Recent Developments in the Full-Scale Testing of Spent Fuel Casks

Nuclear Waste Technical Review Board
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U.S. Nuclear Regulatory Commission
Approval Standards for Spent Fuel Shipping Casks

- Spent Fuel Casks are certified to be **accident resistant**. They must withstand:
  - Thirty foot drop onto unyielding surface.
  - Forty inch drop onto a steel puncture pin.
  - Thirty minute fully engulfing 1475 °F fire.
  - Immersion Test (50 feet).
The NRC periodically assesses the effectiveness of Type B standards in addressing real world accidents.
Accident Studies by SANDIA, BAM, and CEGB

- Operation Smash Hit
  CEGB - Britain

- Rail Cask Collision
  SANDIA

- Rail Fire
  SANDIA

- Rail-Truck Collision
  SANDIA

- Propane Tank Explosion
  BAM - Germany

- Truck Collision
  SANDIA
Package Performance Study

• Commission approved the testing of a full-scale, NRC certified rail transportation cask in May 2004
  – Authorized staff to purchase a single NRC certified rail cask
  – Realistically conservative test
  – Sufficient instrumentation to collect data for validating analytical methods, including scaling
  – Fully engulfing fire
Full-Scale Impact Testing

• Completion of new drop test facility in Horstwalde, Germany
• Full-scale drop tests
  – GNB-CONSTOR V/TC Cask
  – MHI-MSF69 BG Cask
Initial ground excavation and soil preparation
Excavation and lining of a cavity for the unyielding surface. (46 ft x 46 ft x 16.5 ft).
Placement of steel reinforcement bars, and test instrumentation (force and strain gauges)
Pouring concrete for the unyielding surface
Initial construction work on enclosed test building
Finished skeleton of enclosed test building (left) and top of drop tower (right)
Top of drop tower being hoisted into place by an 80-ton portable crane.
Left: 200- ton winch and cask release mechanism being hoisted into place at top of drop tower.

Right: Close-up of cask release mechanism
BAM Drop Test Facility in Horstwalde, Germany

<table>
<thead>
<tr>
<th>Hoist Capacity</th>
<th>Unyielding Surface</th>
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<tbody>
<tr>
<td>Maximum weight of test object</td>
<td>Impact pad area (steel plate)</td>
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<tr>
<td>200 tons</td>
<td>32x15x0.75 ft</td>
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<tr>
<td>30 feet</td>
<td>170,000 lbs</td>
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GNB-CONSTOR V/TC Cask

Full-Scale Drop Test

Horstwalde, Germany

September 21, 2004
Full-scale Drop Test
CONSTOR
weight: 182 t

III.3 / 0994
21.09.2004
GNB-CONSTOR V/TC Cask

Side view after 9-meter side drop test
End view after 9-meter side drop test
MHI-MSF69 BG Cask
Full–Scale Drop Test
Horstwalde, Germany
September 24, 2004
MHI-MSF69 BG Spent Fuel Cask being prepared for shallow angle drop test
Test preparation for MHI-MSF69 BG
Spent Fuel Cask (shallow angle drop)
MHI-MSF69 BG Spent Fuel Cask after shallow angle (10°) drop test

Side view

End view
Concluding Remarks

- Type B accident condition tests provide a high degree of protection against real life accidents.
- NRC periodically re-assesses the effectiveness of Type B standards to reflect changes in package design and accident statistics.