



# Surplus Plutonium Disposition Supplemental Environmental Impact Statement (SPD Supplemental EIS)



## Background and Alternatives

To reduce the threat of nuclear weapons proliferation, the U.S. Department of Energy (DOE) is engaged in a program to disposition its surplus, weapons-usable plutonium in a safe, secure, and environmentally sound manner by converting such plutonium into proliferation-resistant forms that can never again be readily used in nuclear weapons.



**Plutonium Button**

DOE has prepared a number of National Environmental Policy Act (NEPA) documents regarding the surplus plutonium program. In the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement (Storage and Disposition PEIS, DOE/EIS-0229, December 1996)*, DOE evaluated the potential environmental consequences of alternative strategies for the long-term storage of weapons-usable plutonium and highly enriched uranium and the disposition of weapons-usable plutonium that has been or may be declared surplus to national

security needs. DOE selected a dual-path strategy for disposition that would allow immobilization of some or all of the surplus plutonium in glass or ceramic material for disposal in a geologic repository, and fabrication of some surplus plutonium into mixed uranium-plutonium oxide (MOX) fuel for irradiation in existing domestic commercial reactor(s), with subsequent disposal of the spent fuel in a geologic repository<sup>1</sup> (62 FR 3014, January 21, 1997). DOE also decided that an immobilization facility would be located either at the Hanford Site in Washington or at the Savannah River Site (SRS) in South Carolina.

In November 1999, DOE issued the *Surplus Plutonium Disposition Environmental Impact Statement (SPD EIS, DOE/EIS-0283)*. The *SPD EIS* tiered from the *Storage and Disposition PEIS* and included an analysis of the potential environmental impacts associated with alternative technologies and sites to implement the dual-path plutonium disposition strategy. The *SPD EIS* also analyzed the impacts of using MOX fuel in certain domestic commercial reactors to generate electricity. In January 2000, DOE decided to construct and operate three disposition facilities at SRS: (1) the Mixed Oxide Fuel Fabrication Facility (MFFF) to fabricate up to 33 metric tons of surplus plutonium into MOX fuel;<sup>2</sup> (2) the Pit Disassembly and Conversion Facility (PDCF) to disassemble nuclear weapons pits and convert the plutonium metal to an oxide form for use as feed material for MFFF; and (3) an immobilization facility using ceramic can-in-canister technology that would allow for the immobilization of approximately 17 metric tons of surplus plutonium (65 FR 1608, January 11, 2000). Using the can-in-canister technology, DOE was to immobilize plutonium in a ceramic form, seal it in cans, and place the cans in canisters to be filled with borosilicate glass containing intensely radioactive high-level waste at the Defense Waste Processing Facility (DWPF).

<sup>1</sup> DOE has since decided to terminate the previously planned Yucca Mountain repository for geologic disposal of spent nuclear fuel and high-level radioactive waste. DOE has established a Blue Ribbon Commission on America's Nuclear Future (Blue Ribbon Commission) to develop and recommend alternative storage and disposal approaches for spent nuclear fuel and high-level radioactive waste. Notwithstanding termination of the Yucca Mountain Program, DOE remains committed to meeting its obligations to manage and ultimately dispose of spent nuclear fuel and high-level radioactive waste.

<sup>2</sup> In the 2000 Record of Decision (ROD), DOE noted that it had awarded a contract to Duke Engineering & Services, COGEMA Inc., and Stone & Webster (known as DCS) that included reactor irradiation of MOX fuel at Duke Energy's Catawba and McGuire Nuclear Stations. The SPD EIS and ROD also addressed two Virginia Power reactors at the North Anna Nuclear Station in Virginia. Virginia Power's involvement in the MOX program ended soon thereafter.

In 2002, DOE cancelled the immobilization portion of the plutonium disposition strategy (67 FR 19432, April 19, 2002). In 2003, DOE affirmed the MOX-only approach for plutonium disposition, in which 34 metric tons (increased from 33 metric tons) of surplus plutonium, including approximately 6.5 metric tons of the non-pit plutonium originally intended for immobilization, would be dispositioned by fabrication into MOX fuel for use in power reactors (68 FR 20134, April 24, 2003).

In December 2005, DOE completed the *Environmental Assessment for the Safeguards and Security Upgrades for Storage of Plutonium Materials at the Savannah River Site* (DOE/EA-1538) and issued a Finding of No Significant Impact. Among other things, this environmental assessment analyzed impacts associated with installation of a Container Surveillance and Storage Capability (CSSC) in an existing facility in K-Area at SRS. CSSC would provide stabilization and packaging capabilities, including direct metal oxidation, to fulfill plutonium storage requirements pursuant to DOE Standard 3013, *Stabilization, Packaging, and Storage of Plutonium-Bearing Materials*.

In 2007, DOE decided to consolidate surplus non-pit plutonium stored separately at the Hanford Site,



**Nuclear material storage in the K-Area Complex**

Los Alamos National Laboratory (LANL), and Lawrence Livermore National Laboratory (LLNL) into a single storage location in K-Area at SRS, pending disposition (72 FR 51807, September 11, 2007). Shipments from the Hanford Site have been completed, and shipments from LANL and LLNL to SRS for consolidated storage are continuing.

In November 2008, DOE completed a supplement analysis (DOE/EIS-0283-SA-2) related to the treatment and solidification of certain liquid low-level radioactive waste and transuranic waste to be generated by MFFF and PDCF. DOE decided to construct and operate a standalone waste solidification building in F-Area at SRS (73 FR 75088, December 10, 2008); this facility is now under construction.

In this *Surplus Plutonium Disposition Supplemental Environmental Impact Statement (SPD Supplemental EIS)*, DOE will analyze the potential environmental impacts of reasonable alternatives to disposition additional plutonium from pits (referred to as “pit plutonium”; a pit is the core of a nuclear weapon), which have been declared surplus to national defense needs, as well as reasonable disposition alternatives for approximately 6 metric tons of non-pit plutonium. The SEIS will also analyze the impacts of irradiating MOX fuel in Tennessee Valley Authority (TVA) reactors at the Sequoyah and Browns Ferry nuclear plants and will analyze options for the construction and operation of a Pit Disassembly and Conversion (PDC) capability. This *SPD Supplemental EIS* will not reconsider decisions already made to disposition surplus plutonium, other than the decision discussed below to construct a standalone PDCF.

### **Preferred Alternative**

The MOX fuel alternative is DOE’s preferred alternative for surplus plutonium disposition. DOE’s preferred alternative for disposition of surplus plutonium that is not suitable for MOX fuel fabrication is disposal at the Waste Isolation Pilot Plant in New Mexico.

DOE’s preferred alternative for pit disassembly and the conversion of surplus plutonium metal to feed material for the MFFF, is to use some combination of facilities at TA-55 at LANL, K-Area at SRS, H-Canyon/HB-Line at SRS, and MFFF at SRS, rather than to construct a new stand-alone facility at SRS. This would likely require the installation of additional equipment and other modifications to some of these facilities.

## Options for Pit Disassembly and Conversion

### ***PDCF in F-Area at SRS***

Under this option, DOE would construct and operate a standalone PDCF in F-Area at SRS to convert plutonium pits and other plutonium metal into an oxide form suitable for feed to MFFF, as described in the *SPD EIS* and consistent with DOE's decision announced in the 2000 Record of Decision (ROD) for that EIS, as modified by the 2003 ROD.

### ***PDC Capability in K-Area at SRS***

Under this option, DOE would not construct the standalone PDCF; instead, DOE would install and operate a capability in K-Area at SRS to perform the functions of PDCF.

### ***PDC in Existing Facilities - PF-4 at LANL, MFFF, H-Canyon/HB-Line and K-Area***

Under this option, DOE would not construct the PDCF; instead DOE would augment or expand existing capabilities in the Plutonium Facility (PF-4) at LANL to disassemble pits and provide plutonium metal or oxide to MFFF for use as feed material. In addition, DOE would modify MFFF to add the capability to oxidize plutonium metal. Also under this option, DOE would utilize capabilities in H-Canyon/HB-Line to augment the plutonium oxide feed to MFFF supplied by other facilities.

## Options for Disposition of Surplus Plutonium



***Liquid waste stabilization at the Defense Waste Processing Facility***

### ***MOX Fuel Option***

After processing through the PDC capability, surplus plutonium would be used as feed for MFFF. After fabrication in MFFF, MOX fuel would be sent to qualifying commercial nuclear reactors for irradiation to produce electricity.

As noted above, TVA is considering use of MOX fuel in five TVA reactors. This *SPD Supplemental EIS* will evaluate the impacts of modifications to, and operation of, the five TVA reactors to accommodate MOX fuel.

### ***Glass Can-in-Canister Immobilization to DWPF Option***

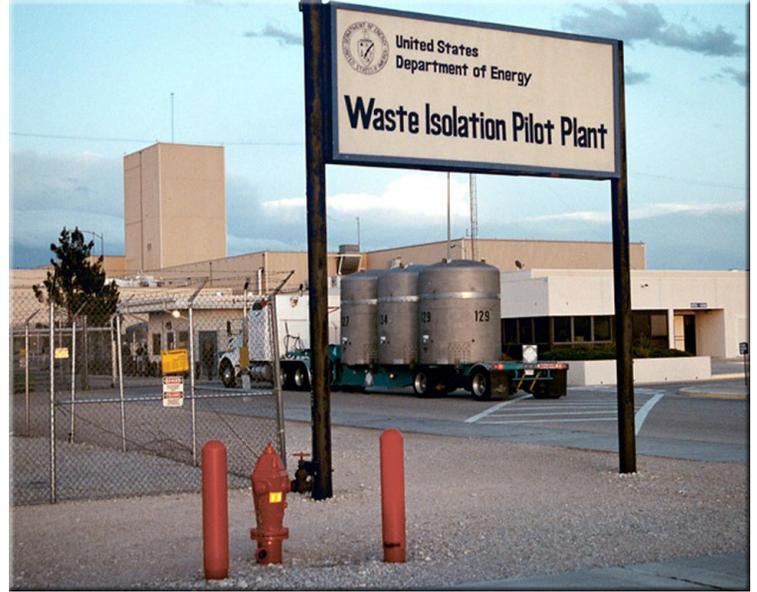
DOE would establish and operate a glass Can-in-Canister Immobilization capability in K-Area at SRS. Plutonium oxide would be immobilized in glass. Canisters containing the immobilized plutonium can-in-canister assemblies would be filled with vitrified high-level radioactive waste in DWPF. Filled canisters would be stored in the Glass Waste Storage Buildings.



***HB-Line gloveboxes***

### ***H-Canyon / HB-Line to DWPF Option***

DOE would use the H-Canyon/HB-Line to process surplus non-pit plutonium for disposition. Plutonium materials would be dissolved, and the resulting plutonium-bearing solutions would be sent to a sludge-batch feed tank and then to DWPF for vitrification in high-level radioactive waste canisters. The canisters would be stored in the Glass Waste Storage Buildings.



***Transuranic waste arriving at the Waste Isolation Pilot Plant***

### ***Waste Isolation Pilot Plant (WIPP) Option***

DOE would establish and operate a capability to prepare and package non-pit plutonium for disposal as transuranic waste at WIPP, provided that the material meets the WIPP waste acceptance criteria.

### ***To Submit Comments or Request More Information:***

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