Handling of failed fuel:
From reactor to final repository by reconditioning in Studsvik concrete cells

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Outline

• Background
• Transport from NPP
• Reception control and Safeguard
• Cutting
• Drying
• Encapsulation
• Final storage
Handling of failed fuel in Sweden

- Hundreds of failed fuel rods at Swedish power plants
- Stored in failed rod cartridges in reactor pools
- The failed rods at the nuclear power stations are leaking radio nuclides increasing dose problems and increasing waste for final disposal
- The failed rods contain water and are not accepted in the final storage of spent nuclear fuel
- Authority requirement to reduce this liability
- Studsvik Hot cell laboratory (HCL) has for several decades had a working route for disposal of fuel residuals from hot cell examinations
- The method has been adapted for treatment of failed rods for final disposal in Sweden
Transport from NPP

NPP rod quivers were transported to minimize handling in the plant pool and thereby avoiding handling difficulties and rod breaks in pool

Different casks for different requirements
• NCS 45
  • BWR
• 29t
  • PWR

Modes of transport
• By sea
• By road

Special arrangement required in some cases
Reception control and Safeguard

• Unloading and documentation
Cutting

• Cutting off top and bottom end plugs and cutting the fuel stack in short lengths ensure effective vacuum drying:
  • Avoids evacuation through small pin-holes or failure sites clogged with debris/sludge
  • Avoids evacuation through very long, narrow and tortuous paths of fuel cracks
Drying

- Repackaging in steel capsules
- First vacuum drying (ASTM C1553)
- Pressure rebound test (PRT) First vacuum drying typically requires 24-48 hours
- Second vacuum pumping requires 2-3 hours
- PRT of primary canisters before final weld sealing shows adequate dryness

![Image of canisters and vacuum setup]

![Graph of final pressure rebound test]

All plotted for 30 min after pressure passing 1 mbar
Encapsulation
Final storage

Loading of transport box (PWR assembly dimensions)

PWR design

BWR design