



Savannah River Site Watch

Savannah River Site Watch
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Contact: Tom Clements, Director, SRS Watch, tel. 803-834-3084, cell 803-240-7268

**Surplus Weapon-Grade Plutonium at Savannah River Site can still be Vitrified in High-level Waste,
According to Savannah River National Lab Document Obtained via FOIA Request**

**DOE Analysis on Plutonium Disposition Incorrect in Stating Not Enough High-Level Waste Remains
at Savannah River Site for Immobilization of 34 Metric Tons of Plutonium**

Columbia, SC --Documents prepared by the Savannah River National Laboratory (SRNL) indicate that enough high-level waste remains to vitrify all the plutonium now stored at the Savannah River Site (SRS) - 13 metric tons - as well as much or all of the 34 metric tons of plutonium covered in the US-Russia Plutonium Management and Disposition Agreement (PMDA).

A SRNL research document dated December 2010 and entitled **PLUTONIUM SOLUBILITY IN HIGH-LEVEL WASTE ALKALI BOROSILICATE GLASS** - obtained by Savannah River Site Watch (SRS Watch) via a Freedom of Information Act request - confirms that enough canisters yet to be filled with vitrified high-level waste (HLW) could likely accommodate more than 34 metric tons of plutonium.

The SRNL documents states that about 18 kilograms of surplus weapon-grade plutonium could be immobilized in a single canister in the Defense Waste Processing Facility (DWPF). Given that over 3500 canisters are yet to be filled and that the current fill rate is 125 canister per year, there are a sufficient number of canisters remaining to develop and implement an immobilization program and immobilize the plutonium covered in the US-Russia agreement. (3000 canisters x 18 kg plutonium/canister = 54,000 kg = 54 metric tons)

"It is clear that the option of immobilizing surplus plutonium in high-level waste at SRS holds great promise and can be implemented to dispose of the nation's surplus plutonium," according to Tom Clements, director of Savannah River Site Watch (SRS Watch). "The plutonium analysis has made a mistake in its assessment of the plutonium immobilization option, which must be immediately subject to intensive research and development as it remains a more effective alternative to the mismanaged MOX approach."

Further, the SRNL document **Reevaluation of Vitrified High-Level Waste Form Criteria for Potential Cost Savings at the Defense Waste Processing Facility**, from February 2013, also affirms that about 18 kilograms of plutonium (or about 1% of canister fill weight) can be immobilized in a DWPF canister as long as it was homogeneously mixed into the glass material being poured into the canister.

An SRS presentation - ***Environmental Management Cleanup Program Performance Measures Targets for Fiscal Year 2014*** - made to the SRS Citizens Advisory Board (SRS CAB) on April 22, 2014 stated that 3778 canisters had been filled with vitrified high-level waste as of February 2014, out of a total of 7580 canisters to be filled. Thus, 3802 canisters remained to be filled. The presentation to the CAB shows that the goal for the number of canisters to be filled in Fiscal Year 2014 is 125. The presentation, by Rich Olsen, Planning Analyst with DOE-Savannah River revealed that only 25 canisters had been filled through February 2014. In response to a question by SRS Watch, Mr. Olsen stated that the 125-canister goal could be achieved.

A U.S. Department of Energy plutonium disposition assessment released on April 29 contradicts the SRNL assessment by claiming that the option to immobilize surplus plutonium is no longer viable given an inadequate amount of remaining high-level waste into which the plutonium could be immobilized. The ***Analysis of Surplus Weapons-Grade Plutonium Disposition Options*** clearly states, in contradiction to SRNL research documents, that “there is not enough HLW remaining to dispose of 34 MT of surplus plutonium.” SRS Watch questions this assessment.

The plutonium disposition analysis does acknowledge that some plutonium could be immobilized by introducing it directly into high-level waste tanks via the H-Canyon reprocessing plant: “DWPF and the remaining HLW could be used to immobilize up to 6 MT of plutonium as part of a potential hybrid disposition approach.” The hybrid approach would immobilize 6 metric tons of plutonium while disposing of the remainder in the Waste Isolation Pilot Plant (WIPP).

The analysis affirms that a significant amount of SRS plutonium was immobilized via introduction into the high-level waste system, revealing the promise of this method: “Since 2002, DOE has utilized this method to dispose of approximately 340 kg of surplus plutonium; however, operations were suspended to minimize impacts to the liquid waste system and to implement the more cost effective method of disposing of the plutonium at SRS through downblending and disposal at WIPP.” The 340-kg figure may be inaccurate as SRS officials have told SRS Watch that the figure is closer to 100 kg but no documentation as to the amount of plutonium immobilized has been provided by SRS and such documentation was left out of the plutonium disposition analysis.

“There is no demonstration in the DOE’s analysis to back up the claim that a significant amount and perhaps all surplus plutonium cannot be immobilized, underscoring that that research that went into the assessment may have been inadequate,” said Clements. “The analysis appears to have overlooked the extensive history of immobilization research and that enough high-level waste remains to get the immobilization job done. While there are technical issues to be worked out, the immobilization option merits much closer scrutiny given its potential as a more proliferation-resistant method of plutonium disposition than MOX,” said Clements.

The cost of the immobilization option presented in the just-released plutonium disposition analysis is unrealistic as it does not evaluate the cost of direct immobilization of plutonium in DWPF canisters, according to SRS Watch. “A review of costs of direct immobilization is needed and that fact that it was not prepared reveals a critical flaw in DOE’s analysis,” said Clements.

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Notes:

SRS, **Environmental Management Cleanup Program Performance Measures Targets for Fiscal Year 2014**, April 22, 2014,

http://www.srs.gov/general/outreach/srs-cab/library/meetings/2014/slm/0422_olsen.pdf

Savannah River National Lab, **Reevaluation of Vitrified High-Level Waste Form Criteria for Potential Cost Savings at the Defense Waste Processing Facility**, WM2013 Conference, February 24 - 28, 2013, Phoenix, AZ, USA, SRR-STI-2013-00006,

http://www.srswatch.org/uploads/2/7/5/8/27584045/srnl_pu_concentration_limit_in_hlw_glass_srnl_feb_2013.pdf

“The 1 wt% in glass plutonium concentration translated to ~18 kg plutonium per DWPF canister. This would be ~10X the current allowed limit per the WAPS / International Atomic Energy Agency (IAEA) specification (2500 g/m³ of glass) and about 30X the current 897 g/m³ limit. The studies showed that the plutonium was homogeneously distributed and did not result in any formation of plutonium-containing crystalline phases as long as the glass was prepared under “well-mixed” conditions.” (page 6)

SRNL, **PLUTONIUM SOLUBILITY IN HIGH-LEVEL WASTE ALKALI BOROSILICATE GLASS**, December 2010, SRNL-STI-2010-00766, http://www.srswatch.org/uploads/2/7/5/8/27584045/srnl-sti-2010-00766_pu_solubility_in_dwpf_canisters_2010.pdf

“A Pu loading of 1 wt % in glass translated to ~18 kg Pu per Defense Waste Processing Facility (DWPF) canister, or about 10X the current allowed limit per the Waste Acceptance Product Specifications (2500 g/m³ of glass or about 1700 g/canister) and about 30X the current allowable concentration based on the fissile material concentration limit referenced in the Yucca Mountain Project License Application (897 g/m³ of glass or about 600 g Pu/canister). Based on historical process throughput data, this level was considered to represent a reasonable upper bound for Pu loading based on the ability to provide Pu containing feed to the DWPF.” (page v)

FOIA response cover letter from DOE on immobilization of plutonium, April 14, 2014,

http://www.srswatch.org/uploads/2/7/5/8/27584045/foia_on_plutonium_immobilization_april_14_2014.pdf

SRS **Interim Action Determination – Processing of Plutonium Materials in H-Canyon at Savannah River Site** -made under the National Environmental Policy Act - to process “up to 320 kg of plutonium” via H-Canyon and into DWPF for vitrification in high-level waste canisters, September 25, 2009, <http://energy.gov/sites/prod/files/EIS-0283-S2-IAD-2009.pdf>

DOE study “**Analysis of Surplus Weapons-Grade Plutonium Disposition Options**,” April 29, 2014, <http://nnsa.energy.gov/aboutus/ourprograms/dnn/fmd/plutonium/pudispositionoptions>

“Given a lifecycle cost estimate for the program of approximately \$30 billion or more and a challenging budget environment, the current MOX approach must be critically examined alongside costs of other potential options to complete the plutonium disposition mission.”

“SRS has been operating its Defense Waste Processing Facility (DWPF) since 1996 to vitrify HLW into glass logs. However, since nearly half of SRS’s HLW has already been remediated, there is not enough HLW remaining to dispose of 34 MT of surplus plutonium. In addition, DWPF is scheduled to complete

operations by 2032, which would likely be before a new immobilization facility could be designed and constructed. [SRR-LWP-2009-00001]" (page 17)

"Two potential variants of the immobilization option that were considered during the early stages of this analysis were:

1. The use of H-Canyon at SRS to dissolve the plutonium and then transfer it to the HLW system for vitrification into glass through the DWPF.
 2. Direct injection of plutonium into the DWPF or WTP melter process for HLW.
- Regarding the first variant, there is not enough HLW at SRS to vitrify the full 34 MT of plutonium with the limitations of the H-Canyon dissolution process and the waste transfer capabilities. However, a limited amount of plutonium (approximately 6 MT) could be immobilized in this variant. The second variant, although technically feasible, would require significant research, development, and demonstration (RD&D) to determine the loading limits of each glass canister, determine the controls required to prevent criticality during the injection process, and develop the design modifications required for the injection process. [Vitreous Laboratory 2013]" (page 17)

For this variant, there is not enough HLW at SRS to vitrify the full 34 MT of plutonium. DWPF has been operating since 1996 to vitrify HLW into glass logs. Because a significant amount of SRS's HLW has already been remediated (nearly half), there is not enough HLW remaining to dispose of 34 MT of surplus plutonium. In addition, DWPF is scheduled to complete operations by 2032. [SRR-LWP-2009-00001] However, DWPF and the remaining HLW could be used to immobilize up to 6 MT of plutonium as part of a potential hybrid disposition approach. Since 2002, DOE has utilized this method to dispose of approximately 340 kg of surplus plutonium; however, operations were suspended to minimize impacts to the liquid waste system and to implement the more cost effective method of disposing of the plutonium at SRS through downblending and disposal at WIPP. Since this variant does not disposition all 34 MT of surplus plutonium, it was not fully developed. (C-E-14)

Processing up to 6 MT of surplus plutonium would generate up to 20 to 48 additional canisters depending on the plutonium loading. (C-E-15)

Contact:

Tom Clements
Director, Savannah River Site Watch (SRS Watch)
<http://www.srswatch.org/>
Columbia, South Carolina
tel. 803-834-3084
cell 803-240-7268
tomclements329@cs.com