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PLUTONIUM FINISHING PLANT STABILIZATION ENVIRONMENTAL IMPACT STATEMENT RECORD OF DECISION

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DEPARTMENT OF ENERGY: Record of Decision for Plutonium Finishing Plant Stabilization Final Environmental Impact Statement, Hanford Site, Richland, Washington

AGENCY: U.S. Department of Energy

ACTION: Notice of Record of Decision

SUMMARY: The U.S. Department of Energy (DOE) has prepared this Record of Decision (ROD) pursuant to the Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] 1500-1508) and the DOE NEPA regulations (10 CFR 1021). The ROD is based on the analyses of environmental impacts identified in the Plutonium Finishing Plant Stabilization Final Environmental Impact Statement (DOE/EIS-0244-F); consideration of project costs; compliance requirements for systems involved in stabilizing plutonium-bearing material; and public and agency comments.

DOE has prepared the Final Environmental Impact Statement (EIS) to provide an objective technical basis for evaluating alternatives to: 1) convert the plutonium-bearing materials at the Plutonium Finishing Plant (PFP) Facility into a more stable, safer form; 2) reduce radiation exposure to PFP Facility workers; and 3) reduce the cost of maintaining the PFP Facility and its contents at the Hanford Site, Benton County, Washington. The actions evaluated in the Final EIS would stabilize PFP Facility materials that represent environmental, safety, or health vulnerabilities in their current condition. Existing vulnerabilities are the result of discontinuing nuclear material production and processing operations following the end of the Cold War. Although DOE has initiated programmatic environmental evaluations on the ultimate disposition of nuclear materials in the DOE complex which are now surplus to national defense requirements, the implementation of decisions regarding ultimate disposition will take several years. In the interim, DOE wants to eliminate vulnerabilities associated with certain current nuclear material storage configurations in order to protect the environment and the health and safety of workers and the public.

Reviews by DOE and the Defense Nuclear Facilities Safety Board (DNFSB) have identified environmental, safety, and health vulnerabilities associated with the continued storage of certain nuclear materials at the PFP Facility in their current location and physical condition. The Final EIS evaluates alternatives for managing these materials. In making the decisions announced in this ROD, DOE considered environmental and health impacts, costs, engineering feasibility, technology availability, and, to the greatest possible extent, stakeholder concerns and preferences.

After careful consideration of environmental impacts, costs, engineering evaluations, and public and agency comments, DOE has decided to implement a

select group of stabilization alternatives identified in the Final EIS. These include three out of four of the preferred stabilization alternatives supplemented by other stabilization and immobilization processes analyzed in the final EIS. DOE is documenting this determination in this ROD. The action will involve the removal of readily retrievable plutonium-bearing material in hold-up at the PFP Facility, and the stabilization of this and other plutonium-bearing material at the PFP Facility. Following stabilization, plutonium-bearing material will be in a form suitable for interim storage in existing vaults at the PFP Facility. Plutonium-bearing material having low plutonium content (less than 50 weight percent) and meeting criteria established by DOE may be immobilized through a cementation process at the PFP Facility. All immobilized material will be transferred to solid waste management facilities at the Hanford Site and, as a consequence, will be removed from safeguards control. In selecting these alternatives, DOE has identified the most suitable strategy for reducing the long-term risk to the public, workers, and the environment.

EFFECTIVE DATE: The actions set forth in this ROD are effective upon being made public on June 28, 1996, in accordance with DOE's NEPA implementation regulations (10 CFR 1021.315).

ADDRESSES: For further information on the stabilization of material at the PFP Facility or this ROD or to receive a copy of the Final EIS, please contact: Mr. Ben F. Burton, U.S. Department of Energy, Richland Operations Office, Attn: PFP-EIS, P.O. Box 550, MSIN B1-42, Richland, Washington 99352, (509) 946-3700.

For further information on DOE's NEPA process, please contact: Ms. Carol Borgstrom, Director, Office of NEPA Policy and Assistance (EH-42), U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, D.C. 20585, (202) 586-4600 or (800) 472-2756.

The ROD, Final EIS, and reference documents are available in the public reading rooms and libraries identified in the Federal Register Notice that announced the availability of the Final EIS (61 FR 26178) or by calling (509) 946-3700.

I. BACKGROUND

In 1943, the federal government selected the Hanford Site as part of the Manhattan Project to produce plutonium for national defense needs. Metallic uranium fuel was irradiated in nuclear reactors at the Hanford Site to produce plutonium. Chemical processing separated the irradiated plutonium from the other elements in the irradiated fuel. The product was plutonium nitrate, which needed further processing to produce the metallic form used in nuclear weapons. Initially, the plutonium nitrate was shipped offsite for this additional processing. The post-war construction of the PFP Facility at the Hanford Site's 200 West Area eliminated this necessity.

Located approximately 51 kilometers (32 miles) northwest of Richland, Washington, the PFP Facility includes production and recovery areas, laboratories for routine analysis and research, and secure vaults for storage

of plutonium. Currently, about 240 employees are physically located within the fenced area of the PFP Facility. Additional staff is located outside the fenceline, bringing the total number of employees to 592 people.

When PFP Facility production operations stopped in 1989, most of the processing residues remained either in storage containers or on surfaces in enclosed process areas as hold-up. DOE has recognized the need for a plan that would result in the:

- Stabilization of plutonium-bearing materials at the PFP Facility to a form suitable for interim storage;
- Removal of readily retrievable, plutonium-bearing materials left behind in process equipment, process areas, and air and liquid waste management systems as a result of historic uses; and
- Placement of stabilized fissile material in existing vaults at the PFP Facility for interim storage.

In June 1993, DOE announced its proposal to operate certain processes in the PFP Facility to stabilize plutonium-bearing materials and to prepare an Environmental Assessment (EA) pursuant to NEPA. As part of the NEPA process for the EA, DOE conducted public meetings in the summer and fall of 1993 to discuss the proposal to stabilize the plutonium-bearing materials. As a result of the public comments received, DOE decided that an EIS would be the appropriate level of NEPA review.

On October 27, 1994, a Notice of Intent was published in the Federal Register (59 FR 53969) that identified the purpose, scope, and preliminary alternatives for the Draft EIS and invited the public to participate in the scoping process. Public meetings on the EIS scope were conducted in six Washington and Oregon cities. The public scoping process ended on December 12, 1994. Both oral and written comments were received during the Draft EIS scoping process.

The Draft EIS (DOE/EIS-0244-D) was issued in November 1995. The Draft EIS presented alternatives that would achieve the purpose and need of the program and included analyses of the potential environmental impacts that would result.

On December 5, 1995, a Notice of Availability was published in the Federal Register (60 FR 62244) which formally announced the release and availability of the Draft EIS. The public hearing date, time, and location were also published and public comments on the Draft EIS were requested. A public meeting on the Draft EIS was held in Pasco, Washington, on January 11, 1996. While the comment period officially ended on January 23, 1996, DOE decided to accommodate comments received through February 15, 1996. Both oral and written comments were received during the comment period.

Based on existing and draft DOE policy on plutonium disposition, and a comment received during the public hearing, DOE decided to evaluate another alternative not contained in the Draft EIS. This alternative would involve

the immobilization of materials that have a low associated plutonium content and thus do not warrant stabilization measures and vault storage as do the other plutonium-bearing materials analyzed in this EIS. These materials would be immobilized through a cementation process, packaged, and transported to a Hanford Site solid waste management facility.

The plan to include this alternative in the Final EIS was announced in the Federal Register on May 2, 1996. The announcement also opened the alternative for public comment during a 21-day comment period. Comments received are considered in this ROD.

The Final EIS was issued in May 1996. In addition to the analysis presented in the Draft EIS, the Final EIS contained responses to comments received on the Draft. On May 24, 1996, a Notice of Availability was published in the Federal Register (61 FR 26178) which formally announced the release and availability of the Final EIS.

II. ALTERNATIVES EVALUATED IN EIS

Preferred Alternative: The plutonium-bearing materials at the PFP Facility can be separated into two categories: 1) materials that are stored in vaults or gloveboxes; and 2) materials referred to as hold-up. The preferred alternative identified in the Final EIS would involve the removal of readily retrievable plutonium-bearing material in hold-up and the stabilization of this and plutonium-bearing materials in vaults and gloveboxes.

The PFP Facility contains a variety of reactive plutonium-bearing materials that are chemically and physically dissimilar. These materials have been grouped into four inventory categories. The preferred alternative includes the following stabilization process for the four inventory groups:

1) Plutonium-bearing solutions
   - Ion exchange, vertical calcination, and thermal stabilization;

2) Oxides, fluorides, and process residues
   - Thermal stabilization using a continuous furnace;

3) Metals and alloys
   - Repackaging; and

4) Polycubes and combustibles
   - Pyrolysis.

The preferred alternative for stabilization would involve processing the plutonium-bearing materials at the PFP Facility into a form suitable for interim storage in existing PFP Facility vaults. When stabilized, the material would have minimal chemical reactivity and would remain in solid form with a low water and organic content.

The preferred alternative would also involve removing and stabilizing plutonium-bearing material currently in hold-up at the PFP Facility. Hold-up is material that has accumulated or been retained in PFP Facility gloveboxes,

hoods, process equipment, piping, exhaust and ventilation systems, and canyons as a result of 40 years of plutonium-processing operations at the Facility. The removal activities would be limited to substantive quantities of readily retrievable plutonium-bearing material currently in hold-up. Due to the nature and location of the material in hold-up, various technologies would be employed to remove the material for subsequent stabilization. The removal methods would include chemical and mechanical processes and disassembly. No exterior construction or major internal modification to the PFP Facility is planned for facility stabilization.

Alternatives: In addition to the preferred alternative, alternative stabilization processes and an immobilization process have been analyzed. These alternatives include:

- Plutonium-bearing solutions
  - Hydroxide precipitation followed by thermal stabilization;
- Oxides, fluorides, and process residues
  - Batch thermal stabilization using muffle furnaces and
  - Immobilization;
- Metals and alloys
  - Batch thermal stabilization using muffle furnaces; and
- Polycubes and combustibles
  - Batch thermal stabilization,
  - Molten salt oxidation, and
  - Immobilization.

No Action Alternative: Under the no action alternative, actions would be limited to ongoing maintenance and security activities necessary for safe and secure management of the PFP Facility. DOE would not install processes to stabilize the plutonium-bearing materials at the PFP Facility. However, plutonium-bearing materials stored in the PFP Facility vaults that constitute an immediate safety hazard would continue to be repackaged as necessary for interim storage. In addition, the DOE would not remove plutonium-bearing materials in hold-up at the PFP Facility. The plutonium-bearing materials would remain within or on PFP Facility systems.

III. ENVIRONMENTAL IMPACTS OF ALTERNATIVES

In the Final EIS, DOE evaluated each alternative to assess the full range of potential environmental impacts.

The impact analysis showed that there would be no measurable impacts to geology, seismology, and soils; water resources and hydrology; air quality; noise and sound levels; ecosystems; transportation; land use; or archaeological resources. No income or population group would experience disproportionate health or environmental effects under any of the alternatives. Environmental categories where potential impacts were identified include population and socioeconomics, historic resources, and anticipated health effects.

Preferred Alternative: Environmental effects identified under the preferred alternative are primarily related to health, population and socioeconomics, cost, and historic resources.

For the preferred alternative, the total PFP Facility worker radiation dose for stabilization and removal would be 930 person-rem. The total radiation dose to offsite individuals would be 14 person-rem. Based on commonly accepted dose to risk conversion factors, the probability of latent cancer fatalities to these affected groups would be 0.37 and 0.0070, respectively. Therefore, no latent cancer fatalities would be anticipated.

Population and socioeconomic effects resulting from the preferred alternative would be small. The estimated staff of 592 at the PFP Facility would be temporarily increased by approximately 10 percent. Following the completion of the preferred alternative, staff levels would be reduced to approximately 250. There would be less than a 1 percent change to the area's population or economics from this alternative. The anticipated change from the preferred alternative would be too small to meaningfully influence the Benton and Franklin County economies or impact the existing infrastructure.

The removal activities under the preferred alternative would be intrusive and destructive, and would involve equipment removal. Impacts to the Remote Mechanical A Line, the Plutonium Reclamation Facility, and any of the PFP facilities currently eligible for the National Register of Historic Places would require mitigation to preserve the history of these historic resources. These mitigation measures have been agreed to in a Memorandum of Agreement between DOE and the Washington State Historic Preservation Officer.

Alternatives: Environmental effects identified under the alternative stabilization processes are primarily related to health, population and socioeconomics, and historic resources. The environmental effects associated with these alternative stabilization processes to population and socioeconomics and historic resources are similar to those discussed for the preferred alternative.

Environmental effects from implementing an immobilization process are primarily related to waste storage capacity. It is anticipated that the immobilization alternative would generate up to 1,600 drums of transuranic waste, with each drum containing approximately 170 grams of plutonium. Hanford Site solid waste management facilities would manage all transuranic waste generated by this process over the six-year period. There is currently space for approximately 500 drums at the Transuranic Waste Storage and Assay Facility. Additional space would become available when existing drums at the facility are transferred to other Hanford Site solid waste management facilities.

No Action Alternative: For the no action alternative, the total PFP Facility worker radiation dose would be 53 person-rem per year. The total radiation dose to offsite individuals would be 0.26 person-rem per year. Based on commonly accepted dose to risk conversion factors, the probability of latent cancer fatalities to these affected groups during an assumed 30 years operational life of the no action alternative would be 0.64 and 0.0039, respectively.

Population and socioeconomic effects resulting from the no action alternative would be small. The existing staff at the PFP Facility would be reduced by approximately 100 because ongoing cleanup and stabilization activities would cease. The decrease in staff would be too small to meaningfully influence the Benton and Franklin County economies or impact the existing infrastructure. However, the PFP Facility would be required to maintain this work force indefinitely.

Selected Alternatives: As with the preferred alternatives, the environmental effects identified under the selected alternatives are primarily related to health, population and socioeconomics, cost, and historic resources.

For the selected alternative, the total PFP Facility worker radiation dose for stabilization and removal would be 1,120 person-rem. The total radiation dose to offsite individuals would be 25 person-rem. Based on commonly accepted dose to risk conversion factors, the probability of latent cancer fatalities to these affected groups would be 0.45 and 0.013, respectively. Therefore, no latent cancer fatalities would be anticipated.

Population and socioeconomic effects would be the same as the preferred alternative. Impacts on historic resources and proposed mitigations would also be the same.

IV. ENVIRONMENTALLY PREFERRED ALTERNATIVE

To determine the environmentally preferred alternative, the short-term (six years or the time required to implement the selected alternatives) and long-term (greater than six years) time frames are considered.

Over the short-term, the no action alternative would not result in increased PFP Facility worker or public radiation exposure, costs, or loss of historic resources. These impacts would occur under all other alternatives analyzed. Therefore, in the short-term, the no action alternative could be considered preferable to the other alternatives. However, implementation of the no action alternative would not resolve the long-term health risks associated with the current form of the plutonium-bearing material within the PFP Facility.

Implementation of the preferred alternative, identified in the Final EIS, or the alternatives selected by this ROD would result in increased exposure to Hanford Site workers and the public during the anticipated six-year period of operation. However, following completion of all proposed activities the radiation exposure to in-facility workers would drop to 45 percent of its current level. Continued exposure following the completion of stabilization

and immobilization would be the result of facility transition until final disposition of the facility. Under the no action alternative the high background radiation levels would continue indefinitely. In about 30 years the radiation exposure to workers from the no action alternative would exceed the radiation exposure from the preferred or selected alternatives and would correspondingly result in greater health risk. Therefore in the long-term, the environmentally preferred alternative would be to stabilize and immobilize reactive plutonium-bearing material in the facility.

The no action alternative does not address the continued degradation of the PFP Facility and the containers in which the plutonium-bearing materials are stored. Since the PFP Facility is over 40 years old, there is a higher likelihood in the long-term of a release to the environment under accident conditions than would be anticipated under the preferred alternative, other stabilization alternatives, or the immobilization alternative.

V. OTHER CONSIDERATIONS

In addition to the assessment of environmental impacts provided by the Final EIS, DOE considered the plutonium disposition criteria, costs, the recommendations of the DNFSB, the Storage and Disposition of Weapons-Usable Fissile Material Draft EIS (DOE/EIS-0229-D), and comments received on the immobilization alternative and Final EIS in determining a course of action to meet the need for interim management of the plutonium-bearing material. Comments received on the immobilization alternative and the Final EIS are discussed in Section VI.

Plutonium Disposition Criteria: In January 1996, A DOE office internally circulated for review and comment a draft policy for the disposition of excess plutonium-bearing residues containing less than 50 weight percent plutonium. Under this draft policy, plutonium-bearing material would be processed to one of two end-states: 1) plutonium packaged for storage in accordance with DOE storage standard; or 2) waste suitable for disposal at the Waste Isolation Pilot Plant. This policy would require that a determination of which end-state is more cost-effective be made by the responsible field office and approved by the appropriate DOE Secretarial Officer. As a result, the Final EIS included an alternative to immobilize candidate plutonium-bearing material through cementation.

The cementation process was favored for immobilization because: 1) the ingredients are inexpensive, safe, and readily available; 2) the equipment needs are simple; 3) the final waste form has proven stability; 4) it meets the safeguards and security requirements; and 5) it meets the Hanford Site solid waste acceptance criteria and has been used extensively at the Hanford Site for immobilizing wastes. In contrast, immobilizing of materials in a glass (i.e., vitrification) or a ceramic matrix was not considered desirable because of the cost, specialized equipment required, lack of such equipment on the Hanford Site, and lack of site experience. These factors would result in delays in implementing these alternatives and additional health and safety risks. Another alternative would be to mix the plutonium with uranium to produce a mixed oxide fuel suitable for energy production in a nuclear power reactor. Because of the relatively small quantity of plutonium material being

considered, it was not considered reasonable to develop the technology at the Hanford Site to support this alternative.

The Final EIS contains the statement, "The ... Record of Decision will not include a decision on the immobilization alternative unless this draft policy or a comparable policy has been finalized." This policy has not been finalized, therefore decisions to immobilize plutonium-bearing materials will continue to be made in accordance with factors and provisions contained in the April 1994 DOE memorandum from Mr. C. Halsted, then Acting Director, Office of Nuclear Weapons Management.

The Halsted memorandum provides evaluation factors for discard decisions for plutonium-bearing material. These factors are: worker safety, minimizing environmental impact, regulatory concerns, waste minimization, disposal technical factors, technical risk, stakeholder interest, risk assessment, implementation time and feasibility, proliferation potential, cost, and interim storage feasibility. These factors will be applied to the categories of plutonium-bearing material potentially suitable for immobilization. Future policies of this nature will be evaluated in connection with decisions to immobilize low concentration materials.

Costs: In the long-term, cost savings would be achieved by removing, stabilizing, and/or immobilizing the plutonium-bearing material at the PFP Facility versus continuing to operate the Facility in its current condition.

Implementation of the preferred alternative would result in a ten percent increase in expenditures from the estimated fiscal year 1995 level of $80 million to approximately $89 million. Following completion of stabilization and removal activities in about six years, the expenditures at the PFP Facility would decline to approximately $34 million per year.

The cost of implementing the other alternatives would be comparable to the cost of the preferred alternative.

Under the no action alternative, the cost of operating the Facility would drop by approximately 17 percent from the fiscal year 1995 level of $80 million to approximately $67 million in fiscal year 1997. This reduction would result from a cessation of ongoing interim actions. This expenditure would go on indefinitely and may increase as the Facility ages and needs additional maintenance. In approximately 10 years, the cost of continuing to maintain the PFP Facility would exceed the cost of stabilization.

Defense Nuclear Facilities Safety Board (DNFSB): The DNFSB is chartered by Congress to review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of DOE's defense nuclear facilities (including applicable DOE Orders, regulations, and requirements). The DNFSB recommended to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected. In Recommendation 94-1, the DNFSB noted that it was concerned that the halt in production of materials to be used in nuclear weapons froze the manufacturing pipeline in a state that, for safety reasons, should not be allowed to persist unremediated.

In Recommendation 94-1, the DNFSB specifically advised: "that an integrated program plan be formulated on a high priority basis, to convert within two to three years the materials" plutonium metal that is in contact with, or in proximity to, plastic "to forms or conditions suitable for safe interim storage;" that the plan "will require attention to limiting worker exposure and minimizing generation of additional waste and emission of effluents to the environment;" and finally, that the plan "should include a provision that, within a reasonable period of time (such as eight years), all storage of plutonium metal and oxide should be in conformance with the DOE standard on storage of plutonium."

All alternatives evaluated in the Final EIS, with the exception of the no action alternative would achieve the recommendation of the DNFSB.

Fissile Material Programmatic EIS: The Storage and Disposition of Weapons-Usable Fissile Material Programmatic Draft EIS (DOE/EIS-0229-D) evaluates alternatives for the long-term storage and disposition of plutonium and other special nuclear material. None of the alternatives considered in the Plutonium Finishing Plant Stabilization Final EIS would preclude alternatives considered in the programmatic EIS.

VI. COMMENT ON IMMOBILIZATION ALTERNATIVE AND FINAL EIS

DOE received three comments from individuals and organizations on the Immobilization Alternative and the Final EIS.

1. **Comment**: Gordon Rogers provided the following comment:

> I have no objection to the alternative for immobilization in general. However, DOE should consider the additional security costs associated with the relatively large amount of plutonium-bearing material to be sent to the solid waste management facilities. The security provisions in place at the PFP Facility are more stringent than at the Hanford Site solid waste management facilities.

Response: According to DOE Order 5632.1C, Protection and Control of Safeguards and Security Interests, protection and control shall be provided in a graded, cost-effective fashion in accordance with the potential risks to the national security and/or health and safety of DOE and contractor employees, the public, and the environment. By a graded approach, the DOE intends that the level-of-effort and magnitude of resources expended for the protection of a particular security interest are commensurate with the security interest's importance or the impact of its loss, destruction, or misuse.

DOE Order 5633.3B, Control and Accountability of Nuclear Materials, defines materials attractiveness levels for the purpose of applying safeguards and security requirements. Prior to implementing the immobilization of plutonium residues, DOE will ensure that the material in its final form is placed in a category which will not impose additional safeguards and security requirements upon the Hanford Site solid waste facilities.

2. **Comment**: The following comment was received from the Washington State Department of Ecology, Nuclear Waste Program:

> The fact that U.S. Department of Energy has not made a decision on whether this material has beneficial use seems inconsistent with the proposal to immobilize and transfer it to the Hanford Site Solid Waste Management Facilities. The new alternative addendum should fully describe the applicability of the State of Washington Hazardous Waste Management Act (HWMA) to the immobilization of the plutonium bearing material being considered. The addendum should provide a regulatory rationale that supports this new alternative. Please refer to our letter to Mr. James E. Mecca, dated April 7, 1996, where we clearly state the materials which contain Special Nuclear Material (SNM) at PFP are regulated wastes under the HWMA, so long as 1) they classify as a solid waste, 2) they classify as a mixed waste, and 3) they designate pursuant to Chapter 173.303.070 WAC.

Response: The DOE has not classified any special nuclear material (SNM) currently in storage at the PFP Facility as waste. The materials stored at the PFP Facility have been determined to be excess to the nuclear weapons program needs, but an ultimate disposition for the material has not been determined.

There is currently existing guidance contained in a 1994 DOE memorandum from Mr. C. Halsted, then Acting Director, Office of Nuclear Weapons Management, providing evaluation criteria for the economic and other discard related approaches for these materials. Lacking updated policy for these materials, the Final EIS provides an approach to utilize the existing guidance to evaluate the SNM inventory at the PFP Facility.

Before proceeding with the alternative to immobilize residues, DOE recognizes that agreement upon an acceptable regulatory strategy will need to be reached with the Washington State Department of Ecology (Ecology). In the event that a regulatory path cannot be achieved, then the economic factors in the evaluation of candidate residues will likely drive the residues to be thermally stabilized for storage or result in a further evaluation of the alternatives for recovery of the plutonium rather than it being immobilized for discard. The discussion below assumes that a path forward can be achieved.

As the total inventory of material is evaluated, those items that are determined to be suitable for discard will be immobilized to the current Waste Isolation Pilot Project (WIPP) criteria and the Nuclear Safeguards and Security criteria. The SNM material would be removed from the PFP Facility inventory and transferred to a Hanford Site solid waste management facility for future shipment to the WIPP disposal area. The material would be defined as a waste at the point where the DOE requirements for discard are met; i.e., the material form and plutonium quantity are such that non-proliferation protection (safeguards) are no longer required. At the point of solid waste generation, DOE would designate the wastes as applicable under Washington

Administrative Code (WAC) 173-303-070, and would implement any applicable requirements of WAC 173-303 for dangerous waste accumulation, transportation, and storage to the extent that non-SNM components are present which would require designation as dangerous waste.

As discussed above, DOE is currently working with Ecology to develop a regulatory path forward. Resolution of this issue will be needed before DOE can implement plans to immobilize plutonium-bearing material in vault storage and hold-up.

3. **Comment**: The following comment was received from the Washington State Department of Ecology, Nuclear Waste Program:

> The new alternative does not clearly compare or contrast the difference between the description and quantities of plutonium-bearing materials potentially suitable for immobilization under Section 3.1.3 of the PFP-EIS and the new alternative. Please provide further clarification of the description and quantities between the two.

Response: The description and quantity of plutonium-bearing materials potentially suitable for immobilization, discussed in Section 3.1.3 and Appendix E of the Final EIS, are equivalent. Because the inventory of the plutonium-bearing material at the PFP Facility is of a varied nature, the material was grouped into inventory categories. These categories correspond to the inventory categories presented for stabilization.

Up to 272 kg (599 lbs) of plutonium are candidates for immobilization. This number includes approximately 222 kg (489 lbs) of plutonium contained in 1,500 items that are currently stored in PFP Facility vaults and 50 kg (110 lbs) of plutonium in hold-up. The plutonium-bearing material in vault storage includes approximately 91 kg (200 lbs) of oxides with less than 50 weight percent of plutonium, 81 kg (178 lbs) of ash residues, 43 kg (95 lbs) of slag and crucible residues, and 7 kg (15 lbs) of miscellaneous plutonium-bearing material. The plutonium-bearing material in hold-up includes up to 4.5 kg (10 lbs) of plutonium from the E-4 ventilation system ductwork; up to 4.3 kg (9.5 lbs) of plutonium from vacuum process piping; up to 28 kg of plutonium from gloveboxes and hoods; and up to 12.5 kg (27.5 lbs) of plutonium from the Plutonium Reclamation Facility canyon.

VII. DECISION

DOE prepared the Draft and Final EIS to evaluate environmental and human health impacts associated with operation of systems to continue the safe management of plutonium-bearing material at the PFP Facility. After careful consideration of environmental impacts, costs, engineering evaluations, and public and agency comments, DOE has decided to implement a select group of stabilization alternatives identified in the Final EIS. These include three out of four of the preferred stabilization alternatives supplemented by other stabilization and immobilization processes analyzed in the Final EIS. The action will also involve the removal of readily retrievable plutonium-bearing material in hold-up at the PFP Facility and the stabilization of this and

other plutonium-bearing material at the PFP Facility. Following stabilization, plutonium-bearing material will be in a form suitable for interim storage in existing vaults at the PFP Facility. Plutonium-bearing material having low plutonium content and meeting criteria established by DOE may be immobilized through a cementation process at the PFP Facility and transferred to a Hanford Site solid waste management facility for storage. By selecting a suite of alternatives, DOE anticipates that health impacts to workers, and the cost to implement the action will be reduced. DOE is documenting this determination in this ROD.

This action will reduce radiation exposure and risk to workers and the public, and future resources needed to safely manage the PFP Facility.

Since the PFP Facility contains a variety of reactive plutonium-bearing materials that are chemically and physically dissimilar, various processes will be required to stabilize these materials. The primary means to accomplish this will be through the implementation of the stabilization processes described under the preferred alternative in the Final EIS. However, stabilization of some portion of the plutonium-bearing materials may be better accomplished through one of the alternative stabilization processes analyzed in the Final EIS. For this reason, DOE may implement these alternative processes on a case-by-case basis. The primary stabilization processes which will be implemented for each inventory category are:

1) **Plutonium-bearing solutions**: For Plutonium-bearing solutions two alternatives are selected.

- Ion exchange, vertical calcination, and thermal stabilization. Most plutonium-bearing solutions will be stabilized by thermal treatment using a vertical calciner. For this application, the feed material will include plutonium nitrate solutions, solutions containing chlorides, caustic solutions, and dissolved plutonium fluoride.

In order to utilize the vertical calcination process, some of the plutonium-bearing solutions will require pretreatment by ion exchange to remove chemical constituents that are not compatible with the vertical calcination process or the process equipment. In addition, the calciner product may require further thermal stabilization in order to meet DOE's "Criteria for Safe Storage of Plutonium Metals and Oxides" (DOE-STD-3013-94).

The combined ion exchange/vertical calciner/thermal treatment process will be capable of processing most of the inventory of plutonium nitrate and chloride solutions. It also will be able to process the plutonium fluoride solids if they are first dissolved and converted to the nitrate form using an acid dissolution pretreatment operation. This will increase the quantity of material to be stabilized from 335 kg (738 lb) plutonium to 338 kg (745 lb) of plutonium associated with approximately 4,800 l (1,268 gal) of solution.

- Hydroxide precipitation followed by thermal stabilization. Plutonium-bearing solutions could be alternatively treated by a relatively simple hydroxide precipitation process. The resultant plutonium precipitate will then be thermally stabilized to an oxide form capable of meeting DOE's

"Criteria for Safe Storage of Plutonium Metals and Oxides," (DOE-STD-3013-94). This alternative would be applied to the portion of the plutonium-bearing solutions that are determined to be unsuited for vertical calcination. An example would be material that could create a resinous residue or cause corrosion within the vertical calciner. No more than 20 percent of the plutonium solutions are anticipated to fall into this category.

Caustic or other hydroxide-forming reagents will be added to the solution, gradually increasing the pH until insoluble plutonium hydroxide is formed. The plutonium hydroxide and other metal impurities, such as nickel, chromium, and iron, will precipitate out and be filtered from solution. The filtered solids will then be thermally processed into a stable oxide form.

2) <u>Oxides, fluorides, and process residues</u>: For oxides, fluorides, and process residues one alternative was selected.

- Batch thermal stabilization using muffle furnaces. Although it would result in additional radiation exposure to the PFP Facility worker, over the preferred alternative, this alternative was selected because development of the continuous process furnace has not proceeded as anticipated and the continuous furnace may not be capable of producing product that meets DOE's "Criteria for Safe Storage of Plutonium Metals and Oxides" (DOE-STD-3013-94). In addition, some of the materials are not amenable to continuous process furnace due to their size, moisture content, or high organic content. These materials, however, can be processed through a batch thermal stabilization process.

Under the batch thermal stabilization using muffle furnaces process, the plutonium-bearing solids will be fed into a muffle furnace which is elevated to a temperature of approximately 1,000°C (1,832°F). The high temperature air environment lowers the residual moisture level and facilitates conversion of incompletely oxidized plutonium to plutonium oxides.

Material that meets the DOE storage standard would not require any additional thermal stabilization and will be directly repackaged. Plutonium fluorides will pose problems in the muffle furnace due to the corrosive nature of fluoride-bearing gases that could be liberated. The plutonium fluorides may be pretreated using an acid dissolution process and blended with the plutonium-bearing solutions. Alternately, a corrosion control program may be established and the fluorides sent through the muffle furnace.

This process may stabilize 2,417 kg (5,329 lb) of plutonium. The resultant plutonium oxides will be tested in accordance with the DOE storage standard. Product deemed acceptable may be packaged using existing capabilities at the Hanford Site and placed in the vault(s) at the PFP Facility for storage. Product not meeting the DOE storage standard will be recycled through the muffle furnace. The product may be retrieved and repackaged at a later date to meet the DOE storage standard specifying organic-free containers when a bagless transfer system becomes available at the Hanford Site. Alternatively, the material may go directly to an organic free container.

3) **Metals and alloys**: For metals and alloys two alternatives are selected.

- Batch thermal stabilization using muffle furnaces. The plutonium-bearing solids will be fed into a muffle furnace and elevated to a final temperature of approximately 1,000°C (1,832°F). The high temperature air environment facilitates conversion of the metal and alloys to metal oxides (i.e., plutonium oxides).

A total of 770 kg (1,698 lb) of plutonium may be stabilized using this process. The resultant product will be tested in accordance with the DOE storage standard. Product deemed acceptable will be packaged using existing capabilities at the Hanford Site and placed in the vault(s) at the PFP Facility for storage. It is assumed that the metals and alloys may require more than one thermal processing cycle to achieve the desired oxide product. The product may be retrieved and repackaged at a later date to meet the DOE storage standard specifying organic-free containers once a bagless transfer system becomes available at the Hanford Site. Alternatively, the material may go directly to an organic-free container.

- Repackaging. Non-destructive testing could indicate that some plutonium metals and alloys may safely be repackaged without thermal stabilization. These materials would be repackaged using methods that do not rely upon organic seals or plastic bags. The repackaged materials will be stored in the vault(s) at the PFP Facility and routinely monitored until final disposition.

4) **Polycubes and combustibles**: For polycubes and combustibles, because of technical uncertainties associated with the preferred alternative, two alternatives are selected.

- Pyrolysis. This alternative is a thermal process involving distillation and decarbonization, that separates the plutonium oxides from the polystyrene. The product, stable plutonium oxides, will be packaged and returned to the vaults at the PFP Facility.

The pyrolysis process has the capability for processing other combustibles such as rags and polyethylene. If part of the inventory of combustibles is not suitable for pyrolysis, those combustibles may be sent to the Hanford Site solid waste management facilities for storage.

A total of 35 kg (77 lb) of plutonium may be stabilized by this alternative. The resultant plutonium oxide will be thermally tested in accordance with DOE's "Criteria for Safe Storage of Plutonium Metals and Oxides" (DOE-STD-3013-94). Product determined to be acceptable will be packaged using existing packaging capabilities and placed in the vault(s) at the PFP Facility for storage. Product not meeting the DOE storage standard will be run through additional thermal stabilization processes.

- Batch thermal stabilization. Alternatively, a process involving batch thermal stabilization of the plutonium-bearing polycubes and combustibles could be used. Although the thermal stabilization method used for the two types of materials is the same, each type of material will be processed separately. The polycubes or combustibles will be fed into a muffle furnace,

which is elevated to a temperature of approximately 300°C (572°F). Initially, the furnace will be purged with nitrogen gas to maintain an inert environment and prevent combustion of the organic component. At 300°C (572°F), the organic component of the feed will be driven off into a secondary combustion chamber. The plutonium-bearing material remaining in the muffle furnace will be exposed to air and elevated to approximately 1,000°C (1,832°F). The high temperature environment facilitates conversion of incompletely oxidized plutonium to plutonium oxides.

5) **Removal of holdup**: This ROD will also implement the preferred alternative for removal. The removal activities will be limited to plutonium-bearing materials that are readily retrievable. Plutonium-bearing material with a high quantity of plutonium will be stabilized as described above. Material with a low plutonium content may be immobilized and sent to a Hanford Site solid waste management facility for storage. Due to the nature and location of the material in hold-up, various technologies will be employed to remove the material for subsequent stabilization. All technologies analyzed in the Final EIS will be utilized to some degree. Four areas of the PFP Facility have been identified for removal of readily retrievable hold-up material: ductwork, vacuum system piping, gloveboxes and hoods, and the Plutonium Reclamation Facility canyon floor. These areas represent locations where a high quantity of plutonium-bearing material exists as hold-up and where removal actions will be beneficial in reducing the exposure risk. Non-readily retrievable plutonium-bearing material with a low quantity of plutonium will remain in hold-up at the PFP Facility. This material will be addressed when DOE makes a decision to decontaminate and decommission the PFP Facility.

6) **Immobilization**: Candidate plutonium-bearing material with low plutonium content may be immobilized and discarded. The plutonium-bearing material will include: 1) materials that are containerized and stored in vaults or gloveboxes; and 2) hold-up material.

The immobilization process will be applicable for up to 272 kg (599 lbs) of plutonium from selected quantities of the following plutonium-bearing materials:

Oxides, fluorides, and process residues (not applicable for any fluorides or for oxides greater than 50 weight percent plutonium)
- Immobilization of candidate materials

Polycubes and combustibles (not applicable for polycubes)
- Immobilization of candidate materials

Low plutonium content material removed from hold-up (less than 50 weight percent plutonium)

The immobilization process will include a cementation step which will fix the plutonium-bearing material into a solid matrix, packaging the cemented materials into appropriate shipping containers, and transporting the containers to a Hanford Site solid waste management facility for storage.

VIII. MITIGATION

Since land use and water resources would not be impacted by the preferred alternative or other stabilization alternatives analyzed in the Final EIS, no mitigation measures would need to be taken in regard to these resources. Mitigation measures in place for the PFP Facility have been discussed in the Final EIS (e.g., High-efficiency particulate air filtration of exhaust pathways).

To ensure that activities and consequences (e.g., radiological dose to PFP Facility workers) for normal/routine activities would remain within established requirements, and to ensure that the risk of accidents would be minimized, numerous measures would be taken in association with the preferred alternative. These measures include adequate (engineered) design features for gloveboxes, systems, and components; the development of safety analyses consistent with the process established by DOE; and the implementation of numerous programs that already exist at the Hanford Site. Examples of these programs are as follows:

- Maintenance program - Ensures that hardware performs as expected when demanded
- Fire protection program - Mitigates property loss and minimizes human health impacts due to fire
- Criticality prevention program - Mitigates potential human health impacts of an inadvertent criticality
- Radiological controls program - Mitigates routine and accident-related doses
- Industrial hygiene program - Mitigates routine and accident-related chemical exposure
- Training program - Minimizes and mitigates adverse impacts to personnel by training them in proper ways to perform their job and to respond during emergency events.

Certain removal activities will substantially alter or demolish existing equipment and facilities at the PFP Facility which have been found to be eligible for inclusion in the National Register of Historic Places. A Memorandum of Agreement between DOE and the Washington State Historic Preservation Officer has been accepted by the Advisory Council on Historic Preservation. This agreement addresses the measures that will be required to mitigate these adverse impacts. Because all practical means to avoid or mitigate environmental impacts from this removal action are incorporated in the PFP Facility and practices, DOE has determined that there is no need to prepare a Mitigation Action Plan in accordance with Section 1021.331(a) of DOE's regulations implementing NEPA (10 CFR 1021)

ISSUED: This ROD for PFP Stabilization EIS is issued by DOE, Richland Operations Office, Richland, Washington on June 25, 1996.

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