



**SUBISSUE 4: HLW GLASS DEGRADATION AND RADIONUCLIDE RELEASE**

**Presented by  
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**Appendix 7 Meeting: Container Life and Source Term**

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## OUTLINE OF PRESENTATION

- **NRC TPA3 SENSITIVITY ANALYSIS**
- **ACCEPTANCE CRITERIA**
- **RESOLVED TOPICS**
- **DETAILED TOPICS:**
  - **Mode of Water Contact**
  - **Leach Rate**
  - **Colloid Contribution**
  - **Hydration**
  - **Artificially High Initial leach Rate in TSPA-VA**
  - **Groundwater Chemistry in Waste Package**
  - **Interaction between HLW Glass and Spent Fuel**
  - **QA of HLW Glass Sample and Field Tests**
  - **Release Scenarios**

## NRC TPA3 SENSITIVITY ANALYSIS

- **Using DOE's model from TSPA-VA to adjust input parameters for TPA3.2, 15% for 10,000 year and 5% for 50,000 year**

### ACCEPTANCE CRITERIA

- (1) DOE has taken into account all types of HLW glass planned for YM disposal.
- (2) DOE has identified and considered likely processes for the degradation of HLW glass and the release of radionuclides from the EBS, i.e., dissolution of the primary phase, formation of secondary minerals and colloids; microbial action; and radionuclide release and transport from the WP emplacement drifts.
- (3) DOE has demonstrated that the numerical models used for determining the rate of dissolution of HLW glass and the rate of radionuclide release from the EBS are adequate representations, taking into consideration the associated uncertainties, of expected HLW glass performance, and are not likely to underestimate the actual rate of degradation of the HLW glass and the subsequent rate of release in the repository environment.
- (4) DOE has assessed the compatibility of HLW glass with internal components of the WP in the evaluation of radionuclide release, taking into consideration co-disposal with DOE-owned SNF in the same SP. Specifically, HLW glass should not compromise the performance of the WP.
- (5) DOE has justified the use of test results for HLW glass not specifically collected for the YM site for the environmental conditions expected to prevail after breaching of the containers at the YM site.
- (6) DOE has conducted a consistent, sufficient, and suitable corrosion testing program at the time of the LA submittal. In addition, DOE has identified specific plans for further testing to reduce any significant area(s) of uncertainty as part of the performance confirmation program.
- (7) DOE has established an adequate program of monitoring radionuclide release from the WP during the performance confirmation period, to assure that assumptions and calculations regarding HLW glass dissolution and radionuclide release are appropriately substantiated.

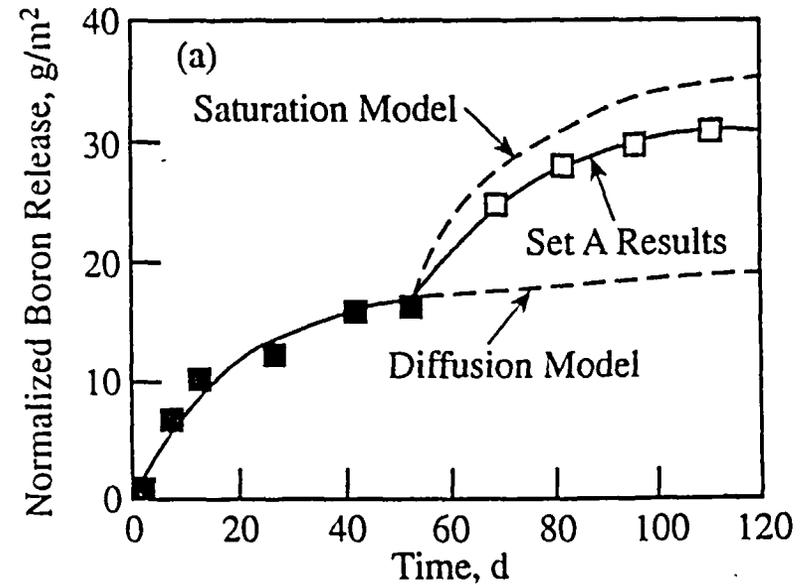
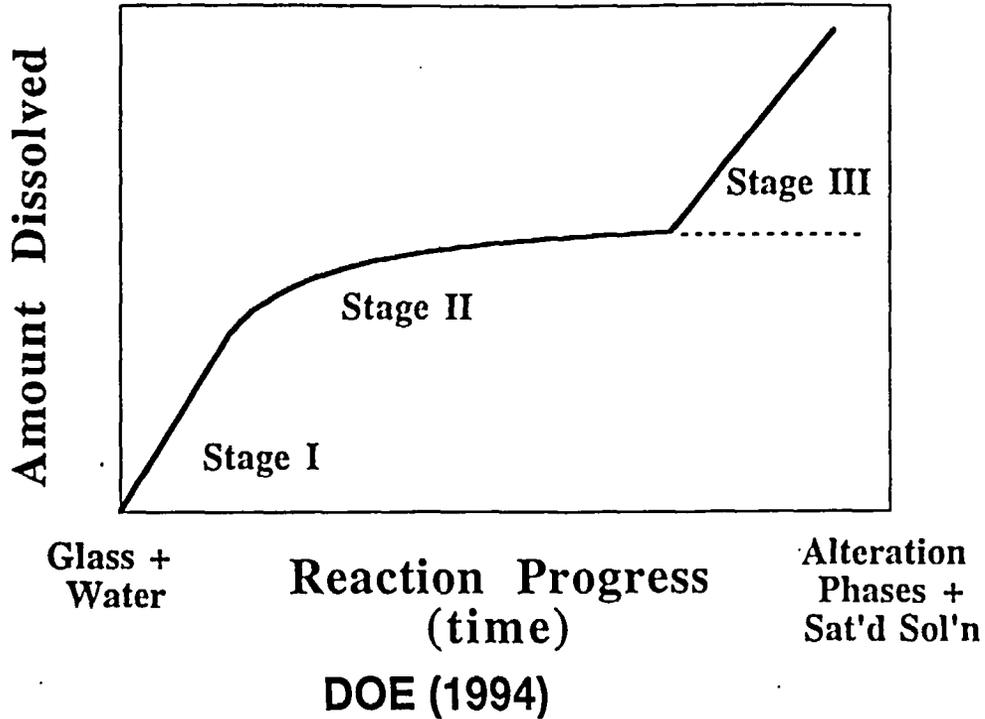
## **RESOLVED TOPICS**

- **HLW Glass Type**
- **Inventory and Distribution of Radionuclide**
- **Leaching Process in General**

## DETAILED TOPICS

- Leach Rate

- Stage 3 dissolution rate: leach excursion because of the precipitation of secondary phase



Ebert et al. (1998)

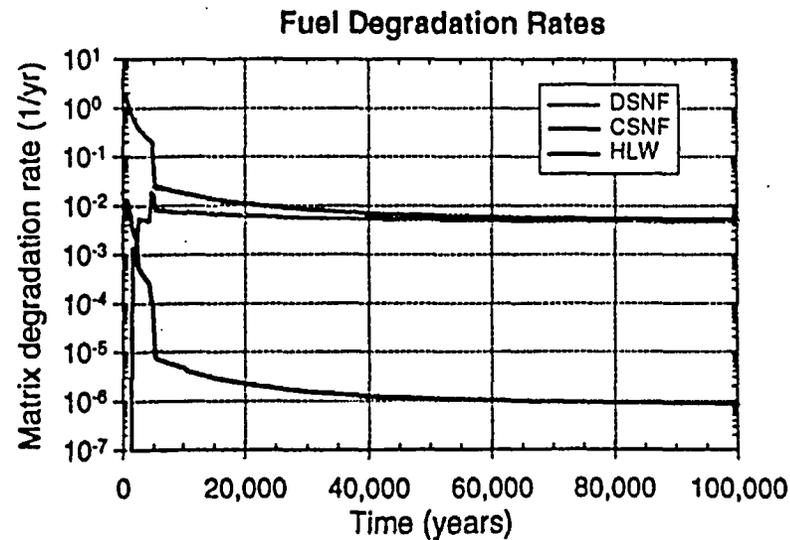
- **Colloid contribution:**

Nearly 100 % of Pu release was colloidal. A steep increase in radionuclide release for Pu and Am after 400 weeks in drip tests

- **Hydration:**

The hydrated layer formed in vapor phase may lead to a pulse release of radionuclide later in direct contact with groundwater.

- **Artificially high initial leach rate in TSPA-VA (DOE, 1998)**



- **Groundwater chemistry in waste packages**
- **Was interaction between HLW glass leaching and spent-fuel dissolution considered?**
- **Do the doped concentrations of radionuclides in simulated HLW glass represent real concentrations in the HLW glass?**
- **Comparison with field test results is recommended (e.g., microbe effects).**
- **The role of perforation is not well understood: controlled release from limited diffusion path or accelerated release by the formation of severe chemistry**

## **SUMMARY**

- (1) The dose is insensitive to HLW glass leaching.**
- (2) Acceptance criteria were presented.**
- (3) Potential dose contributors are stage 3 leaching, colloid, and hydration.**
- (4) Other topics discussed include mode of water contact, TSPA-VA, chemistry inside waste package, interaction between HLW glass and spent fuel, QA of HLW glass and field tests, and release scenarios**