CANADIAN INTERIM STORAGE PLANS & INTEGRATION WITH DISPOSAL

Mohan Rao, Ontario Hydro

Technical Challenges to Interim Storage of Spent Fuel
US Nuclear Waste Technical Review Board Meeting,
Dallas, Texas, November 1-2, 1993
CANADIAN INTERIM STORAGE PLANS & INTEGRATION WITH DISPOSAL

Mohan Rao, Ontario Hydro

Technical Challenges to Interim Storage of Spent Fuel
US Nuclear Waste Technical Review Board Meeting,
Dallas, Texas, November 1-2, 1993
STORAGE HIGHLIGHTS IN CANADA

• Seven CANDU Stations

• Used Fuel Bundles (17,000 Mg)

• Mostly wet storage; 700 Mg in dry storage
  • pools
  • Canisters/Dry Storage Containers (DSCs)
DRY STORAGE CANISTER
Dry Storage Container (DSC)
FUTURE PLANS/INTEGRATION HIGHLIGHTS

• Disposal Plan

• Extended storage as a contingency

• Wet storage integration
  • Defuelling/transport/disposal

• Dry storage integration
  • Defuelling/transport/disposal
  • Direct disposal (DSCs)

DSC is being developed as a multi-purpose container.
Expanding clay & crushed granite

Crushed granite and clay

Concrete Plug

Access Tunnel

To surface
DSC - ROLE
AS A MULTI-PURPOSE CONTAINER (MPC)

1. Reference concept
   • three barriers, three fuel handling steps

2. Alternate/future concept
   • DSCs as MPC
   • cost/benefits
DSC - BACKGROUND

- On-site waterpools getting filled
- Dry storage developed as a storage alternative
- Design is suited for multi-purpose use (storage, transportation and disposal)
- Will be used at Pickering

Pickering will have Canada's "MRS"
DRY STORAGE - DOUGLAS POINT
DSC - DEVELOPMENT

1. DSC - approved storage container
   • demonstration
   • Pickering facility
   • future facilities - Bruce
   • extended storage

2. DSC - transportation
   • licensing tests

3. DSC - disposal container concept
   • number of issues
   • need for significant R&D
DSC - STORAGE CONTAINER

- 2.1 m x 2.2 m x 3.5 m, 384 fuel bundle payload, 500 mm reinforced HD shielding concrete

- Two prototypes

- Licensed for use at Pickering
  - Phase I - 62 DSCs
  - Phase II - 700 DSCs

- Above-ground building (first stage)

DSC is a licensed storage concept
DSC DETAILS

- Shield Plate
- Lid Locating Pin
- Seal/Structural Weld
- Fuel Modules (Total 4)
- Reinforced High Density Concrete
- Steel Inner Liner
- Steel Outer Liner
- Vent Port
- Lift Plate
- Fuel Bundles (Total 384)
- Drain Port
- Safeguards Seal
DSC -- TRANSPORTATION CONTAINER

- Foam-core, steel-lined impact limiters
- Additional armour
- Type B test compliance (Impact, puncture, fire)
- Desktop analysis

DSC is considered transportable.
DROP TEST (PHOTOGRAPH 1)
DROP TEST
(PHOTOGRAPH 2)
DROP TEST
(PHOTOGRAPH 3)
DSC - EXTENDED STORAGE

- Concrete durability research
- Fuel durability research

DSC is a potential component for extended storage.
DSC - DISPOSAL CONTAINER CONCEPT

- Reduced Handling
- Reduced demand on strategic metals (Titanium)
- Better shielding/access

Barrier effectiveness of DSC in disposal is being studied
DSC - KEY DISPOSAL CONDITIONS

- 500 year containment
- 13 MPA pressure
- Less than 100°C temperature
- 5 W bundle heat
- Environmental Conditions

DSC conditions more stringent than storage and transportation
DSC/REPOSITORY COMPATIBILITY ISSUES

1. Mechanical handling
   • vault design
   • container emplacement
   • overpack

2. Structural performance
   • strength
   • containment

3. Concrete durability
   • aging effects
   • thermal effects
   • wasteform/geochemical effects

4. Liner corrosion
   • inner/outer liners
   • microbial
5. Hydrogen generation
   • production/transport
   • effect on disposal performance

6. Chemistry-related issues
   • hyperalkaline media
   • corrosion

7. Performance/cost issues
   • overall safety/system cost
   • retrievability

Some degree of resolution of issues needed for taking up R&D
CONCLUSIONS
TO DATE

- DSC is licensed storage concept and licenseable for transport
- OH commited to the use of DSC for interim storage
- DSC has the potential as a disposal barrier
- Disposal issues need to be resolved and commitment needed for R&D
- DSC is economic for storage alone; additional savings from the use of DSC as MPC likely