U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

PRESENTATION TO THE NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: WASTE FORM AND MATERIALS TESTING CONSIDERATIONS

PRESENTER: DR. GREGORY E. GDOWSKI

PRESENTER'S TITLE AND ORGANIZATION: CHEMICAL ENGINEER
KMI/LAWRENCE LIVERMORE NATIONAL LABORATORY
LIVERMORE, CALIFORNIA

PRESENTER'S TELEPHONE NUMBER: (510) 423-3486

OCTOBER 8 - 10, 1991

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Outline of Presentation

- Introduction
- Low thermal loading testing considerations
- High thermal loading testing considerations
- Other testing considerations
- Summary

Thermal Loading Temperature Scenarios

- **Low thermal loading**
  - **Temperature always remains below boiling**
- **High thermal loading**
  - **Temperature initially above boiling but eventually will be below boiling**

Low Thermal Loading Testing Considerations

Low temperature testing

- Degradation of container materials and Zircaloy cladding
- Hydride precipitation and reorientation in Zircaloy cladding
- Oxidation and dissolution of UO_2 fuel pellets
- Hydration and dissolution of borosilicate glass

High temperature testing

- Accelerated testing
  - Must ensure that mechanisms of degradation do not change with temperature

High Thermal Loading Testing Considerations

High temperature testing

- Aging and oxidation of container materials
- Other degradation modes of container materials
- Creep/stress rupture of Zircaloy cladding
- Hydrogen effects in Zircaloy cladding
- Oxidation of UO_2 fuel pellets
- Hydration of borosilicate glass
- Accelerated testing

High Thermal Loading Testing Considerations

Low temperature testing

- **Low thermal loading testing**

- **Tests on materials modified by high temperature processes**
  - **Dissolution of U_3O_8 / UO_3**
  - **Dissolution of hydrated borosilicate glass**
  - **Degradation resistance of oxidized and aged container materials**

Other Testing Considerations

- Backfill/container material interaction
- Waste package component interaction
- Final closure

Summary

- Degradation phenomena and concerns have been identified for both high and low thermal loading scenarios
- Testing is required to characterize and model the degradation modes of materials and waste forms
- Testing should proceed simultaneously with engineered barrier system design