Recommendation #270
Increase Loading of Excess Plutonium

Background:

The CAB is increasingly becoming concerned about the ability of the DOE to dispose of excess plutonium in an efficient, timely, and effective manner. As noted below the manner of disposition has undergone a number of revisions in DOE's approach to treatment and processing. One viable approach presently being examined by DOE is the loading of plutonium into nuclear waste canisters in very small amounts. Unless DOE increases the loading this approach may be inadequate. Background and elaborating information is provided below.

As of several years ago, the DOE proposed three (3) disposition paths for "excess" plutonium (e.g. plutonium at SRS that is not needed for national defense or that does not meet defense specifications): the mixed oxide fuel ("MOX") facility (currently under construction); treatment through the existing H-Canyon facility; and a proposed plutonium vitrification facility (referred to as a "Pu Vit" facility) which was later discarded as too cost ineffective. Therefore, in July 2008 the DOE indicated that a two (2) path approach was sufficient with approximately **thirteen (13) metric tons** of excess plutonium to be processed for disposition. This two-path approach is the presently approved disposition pathway. However, key to that dual disposition approach is the continued use of H Canyon, which is scheduled to complete its mission of processing enriched uranium in 2019.

The DOE-SR's Enriched Uranium Disposition project was initiated in August 2006, for the treatment in H-Canyon of several uranium-laden materials (including Spent Nuclear Fuel from domestic research or educational reactors, Highly Enriched Uranium from foreign sources, and Aluminum-clad Spent Nuclear Fuel from around the DOE complex). The current project is scheduled for completion by the end of 2019. [January 13, 2009, Charles Nickell presentation]. A NEPA analysis and associated decision is scheduled for this Summer, 2010, for processing of the Aluminum-clad Spent Nuclear Fuel from foreign and research reactors now stored in the L-area Basin. This Spent Nuclear Fuel from across the DOE complex would be processed through H-Canyon and the vitrification of the associated liquid waste stream would be in the Defense Waste Processing Facility ("DWPF"). This project would result in an incremental production of about 250 canisters from the DWPF. (Jean Ridley oral presentation to the CAB Waste Management Committee, May 4, 2010). (included in DOE-SRS "Liquid Waste System Plan, Revision 15" (January, 2010), SRR-LWP2009-00001.)

The canisters produced in DWPF have the waste from the enriched uranium processing streams noted above in addition to legacy waste material in the waste streams from earlier years of operation. If any plutonium is added to waste it represents a fissile material that must be considered and dealt with from a criticality standpoint in addition to any fissile materials that are presently in the existing waste streams. It is estimated that approximately 1300 kg of "fissile material" currently resides in the liquid waste in the SRS Tank Farms, the vast majority from legacy operations during the Cold War. To address this concern a current administrative fissile maximum of 897 g/m3 is set for the borosilicate glass in the canisters produced by the DWPF. Liquid waste "batches" are sampled and analyzed and evaluated to assure that fissile material and other constituents in the vitrified glass matrix will be as planned. If a fissile material concentration of 897 g/m3 in glass is maintained, the 1300 kg of fissile material in the legacy liquid waste would be vitrified in DWPF canisters in varying amounts (mass) over the next several decades,

[1] H-Canyon is the only operational domestic facility capable of large-scale reprocessing of special nuclear materials and spent nuclear fuel.
[2] Referred to in other instances as 12.8 metric tons. A metric ton equals 1000kg. 1000kg is about 1.1 U.S. "short" ton.

ranging from 33 kg to 212 kg per processed liquid waste batch. Section 6.2 of the SRS "Liquid Waste System Plan, Revision 15" (January, 2010), SRR-LWP2009-00001.

While DOE appropriately places a great emphasis on controlling the fissile content in the SRS liquid waste stream, keeping the fissile concentrations very low (897 g/m^3) the plutonium concentrations must be increased to accommodate the additional excess plutonium. There simply may not be enough waste canisters to dispose of all the plutonium. Plutonium concentrations in the liquid waste to be processed through the DWPF represent extremely low concentrations relative to potential criticality concerns or relative to security/safeguards standards. ANSI Standard 8.1 (1998) sets a limit of 7.3 g/L (7,300 g/m3) in aqueous solutions for fissile material; an IAEA standard for security and safeguards, adopted by DOE Environmental Management in the EM *Waste Acceptance Product Specifications* ("WAPS"), is 2500 g/ m3. At a concentration of 897 g/m3, no criticality analysis for the borosilicate glass matrix in the DWPF canisters is required, as this concentration is almost an order of magnitude (10X) lower than the ANSI standard and safe. The 897 g/m3 figure merely represents the nominal amount of fissile material in the legacy liquid waste in or about 2006. (Jean Ridley oral presentation to the SRS-CAB Waste Management Committee, May 4, 2010)

The 897 g/m3 figure is not a safety or security limit for the concentration of plutonium in liquid waste, and is not related to, or codified in, any industry or regulatory standard; the figure merely represents an amount of fissile material loading into the DWPF canisters that would achieve processing of the SRS liquid waste. Again, the concentration is far below any such limit or standard. DWPF analyzes each sludge batch and ensures it is safe through the Nuclear Criticality Safety Evaluations (NCSEs).

There are currently 2241 canisters stored in the SRS Glass Waste Storage Building #1 and approximately 683 (as of 5/10/10) stored in the SRS Glass Waste Storage Building #2. Total storage capacity of Glass Waste Storage Building #2 is 2339 canisters, and a total of approximately 7,200 canisters are estimated to be produced in the "Base Plan" for treatment and vitrification through the DWPF of the legacy liquid waste. SRS "Liquid Waste System Plan, Revision 15" (January, 2010), SRR-LWP2009-00001.

DOE has identified approximately 5 metric tons (5000 kg) of the 13 metric tons of excess plutonium/ fissile material which could be processed through H-Canyon and then placed into DWPF canisters. However, if the 5 metric tons of this additional plutonium were to be processed through H-Canyon while maintaining the 897 g/m3 concentration in the vitrified glass produced in the DWPF, approximately 6000 more canisters (the equivalent of three additional glass waste storage buildings) would be produced. Moreover, the addition of the 6,000 canisters would extend the operation of DWPF, and the feed tanks for sludge processing, through the end of 2037. Section 6.2 of the SRS "Liquid Waste System Plan, Revision 15" (January, 2010), SRR-LWP2009-00001.

DOE-SR has a well-developed Risk Management Plan associated with the Liquid Waste System Plan. [Cite January 13, 2009, Joint Committee presentation by Soni Blanco and Gavin Winship.] The Risk Management Plan has been highly successful in identifying project risks and, through multi-discipline reviews, in developing strategies to avoid, reduce, or mitigate project-execution risks in order to assure

[3] DOE continues to evaluate an overall plutonium disposition game plan. However, as reflected in the January, 2010, SRS Liquid Plan, Revision 15, an alternative under active consideration is the H-Canyon/DWPF path. Significantly, this path has been embraced by the DOE for several years. Another alternative, which would require regulatory approval or concurrence by the State of New Mexico, is shipment to and disposal in the Waste Isolation Pilot Project in Carlsbad. In contrast to the New Mexico alternative, no regulatory approval or concurrence would be needed for additional loading of fissile material ***currently resident at SRS*** into DWPF canisters.

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successful completion of SRS missions, including the Enriched Uranium Disposition project. The Plan also identifies opportunities to accelerate schedules and decrease costs. Assumptions, such as the absence of a leak in the liquid waste storage tanks, may be identified as project risks in the Plan. The ability of DOE-SR to increase the plutonium loading in the canisters produced by the DWPF above the 897 g/m3 figure was an identified project risk (Risk Assessment ID Number 243).

On February 4, 2010, DOE-SR directed the liquid waste contractor, Savannah River Remediation, LLC, "to promptly transition sludge batch preparation to the WAPS [Waste Acceptance Products Specifications] plutonium concentration limit of 2,500 g/m3…" Additionally, DOE-SR informed the contractor to continue on-going analysis of increased loading of DWPF canisters with higher fissile concentrations above the 2,500 g/m3. February 4, 2010, letter from Terrel J. Spears, DOE Contracting Officer's Representative to James French, President and Project Manager, Savannah River Remediation, LLC.

The SRS-CAB was informed on May 4, 2010, that DOE decided to rescind this direction to the liquid waste contractor, and would "maintain the 897 g/m3 loading as a result of pending litigation" associated with DOE's intention to withdraw the License Application for Yucca Mountain.

On May 3, 2010, a federal appeals court denied a request by South Carolina to immediately stop DOE from shutting down the Yucca Mountain project, because South Carolina could not show it met the "stringent standards required for an injunction or stay pending court review." In particular, the court referred to the state's failure to demonstrate "irreparable harm" from the project's closure. DOE spokeswoman Stephanie Mueller has been quoted in the media as stating, "It means the court agreed that the Department can proceed with winding down the Yucca project responsibly while the litigation proceeds so as not to needlessly waste taxpayer money."

Comments:

For over a year, the SRS CAB has been following the potential for increased loading of fissile material through the DWPF. The 897 g/m3 figure in the Yucca Mountain application seems inadequate to dispose of known plutonium quantities in addition to other amount that be identified later. In our view the 897 g/m3 figure is outdated and inconsistent with DOE's current missions, and an artificial barrier to prudent processing of the liquid wastes with increased plutonium loading. DOE should have addressed the erroneous figure in the revision to the Yucca Mountain application of February 19, 2009. The public is concerned about the safe and economical placement of excess plutonium into the DWPF canisters; the 897 g/m3 figure is inappropriate and should be corrected at the program implementation level at SRS immediately by re-confirming DOE-SR's February 4, 2010 directive to the liquid waste contractor.

[4] Loading to 4000 g/m3 was preliminary evaluated by DOE-SRS as within safety, security and criticality limits in Risk Assessment No. 243 (need confirmation)

[5] In June, 2008, the DOE application filed an application with the NRC for a license for a National Repository at Yucca Mountain. http://www.nrc.gov/waste/hlw-disposal/yucca-lic-app.html On February 19, 2009, the DOE filed an "update" to the application. On March 3, 2010, the DOE filed a motion with the NRC to withdraw the application. The NRC Commissioners have directed that the NRC issue a decision on this motion by June 1, 2010.
http://www.nrc.gov/reading-rm/doc-collections/commission/orders/2010/2010-13cli.html

[6] The SRS-CAB does not consider the placement of plutonium or liquid waste into the canisters and interim storage in the Glass Waste Storage Buildings as "disposition" by the DOE. Section 3155(c) of Public Law 107-107, referred to as the "National Defense Authorization Act for Fiscal Year 2002" requires DOE to prepare a "Plan for Disposition" that calls for "disposal of the surplus defense plutonium and defense plutonium materials currently located at the Savannah River Site…" A "disposition plan" is a disposal plan under this Law, and placement in the Glass Waste Storage Buildings is an incomplete disposition plan.

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Recommendation:

The Savannah River Site Citizens Advisory Board (SRS CAB) recommends the following:

1. Increase plutonium loading to 2500 g/m3 as set forth in DOE's February 4, 2010 directive to the liquid waste contractor, and pursue additional loading to the maximum extent safe and practicable. If DOE continues to pursue the 897 g/m3 loading, please provide the CAB with an explanation of the technical, legal, and practical reasons for maintaining that level.
2. Explain to the CAB why DOE's risk management and communication systems failed to assure that the 897 g/m3 figure was revised to a correct figure in the revision to the Yucca Mountain application dated February 19, 2009 so as to eliminate the previously-identified Plan Risk No. 243.
3. Assure that any future DOE license application filed with NRC or other governmental authority for any geological repository accurately reflects EM's Waste Acceptance Product Specifications ("WAPS") of 2500 g/m3 (or such other higher loading as may be justified by EM evaluations) or, if DOE's license application for Yucca Mountain is pursued, assure that an amendment to the application for such higher loading level(s) be pursued diligently and quickly.

Recommendation amended to send a carbon copy to The Blue Ribbon Panel on Yucca Mountain.

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