

# BGRR and HFBR Decommissioning Projects



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**BROOKHAVEN**  
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# Brookhaven Graphite Research Reactor (BGRR) -- History

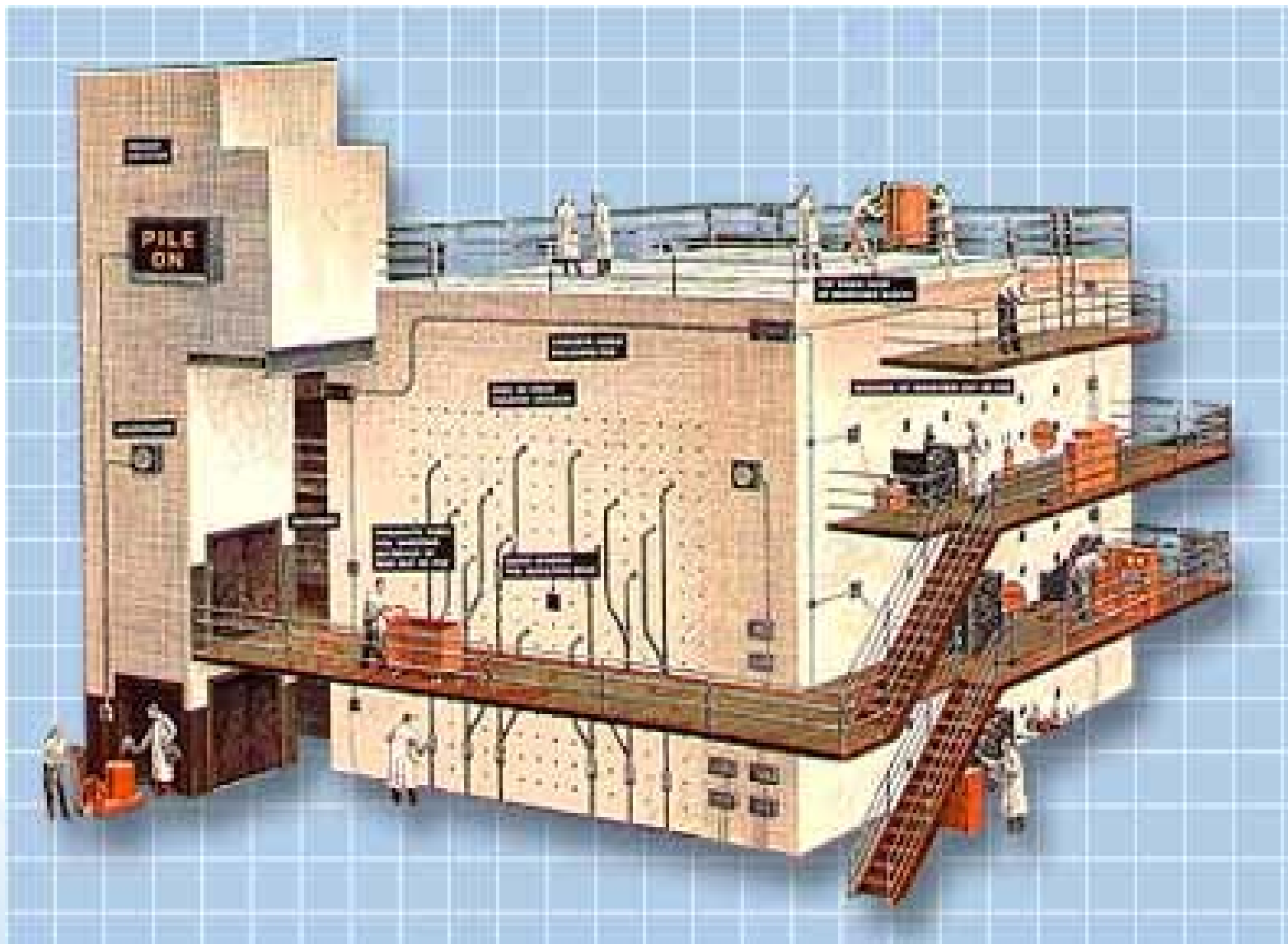
- Operated 1950 – 1968
- Decommissioning actions completed:
  - Fuel removed (1972)
  - Primary air cooling fans (2000)
  - Pile fan sump (2001)
  - Above-ground ducts (2002)
  - Canal house and water treatment house (2002)
  - Exhaust air coolers and filters (2005)
  - Below-ground duct liner (2005)



# BGRR – Final Remedy

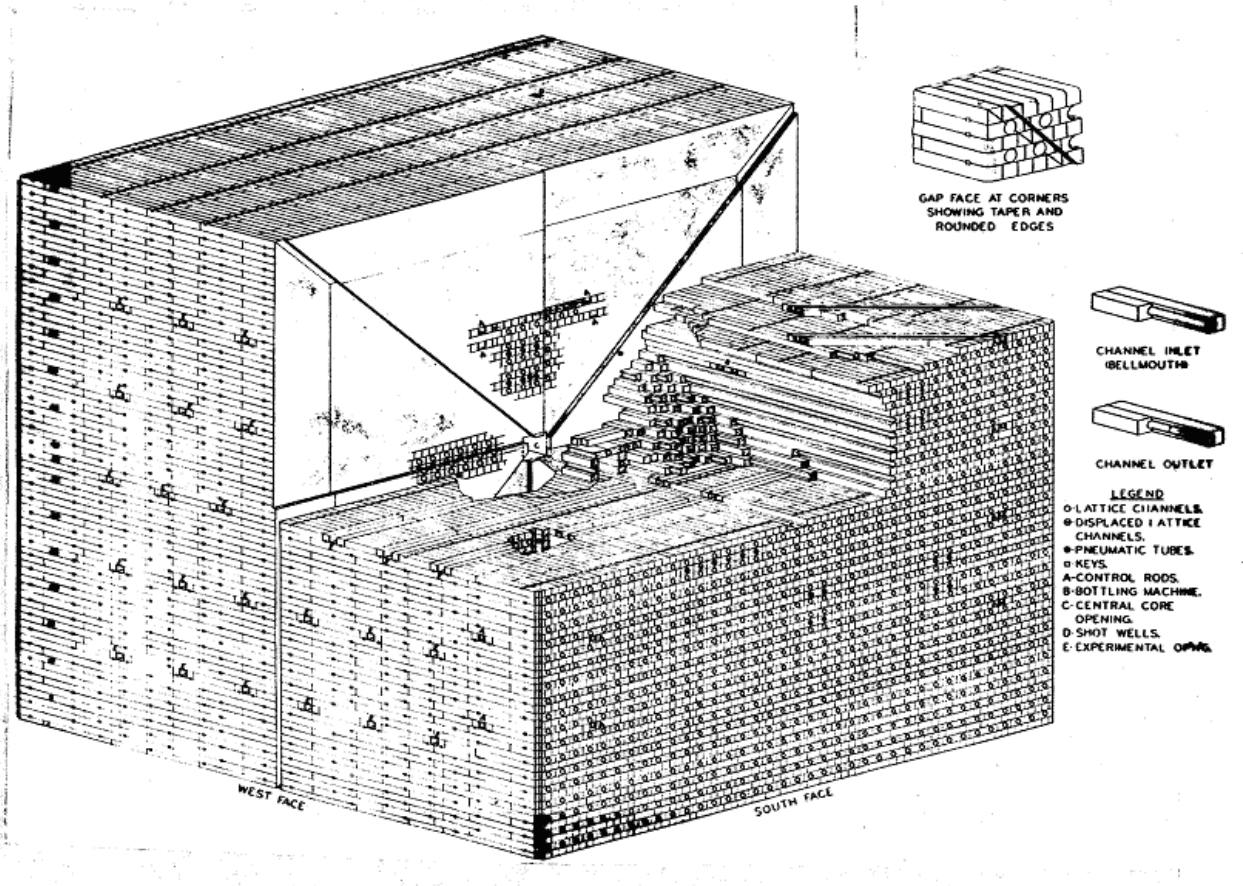
- Record of Decision (ROD) finalized March 2005
- Includes completed actions and the following:
  - Removal of graphite pile
  - Removal of biological shield
  - Installation of engineered cap
  - Ground water monitoring
  - Land use and institutional controls

# BGRR



# BGRR Graphite Pile Details

- 25' Cube
- 1.4 million lb
- 60,000 graphite blocks - 4" x 4" square by up to 45" long
- Radiation level of an "average" graphite block
  - ~21 mR/hr contact
  - ~3 mR/hr @ 1 foot
  - ~0.6 mR/hr @ 3 feet

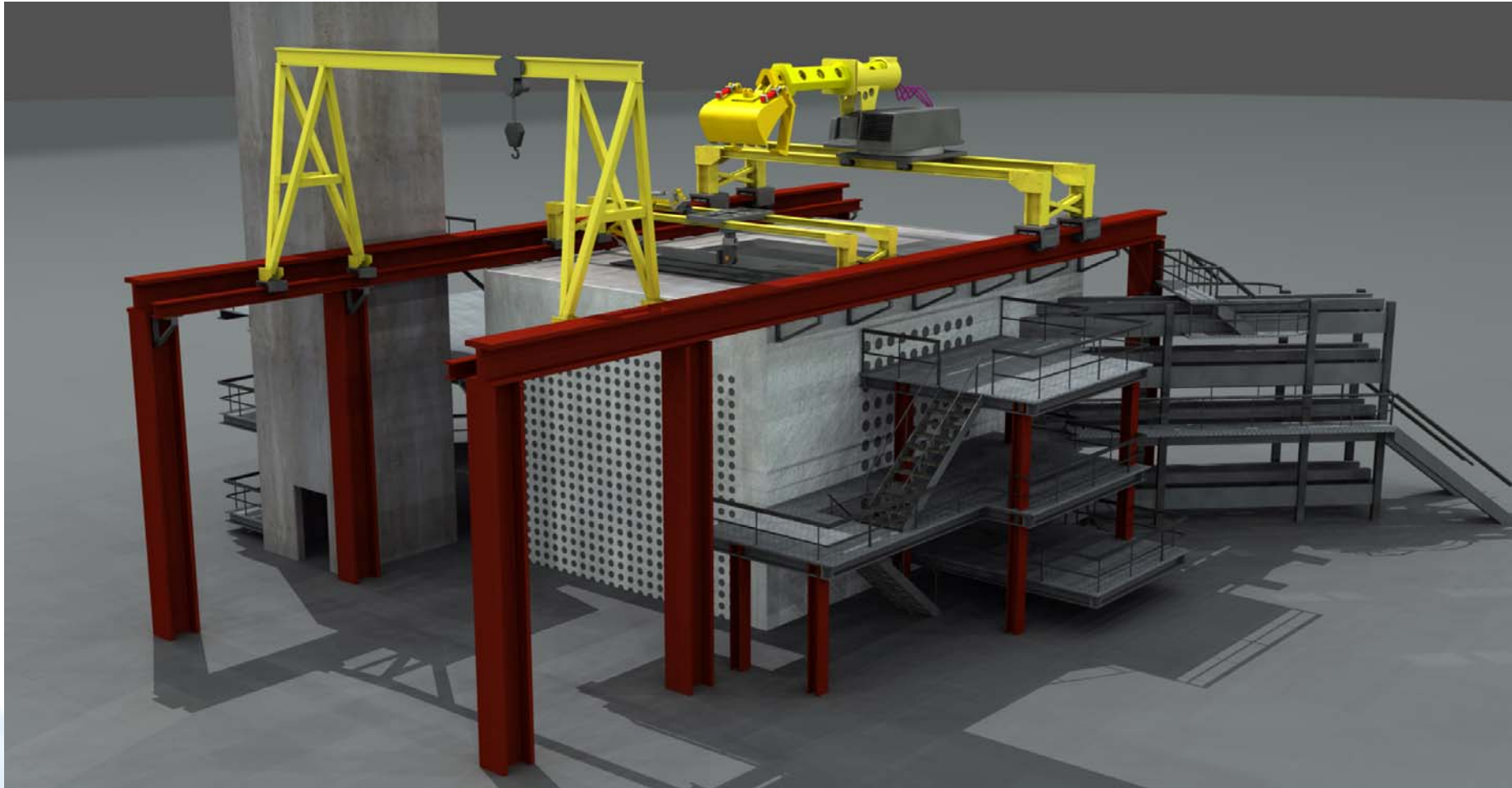


# Total Activity and Radionuclide Mixture

Total activity of the graphite pile – 787 Curies

- Fixed activity including miscellaneous non-graphite equipment – 782 Curies
  - Predominant radionuclide: C-14 (73%)
- Removable activity – ~5 Curies
  - Predominant radionuclide: Ni-63 (65%)
- There are beta, gamma and alpha emitting nuclides in the pile – the majority of the activity produces low energy beta radiation

# Remote Graphite Removal Equipment

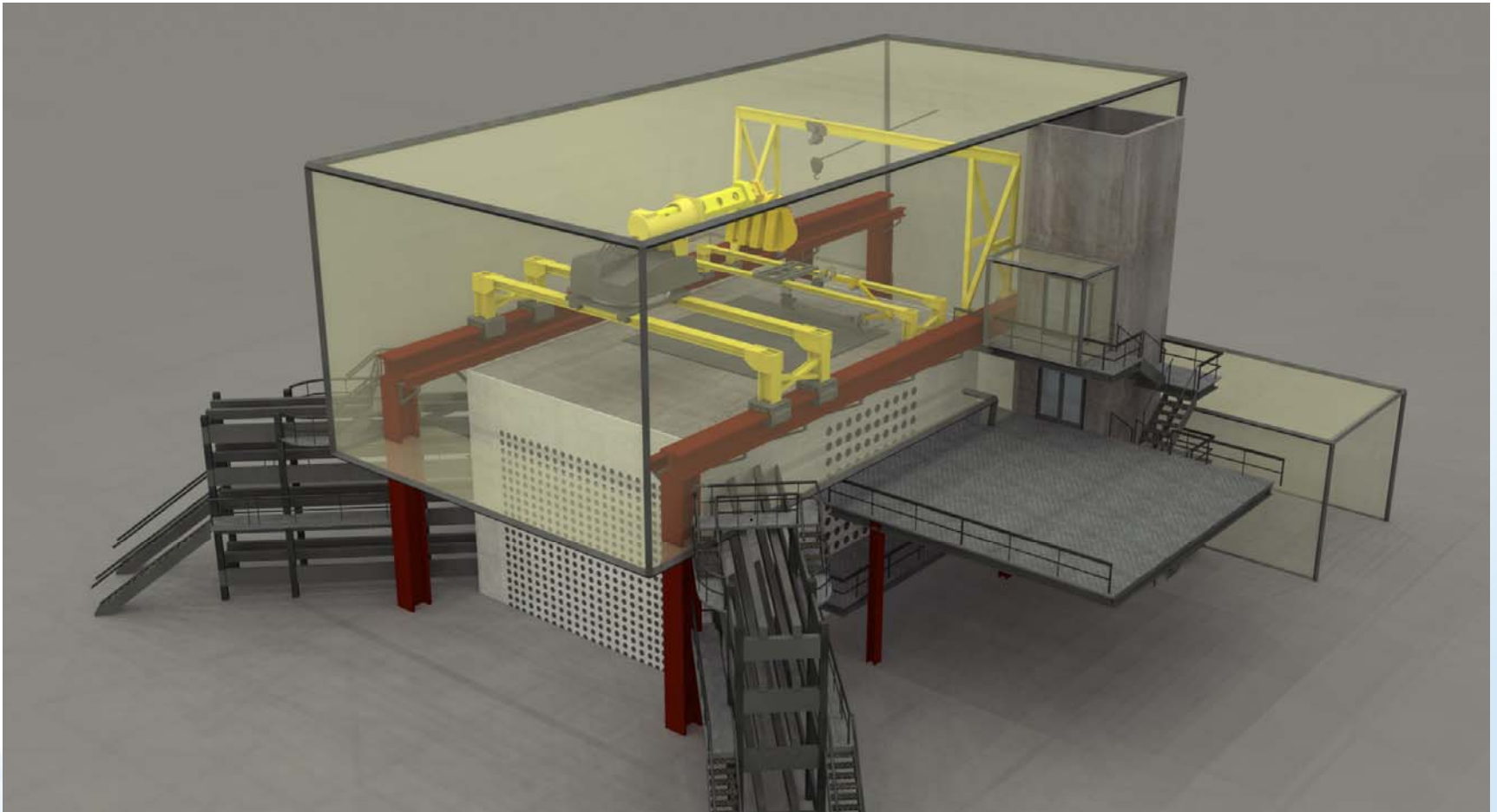


# Remote Manipulator for Graphite Removal





# Contamination Control Enclosure (CCE)



# CCE



# CCE -- Airlock



# HEPA Filters



# Ventilation Exhaust



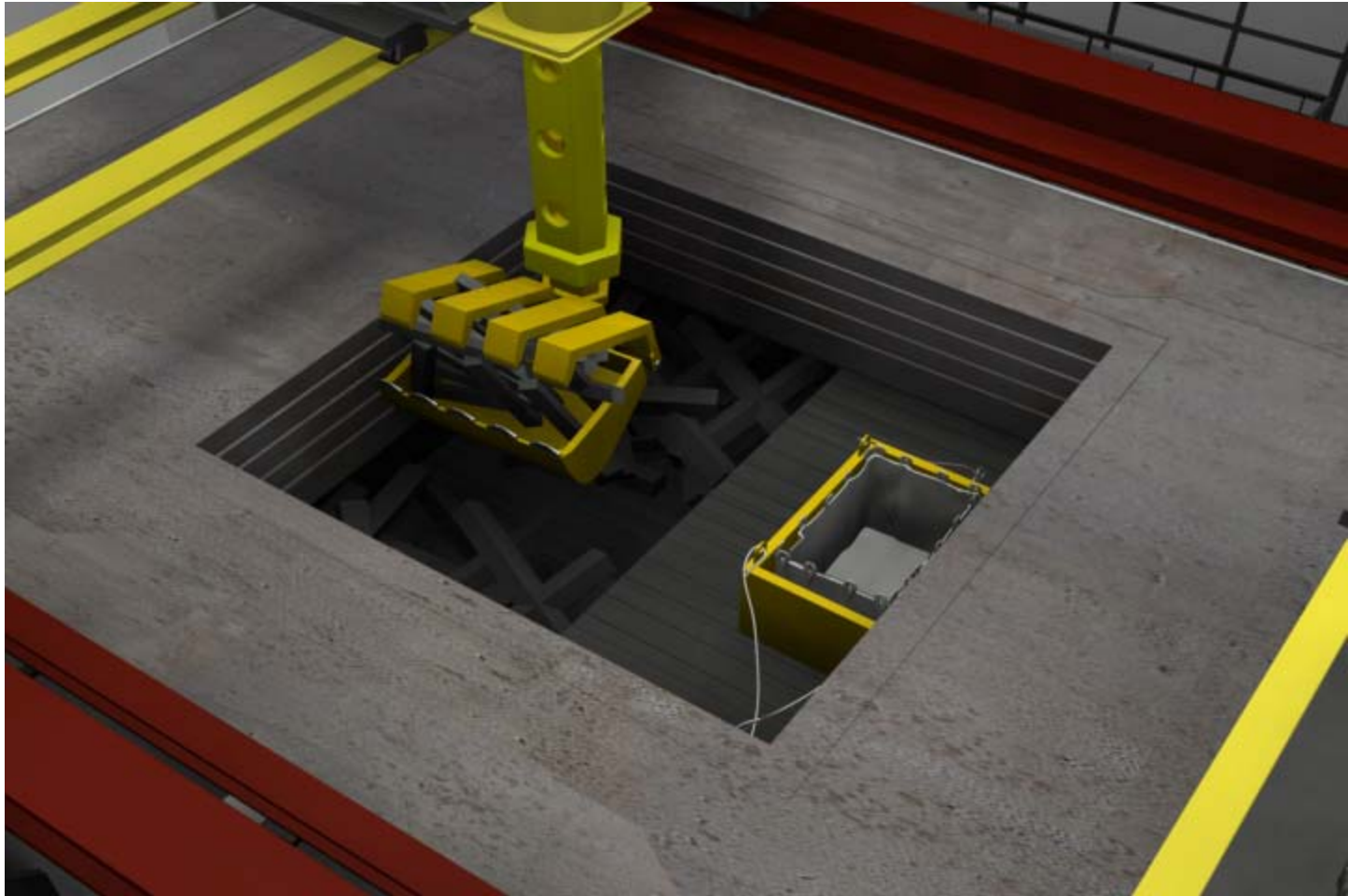
# Control Trailer



# Remote Controls

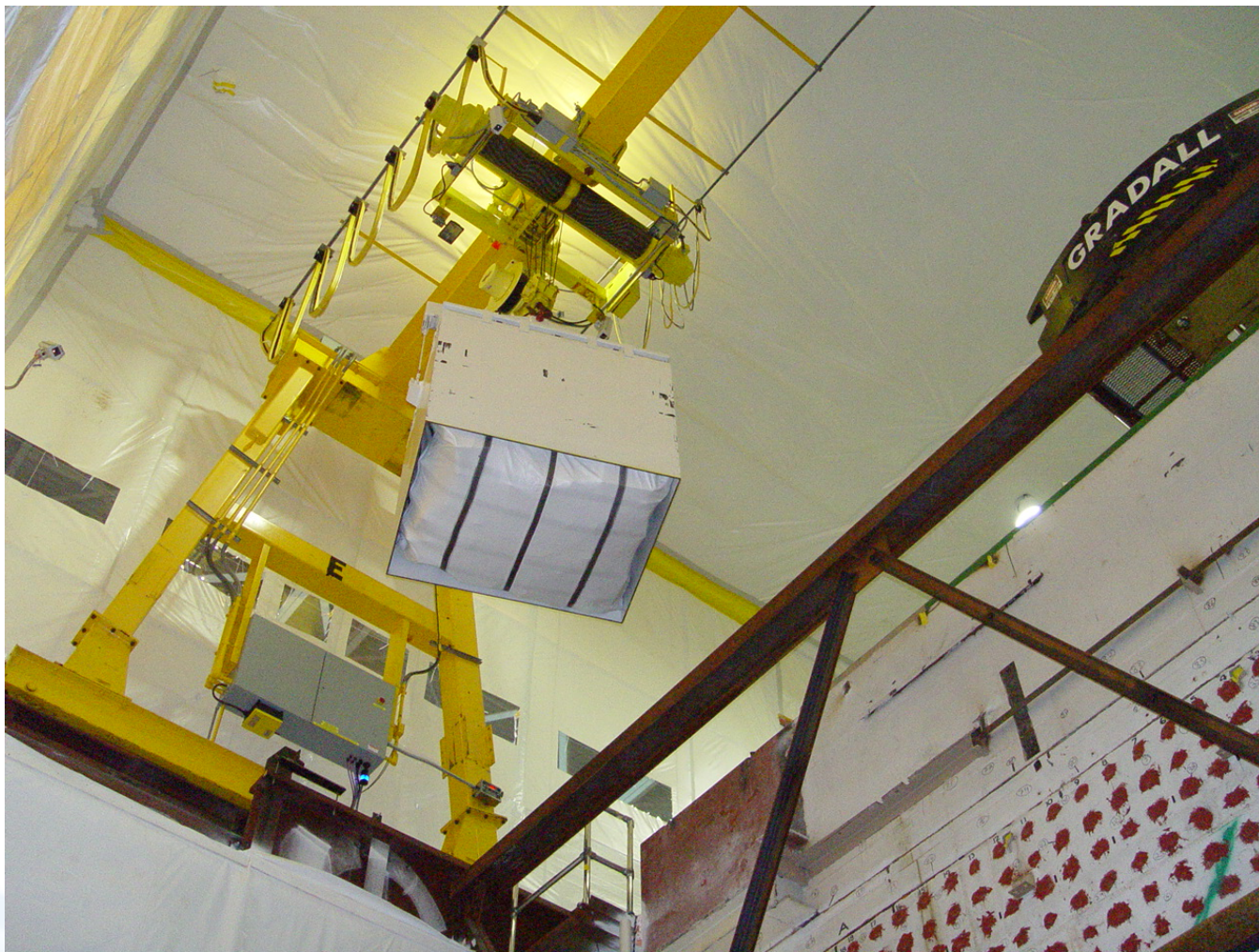


# Graphite Removal





# Moving Supersack with Graphite to Industrial Package (IP) – 1 Box (Dry Run)



# Graphite Loading



- Supersack loaded into load frame
- Graphite remotely loaded into supersack
- Load frame with filled supersack remotely lowered from pile top into IP-1 box
- Supersack disengaged from load frame
- Load frame removed from box

# IP-1 Box for Shipping Graphite



- ~ 200 boxes of graphite
- An “average” box of graphite will be:
  - ~ 65 mR/hr on contact
  - ~ 0.8 mR/hr at 20 feet

# IP-1 Box Sealed and Clipped



# Shielded Multi-Use Type A Container



- Estimated up to 10% of graphite boxes could contain elevated readings up to 3,000 mR/hr on contact
- Boxes to be placed into a Type “A” package.
- Shielded Multi-use Type “A” Container (SMAC) has been selected
- SMAC capable of shielding up to 7,000 mR/hr

# Transportation of Waste to Nevada Test Site



SMAC Shipment

- Surveys performed to ensure compliance with Department of Transportation requirements
- Estimate 60 flatbed truck shipments and 20 SMAC shipments

# Graphite Pile Removal – Worker and Public Safety

- Extensive testing of equipment, operator training and dry runs
- Remote operations
- Graphite handling inside CCE
- CCE maintained at negative pressure with respect to atmosphere to prevent uncontrolled releases
- Three levels of reviews prior to authorization for graphite removal:
  - Management Self Assessment
  - BSA Readiness Assessment
  - DOE Readiness Assessment

# Graphite Pile Removal – Status and Next Steps

- Installation of equipment – Completed
- Management Self Assessment – Completed
- BSA Readiness Assessment – Completed
- DOE Readiness Assessment – December 2009
- Authorization for graphite removal – December 2009
- Graphite removal and shipment – January-April 2010



# High Flux Beam Reactor (HFBR) -- History

- Operated 1965 – 1996
- Permanently shut down in 1999
- Decommissioning actions completed:
  - Disposal of fuel (1998)
  - Disposal of primary coolant (2001)
  - Removal of scientific equipment (2003)
  - Dismantling of selected ancillary buildings (2006)
  - Cleanup of waste loading Area (2008)
  - Disposal of Control rod blades and beam plugs (2009)



# HFBR Control Rod Blade Removal



# HFBR – Final Remedy

- Record of Decision (ROD) finalized April 2009
- Includes completed actions, near-term actions, removal of large activated components after a safe storage period (not to exceed 65 years), ground water monitoring, and land use and institutional controls
- Most near term actions to be completed by 2020 have been accelerated to 2011 using American Recovery and Reinvestment Act funding

# HFBR – Final Remedy

- Incorporates CAC recommendation for five-year technical reviews
- Technical reviews will be included in CERCLA reviews (instead of separate reviews recommended by CAC)
- Reviews will assess the feasibility of reducing safe storage period taking into consideration advances in cleanup technologies, impacts on worker safety, public health, land use and other factors (as recommended by CAC)

# HFBR – Final Remedy

- Addresses CAC recommendation for reducing the safe storage decay period to 50 years
- Safe storage decay period of (not to exceed) 65 years is based on worker safety considerations: reducing radiation dose rate (calculated on the basis of activation analysis) from large components to below 100 mR/hr at one foot

# HFBR – Final Remedy

- Includes provision for re-evaluating the decay period based on actual measurements after the removal of control rod blades (radiation measurements taken after control rod blade removal show excellent agreement between calculated and measured dose rates)
- Results of the re-evaluation will be documented in the next five-year review scheduled for 2011

# HFBR – Next Steps

- Complete near-term actions, including removal of underground utilities and piping, fan houses and stack
- Prepare reactor confinement building for safe storage

# Environmental Restoration Projects in Progress



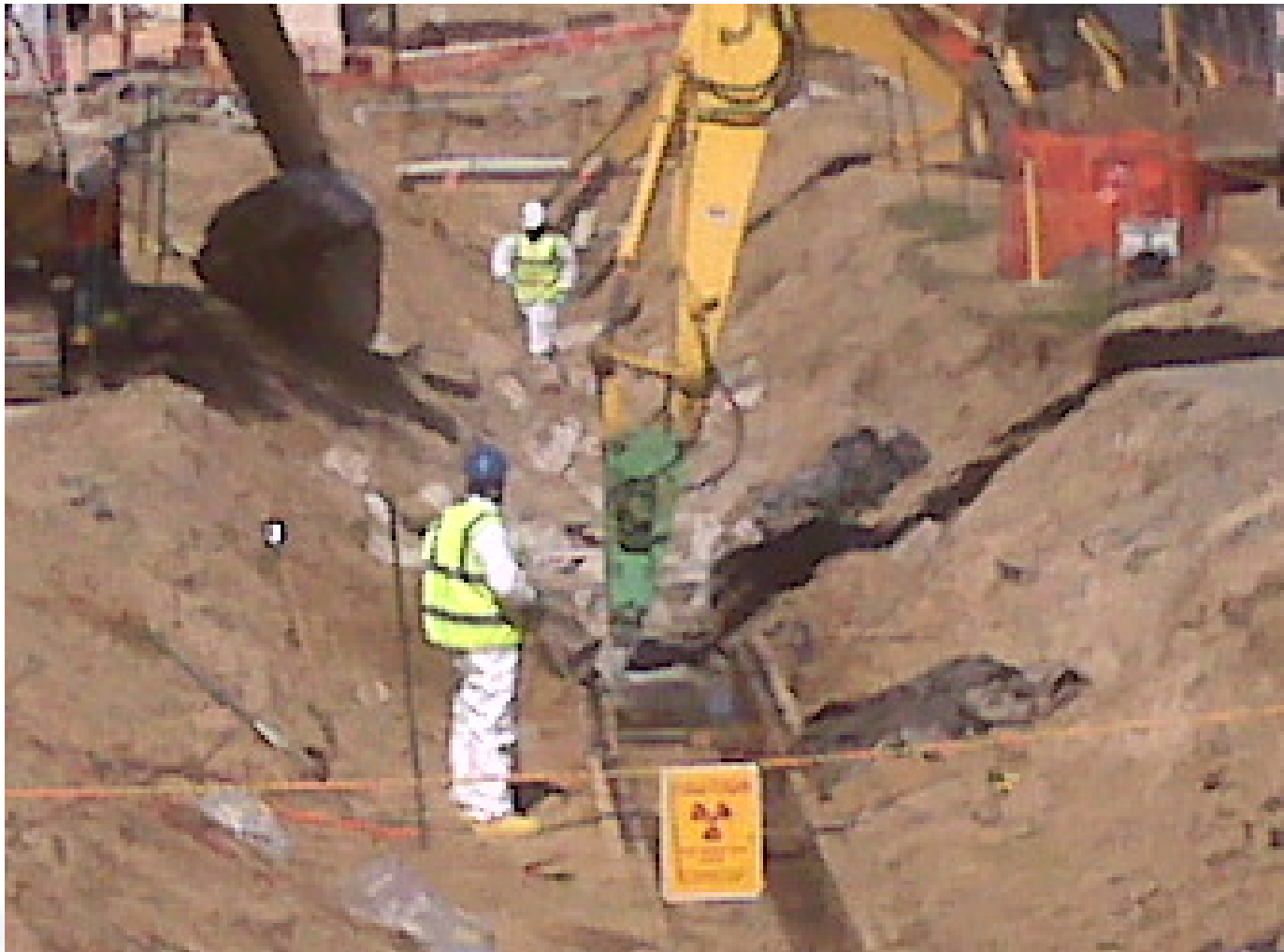
# Former HWMF Perimeter Area Soil Remediation



# Removal of Waste Transfer Pipes



# Removal of Waste Transfer Pipes



# Planning for Removal of Fan Houses



# Planning for Stack Removal

