DEFENSE NUCLEAR FACILITIES SAFETY BOARD

February 3, 1994

MEMORANDUM FOR: George W. Cunningham, Technical Director

FROM: Davis Hurt

SUBJECT: Application of the Draft Plutonium Storage Standard to Building 707 Resumption - Rocky Flats

1. **Purpose:** The purpose of this memorandum is to bring to the Board's attention the fact that the proposed calcination operations in Building 707 at the Rocky Flats Plant will not comply with the terms of the standard. The memorandum explains the areas of non-compliance and discusses steps that could be taken to bring them into compliance. There are processing issues and container issues.

2. **Background:** The Department of Energy (DOE) has developed a draft standard on long-term storage of plutonium metals and oxides. (Our most current copy is attached to this memorandum.) As of this writing, the standard is still circulating within DOE; and is expected to be issued for public comment within a month. My colleagues and I have discussed the draft standard with many plutonium processing engineers from around the Complex. It appears that the standard in its present form enjoys considerable support, and final standard is expected to be very similar to the draft version.

3. **Discussion:**

   a. Processing Issues

      1. Temperature: The draft standard would require that thermal stabilization be conducted at 1,000°C. The Building 707 calciners will reach a maximum temperature of approximately 500°C. The staff discussed the possibility of reaching a higher temperature with Rocky Flats personnel. The Rocky Flats position is that the calciners were not designed to operate much above 500°C, and have never been operated much above 500°C. (At this point, the staff has not sought to confirm that assertion.) It is not obvious why the calciners could not be heated to 1,000°C, but there would clearly have to be a detailed evaluation of safety and operational issues involved, as well as testing at the higher temperature. Those activities would presumably delay resumption.

2. Hold Time: The draft standard would require that the peak temperature be maintained for 1 hour. The Building 707 calciners will not maintain their peak temperature for any specific time, and will normally begin cooling the material down as soon as the peak is reached. As with the basic temperature issue, evaluation and testing would be required to determine if the calciners could be safely held at 1,000°C for an hour.

3. Moisture: The draft standard would require that the stabilized oxide be cooled, handled, and packaged in an atmosphere having a moisture content of 100 ppm or less. The moisture content of the air in the Building 707 Module J glove boxes is not controlled or measured, and will certainly be much higher than 100 ppm. Only a few of the rooms or glove boxes in Building 707 ever had engineered moisture controls, and the tightest limit was about 600 ppm (in the pit assembly area). A significant amount of new equipment would probably have to be installed to meet this requirement, probably including not just dehumidifiers but new glove boxes that would prevent in-leakage of room air.

b. Container Issues: The container issues are academic unless the processing issues are addressed first. It would not be safe to put improperly processed oxide in containers that comply with the standard (hermetically sealed containers) because of the potential for gas generation and overpressurization. The Rocky Flats plan is to put the calcined plutonium oxide in a slip-lid can, tape the lid, remove the can from the glove box in a plastic bag by way of a bag-out port, put the bagged-out container in a second plastic bag, place the whole assembly in a second slip-lid can, and tape the lid. There are basically two container issues:

1. Sealing: The draft standard would basically require two nested, hermetically sealed, leak-testable, plastic-free containers. The Rocky Flats plan is to use two slip-lid cans. The standard would allow a lower-grade container (not leak-testable or hermetically sealed, for example) to serve as an innermost container if it were overpacked with two qualified containers. But even the lower-grade container would have to be "sealed", which would seem to disqualify the slip-lid cans. For overpacking to be a viable option, Rocky Flats would have to use a sealed container, such as a screw-lid can or food-pack can.

   It is possible that Rocky Flats does not possess containers that would qualify as one of the two hermetically sealed containers called for by the standard. For all practical purposes, a qualified container would have to be welded shut or have a bolted lid with a metal gasket. Rocky Flats sometimes uses bolted-lid "pressure cookers" to provide air-tight storage, but they normally have an elastomer gasket, which would disqualify them. It is probably possible to fit the pressure cookers with a metal gasket, but Rocky Flats may not have enough pressure cookers to accommodate all of the stabilized oxide. And they may not have enough storage space in the vaults to accommodate so many pressure cookers, which are much larger than the outer slip-lid cans.

2. Plastic: Even if a qualified, sealed container could be used in Building 707, there is the question of how to get the container out of the glove boxes without using plastic bags. Any container handled in the glove boxes will presumably get contaminated with loose plutonium oxide. The draft standard would not allow organic material of any kind in any of the containers, so the bag-out methods used at Rocky Flats for contamination control would create a problem. It would not be allowable to directly overpack a bagged-out container with a qualified container even if the bagged-out container itself were sealed and otherwise acceptable.

   Once such a container is bagged out, it would eventually have to be bagged back into the glove boxes for decontamination and removal by other means. There are two downdraft tables in Building 707 for removing items from the glove boxes without plastic bags, but the tables are not located in Module J, and there is no provision at present for decontaminating the outside of the containers anyway.

c. Options:

There are two possible courses of action: postpone processing until all terms of the standard can be complied with, or proceed according to plan, recognizing that the product will not be qualified for long-term storage. Each course of action has some disadvantages.

Postponing processing means living with the risks posed by the duct residues and other potentially unstable plutonium oxides for some additional time. How long is hard to predict. As discussed above, some fairly major changes in apparatus and infrastructure would be required to comply with the standard. At some sites, it would probably be possible to add the necessary new equipment and develop new procedures within a few months. Recent history suggests that it would take far longer at Rocky Flats, possibly several years. As a generality, the staff has advocated faster action at Rocky Flats to stabilize plutonium in storage. Even though the duct residues and impure oxides are not among the most dangerous materials in storage, and even though the start-up of the Building 707 calciners is only a small step toward stabilizing the total inventory of impure oxides, it is the only significant step on offer for the near future.

The disadvantages of proceeding with the current plan are of two sorts. The more tangible problem is that the material will definitely have to be re-processed later, with all of the negative consequences that implies in terms of radiation exposure, risk of accidents, and contribution to site effluents. When the Board considered Building 707 resumption last year, the draft standard did not exist, and it was possible to hope that the calciner product would be compatible with future long-term storage standards (although many people had doubts). It is no longer possible to hope that. The less tangible, but no less important, problem with proceeding is the bad example it sets. The first plutonium processing activity at Rocky Flats since the 1989 shutdown will not comply with an important and directly applicable new standard.

Attachment:
Department of Energy Criteria for Storage of Plutonium Metals and Oxides (Draft), January 12, 1994

ATTACHMENT

DEPARTMENT OF ENERGY
CRITERIA
FOR
STORAGE OF PLUTONIUM METALS AND OXIDES

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January 12, 1994

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Forward

The end of the Cold War and the new arms control agreement is leading to the retirement of large numbers of weapons and an excess of plutonium that will require long-term management. Plutonium storage practices at Department of Energy (DOE) facilities evolved over decades of programmatic need to support nuclear weapons development and production. These storage practices reflected a desire to maintain plutonium in metal form for prompt recycling into weapons components. Prior to the end of the Cold War, weapons plutonium was always either in-process or in-use. Safety requirements and procedures governing plutonium storage were primarily for the short term, not for long term storage.

This standard establishes explicit safety criteria for long-term storage of plutonium metal and plutonium oxide at DOE facilities. The facilities may need to repackage the stored plutonium to meet these changed criteria. Materials packaged to the long-term criteria should not need subsequent repackaging (or reconfiguration), and should assure safe storage of plutonium for at least 50 years or until final disposition for the plutonium becomes available.

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The following authors contributed to this document:

Randy Bigler, Westinghouse Savannah River Corp.
Dennis Brandt, Los Alamos National Laboratory
Lisa Chan, Department of Energy, Defense Programs
Dae Y. Chung, Department of Energy, Defense Programs
Donald T. Chung, SCIENTECH, Inc.
Thomas J. O'Connor, Department of Energy, Nuclear Safety
Raymond Cooperstein, Department of Energy, Defense Programs
Scott H. Davies, Rocky Flats (EG&G)
Richard J. (Jack) Erfurdt, Rocky Flats (EG&G)
Rowland E. Felt, Westinghouse Idaho Nuclear Company
Leonard W. Gray, Lawrence Livermore National Laboratory
John M. Haschke, Los Alamos National Laboratory
Joseph C. Martz, Los Alamos National Laboratory
David Michlewicz, Department of Energy, Defense Programs
Jofu Mishima, Science Applications International Inc.
David M. Pinkston, Science Applications International Inc.
Jerry Stakebake, Rocky Flats (EG&G)
Michael F. Stevens, Los Alamos National Laboratory
Joseph A. Teal, Westinghouse-Hanford
Alan K. Williams, Science Applications International Inc.
Warren Wood, Los Alamos National Laboratory

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1.0 Purpose and Scope

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1.1 Purpose:

This standard provides criteria for safe storage of plutonium for at least 50 years. These criteria provide for stable plutonium forms in containers that would survive normal storage and postulated accidental conditions. They should also minimize the need for additional handling during storage.

Surveillance, inspection and documentation requirements for the safe storage of plutonium are also identified.

1.2 Scope:

This standard addresses the safe storage of plutonium metal, selected alloys (e.g. gallium and aluminum alloys), and plutonium oxide that contains a minimum of 50 weight-percent plutonium. It does not address storage of sealed weapons components containing plutonium, or storage of liquids, residues, waste or material containing more than 3% plutonium-238 weight content. Safeguards and security considerations are also excluded from the scope of these criteria. The criteria in this guidance are subject to update and review as needed.

The nominal plutonium isotopic concentrations for various grades of plutonium are typically as follows:

	^{238}PU	^{239}PU	^{240}PU	^{241}PU	^{242}PU
Weapons Grade	0.01	93	6.0	0.75	0.01
Fuel Grade	0.1	86	12	1.6	0.2
Power Grade	1.0	62	22	12	3.0

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2.0 Definitions

ALARA - As low as reasonably achievable.

Alloy - A substance composed of two or more metals united by being fused and dissolved in each other when molten.

ANSI - American National Standards Institute.

Bagless Transfer Can - Bagless transfer can is an option for boundary container. (See Figure 1) A bagless transfer can may be placed directly into the primary containment vessel. It would be used to remove plutonium from a contaminated glove box enclosure without the use of any plastic bags or other organic or degradable material.

Boundary Container - This is a container that will be placed into the primary containment vessel and provides the inner-most barrier against contamination. (See Figure 1)

Complex 21 - The reconfigured, future nuclear weapons complex.

Conversion - An operation for changing material from one physical or chemical form, use, or purpose to another.

Data Base - A computerized listing of retrievable information for analysis and materials management. The data will serve to identify the location and characteristics of individual stored material containers for analysis and assessment of stored materials.

Design Basis Accident for Container - Any credible accident involving a container other than one initiated by natural phenomena external to the storage facility (e.g.,. drop, crush or fire, but not earthquake).

DOE - U.S. Department of Energy.

In-Process, In-Use Material - Material that is integral to the manufacturing or recycle processes involved with continuity of operations.

Loss on Ignition (LOI) - Percentage loss of weight associated with heating a specified quantity of material to a specified temperature and holding it for a specified time in a given condition.

Material Container - The inner container that is in contact with the stored material. (See Figure 1) This may either be the boundary container, or a container that resides inside the boundary container.

MC&A - Material Control and Accountability.

NFPA - National Fire Protection Association

Oxide - Plutonium compounds and /or mixtures which are stable in oxygen-containing atmospheres, contain at least 50 mass % plutonium. These compounds and/or mixtures consist primarily of plutonium dioxide but may contain minor fractions of other inorganic and plutonium compounds.

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Primary Containment Vessel - The storage container that is relied on to provide the outer containment boundary for long-term storage in a non-contaminated area. (See Figure 1) This vessel will also serve as the primary shipping container.

Process - To extract, separate, purify or fabricate a material by physical, chemical or mechanical means.

Residue - Excess process material or scrap from a manufacturing or purification operation which contains sufficient plutonium to not be classified as waste.

Stabilize - To convert a substance or material to a non-reactive/less reactive form.

Storage - Any method for safely maintaining items in a retrievable form for subsequent use.

Storage Facility - The building structure and other confinement systems that house the containers.

Thermal Stabilization - A process that exposes a plutonium material to high temperature in order to remove adsorbed moisture, gases and chemically bonded compounds. This is almost always done in an oxidizing environment such as air.

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3.0 Relevant Orders, Standards and Documents

DOE Order 5480.3, Safety Requirements for the Packaging and Transport of Hazardous Material, Hazardous Substances and Hazardous Waste, 7-9-85

DOE Order 5480.5, Safety of Nuclear Facilities, 9-23-85

DOE Order 5480.11, Radiation Protection for Occupational Workers, Change 3, 6-17-92

DOE Order 5480.23, Nuclear Safety Analysis Reports, 4-30-92

DOE Order 5660.1, Management of Nuclear Materials, 11-30-88

DOE Order 5633.4, Nuclear Materials Transactions: Documentation and Reporting, 2-9-86

DOE Order 6430.1A, General Design Criteria, 4-6-89

DOE EH-0256T, US DOE Radiation Control Manual, June, 1992

ANSI N14.5-1987. Standard for Radioactive Materials - Leakage Tests on Packages for Shipment, American National Standards Institute, Inc., New York, NY.

ANSI/ANS 16.5-1975 (reaffirmed 1987). Standard - Guide for Nuclear Criticality Safety in the Storage of Fissile Materials, American Nuclear Society, LaGrange Park, IL.

DOE/DP (Number to be provided) Assessment of Plutonium Storage Safety Issues at Department of Energy Facilities. (Date to be provided)

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4.0 Criteria

To minimize hazards to the workers, the public, and the environment associated with the storage of plutonium and its compounds, the following criteria are established. The bases for the criteria are provided in Appendix A.

4.1 Material Form

A. The stored plutonium materials shall be in metal or oxide form.

B. The forms shall be retrievable for possible future use.

C. The quantity of stored plutonium metal or oxide permitted per container shall be as close as possible to but not greater than 4.5 kg of plutonium.

D. Plutonium Metal

1) Stored metal pieces shall have a thickness greater than 1.0 mm or have a specific surface area less than 1 cm^2/g.

2) Plutonium metal shall be free of loose oxide.

3) Plutonium metal shall be packaged and stored in a dry (preferably mildly oxidizing) atmosphere.

E. Plutonium Oxide

1) Plutonium oxide shall be thermally stabilized (in an oxidizing atmosphere at an uniform powder temperature of 1,000 °C (1,832 °F) for 1 hour before cooling and packaging) prior to storage.

2) At the time of packaging, loss on ignition shall not exceed 0.5% by weight of the representative sample.

3) Following stabilization, oxide shall be cooled, handled, and packaged for storage in a dry atmosphere having a moisture content of 100 ppm or less.

4.2 Packaging

Packaging requirements for safe 50-year storage of plutonium calls for providing two protective barriers against the spread of contamination. Design of the barriers shall allow for inspection and surveillance. The barriers shall provide leak-tight seals. The space between the inner barrier and outer barrier shall be free of transferrable contamination. The inner barrier is the boundary container. The outer barrier is the primary containment vessel. Material containers that do not meet the criteria for boundary container will not be credited as a barrier. (See figure 1)

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4.2.1 Material Container

A Material container is any inner container that is in contact with the stored material. Any material container design has to be approved by DOE. Sealed material container may be packaged in a boundary container for long-term storage if it is free of all organic material such as plastic bags, organic coatings, and gaskets.

A material container may also be the boundary container if it meets the requirements for boundary container in Section in 4.2.2.

If a material container is not the boundary container, it must meet the following dimensional requirements for fitting into a boundary container.\

- Maximum outer diameter of 4-1/2" (11.4 cm)
- Maximum external height of 8-1/4" (21.0 cm)

4.2.2 Boundary Container

A boundary container fits directly in the primary containment vessel, and provides an inner barrier against contamination. Any boundary container design has to be approved by DOE. A boundary container must meet the following requirements:

A. Dimensional requirements to fit into a primary containment vessel, the dimension of a boundary container shall not exceed the following limits.
   - Maximum outer diameter of 4-3/4" (12.0 cm)
   - Maximum external height of 8-1/2" (21.6 cm)

B. The contents of each boundary container shall be marked on the exterior of the container and noted in the data base referred to in Section 4.6.

C. Boundary container for plutonium metal and oxide storage shall be designed to allow for ready retrieval of their contents.

D. Boundary containers for plutonium metal or oxide shall be free of all organic material such as plastic bags, organic coatings, and elastomeric gaskets.

E. Boundary containers for plutonium metal and oxide shall be of stainless steel or equivalent construction.

F. Boundary container shall be hermetically sealed and tested after initial fill to have a leak rate equal to or less than $1x10^{-7}$ standard cm^3 helium per second as defined in ANSI N14.5.

G. QA documentation of materials and packaging shall be provided for a boundary container.

H. The exterior of the boundary container shall be free of any transferable contamination.

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4.2.3 Primary Containment Vessel

Primary containment vessel is relied on to provide the outer containment barrier for safe long-term storage in a non-contaminated area. (See Figure 1) This vessel will also serve as the primary shipping container. DOE will provide the design for the standard primary containment vessel in FY 94. The primary containment vessel will meet the following requirements:

A. General requirements
- Storage container will be designed for dual use as a primary containment vessel for shipping and for long-term storage
- Maximum mass of fissile plutonium will be 4.5 Kg plutonium per storage container
- The storage container will be welded closed at the shipper site.
- Oxide or metal will be packaged in an inner boundary container meeting the requirements noted in Section 4.2.1 or 4.2.2.

B. Structural requirements
- Vessel meets the requirements of the ASME Boiler and Pressure Vessel Code
- Vessel capable of being reused after being opened one (1) time
- Minimum design life of 50 years with no routine maintenance
- Vessel fabricated of material to provide a corrosion resistant containment boundary
- Vessel shall meet DOT requirements for primary shipping container
- Vessel meets storage requirements after the following normal occurrences:
  * 122 cm (4 ft) drop
  * 61 cm (2 ft) crush with primary containment vessels interacting
  * vehicle vibration
  * handling shock
  * compression weight of 5 primary containment vessels
- Vessel remains leak tight as defined by ANSI N14.5 after the following one time abnormal occurrences:
  * 9 meter(30 ft) free drop
  * 9 meter(30 ft) crush with primary containment vessels interacting
  * vehicle crush as defined in the SAR
  * puncture as described in the SAR

C. Design temperature and pressure
- Primary containment vessel shall be designed for 35.2 Kg/sq cm (500 psig) internal pressure at 204 °C (400 °F)

D. Dimensional Requirements
- The oxide/metal primary containment vessel meets the following dimensional requirements
  * Maximum inside diameter of 13.3 cm (5-1/4")
  * Maximum outside diameter 15.2 cm (6")
  * Maximum external height of 43.2 cm (17") for vessel as a shipping container

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E. Packing requirements
- All packing material non-combustible per NFPA
- All packing material non-organic
- Steady state metal temperature not to exceed 100 °C (212 °F)
- Vessel loaded with an internal non-reactive atmosphere (to be specified)
- Primary containment vessel capable of holding 4.5 Kg (9.9 lb.) of Pu as oxide with 2.5 liters (153 in^3.)of free volume (free volume includes space interior to boundary and/or material containers)
- Vessel meets requirements of 10 CFR 71, 49 CFR 173 and DOE 5480.3

F. Containment requirements
- Provisions provided for purge and backfill
- Vessel can be resealed to original integrity after gas sampling operation is complete
- Nondestructive examination of resealed vessel is possible to determine integrity of resealed vessel
- Sealed vessel tests leak tight as defined by ANSI N14.5
- Vessel provided with all welded closures and ports

G. Other requirements
- Container design compatible with automatic handling equipment
- Bar codes for identification and accountability placed on container for manual or remote reading by robot or automated guided vehicle
- Bar codes that will remain readable for more than 50 years
- Surface of container uniform in color except for vision targets
- Vision targets have a permanent high contrast color relative to container
- Accessibility provided for in situ Material Control and Accountability measurements

4.3 Storage Facility

A. New storage facilities or modifications to existing storage facilities shall meet the requirements of DOE Order 6430.1A.

B. Current storage facilities shall be evaluated for compliance with DOE Order 6430.1A. A backfit analysis shall be performed to determine what upgrades may be necessary to the facilities for compliance with the Order.

4.4 Inspection and Surveillance

A. Inspection and surveillance procedures shall identify:

1) Prerequisites

2) Acceptance criteria

3) Specific instructions to ensure that rejected items are repackaged and reinspected for acceptance after identification.

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B. Inspections and surveillance shall be performed only by qualified individuals.

C. Formal methods and responsibilities shall be documented and maintained for independent review and evaluation.

D. Inspection of primary containment vessel shall be integrated with inspections for Material Control and Accountability (MC&A) to minimize container handling and attendant radiation exposure to levels as low as reasonably achievable (ALARA).

E. Surveillance testing frequency, container sampling size and item selection shall be established using a statistical approach to ensure primary containment vessel integrity is maintained with a high degree of confidence. Testing frequency should be adjusted to account for surveillance failures.

F. Initial container inspections shall be performed within a fixed time following container closure. Subsequent inspections and surveillance shall be performed within the established time frequencies.

G. Baseline container weight and outer diameter shall be recorded as references for checking weight changes and container distortion.

H. Surveillance testing shall include weighing, measuring outside diameter of primary containment vessel, and analysis of gas between the boundary container and the primary containment vessel.

I. Actions taken for inspection and surveillance failures should be in accordance with approved procedures and DOE reporting requirements.

4.5 Documentation:

A. A data base to serve as a master list of relevant information for the stored plutonium materials should be maintained.

B. The data base should contain as a minimum:

1) Material Characteristics - Identification of the following:
- form,
- quantity,
- material type in the material container or boundary container,
- source of stored material,
- specific process condition,
- date and condition of packaging,
- radiation field, and
- other pertinent information relative to the contents.

2) Type of inspection test performed, including equipment used and individuals performing inspections, and the dates of inspection.

3) Inspection results.

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C. A schedule should be maintained for safety surveillance testing which includes:

1) Test frequency and sample size identification;

2) Facility group responsible for performing each test;

3) Surveillance test results and individuals performing inspections.

D. Primary Containment Vessel - Information should include an individual identification code or number and data on container history (date of packing, weight, packing configuration, leak test results, results of periodic tests for integrity, and storage history).

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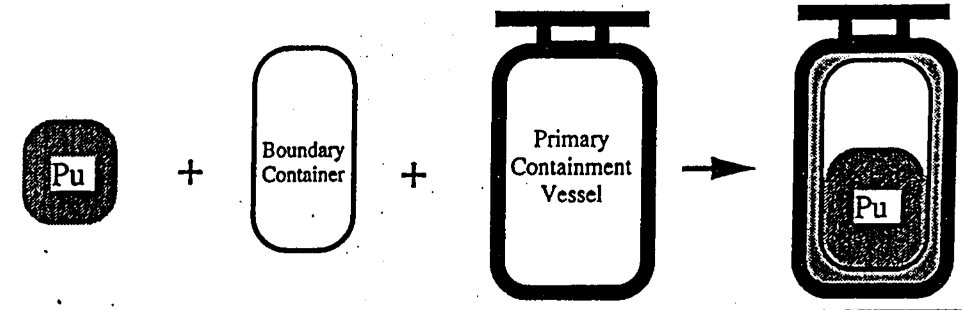
Figure 1. Packaging Options for 50-Year Storage

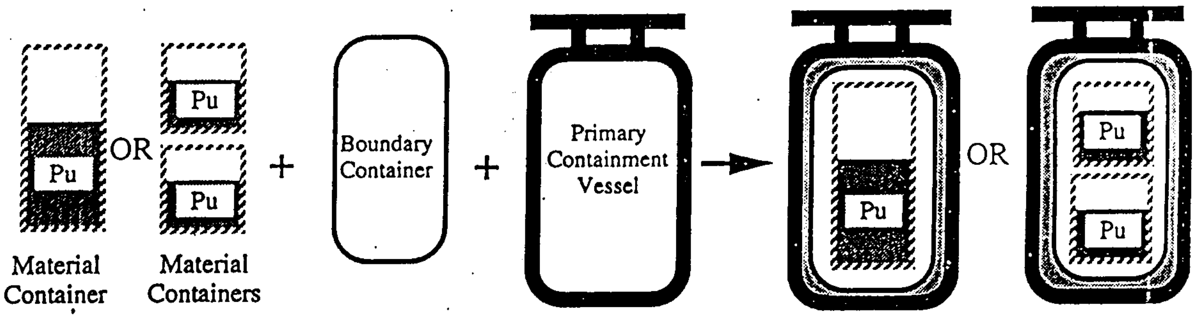
Option 1

Plutonium is loaded directly into boundary container. The boundary container is stored in the primary containment vessel.



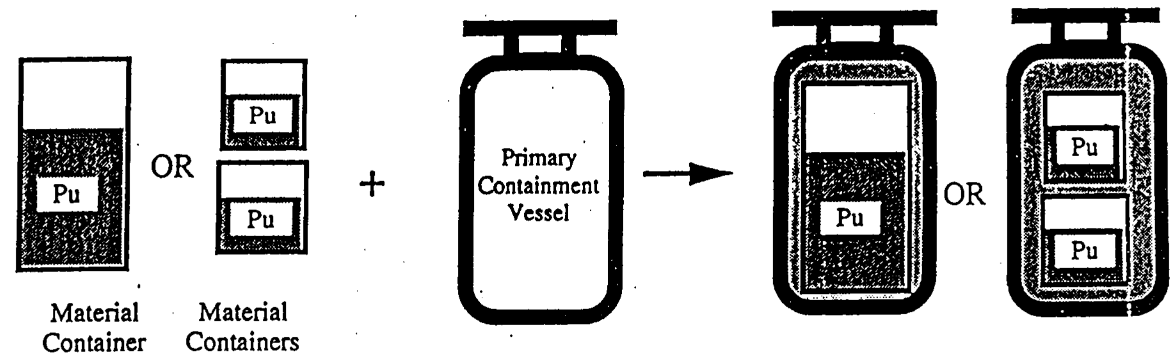
Option 2

Plutonium is packaged in a material container. The material container (or containers) does not meet the criteria for boundary container. Thus, the material container(s) is sealed in a boundary container. The boundary container is then stored in a primary containment vessel.



Option 3

Plutonium is packaged in a material container. The material container package meets the criteria for a boundary container. Thus, no additional boundary container is needed. The material container (or containers) is stored directly in a primary containment vessel.



Barrier provided by the primary containement vessel

Barrier provided by a boundary container

Barrier provided by a material container that does not qualify as a boundary container

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APPENDIX A

BASES FOR PLUTONIUM STORAGE CRITERIA

1.2 Scope

The 3% plutonium-238 is based on upper limit isotopic concentrations of plutonium-238 for weapons grade, fuel grade, and power grade plutonium. Higher concentrations of plutonium-238 present both radiation and heat removal problems.

Power grade plutonium containing higher concentrations of plutonium isotopes other than plutonium-239 is from the first irradiation of uranium fuel. It does not include recycle Mixed Oxide (MOX) fuel, since there are no reprocessing facilities operating in the United States.

The minimum 50 weight-percent value for plutonium oxides is based on analysis of the plutonium inventories throughout the DOE Complex. The majority of oxides are either rich (>70% Pu), or lean (<30% Pu). The 50% value is considered as a minimum value, per presentation of the Team Summary Report on the Complex-21 Plutonium Storage Facility Materials Identification and Acceptance Criteria (MIAC) at the Albuquerque, NM, workshop in May, 1993. Section I of the "Assessment of Plutonium Storage Safety Issues at Department of Energy Facilities" (Assessment Report) states that residues less than 50 mass % Pu are excluded.

4.1 Material Form

4.1.A Metal or oxide forms can be safely stored for long periods of time as discussed in the Assessment Report.

4.1.B Ultimate disposition of the stored plutonium is not known. If the plutonium materials are to be used in civilian applications, such as forreactor fuel, the material may require some processing before use. If the material is to be discarded, the criteria for discard requires development. Encapsulating plutonium in inert materials, such as by vitrification, is not considered in these criteria.

4.1.C Safety analyses per the 5480 series of DOE orders will dictate the batch size of plutonium in a given container.

4.1.D.1 The specified thickness or surface area is discussed in the Assessment Report, Section II.F, "Pyrophoricity" and Section V.B.1, "Chemical Reactivity."

4.1.D.2 The presence of an oxide layer on stored metal is not considered detrimental. Loose oxide may be removed from the metal by brushing prior to placement into a primary container.

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4.1.D.3 The Assessment Report, Section II.B, discusses reactions of plutonium metal with moisture. The reaction products result in degradation of the plutonium and creation of pyrophoric hydrides (see Section II.C of the Assessment Report) in the container.

4.1.E.1 The Assessment Report, Section II.B, states that temperatures up to 1,000 °C (1,832 °F)for one hour are necessary to remove adsorbed and chemically bound water.

4.1.E.2 The Assessment Report, Appendix C and Appendix D, provide calculations for determining loss on ignition values (LOI).

4.1.E.3 The Assessment Report, Section VI.B provides the permissible limit for storing qualified, stabilized oxides. Section VI.B provides a criterion of <100 ppm moisture for both oxide and metal handling and storage.

4.2 Packaging

4.2.2A The dimensional limits for the boundary container are based on the primary containment vessel design.

4.2.2B The contents of the primary container need to be identified both on the container and in the data base. Proper container identification is needed not only for storage safety, but also for Materials Control and Accountability.

4.2.2C Retrieval of plutonium either for Defense Programs use or disposal should not result in high personnel exposures caused by operator handling time.

4.2.2D The Assessment Report, Section II.D, discusses effects of plastics, hydrogenous compounds, and organic materials in storage of plutonium. Section IV.B provides the moisture limit for qualified, stabilized oxides. Long-term storage requires exclusion of all of these materials from the containers

4.2.2E Based on LANL experience and current evaluations in storing plutonium materials.

4.2.2F Leak testing of containers is necessary to ensure that moisture and other reactive vapors do not enter the primary container. The leak rate specified is found in Section VI.B of the Assessment Report. The ANSI N14.5-1987 standard states that the leak rate of transportation packages should not exceed $1x10^{-7}$cc per second. The less restrictive value for storage is based on container storage within a storage facility as defined in Section 2.0.

4.2.2G QA requirements to be developed.

4.2.2H Leak surveillance of boundary container requires that the space between the two barriers (exterior surface of the boundary container and the inner surface of the primary containment vessel) be free of contamination. Radioactive contamination in the space will be taken as an indication of boundry container leak.

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4.2.3 Primary Containment Vessel
TO BE ADDED

4.2.3A General requirements
TO BE ADDED

4.2.3B Structural requirements
TO BE ADDED

4.2.3C This requirement for storage based on a 0.5 % water content of the oxide.
TO BE ADDED

4.2.3D Dimensional Requirements
TO BE ADDED

4.2.3E Packing requirements
TO BE ADDED

4.2.3F Containment requirements
TO BE ADDED

4.2.3G Other requirements
TO BE ADDED

4.3 Storage Facility

4.3.A Basis is DOE Order 6430.1A

4.3.B Basis is DOE Order 6430.1A

4.4 Inspection/Surveillance

Items in this section are based on the NRC Inspection and Enforcement Manual, Inspection Procedures 61700, 61701, and 61725.

4.5 Documentation

Based on sound Records Management practices within the nuclear industry.

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