

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

**NUCLEAR WASTE TECHNICAL REVIEW BOARD
FULL BOARD MEETING**

**SUBJECT: PLANNING FOR DOE NUCLEAR
MATERIALS THAT MAY BE DESTINED
FOR GEOLOGIC DISPOSAL**

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Presentation Objectives

- **General Information on All Waste Forms**
 - **CRWMS Strategic Goals**
 - **OCRWM Program Technical and Planning Bases**
 - **Departmental Activities on Disposition Pathways**
 - **Key Generic Considerations for Incorporation**
- **Specific Activities for DOE Materials**
 - **Department Decisionmaking**
 - **Material or Waste Inventories**
 - **Status of DOE Activities and Preliminary Evaluations**

OCRWM Strategic Goals

**Primary Program Goal:
Lead the collaborative Development
and Implementation of National policy
for disposal of SNF and HLW**

Strategic Goal 1

**Participate Actively in Key
Deliberations which Affect Disposal
of DOE nuclear materials**

Strategic Goal 2

Current Program Planning

- **OCRWM Technical Requirements limit receipt of spent nuclear fuel and vitrified high-level waste in primary emplacement area to 70,000 metric tons**
 - **63,000 metric tons of SNF from civilian reactors**
 - **7,000 metric tons equivalent of vitrified HLW**
 - **Current planning is for disposal in first repository of SNF and HLW not subject to RCRA**
 - **Additional capacity only as a future growth option**

Department Focus on Permanent Disposal of Radioactive Wastes

- **DOE is addressing vulnerabilities with the management and disposition of nuclear materials**
 - **Defense Nuclear Facility Safety Board Recommendations**
 - **NAS Management and Disposition of Excess Weapons Plutonium**
 - **Establishment of Office of Fissile Materials Disposition**
 - **Baseline Management Inventory Report**
 - **Final disposal pathway for some nuclear materials not defined**
 - **Materials In Inventory Report**
 - **Identifies materials with no current or future use**
 - **Baseline Environmental Management Report**
 - **Annual report to Congress on cost and schedule to cleanup**
 - **Waste Management Programmatic EIS**

Key Waste Form Considerations

- **Inventory and Characterization Data** (Qualification Back Up Slide)
- **Statutory and Regulatory Analysis** (NWPA Considerations Back Up)
- **Criteria for the Waste Package and its Components**
- **Design and Operational Concepts**
 - Waste Package Designs
 - CRWMS Operational and Handling Aspects
- **Long-term Performance**
 - Engineered Barrier and Total System Performance Assessment
 - Long-term Criticality Analysis
- **Disposal Cost Estimates and Schedule Implications**

Incorporating DOE Nuclear Materials

- **Conduct Preliminary Analyses**
 - **Comparative evaluation against standard waste form characteristics**
- **Modify Planning and Design Bases**
 - **Baseline Change Proposals and Impact Evaluations**
 - **Revise Planning, Technical Requirements, and Design Documents**
 - **Identify changes to work scope**
- **Incorporate into Program Development Activities**
 - **Develop Detailed Design and Licensing Strategies**
 - **Conduct Environmental Impact Evaluations**
 - **Develop Detailed Waste Acceptance Criteria**

Materials Under Investigation

- **Currently evaluating potential geologic disposal of other highly radioactive materials**
 - **Department-owned spent nuclear fuel**
 - **Surplus Weapons Fissile Material**
 - **Alternate immobilized high-level waste**
 - **Cesium and Strontium Capsules**
 - **Greater-than-Class C Low-level Waste**

DOE-owned spent nuclear fuel

Department Decisionmaking

- **Programmatic SNF and INEL EIS and ROD**
 - **Safe interim storage at regional sites**
 - **Department planning basis to dispose of some or all DOE SNF in a first geologic repository**
- **Foreign Research Reactor SNF EIS**
- **Interim Nuclear Materials Management EIS**
- **Management of SNF from the K-Basins at Hanford EIS**
- **Container Systems for Naval SNF Management EIS**
- **Consent agreements with Idaho and Colorado**

DOE SNF Inventory by 2035

• N-reactor Production Fuel	2,100 MTHM
• Naval propulsion reactor SNF	65 MTHM
• Research Reactor SNF	62 MTHM
• Special-case Commercial SNF	186 MTHM
• SRS DefenseProduction SNF	184 MTHM
• Experimental SNF	116 MTHM
• Graphite SNF	28 MTHM

Total : 2,741 MTHM

Requirements and Data Needs for DOE Spent Nuclear Fuel

- **“Preliminary Requirements for Disposition of DOE SNF Requiring Deep Geologic Disposal”**
- **Report on data needs for DOE SNF as part of Unified Database development**
- **EM site visits to assess quality of data**
- **Development of SNF characterization test plans**
- **Submittal of initial baseline change proposal on DOE SNF**
 - **Revise 7,000 MTHM defense allocation to displace some HLW with up to 2,333 MTHM of DOE SNF**

Activities and Preliminary Evaluations for DOE Spent Nuclear Fuel

- **Established DOE SNF Steering Group**
- **Evaluate work scope and schedule impacts for DOE SNF**
- **Continue PA and criticality evaluations of DOE SNF**
- **Research Reactor SNF**
 - **Assessment of Al-clad research reactor SNF disposal alternatives**
 - **FRR Direct Disposal Feasibility and Cost Analysis**
- **N-Reactor SNF**
 - **Evaluating potential for pyrophoricity under repository conditions**
 - **RW review of N-reactor multicannister overpack design specs**

Surplus weapons-usable fissile material

Departmental Decisionmaking

- **PEIS on Storage and Disposition of Weapons-usable Fissile Materials issued in March 1996**
 - **Addresses Administration non-proliferation policy**
 - **Evaluates disposal considerations of various options in a hypothetical repository**
- **Record of Decision will narrow the potential options to a small set of preferred alternatives**

Inventory Characterization of Dispositioned Weapons Materials

- **Reactor Disposition Forms**
 - **BWR and PWR mixed oxide spent nuclear fuel**
 - About 250 MPC-sized waste packages with 40 BWR assem
 - About 488 MPC-sized waste packages with 4 PWR assem
 - **These options could be alloted to civilian allocation**
- **Immobilized Forms**
 - **Vitrified waste form**
 - About 600 canisters similar to DWPF canisters
 - **Crystalline ceramic waste form**
 - **Glass-bonded zeolite waste form**

Activities and Preliminary Evaluations on Weapons-usable Fissile Materials

- **Conducted long-term criticality evaluations**
 - Analyses of intact waste forms remain subcritical
 - Conducting evaluations of degraded waste forms
- **Conducted total system performance assessments**
 - Comparative releases generally two orders of magnitude lower
- **Analyzed operational and handling considerations**
 - Impacts expected to be minimal due to small quantities
 - Waste form availability consistent with repository schedules
 - Repository operations to be evaluated as part of non-proliferation
- **Evaluated regulatory and statutory implications**
 - Immobilized forms need rulemaking or legislative clarification

Hanford Tank Waste Remediation Department Decisionmaking

- **Draft TWRS EIS issued March 1996**
 - **Assesses several tank waste cleanup alternatives**
 - Preferred alternative is for disposal in a repository
 - No preferred alternative for Cs/Sr capsules
- **RFP for privatizing cleanup operations issued**
 - **Vendor proposals on treatment of HLW tanks using borosilicate glass as preferred approach**
 - **Identifies requirements to be met if a non-standard immobilized HLW form is proposed**

Inventory Characterization for Hanford HLW

- **TWRS EIS options result in 1,500 to 587,000 DWPF-size canisters of borosilicate HLW glass**
- **Cost efficiencies mandate other ways of immobilizing and TWRS RFP allows for alternative forms**
- **Possible options include other silica glasses, ceramics, and metallic forms**

Activities and Preliminary Evaluations for Hanford HLW

- **Preliminary Requirements for Vitrified HLW**
- **Preliminary TSPA-Sensitivity Study for an Alternate Immobilized HLW Form**
- **Preliminary Analysis of 4.5 meter HLW canister**
- **Evaluation of Additional Studies to Determine Disposability of Cs/Sr Capsules**
- **Enhancement of Cost Estimate for Evaluating Immobilized HLW options planned**

Greater-than-Class C low level waste

Department Decisionmaking

- **10 CFR Part 61, Waste Classification**
 - **GTCC must be disposed of in a Part 60 repository unless proposed for disposal in a site licensed under Part 61**
- **Department strategy recommendation**
 - **Intermediate disposal facility for GTCC alone not cost effective**
 - **Co-dispose GTCC with SNF in a geologic repository**
 - **Co-dispose GTCC with DOE-held LLW**
- **Inventory Characterization of GTCC**
 - **Total of approximately 3,000 cubic meters**
 - **Nuclear reactor hardware and other activated metals**
 - **Sealed radiation sources used in commerce**
 - **Other commercial wastes such as filter resins**

Nuclear Waste Policy Act Considerations

- **Sec. 2(12) defines high-level waste as material resulting from reprocessing of spent fuel**
- **Sec. 8 required DOE to evaluate comingling commercial and defense waste**
- **Sec. 114(d) sets a statutory limit of 70,000 MT heavy metal in the first repository**
- **Sec. 160(a) establishes Yucca Mountain as the only candidate site**
- **Sec. 161(b) requires evaluation on need for second repository between 2007 and 2010**
- **Sec. 302(b)(4) requires payments of fees under interagency agreement for disposal**

BACKUP SLIDE

Qualification of Waste Forms

- **Inventory and Characterization**
 - Physical, Chemical, Radiological Properties
 - Characterization Testing
- **Quality Assurance and Qualification of Data**
- **Performance Assessment**
 - Waste Form Performance under Repository Conditions
 - EBS and Total System Performance and Criticality Analyses
 - Validation and Confirmatory Testing
- **Design and Operations**
 - Engineered Barrier System and Facility Designs
- **NEPA/Environmental Assessment**
- **Licensing/Safety Analysis Report**

Key Waste Form Considerations

- **Waste Form Requirements**
 - Solid/No particulates/Non-combustible
- **Waste Package Design Criteria and Considerations**
 - Free Liquids/Non-explosive/-pyrophoric/-Chemically Reactive
 - Solubility/Redox/Hydrating/Radiolysis/Corrosion/Other Interactions
 - Criticality Control
- **Engineered Barrier and Total System Performance**
- **Physical Interface Limitations**
 - Dimension/Weight/Material Compatibility/Radiation/Thermal /Internal Gas Pressure/Canister Surface Contamination/Handling
- **Safeguards and Material Accounting**