into a drum for prolonged storage, it is taken to a RCRA-permitted treatment facility where the acid is neutralized and the absorbent dried. The treated absorbent materials are then packaged to meet the waste acceptance requirements of the transuranic waste storage facility.*
>
> *Example 2: Metal fines from machining operations are routinely generated as a transuranic waste stream. In order to meet the storage requirements and make the waste acceptable for future disposal, the fines are treated by solidification in a cement matrix in 1-gallon cans. Upon curing, the 1-gallon cans are placed in 55-gallon drums along with filler material that prevents shifting within the drum. The drums are then sent to the on-site storage facility.*

Compliance with this requirement is demonstrated by having waste acceptance requirements which prohibit waste that is ignitable or explosive from being accepted for storage unless it has been treated.

Supplemental References: None.

III. N.(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.

Objective:

The objective of this requirement is to ensure that the selection of the location and method for storing transuranic waste is made so that both workers and the containers of waste are provided with adequate protection.

Discussion:

During the development of DOE O 435.1 and DOE M 435.1-1, the storage of radioactive waste was identified as an activity that presented potential risk to the public, workers, and the environment. Numerous weaknesses and conditions which could lead to release of waste or exposure of workers were identified during the safety and hazards analysis and subsequent reviews conducted in support of the Manual documentation. In addition, previous reviews of radioactive waste storage conditions and management practices (e.g., *Complex-Wide Review of DOE's Low-Level Waste Management ES&H Vulnerabilities)* revealed inadequately or improperly stored waste, which presents the possibility of human exposure to radiation and the potential for adverse environmental effects.

The evaluations of storage that were conducted during development of the Order and Manual revealed a variety of current practices and required lengths of storage for transuranic waste. Transuranic waste is stored in dense-pack arrays, in earthen-covered configurations, and in modern, RCRA-compliant storage facilities. In addition, in order to protect the transuranic waste containers, buildings not originally designed or intended for storage are sometimes used when other storage capacity is not available.

As discussed in the General Requirements guidance on storage (DOE M 435.1-1, Section I.2.F.(13)), a principal element of proper storage is ensuring that the container is protected from degradation so that it can perform its intended function until it is disposed. This requires that containers be protected from mechanical damage and from environmental conditions that could impact the waste and container.

> *Example 1: Due to a large decommissioning project generating unanticipated volumes of transuranic waste, Site Z decided to store transuranic waste outside until indoor storage space could be made available. In accordance with the Packaging and Transportation requirements, filtered vents were installed on the drums used for packaging the waste. However, in establishing the radioactive waste management basis for the outside storage pad, personnel failed to recognize the potential for precipitation entering the drums. Rain accumulated on the tops of the drums, then due to fluctuations in barometric pressure, the drums "breathed" through the vents. Water was sucked in through the vents resulting in the need to repackage the waste so that the containers would not corrode and so they could meet the waste acceptance requirements for disposal. Subsequently, any waste drums that had to be left outside were provided with covers that prevented water from accumulating on the tops.*

> *Example 2: Due to a large backlog of transuranic waste, Site Y is required to store transuranic waste outside until it can be shipped to the Waste Isolation Pilot Plant for disposal. The waste is stored in containers which prevent the entrance of precipitation*

(lid with lips extending down over the sides) and which resist corrosion (painted carbon steel). Controls are in place to limit mechanical damage from vehicles and other operations in the area. The containers are inspected on a monthly basis for deterioration and repaired as necessary to maintain containment of the waste (e.g., painted, contained). Personnel are only in the outside storage area during periods of inspections, container maintenance, and container movement. The outside storage has been analyzed and documented to provide adequate protection for the expected storage time. This storage maintains the integrity of the waste and minimizes worker exposure.

Transuranic waste may be stored in facilities designed specifically for waste storage, as well as in facilities or portions of facilities which originally served another function but have now been converted for use a storage facility. Any facility to be used for transuranic waste storage must comply with the applicable requirements of DOE O 420.1, *Facility Safety*. Special attention is to be given to DOE O 420.1, Section 4.2, Fire Protection, when a facility is to be used for the storage of combustible materials. If facilities have the appropriate provisions (e.g., ventilation, fire suppression) for the type of waste being stored, their use is preferable to storing the waste containers outside and subjecting them to the elements.

In making a decision to use a facility for storage and in developing a radioactive waste management basis for the activity, particular attention to protection of workers is needed. Waste is not to be stored in areas where workers are required to spend extended periods of time in performing other duties (i.e., any duties not related to managing and monitoring the waste). This limits the facilities or areas of facilities that should be used for waste storage to those that are excess to current site missions or those that are infrequently accessed as part of normal operations.

Compliance with this requirement is demonstrated if sites have storage capabilities for transuranic waste that provide protection of waste containers so that their integrity will not be damaged through physical or chemical (corrosion) processes and that keep personnel from spending extended periods of time in the areas where transuranic waste is stored.

Supplemental References: None.

III. N.(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.

Objective:

The objective of this requirement is to prevent or minimize the potential exposure of workers and release of radioactive contamination to the environment that could result from allowing transuranic waste containers to degrade. The requirement is intended to ensure that the confinement abilities of containers is routinely evaluated and action taken to ensure the waste remains contained.

Discussion:

The containment of transuranic waste in its container is essential for its safe and effective management. During the development of the *Radioactive Waste Management Manual* (DOE M 435.1), inadequate or substandard waste containers and deterioration of containers were identified as a conditions that could result in the loss of waste containment and potentially impact workers, the public, or the environment. The General Requirements of the *Radioactive Waste Management Manual* (DOE M 435.1-1, Section I.2.F.(13)) assign the Field Element Manager responsibility to ensure that all waste is stored in a manner that protects the integrity of the waste container for the expected time of storage. The responsibility for providing adequate storage that protects the integrity of waste containers is complemented by this requirement to routinely inspect the packages and correct any conditions of container deterioration. This is particularly important for transuranic waste that is to be in relatively long-term storage (e.g., waste that will not be shipped to WIPP for a number of years or non-defense waste for which a disposal facility has not been identified). This requirement applies to all storage of transuranic waste, not just storage at a designated storage facility.

> *Example: An assay facility has two areas where waste is staged, one for containers of waste awaiting assay and another for those to be placed into storage after they have been assayed. The assay facility personnel have established operational procedures for the routine physical examination of all waste containers in either staging area. Existence of the inspection process mitigates concerns about waste residing in the staging areas for longer than normal as a result of assay equipment failure or maintenance. The facility procedures also address actions to be taken if waste container integrity is suspect.*

<u>Inspection</u>. The waste container inspection and corrective action process is to ensure that container integrity is maintained throughout the storage or staging period. The process needs to be tailored to the storage situation. Ideally, the storage configuration would allow visual or remote visual inspections of the outsides of waste containers. The inspection considers:

- General condition of the container, such as areas of rust, scratches, and minor dents. The inspection process includes an evaluation of minor surface conditions to determine their impact on the integrity of the container. Such conditions may not require any action, but are to be noted and corrected if there is a trend indicating eventual deterioration.

- Functioning of the waste container closures. Waste container closures are in place and securely fastened.

- Evidence of leakage. Leakage can indicate a number of problems including unacceptable materials in the waste, inadequate internal containers, insufficient absorbent, or failure of the outer container.

- Evidence of structural problems with the container such as buckling or split seams.

- Bulging of the waste container indicating build up of pressure in the container. Bulging of the container may indicate inappropriate storage conditions (e.g., storing tightly sealed waste containers where they are subject to excessive heating), a condition inside the container that needs to be remediated, and the need to replace the container.

- Examination of waste container marking and labeling to ensure that they are maintained in a legible condition.

Example: Transuranic waste is stored in rows two drums wide and two drums high with an aisle between the rows. The site procedure calls for an operator to inspect the condition of the drums every two weeks and record any potentially adverse conditions.

Some older storage configurations (e.g., dense pack storage where there are multiple rows and layers of waste packages without access space between them) may not allow for direct visual inspection. In such cases, the inspection may have to be done using remote or indirect techniques. Remote techniques include the use of video cameras which provide real time or recorded displays of waste containers which are not accessible for direct inspection. Indirect methods include the use of radiation detectors to determine when a waste container has failed. To the extent possible, direct remote visual inspections are to be used in preference to indirect methods since indirect methods force the inspection and maintenance process into a reactive mode of fixing problems once they have occurred (as detected by an increase in radioactive contamination) rather than a proactive mode of preventing breaching of the waste container.

Example: Drums stored in a dense pack array are in a building that has a continuous air monitor. To ensure adverse waste package conditions are detected as soon as practical, additional monitoring is performed on a routine basis. The additional monitoring involves the collection of smear samples by placing swabs on extensions to check for loose contamination within the array.

Waste containers should be physically examined about every 30 days to ensure that storage conditions have not caused the integrity of the container to be compromised. All waste packaging that exhibits serious deterioration or exhibits a potential for containment of the waste to be jeopardized need to be replaced or overpacked.

> *Example: During the routine inspection of waste drums at a staging area a drum was identified as possibly damaged. Upon detailed inspection, it was determined that a seam of the waste drum had separated. The waste was repackaged and the old drum removed from service.*

Maintenance. The process for waste container maintenance is to include preventive actions as well as corrective actions. Preventive actions would address minor conditions associated with ensuring waste containment. Actions might include cleaning and painting small areas on metal to curb corrosion that could eventually compromise the container. The process also is to provide capabilities to respond to more serious conditions up to and including breaching of the container (e.g, from accidental puncture or corrosion).

Maintenance of containers in response to acute conditions (i.e., conditions where there is a release or imminent threat of a release) provides for prompt containment of the release, assessment of the situation, and remedying the situation. The immediate response is to ensure that release of contamination is controlled. Control actions may be as simple as replacing a bolt or closure ring on a drum, or covering a hole in a container with tape. More serious conditions may require placing the waste container in a catch tray or immediately placing it in an overpack. The condition causing the breach or potential breach must be assessed so that, if necessary, the causative factors can be corrected. If corrosion is affecting the waste container, the reason for the corrosion needs to be determined so an effective response can be made. If there is a corrosive material in the waste container, overpacking may only temporarily correct the problem. In such a situation, it may be more appropriate to treat the waste or to provide a liner that is resistant to corrosion. If there is buckling of the waste container or split seams, an assessment needs to be made of whether the contents are too heavy, whether the container is improperly designed, or whether it was mishandled (e.g., dropped). In cases where an external event is the cause of the damage (e.g., a waste container is dropped or struck by equipment), repackaging or overpacking in a similar container is appropriate.

> *Example: The inspection process in a storage facility identified a waste drum that was corroding even though the container was stored in acceptable conditions and the paint on the drum was in good shape. Storage facility personnel recognized that there was a need to investigate whether the contents of the container were causing the corrosion. Evaluation of the container contents confirmed that the waste was contaminated with corrosive material. The waste was treated to neutralize its corrosivity, then repackaged in a similar container.*

Waste managers are not to interpret the term “maintenance” to imply that refurbishment of deteriorating waste containers is required. The basic premise of this requirement is that potential doses to workers are to be avoided. Therefore, overpacking may be the most appropriate action as opposed to an action requiring handling of the waste and a failed container.

Compliance with this requirement is demonstrated by a documented process for waste container inspection and maintenance at every facility managing transuranic waste, and documentation for all waste container inspections and maintenance actions performed.

Supplemental References: None.

III. N.(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.

Objective:

The objective of this requirement is to promote the removal of retrievably-stored transuranic waste from earthen-covered storage and its transfer to subsequent waste management facilities where there is less potential of release to the environment. Additionally, the purpose of the requirement is to ensure that, to the extent practical, information about the waste is collected and analyzed so hazards associated with the waste can be mitigated through selection of equipment, development of procedures, and implementation of work practices.

Discussion:

The General Requirements chapter of DOE M 435.1-1 assigns the Field Element Manager responsibility for ensuring that waste is stored in a manner that is protective of the public, workers, and the environment. Additionally, the Field Element Manager is responsible for ensuring the integrity of waste containers during the time they are stored (DOE M 435.1-1, Section I.2.F.(13)). This requirement supplements the General Requirement by encouraging the removal of waste from storage configurations that may contribute to the degradation of waste containers.

Following implementation of the 1970 Immediate Action Directive (AEC, 1970) concerning solid waste management, the Department began storing waste suspected of being transuranic waste with the intent of retrieving it for future disposal. Waste disposed of prior to the implementation of the 1970 Immediate Action Directive is not retrievably stored transuranic waste and therefore, is not subject to this requirement. Generally, such wastes are managed pursuant to the *Comprehensive Environmental Response, Compensation, and Liability Act*.

To implement the Immediate Action Directive, a number of DOE sites designed storage configurations that involved placement of containers of transuranic waste (or waste suspected of being transuranic waste) in lined or unlined trenches, or at grade, then covering them with soil. At the time of emplacement, the configuration was intended for 20-year retrievable storage. Much of this waste is still in earthen-covered storage, some of it beyond the originally planned 20 years. Experience gained through investigations and retrieval activities has shown that in some cases the integrity of the containers has been compromised (e.g., moisture condensing on metal containers has led to significant rusting).

During the development of DOE M 435.1-1, *Radioactive Waste Management Manual*, a safety and hazards analysis identified the potential release of radioactivity to the environment from waste packages in earthen-covered storage and the concomitant hazard to retrieval workers, as conditions for which radiological controls were needed. Likewise, it was also recognized that the longer waste containers remain in earthen-covered storage configurations, the greater the likelihood of a release. Therefore, this requirement was developed to promote the movement of waste to more acceptable conditions (i.e., better storage conditions, treatment, or disposal). The hazards to workers are to be mitigated by acquiring as much information as practical about what will be encountered upon exhumation and implementing controls to address those hazards.

Retrieval Plans. Plans for retrieval of waste from earthen-covered storage will vary depending on the stage of development of the retrieval program, and will need to be updated (maintained) as the program progresses. In the early stages, the planning will be primarily programmatic with the focus on identifying and developing the information and infrastructure needed to effect retrieval. This planning integrates with the documented Site-Wide Program (see DOE M 435.1-1, Section I.2.F.(1)) because it reflects the same commitments and milestones addressed in the Site-Wide Program. The plans for retrieval may suffice as the documentation for that portion of the Site-Wide Program. Recognizing that some of the waste placed in earthen-covered storage may not meet the current definition of transuranic waste, the planning needs to address determining whether retrieved containers have transuranic or low-level waste, and the disposition of the different types of waste. The early planning includes the following:

- The scope of the retrieval activity (i.e., the facilities (trenches, above-grade pads, etc.) from which waste will be retrieved);

- A conceptual description of the approach to be used (e.g., method of removing overburden, means of removing tarps and/or plywood covering the waste packages, contamination control during removal operations);

- Data collection (see Pre-Retrieval Evaluation below), analyses, and studies to be conducted in support of retrieval operations;

- Identification of primary facilities and equipment needed to retrieve waste (weather enclosures, drum handling equipment, drum venting equipment, earth moving equipment, transportation vehicles);

- Identification of existing and new support facilities (e.g., needed treatment, storage, and/or disposal facilities);

- Evaluation of retrieved waste containers (inspection, overpacking, assay);

- Management steps for retrieved packages (e.g., venting, storage, treatment, disposal);

- Plans for decommissioning the earthen-covered storage facility following removal of the waste; and

- The cost and schedule for preparing for and accomplishing retrieval of the waste.

Example: A site has waste that was placed into earthen-covered storage under the assumption that it was transuranic waste. As part of the site-wide waste management program, a document is prepared that describes the facilities and equipment envisioned to be needed and the process for retrieving the waste. The document also includes a schedule for collecting and evaluating data associated with the waste, providing the needed facilities and equipment, developing control documentation (e.g., permits, procedures, safety analysis report, health and safety plan), conducting startup activities (operational readiness reviews), and performing the retrieval. The documentation also includes a budget estimate for preparing and conducting the retrieval.

As information is acquired and the infrastructure to support retrieval evolves, the plans for retrieval will need to be updated and become more focused. The planning will become more project specific and include the development of the time-phased plans for retrieving waste, characterization plans, radiological control plans, health and safety plans, and emergency response plans. The planning done at this stage will also be more specific as to the process for exposing and handling drums, including cover removal; waste management (e.g, contaminated soil, plastic, plywood); inspections to be performed; handling non-routine drums (e.g., those that are bulging or deteriorated); venting of drums; assaying; specific plans for disposition of different waste types (including segregation of defense and non-defense transuranic waste as discussed below); marking and labeling; and movement of drums. The planning provides the basis for developing the procedures that will control waste retrieval.

Pre-Retrieval Evaluation. In the early stages of planning, a key activity is the collection and evaluation of data about the waste that is to be retrieved. Some of these data (e.g., location, volumes) may be readily available in existing data bases and will be used in the early planning. However, prior to developing project-specific plans and procedures controlling retrieval activities, a thorough evaluation of available data needs to be made so that appropriate worker protection can be planned.

The evaluation of information relevant to waste characteristics will involve collecting information on the character of the waste, waste containers, and the storage configuration. The evaluation includes an examination of existing burial records, production records, and design drawings of waste containers and the storage facility and can be supplemented by interviews with current and former employees. To the extent the information is available, the evaluation is to identify the following:

- Type of earthen-covered storage facility (e.g., trenches, above-grade pads, drum stacks);
- Waste storage facility design and construction (e.g., above-grade, below-grade, use of tarps and/or plywood);
- Types of containers present (e.g., 55-gallon drums, fiberglass-reinforced plywood, wooden, or metal boxes) and their approximate sizes and weights;
- Radionuclide species and inventory in the containers;
- Chemical constituents in the waste;
- The presence of waste containers with high dose rates (i.e., above contact-handled limits per site radiological control practices);
- Any other waste or facility characteristics that may affect health, safety, or the environment.

Example: To prepare for retrieval of waste from earthen-covered storage, site personnel undertake a review of available information. They compile copies of as-built blue-prints for the storage facility, review the shipping and transfer records that accompanied the *waste when it was received, and based on the records, identify the containers in which the waste is contained. The shipping and transfer records identify the facilities from which the waste was received, which leads to interview of staff who worked at the facilities that generated the waste. Interviews indicate that there may be other radionuclides present than the few reported on the shipping and transfer records. Expected dose rates from the waste containers available from the shipping and transfer records are corroborated by the staff from the generating facilities.*

Evaluation of data about the facility and waste is to be used in developing the detailed retrieval plans and procedures, particularly as they relate to ensuring worker safety. The data can be used to support decisions on container handling procedures (e.g., remote versus contact handling) and the type of personnel protective equipment that may be appropriate. Even if data indicate that a low level of personnel protective equipment is sufficient, initial contact with retrieved waste needs to be undertaken using a high level of protection (e.g., EPA level A or B). Only after the expected level of hazard has been confirmed to be low should the level of personnel protection be lowered.

Example: The evaluation of information about an earthen-covered storage facility leads to the expectation that the waste containers will be in good shape. This means that only Level C protective equipment (anticontamination clothing, no respiratory equipment) is required and that the waste can be contact handled. During initial entry into each storage module, frequent dose rate surveys are conducted and personnel wear respirators until it is confirmed that dose rates are low and there is no airborne hazard.

Compliance with this requirement is demonstrated if personnel have developed plans and continue to show progress towards removing waste from earthen-covered storage facilities and the level of planning is commensurate with the stage of the retrieval program. Early planning describes the approach to be followed and actions to be taken to initiate waste retrieval. Later planning includes the specific activity-based plans that are necessary to support actual waste retrieval. Compliance also is demonstrated by site personnel having collected and compiled information about the storage facility and waste to be retrieved. In addition, the plans and procedures for waste retrieval should reflect consideration of the information compiled about the facility, containers, and waste to be retrieved.

Supplemental References: None.

III. 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.

Objective:

The objective of this requirement is to emphasize that transuranic waste must be treated as necessary to meet the waste acceptance requirements of the storage, or disposal facility or facilities to which it will be transferred.

Discussion:

During the development of DOE O 435.1 and DOE M 435.1-1, treatment of waste was identified as an activity that presented potential risks to the public, workers, and the environment. Requirements that address the weaknesses and conditions that could lead to potential adverse impacts were found in external regulations (e.g., *Clean Air Act* or *RCRA*) or other DOE directives (e.g., 10 CFR Part 835, *Occupational Radiation Protection* or DOE O 360.1, *Training*). The Field Element Manager has a performance-oriented responsibility for ensuring that waste treatment is protective of the public, workers, and the environment (DOE M 435.1-1, Section I.2.F.(14)). The current requirement focuses attention on taking the treatment actions necessary to make waste acceptable for subsequent waste management steps.

The decision to treat waste, i.e., changing the physical or chemical character of the waste, can be driven by either dictated requirements or programmatic needs. Required treatment includes treatment necessary to comply with external regulations (e.g., RCRA, FFCA) or to render waste acceptable for transfer to another facility (i.e., to meet waste acceptance requirements). Waste acceptance requirements for a facility to which transuranic waste is transferred are required by DOE M 435.1-1, Section III.G. These requirements are based on safe handling of the waste and on regulatory compliance. During the development of DOE M 435.1, certain materials which represented a potential fire or explosion hazard were identified as being unacceptable for storage, leading to the need to treat waste composed of these materials so it can be accepted for storage. Waste treatment may range from actions as simple as sorting waste to remove materials which would make the waste unacceptable (e.g., aerosol cans), to more complex technologies such as incineration.

Storage Prohibitions. Manual requirements for transuranic waste storage include classes of items which are prohibited from storage because they represent potential fire or explosive hazards. The materials or classes of items which cannot be stored include dry nitrate-contaminated ion exchange resins, cellulosic material contaminated with strong oxidizers, reactive metals, pyrophoric materials, and volatile organics in high temperature areas. Wastes containing the above-listed materials must be treated to remove or counteract the potential hazard. Nitrate-contaminated ion exchange resins can be stored wet or stabilized so they cannot react. Cellulosic materials can be oxidized under controlled conditions or the oxidizers can be neutralized. Reactive metals and pyrophoric materials can either be oxidized or stabilized (e.g., in concrete) to remove their hazards. Similarly, waste contaminated with volatile organics can be oxidized if it necessary to store the waste in an area of high heat.

Waste with No Path to Disposal. Available treatment options need to be evaluated before a waste is categorized as having no path to disposal, as discussed in Section I.2.F.(19). Application of appropriate treatment can potentially resolve waste acceptance issues for waste types such as:

- heterogenous wastes which contain unacceptable items (e.g., pressurized containers);
- liquid wastes which can be absorbed or solidified;
- wastes classified for security reasons because of shape;
- wastes containing high explosives; and
- wastes containing in excess of 50 ppm polychlorinated biphenyls.

Example: An activity generates an aqueous transuranic waste. In order to make the waste acceptable for storage and eventual disposal at WIPP, a study is performed to determine the most appropriate means of treatment. On the basis of the study, the liquid waste is solidified with an appropriate solidification agent so that the waste meets the acceptance criteria of both the storage facility and WIPP.

For defense waste, WIPP is the disposal facility, so evaluations of needed treatment generally need to consider the waste acceptance requirements of WIPP. However, there are some transuranic wastes for which treatment either is not currently available or will not solve the problem that makes the waste unacceptable for disposal at WIPP (e.g., non-defense waste). Such waste needs to be treated to the waste acceptance requirements of the storage facility to which it will be sent to ensure that it remains safe during the protracted storage period that will be required before disposal issues can be resolved.

Mixed Transuranic Waste. Treatment necessary to comply with agreements reached pursuant to the *Federal Facility Compliance Act of 1992* must also be considered in making treatment decisions. Although it was generally assumed that mixed transuranic waste would be sent to WIPP without treating for the RCRA-regulated component, site personnel need to ensure that commitments made in the Site Treatment Plans and consent orders/agreements are met for both current and newly-generated transuranic wastes.

Treatment for Programmatic Reasons. The requirement to treat waste to meet the waste acceptance criteria of the appropriate storage or disposal facility is not intended to prohibit treatment for other reasons. Waste managers may elect to treat waste for programmatic reasons, but in so doing, must ensure that the waste will still meet the waste acceptance criteria of the facility(ies) to which it will be transferred. Programmatic reasons for treating waste may be to make more efficient use of the TRUPACT II transportation system and thereby reduce risk and cost associated with transportation to WIPP (see Section III.L.(2)), or to decrease the storage or disposal capacity needed.

> *Example: A site is generating significant amounts of compactable transuranic waste. Due to the time expected to pass before shipment to WIPP begins, waste projections indicate that additional onsite storage will be needed to accommodate the as-generated waste volumes. Results of a study indicate that use of a compactor will allow the site to store the projected wastes without building a new storage facility, and will also result in transportation cost savings because fewer TRUPACT II shipments to WIPP will be needed.*

Compliance with this requirement is demonstrated by the custodian of transuranic waste maintaining documentation which identifies the plans for treating waste, and maintaining the records that show waste was treated, if necessary, to meet the waste acceptance requirements of the storage or disposal facility to which it was transferred.

Supplemental References:

1. *Resource Conservation and Recovery Act of 1976,* as amended, October 21, 1986.

2. *Federal Facility Compliance Act of 1992,* as amended, October 6, 1992.

3. *Toxic Substances Control Act*, as amended, , October 11, 1976.

4. DOE, 1996. *Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 5, DOE/WIPP-069, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, NM, April 1996.

III. 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*.

Objective:

The objective of this requirement is to ensure transuranic waste is disposed of in a facility that meets the appropriate regulatory requirements and to establish Headquarters as the DOE authority for making compliance determinations for transuranic waste disposal facilities other than WIPP.

Discussion:

Responsibility for actions associated with transuranic waste disposal are addressed in the *Radioactive Waste Management Manual.* In DOE M 435.1-1, Section I.2.E., the Deputy Assistant Secretary is assigned responsibility for reviewing and approving certain transuranic waste disposal facility performance assessments. Paragraphs included in this portion of guidance explain the cases in which this applies. As discussed in DOE M 435.1-1, Section I.2.F.(15), the Field Element Manager of a site with a transuranic waste disposal facility is responsible for ensuring the safe disposal of transuranic waste, for reviewing performance assessments prior to submitting them to Headquarters, and for maintaining performance assessments.

Starting in the 1970s, the Department began storing waste that was suspected of being contaminated with transuranic isotopes at a concentration greater than 10 nCi per gram of waste. The concentration of 10 nCi/g (370 Bq/g) was an interim limit used pending completion of a technical basis for developing a limit. In 1982, the technical analyses for establishing a limit were discussed at an interagency workshop and the limit was changed to 100 nCi/g (3,700 Bq/g). Shortly after this workshop, the Environmental Protection Agency (EPA) proposed standards which included the 100 nCi/g limit for management and disposal of transuranic waste.

The EPA is responsible for developing generally applicable standards for protection of the environment from radioactive materials pursuant to authority granted by *Atomic Energy Act of 1954*, as amended, and the *Nuclear Waste Policy Act of 1982*, as amended. In 1985, the draft standards EPA proposed in 1982 were promulgated as the *Environmental Standards for the Management and Disposal of Spent Fuel, High-Level and Transuranic Radioactive Wastes*, 40 CFR Part 191. In 1987, the U.S. Court of Appeals for the First Circuit remanded Subpart B of the 1985 standards, "Environmental Standards for Disposal," for further consideration (*Natural Resources Defense Council, Inc.* v. *United States Environmental Protection Agency*, 824 F.2d 1258). In 1992, Congress reinstated a portion of the remanded disposal standards with the passage of the *Waste Isolation Pilot Plant Land Withdrawal Act of 1992,* as amended. Congress also directed EPA to resolve the issues that were the basis for the court remand and reissue the remaining disposal standards. On December 20, 1993, EPA issued the revised sections of the requirements. They became effective on January 19, 1994 (*58 FR 66398*).

<u>Requirements Applicable to Disposal</u>. The bulk of DOE's transuranic waste is related to defense activities and will ultimately be acceptable for disposal at WIPP. Consistent with this fact, most of the Department's focus on transuranic waste disposal has been on the development and opening of WIPP consistent with the requirements of 40 CFR Part 191. For WIPP, and any future facilities if they are developed, the requirements of 40 CFR Part 191 apply, including the revised individual protection and groundwater protection standards.

> *Example: A site determines that it must construct an enhanced engineered disposal facility for a small amount of transuranic waste that cannot be made to meet the WIPP waste acceptance criteria. Since the facility will operate after January 1994, it must comply with the January 1994 revisions to 40 CFR Part 191.*

However, for transuranic waste disposal facilities subject to 40 CFR Part 191 that operated prior to the January 1994 effective date, the older (1985) standards apply. In the Supplementary Information published in the 1993 Federal Register promulgating the revisions to the rule, EPA acknowledges that it previously informed the Department that the 1985 version of 40 CFR Part 191 applied to the Greater Confinement Disposal Facility (Nevada Test Site). The EPA further states that this determination is not changed by the *WIPP Land Withdrawal Act of 1992*, as amended, or the issuance of the revised regulation.

Departmental personnel should also note that the 40 CFR Part 191 regulations do not apply to disposal that occurred prior to promulgation of the regulations. The 1985 version of the regulations states under the applicability section of Subpart B, "Environmental Standards for Disposal," that the standards do not apply to waste disposed prior to the effective date of the rule. This excludes from the regulations waste that is colloquially known as "pre-1970 TRU waste", "suspect buried transuranic waste", and possibly by other names, if the waste is left in place. If the waste is exhumed, the waste becomes subject to the currently applicable regulations. However, as a good management practice, it is recommended that waste meeting the current definition of transuranic waste that was disposed of after 1970, but before 1994, be evaluated in accordance with the 1985 regulations.

> *Example: A site was in the middle of a three-year campaign to dispose of transuranic waste at the time 40 CFR Part 191 was promulgated in 1985. Consequently, some of the waste was disposed of before the effective date of the regulation and some was disposed of after. The site manager decides to include all of the transuranic waste in the performance assessment prepared under 40 CFR Part 191. Because the operation ended*

prior to 1994, the 1985 version of the regulations are applied as the performance measures in the assessment.

Approval Authority. Determination of compliance with the requirements of 40 CFR Part 191 depends on the facility being considered. In the *WIPP Land Withdrawal Act of 1992*, as amended, Congress assigned EPA the responsibility for issuing the standards discussed above and for certifying that WIPP meets the standards. In carrying out this responsibility, the EPA issued criteria by which they would evaluate the DOE certification application and published them as 40 CFR Part 194, *Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations; Final Rule*. The Department is responsible for submitting an application for compliance certification to the EPA. Subsequently, the EPA must determine if the Department complies with the requirements.

Sites other than WIPP are "regulated" by the implementing agency, in this case, DOE. As discussed in the General Requirements chapter of the *Radioactive Waste Management Manual* (DOE M 435.1-1, Section I.2.F.(15)), the Field Element Manager is responsible for reviewing and submitting a performance assessment to Headquarters. The Headquarters Deputy Assistant Secretary for Waste Management will establish a process similar to that used for low-level waste disposal facilities for reviewing and approving performance assessments, and also considers the following:

- General provisions including purpose, scope, definitions, communications, conditions of compliance, and alternative provisions;

- Compliance determinations including completeness and accuracy of compliance submissions and reference materials;

- General requirements that address inspections, quality assurance, models and computer codes, waste characterization, future state assumptions, expert judgment, and peer review;

- Containment requirements considering application of release limits, scope of performance assessments, consideration of drilling events in performance assessments, and results of performance assessments;

- Assurance requirements including active and passive institutional controls, monitoring, engineered barriers, and consideration of natural resources; and

- Individual and groundwater protection requirements that consider the protected individual, exposure pathways, underground sources of drinking water, and the scope and results of the performance assessment.

Example: The manager of a site that disposed of a small amount of transuranic waste ensures the development of a performance assessment that provides a reasonable expectation of meeting the performance measures in 40 CFR Part 191 for the onsite facility. Since the facility is not WIPP, following his review, the site manager submits the performance assessment to Headquarters for approval. The Deputy Assistant Secretary for Waste Management has previously assigned this task to a team that has developed a review plan that documents the criteria to be used. The team proceeds with the review and provides a recommendation back to the Deputy Assistant Manager who makes a final determination and documents it in a memorandum to the site manager.

Compliance with this requirement is demonstrated by timely completion of a technically-acceptable performance assessment that projects compliance with the standards contained in the appropriate version of 40 CFR Part 191 as discussed above. Another aspect of acceptable performance relative to this requirement is development and implementation of a review process that results in completing the compliance determination within one year of Headquarters' receipt of the performance assessment.

Supplemental References:

1. EPA, 1985. "Final Rule, 40 CFR Part 191, Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," *Federal Register*, Vol. 50, No. 182, U.S. Environmental Protection Agency, Washington, D.C., September 19, 1985.

2. EPA, 1993. "Final Rule, 40 CFR Part 191, Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes," *Federal Register*, Vol. 58, No. 242, U.S. Environmental Protection Agency, Washington, D.C., December 20, 1993.

3. EPA, 1996. "40 CFR Part 194, Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations," *Federal Register*, Vol. 61, No. 28, U.S. Environmental Protection Agency, Washington, D.C., February 9, 1996.

4. EPA, 1996. *Compliance Application Guidance for 40 CFR Part 194*, EPA 402-R-95-014, U.S. Environmental Protection Agency, Washington, D.C., March 29, 1996.

5. *Waste Isolation Pilot Plant Land Withdrawal Act of 1992*, as amended, October 30, 1992.

6. *Nuclear Waste Policy Act of 1982,* as amended, January 7, 1983.

7. *Atomic Energy Act of 1954*, as amended, 42 U.S.C. 2011 et seq, 1954.

III. 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.

Objective:

The objective of this requirement is to specify minimum parameters for which information will be routinely collected and analyzed for the purpose of anticipating or identifying undesirable conditions in the management of transuranic waste.

Discussion:

During the development of DOE O 435.1 and DOE M 435.1-1, the hazards and safety analyses identified timely monitoring of radioactive waste management facilities as an effective means of mitigating numerous weaknesses and conditions associated with all phases in the life cycle of waste management. An analysis of existing Departmental requirements for environmental monitoring in DOE 5400.1 and DOE 5400.5 found that they were applicable to all radioactive waste types and all radioactive waste management facilities. Many of the individual conditions evaluated in the safety and hazards analysis which warranted monitoring are already addressed due to implementation of these Order requirements. These two DOE Orders are invoked by DOE M 435.1-1, Section I.1.E.(7).

However, while the general environmental monitoring program and the environmental monitoring plans mandated by DOE 5400.1 and DOE 5400.5 are adequate for most circumstances, requirements have been included in DOE M 435.1-1 to require identification of specific warning signs of impending conditions that could lead to releases, especially for storage of liquid transuranic waste. Requirements III.Q.(1) and III.Q.(2) address these aspects of additional monitoring for transuranic waste facilities.

Parameters Specified. The minimum parameters specified in the requirement (temperature, pressure, radioactivity in effluents, flammable/explosive mixtures of gases) were selected based on their potential significance in predicting and identifying undesirable conditions. Each facility's radioactive waste management basis should include an evaluation of the applicability and significance of the minimum parameters. This evaluation also needs to consider additional parameters to be sampled or monitored to ensure the protection of the public health, the environment, and the workers. If a minimum parameter specified in the requirement is deemed to be not applicable in any way to the active operation of that facility, then that justification should be included in the radioactive waste management basis and when approved, constitutes an exemption to the Manual.

The parameters need to be sampled or monitored with a frequency that is consistent with the need to detect changes in facility performance. The accuracy and precision of measurement required is dictated by the expected variations in the parameters and the level of accuracy and precision needed to identify problems. The monitoring frequency for specific parameters is likewise determined based on the possible time variation of the parameter and the response time required to take mitigating action. For facilities that release radioactivity in effluents, frequent monitoring or continuous monitoring should be considered.

> *Example: A tank is used to store liquid transuranic waste. In evaluating the potential for releases from the tank, it is determined that waste temperature, head space pressure, and radioactivity in the ventilation exhaust must be continuously monitored. An organics sniffer is used on a weekly basis to check for flammable/explosive mixtures of gases in the tank. There are no liquid effluents, so no sampling or monitoring is required.*

The verification that controls and systems are functioning properly is based upon the nature of the transuranic waste management activity and the potential impact resulting from a failure. Verification of active control systems for sampling and monitoring critical facility parameters may require frequent visual inspections or performance testing. Passive controls such as the floor and curbing in a storage facility may only require physical inspection once every year. Verification activities are part of the radioactive waste management basis and are to be documented appropriately.

All transuranic waste management facilities are required to apply the sampling or monitoring requirement for the specified parameters using a graded approach. As previously noted, the methods used and the frequency should be commensurate with the significance of a change in the parameter. This graded approach can extend to determining that it is inappropriate or unnecessary to monitor or sample for specific parameters, but the basis for such a determination needs to be documented.

> *Example: A building is used for the storage of packaged transuranic waste. Based on the auditable safety analysis, sampling and monitoring for the minimum specified parameters are applied in a graded manner depending on the parameter. The facility ventilation system is equipped with a continuous monitor and a sampler. Radioactivity in liquid effluent and pressure are not monitored or sampled because the parameters do not apply to the facility. The inspection procedures for the facility specify that personnel should note whether the temperature in the building is within a range of 55 to 85 degrees*

Fahrenheit. In addition, procedures require personnel to record visual observations of the drums, including whether there is any bulging that indicates pressurization.

Compliance with this requirement is demonstrated if monitoring or sampling for the stated parameters is performed for all facilities with an accuracy, precision, and frequency consistent with timely identification of developing problems and a justification exists in the approved radioactive waste management basis for those specified parameters which are not monitored or sampled.

Supplemental References:

1. DOE, 1988. *General Environmental Protection Program,* DOE 5400.1, U.S. Department of Energy, Washington, D.C., November 9, 1988.

2. DOE, 1990. *Radiation Protection of the Public and the Environmental,* DOE 5400.5, U.S. Department of Energy, Washington, D.C., February 8, 1990.

III. Q.(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.

Objective:

The objective of this requirement is to ensure that the results of safety analyses performed as part of the authorization of transuranic waste facility operations are appropriately translated into monitoring requirements for waste storage so conditions that could lead to exposure of the public or workers, or releases to the environment are detected and mitigated.

Discussion:

During the development of DOE O 435.1 and DOE M 435.1-1, monitoring at radioactive waste management facilities was identified as an effective mitigation of numerous weaknesses and conditions associated with all phases of the life-cycle of waste management. An analysis of existing Departmental requirements for environmental monitoring in DOE 5400.1 and DOE 5400.5 found that they were applicable to all radioactive waste types and all radioactive waste management facilities. Many of the individual conditions that warranted monitoring that were evaluated in the safety and hazards analysis are mitigated due to the implementation of these Order requirements. Therefore, DOE M 435.1-1, Section I.1.E.(7) requires that these two DOE Orders be implemented for environmental monitoring of radioactive waste management facilities.

While the environmental monitoring mandated by DOE 5400.1 and DOE 5400.5 is adequate to detect environmental releases, it was determined that due to the long storage times that occur with transuranic waste, monitoring of additional systems or parameters was needed. The DOE regulation governing radiation exposure of workers (10 CFR Part 835), was also identified as a source of requirements that would require that a set of controls be put in place to protect workers from radiation exposure.

> *Example: Transuranic waste is stored in a building which contains a change room used by waste management workers. Access to the change room requires workers to pass through the area where the waste is stored. The health physics staff takes dose rate readings along the face of the stored transuranic waste, then cordons off a radiological control area that minimizes exposure to staff that must pass through the building.*

Additional systems or parameters that could warn of impending conditions that could lead to worker exposure or releases to the environment may be indicated in the safety analyses performed for transuranic waste management facilities. Some of the monitoring that safety analyses indicate is needed may be also addressed minimum requirements in the other subparagraphs of this monitoring requirement.

The *Nuclear Safety Analysis Reports* Order (DOE 5480.23) and related standards (DOE-STD-3009-93, DOE-STD-1027-92, DOE-EM-STD-5502-04) and the *Facility Safety* Order (DOE O 420.1) provide information on the hazard categorization of facilities and the safety analyses to be performed. Through the conduct of safety analyses, whether they are formal safety analysis reports or auditable safety analyses, facility personnel identify the quantity and form of radioactive and/or hazardous material to be handled at the facility and the operations for managing the waste. The safety analysis establishes a basis for defining the acceptable operations envelope for the facility, and provides the basis for technical safety requirements (TSRs). The technical safety requirements may include requirements for monitoring, however, facility personnel are to also review the safety analysis to determine if the analyses indicate other monitoring that would be prudent.

> *Example: An auditable safety analysis is performed as part of the startup of a transuranic waste storage facility. The safety analysis indicates that a monitoring and sampling system is required on the building exhaust system to ensure releases do not endanger workers, the public, or the environment. Site personnel decided that alpha monitors will be installed in the waste storage bays, in addition to the monitor that is on the building ventilation system, consistent with the defense-in-depth philosophy.*

The safety analyses may also indicate the need for routine inspection of waste packages in storage. Inspections to be performed on waste packages in storage are addressed by DOE M 435.1-1, Section III.N and are discussed in the guidance for that requirement.

Compliance with this requirement is demonstrated if the monitoring requirements in the facility procedures include, at a minimum, monitoring the systems and parameters as indicated by the safety analysis.

Supplemental References:

1. DOE, 1994. *DOE Limited Standard: Hazard Baseline Documentation*, DOE-EM-STD-5502-04, U.S. Department of Energy, Washington, D.C., August 1994.

2. DOE, 1992. *Nuclear Safety Analysis Reports*, DOE 5480.23, U.S. Department of Energy, Washington, D.C., April 10, 1992.

3. DOE, 1992. *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, DOE-STD-1027-92, U.S. Department of Energy, Washington, D.C., December 1992.

4. DOE, 1993. *SAR Preparation Guide*, DOE-STD-3009-93, U.S. Department of Energy, Washington, D.C., 1993.

III. Q.(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.

Objective:

The objective of this requirement is to ensure monitoring of parameters that indicate the quantity of liquid transuranic waste stored in tanks so that changes can be promptly checked to determine if they indicate leakage, overfilling, or other problems. The objective of this requirement also includes tracking of the chemical characteristics of the waste to anticipate and avert undesirable storage conditions.

Discussion:

This requirement specifies additional parameters to be monitored at facilities storing liquid transuranic waste. In developing the requirements for DOE O 435.1 and DOE M 435.1-1, a hazards analyses identified releases resulting from failed containment or from overfilling liquid waste storage tanks as hazards that can result in exposure of workers or the public and releases to the environment. The requirement addresses the operation of monitoring systems to detect storage tank or transfer equipment failure that is of sufficient magnitude to cause a detectable volume change, as well as volume increases that could lead to overfilling of tanks. The monitoring capability should be coupled with operational devices such as automatic shutoffs and bypasses and alarms that will alert operators that action is needed to prevent or mitigate a release. Regardless of the radiological hazard of the waste being stored, leak detection equipment and inspection of catch basins for liquid waste storage facilities should be included in the monitoring program, consistent with the requirements in DOE 5480.22, to prevent unplanned releases of liquid waste in storage.

Liquid Level or Waste Volume. Some changes in liquid level or waste volume can occur normally due to slight changes in temperature or pressure. This requirement addresses measuring liquid level or waste volume in a storage tank for the purpose of prompt detection of acute releases (releases that are detectable visually or by some other gross indicator) and more chronic releases that become apparent over a time frame of hours or days.

> *Example. A large diameter liquid transuranic waste storage tank includes a mechanical level indicator that is read and recorded daily. The level indicator remains stable for six months following the last addition of waste to the tank. The level indicator readings then begin to show a downward trend that totals two inches over a two week period. The level indicator change alerts operators of a potential problem that requires further investigation.*

Surface level is a relatively straightforward parameter to monitor for detection of leakage from a liquid waste storage system. In general, the surface level in a storage tank is an appropriate indicator of waste volume. However, operations and mechanisms that could change the volume in a tank must be considered to ensure all unexplainable level changes are investigated and to discount explainable level changes.

Gas generation and evaporation, as well as intentional additions to and removals from the storage tanks, must be accurately accounted for if the waste liquid level (or volume) is to be used to monitor for leakage. Also, consideration needs to be given to the separate monitoring of the liquid fraction and sludge or solid fraction present in the tank, if layering of the waste is present.

> *Example: In the tank in the example above, an unexpected chemical reaction generates gas that is trapped within the waste matrix or under a semipermeable layer of waste that retards percolation of the gas to the surface of the waste. Consequently, there is an increase in the surface level of the waste. Over time, the gas is released and the waste volume returns to its normal level. Although the change in liquid level in the tank did not appear to be a problem once the gas was released, the generation of gas is identified as an issue that needs further investigation.*

Chemical Characteristics. Experience with situations threatening confinement of liquid radioactive waste in storage tanks led to the part of the requirement focused on monitoring chemical characteristics. Chemical characteristics that are not compatible with the material of construction of waste tanks or transfer equipment often presage containment failure. The frequency of monitoring and the identification of significant tank chemistry parameters should be determined on a facility-, waste-, and tank-specific basis. A recommended program for monitoring and managing waste chemistry as it relates to tank corrosion is described in *Guidelines for Development of Structural Integrity Programs for DOE High-Level Waste Storage Tanks* (BNL-UC-406). Tank waste chemistry also is to be monitored for the potential generation of flammable or explosive gases. Once waste has been characterized and shown to be in essentially a steady state relative to gas generation, it is the addition of new waste that needs to be most closely watched. Selection of parameters is based on the need to protect the public health, the environment, and workers. Monitoring is performed to provide statistically valid information of the relevant tank chemistry and any detected changes in the chemistry of the tank.

> *Example: Some very minor volumes of laboratory spill waste are planned to be added to liquid storage tank YTR. Tank YTR is made of carbon steel and has been in service since 1978. The pH of the spill waste is measured, then adjusted to a pH of 12 to meet the waste acceptance requirements for waste transfers to the tank. The pH testing of the waste is part of the routine monitoring for tank YTR.*

Graded Approach. A graded approach needs to be applied to implementation of this requirement for monitoring liquid wastes in storage. The first consideration for a graded approach is that monitoring parameters and frequencies for liquid waste storage tanks should be specific for each tank. Also, the frequency of monitoring is selected to detect changes commensurate with the potential failure mechanisms and resulting risks of the specific waste being stored.

> *Example: A highly radioactive acidic waste is stored in a stainless steel tank. The tank is at capacity so no waste additions are planned. Monitoring consists of a permanently installed liquid level detector and monthly monitoring of tank pH and chlorine compounds which could cause corrosion. Another tank constructed of carbon steel is routinely used for receipt of new waste. In addition to monitoring the liquid level in the tank and tracking additions and removals, the tank chemistry is checked weekly for pH to ensure that the waste is maintained at a high pH.*

Compliance with this requirement is demonstrated by developing operational procedures for monitoring liquid transuranic waste storage tank liquid level, waste volume, and tank chemistry so that waste volume or chemistry changes are detected in a time frame that will allow implementation of corrective measures to limit public and worker doses and to mitigate unplanned releases of stored liquid waste.

Supplemental References:

1. DOE, 1992. *DOE Fundamentals Handbook, Chemistry*, DOE-HDBK-1015, Module 2: "Corrosion," U.S. Department of Energy, Washington, D.C., June 1992.

2. DOE, 1993. *DOE Fundamentals Handbook, Material Science*, DOE-HDBK-1017, Module 2: "Properties of Metals," U.S. Department of Energy, Washington, D.C., January 1993.

3. DOE, 1997. *Guidelines for Development of Structural Integrity Programs for DOE High-Level Waste Storage Tanks*, BNL-UC-406, Brookhaven National Laboratory, Upton, NY, January 1997.

4. DOE, 1992. *Technical Safety Requirements*, DOE 5480.22, U.S. Department of Energy, Washington, D.C., February 25, 1992.

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