Brookhaven Graphite Research Reactor (BGRR)

Fred Petschauer
Decommissioning Project Manager
BGRR Complex

Brookhaven Science Associates
U.S. Department of Energy
BGRR General Background

- First reactor built for peacetime research on the atom
- Located on Long Island, New York
- Accomplished great science from 1950 to 1968
- All fuel removed in 1972
- Decommissioning began in 2001
- Decommissioning completed in 2014
Reactor was 25ft by 25ft cube of graphite.

Fueled by uranium fuel rods, cooled by circulating air

Surrounded on sides and top by 5 ft thick steel-encased concrete bioshield wall to protect researchers
History and Decommissioning Planning

- Historic operation logs indicated several fuel failures
- Performed video inspection of fuel channels
- Obtained radiological characterization data
Distorted fuel channels

Gaps in graphite mating surfaces

Caused by excessive heat of failed nuclear fuel
Characterization Data

- Graphite
- Biological Shield
- Control Rods
- 701 Building
## Characterization Data - Graphite Inventory

<table>
<thead>
<tr>
<th>Nuclide</th>
<th>Ci</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-14</td>
<td>571</td>
<td>73%</td>
</tr>
<tr>
<td>Ni-63</td>
<td>97</td>
<td>12%</td>
</tr>
<tr>
<td>H-3</td>
<td>78</td>
<td>10%</td>
</tr>
<tr>
<td>Eu-152</td>
<td>21</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Total Activity (all nuclides)</strong></td>
<td><strong>786</strong></td>
<td></td>
</tr>
</tbody>
</table>

Total Graphite Weight = 1,460,000 lbs

TRU = 0.25 Ci (0.36 nCi/gram)
Internal Pile Dose Rates (Year 2000)

Note: Maximum dose rate detected 80 R/hr
Removal of Pile Fan Sump

- 5’x7’x10’ Deep Concrete Vault
- Excavated surrounding soil
- Removed in one piece
Removal of Canal and Water Treatment House
Removal of Above-Ground Ducts

- ~200’ of ducting
- Segmented into 12 pieces
- Largest piece ~300,000 lbs
Concrete Demolition with Brokk Machine
Below-Ground Duct Coolers, Filters and Primary Liner Removal

Filter Removal

Liner Removal
BGRR Conceptual Graphite Removal
BGRR Conceptual Graphite Removal
Pile Top – Crane Installation
Pile Removal Scope of Work

- Removal of boron shot (approx. 1000 pounds)
- Removal of the 16 control rods from the graphite pile and package for disposal
- Removal of the removable concrete plugs from the top of the biological shield to access the graphite pile
- Removal of the air membrane to access the pile
- Removal graphite pile (approx. 60,000 blocks) down to steel bedplates and package for disposal
Pile Waste Management

- Graphite waste packaged in “supersacks” (soft-sided containers) and placed into 144 cubic foot metal boxes.
- Total boxes - 195
- Shipped by truck (91 shipments) to Nevada
- Some boxes required shielding (approx. 39)
Bioshield Waste Management

- Concrete waste packaged into 650 “supersacks” (soft-sided containers) and placed into “gondola” rail cars (approx. 44 gondolas)
- Activated metal packaged into 33 “intermodal” steel boxes and placed onto flatbed rail cars (approx. 8)
- Shipped by rail to commercial burial facility in Utah
Health and Safety Management

- Removal design (utilized robotics) minimized personnel entries into pile cavity (As Low As reasonably Achievable - ALARA)
- Qualified personnel through training and mock-up testing
- Ventilation system designed for maximum dust control and to prevent environmental release
Before Decommissioning

After Decommissioning