

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

**NUCLEAR WASTE TECHNICAL REVIEW BOARD  
ENGINEERED BARRIER SYSTEM, TRANSPORTATION,  
AND SYSTEMS JOINT PANEL MEETING**

**SUBJECT:  
STORAGE**

**EFFECTS OF PROLONGED DRY-  
ON STORAGE AND TRANSPORTATION  
PERFORMANCE OF MPCs**

**PRESENTER:**

**JIM CLARK**

**PRESENTER'S TITLE  
AND ORGANIZATION:**

**DEPUTY MANAGER, STORAGE & TRANSPORTATION  
CRWMS M&O (E. R. JOHNSON ASSOCIATES INC.)**

**PRESENTER'S  
TELEPHONE NUMBER:**

**(703) 204-8920**

**Dallas, Texas  
November 1-2, 1993**

## **Recent Studies**

- **Sandia Report - SAND88-2482, November 1991**
  - **Considerations applicable to the transportability of a transportable storage cask at the end of the storage period**
- **PNL Report - PNL-8072, April 1992**
  - **Foreign experience on effects of extended dry storage on the integrity of spent nuclear fuel**
- **EPRI Report - EPRI TR-102462, June 1993**
  - **Shipment of spent fuel in storage canisters**

# **Sandia Report - TSC Considerations**

- **Sponsored by OCRWM**
- **Briefed to NWTRB on January 6, 1993**
- **Important Technical and Regulatory Considerations**
  - **Containment, criticality control, heat transfer, shielding**
- **Recommended Evaluation Process**
  - **Fuel and cask monitoring (extend present database)**
  - **Evaluations of control casks (corrosion of welds)**
  - **Pre-transport functional testing (seals)**
  - **Administrative process, including recordkeeping for fuels and casks (document storage conditions)**

# **PNL Report - Foreign Experience**

- **Sponsored by OCRWM**
- **Reviews Mechanisms for Degradation**
- **Indicates World-Wide Status and Plans for Dry Storage**
- **Documents Expected Long-Term Integrity**

# **Selected Countries Spent Fuel Storage Highlights PNL Report**

- **Canada (Since 1980)**
  - **600 MTU of CANDU in dry concrete concrete cask**
  - **Temp limit 150°C in air**
- **United Kingdom (Since 1972)**
  - **100's MTU of Magnox in vault storage**
  - **CO<sub>2</sub> storage short-term, then air**
  - **Clad limit 365°C in CO<sub>2</sub>, 150°C in air**
- **Germany (Since 1979)**
  - **3000 LWR rods tested**
  - **Inert gas at 250-430°C**
  - **About 2 year dry storage**

## **PNL-8072 Conclusions**

- **LWR Integrity for Long-Term Storage in Inert Gas at 320-400°C Considered Proven by Countries Surveyed**
- **Relatively Few Results on Effects of Long-Term Storage in Air of Defective LWR Fuels**

# **Shipment of SNF in Storage Canisters**

## **EPRI TR-102462**

- **Prepared by Pacific Nuclear**
- **20 Year to 50 Year Dry Storage**
- **Specific Aging Phenomena**
  - **Radiation-induced**
  - **Thermally-induced embrittlement**
  - **Creep at elevated temperature**
  - **Corrosion**

# **Shipment of SNF in Storage Canisters EPRI Report**

## **Conclusions**

- **Radiation and Thermally-Induced Embrittlement Pose Little or No Risk**
- **Expected Temperatures are Not High Enough to Postulate Deformation Due to Creep**
- **Only Significant Potential is Corrosion**
- **With Proper Material Selection and Corrosion Allowance, No Significant Effects Identified Which Would Preclude Transportation After Extended Storage**



## **Prior OCRWM Dry-Storage RD&D Projects**

- **Performance Testing of Six Systems (1986-1992)**
- **Heat Transfer and Shielding Code Developments (1985-Present)**
- **Spent Fuel Oxidation Testing (1983-1990)**
  - **Final report (PNL-6640 Volume 3) due in November**

# **New OCRWM Project: Spent Fuel Behavior in Long-Term Storage**

- **FY 1994 - FY 2000**
- **Purpose**
  - **Confirm long-term dry storage can be conducted safely**
  - **Provide information for the on-going designs of MRS, ISFSIs and MPCs**
  - **Provide information for dry SNF cask-to-cask transfer designs**
- **Use Two Existing Loaded Casks at INEL**
- **Continue Routine Cask Monitoring**

# **Spent Fuel Behavior Project (Cont'd)**

- **Initiate Enhanced Monitoring**
  - **Quarterly gas sampling (FY94)**
  - **Fuel assembly inspections (FY95 and 5 years)**
  - **Sampling and analysis of fuel rod corrosion products (crud)**
  - **Measurement of seal integrity**
  - **Metal and concrete sample coupons**