Fissile Mass Loading Limit in Defense Waste Processing Facility (DWPF) Glass Waste Canisters

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- Integrated System Materials Processing
  - Identify criteria between Nuclear Materials and Liquid Waste to ensure successful completion of both organizational missions.
  - Provide a joint briefing to the CAB on identified criteria.
  - Provide the CAB periodic updates on criteria completion and impacts to mission performance.

- DOE response included acceptance of all three subparts
  - Today is the first joint briefing on criteria that impacts both organizational missions.

Fissile Mass Loading Limit

- **What is Fissile Material?**
  - This is material capable of sustaining a nuclear chain reaction.
  - The sum of fissile isotopes includes U-233, **U-235**, **Pu-239** and **Pu-241**.

- **Current Criteria:**
  - Current limit is 2,500 g/m3 of fissile material in a Glass Waste Canister.

Fissile Mass Loading Limit (continued)

- **Liquid Waste Factors that are considered in determining fissile loading limit:**
  - Glass durability limits
  - Glass criticality limits
  - DWPF processing criticality limits
- **Nuclear Materials**
  - Basin inventory and H-Canyon processing rate determines the maximum fissile that could be generated for disposition to a sludge batch
  - Number of extra cans produced as a result of Accelerated Basin De-inventory (ABD)
  - Amount of L-Basin inventory dispositioned to DWPF
    - *Desire is to discard all L-Basin items to DWPF*
    - *Prevent standing up an alternative waste processing operation in H-Canyon if ABD mission extends past Tank Farm closure date*

Fissile Mass Loading Limit (continued)

Anticipated Fissile Mass Loading		
Sludge Batch	*Total Fissile (kg)*	*Fissile Conc. Glass (g/m3)*
SB11	645	2,222
SB12	656	2,164
SB13	611	2,156
SB14	770	2,718
SB15	773	2,830
SB16	747	2,732
SB17	783	3,149
SB18	686	2,894
SB19	1015	3,555

Path Forward

- SRNL is developing a data package that includes:
  - Determination of a bounding number based upon the projected maximum fissile concentration in glass for any future DWPF sludge batch.
  - Update on glass chemistry of poured canisters and projections for future DWPF batches.
- This data package is used by Sandia National Lab to perform a closure analysis of a repository for the DOE-Office of Nuclear Energy.
  - Data will be used to update the models supporting a generic repository.
  - The analysis looks at potential interactions with other packages (i.e., spent fuel) in the repository.
- DOE-SR will submit a position paper and approval request to DOE-EM and DOE-NE that includes:
  - New proposed fissile limit for glass.
  - Concurrence from Sandia National Lab based on updated analysis.
- The updated repository limit is expected to be bounded by the processing limits in the SRS facilities.
  - Follow standard Sludge Batch Qualification process that operates within the facility safety basis and demonstrates an acceptable waste form (i.e., “good glass”) per the waste acceptance criteria.

Current Status

- DOE-SR facilitated a kick-off meeting with the main organizations that will be integral through the approval process including:
  - DOE-Office of Environmental Management, DOE-Office of Nuclear Energy, Savannah River National Lab, Sandia National Lab, Savannah River Nuclear Solutions, and Savannah River Mission Completion.
- Previous analysis in the Liquid Waste System
  - For the Excess Plutonium Disposition project, fissile loading levels up to 5400 g/m^3 have been conceptually evaluated (see System Plan 17 alternative analyses).
  - A 2008 Nuclear Criticality Safety Evaluation resulted in allowing for future waste streams that have fissionable material with a higher equivalent U-235 enrichment.
- There has been public support for higher loadings: SRS Citizens Advisory Board supported 2500 g/m^3 (*or higher*) to accelerate the SRS mission
  - CAB adopted Recommendation 270 in May 2010:
    - *DOE should increase the plutonium loading to 2500 g/m^3 and pursue additional loading above 2500 g/m^3 to the maximum extent safe and practicable.*
    - *DOE should include in any future DOE license application for any geological repository to accurately reflect the WAPS level of 2500 g/m^3 or higher as may be justified.*

Potential Stakeholder Concerns

- **Glass Waste Storage Building (GWSB):**
  - The ABD program does not create the need to construct an additional GWSB.
  - Canisters containing ABD material do not impact GWSB storage requirements.

- **Nuclear Safety**
  - Every Liquid Waste facility affected by increased limit will be analyzed for criticality concerns and potential hazards.

Comments/Questions