BGRR D&D Presentation for the DOE ERAD Working Group

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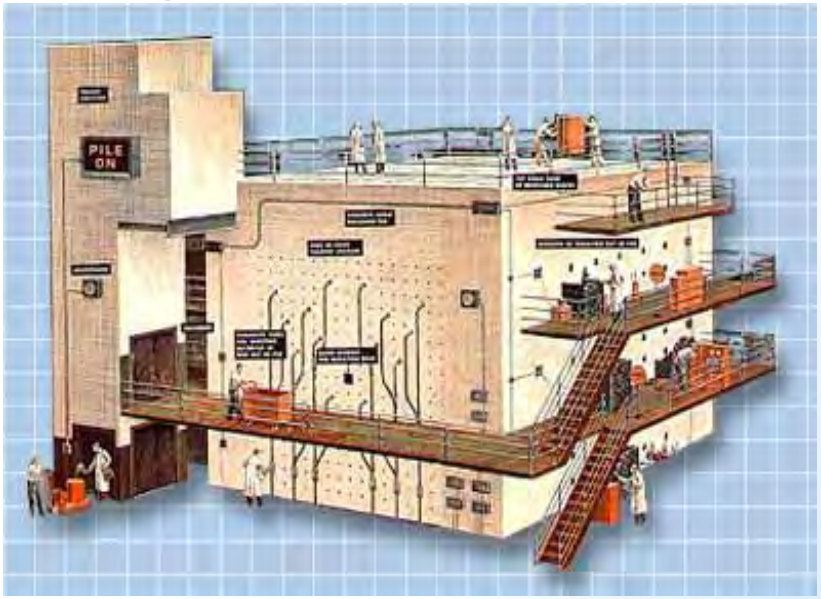
BROOKHAVEN NATIONAL LABORATORY

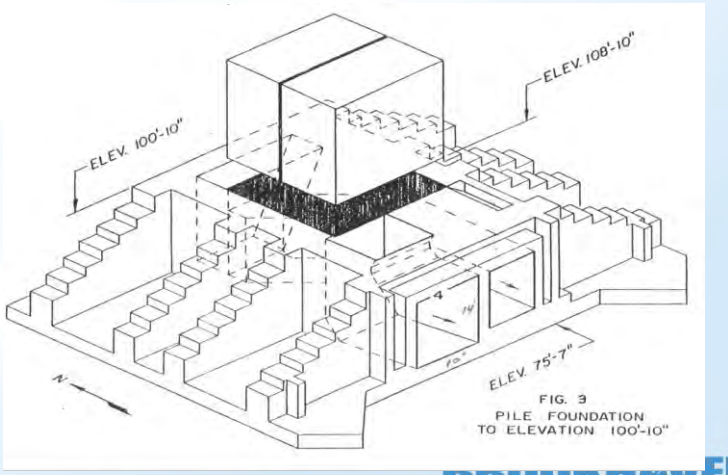
a passion for discovery

Office of Science
U.S. DEPARTMENT OF ENERGY

Brookhaven Graphite Research Reactor (BGRR) -- History

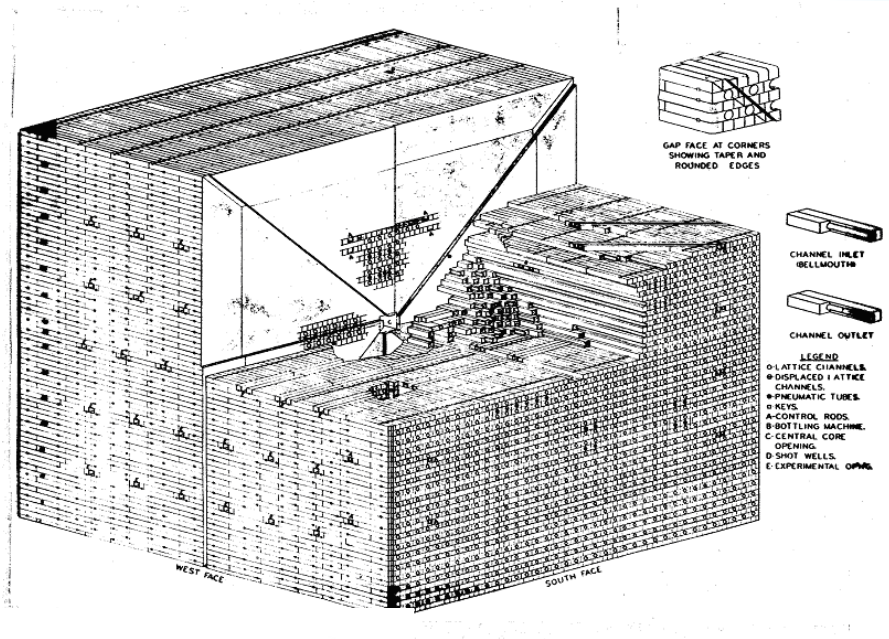
- First reactor built solely for peaceful research
  - Operated 1950 – 1968

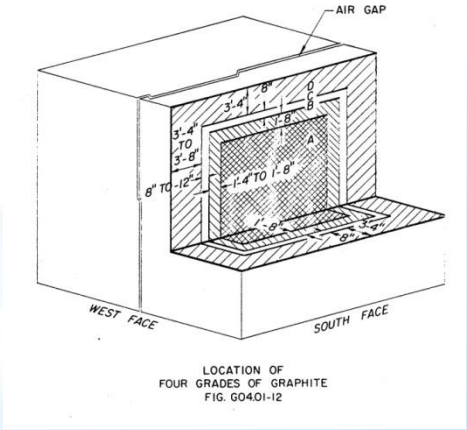




BGRR Graphite Pile Details

- 25’ Cube of graphite
- 1.4 million lb
  - ~ 60,000 graphite blocks
  - 75 layers of 4” square graphite blocks of varying length
- Total Activity 787 Ci
  - Predominantly Carbon-14
  - Also some Nickel-63 and Tritium





LOCATION OF FOUR GRADES OF GRAPHITE
FIG. G04.01-12

BGRR Bioshield Details

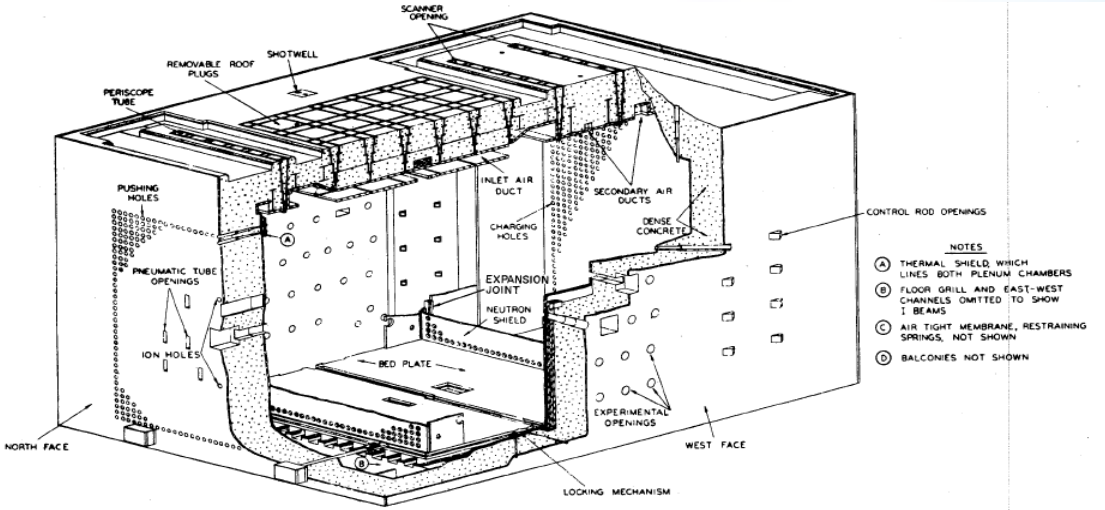
•Constructed of steel and high density limonite concrete containing scrap iron

• Shield – 55 ft long by 37.5 ft wide by 33.5 ft high

• Proceeding from graphite outward - 6 inches steel plate, 4 ft 3 inches high density concrete, and outer 3 inches steel plate

• ~ 10 million lb of steel and concrete

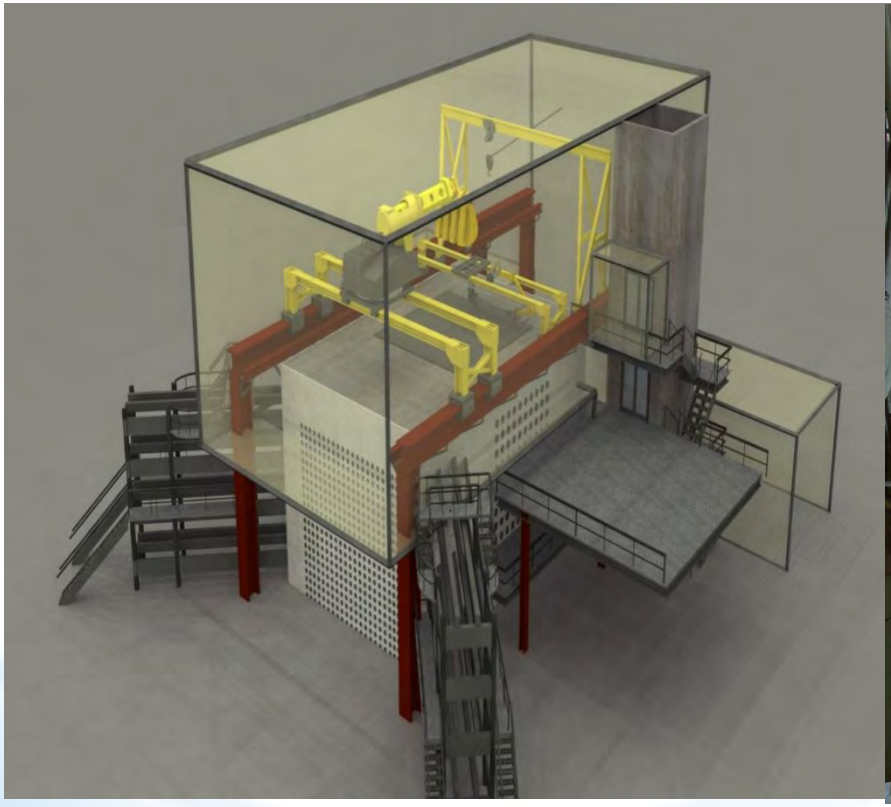
• 81 Ci primarily Ni-63, H-3 and Co-60



CUTAWAY ISOMETRIC VIEW OF SHIELD

FIGURE G04.02-3

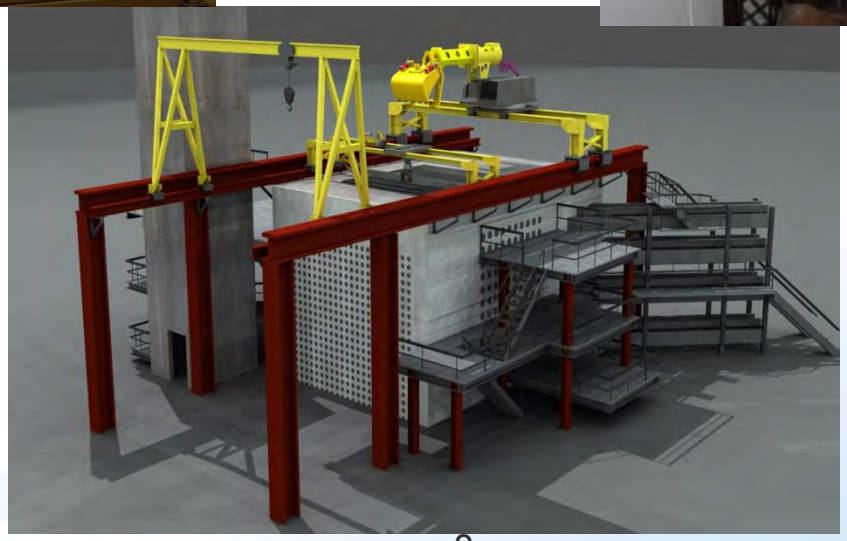
Contamination Control Enclosure (CCE)



Control Trailer

Entrance to CCE

Remote Graphite Removal Equipment



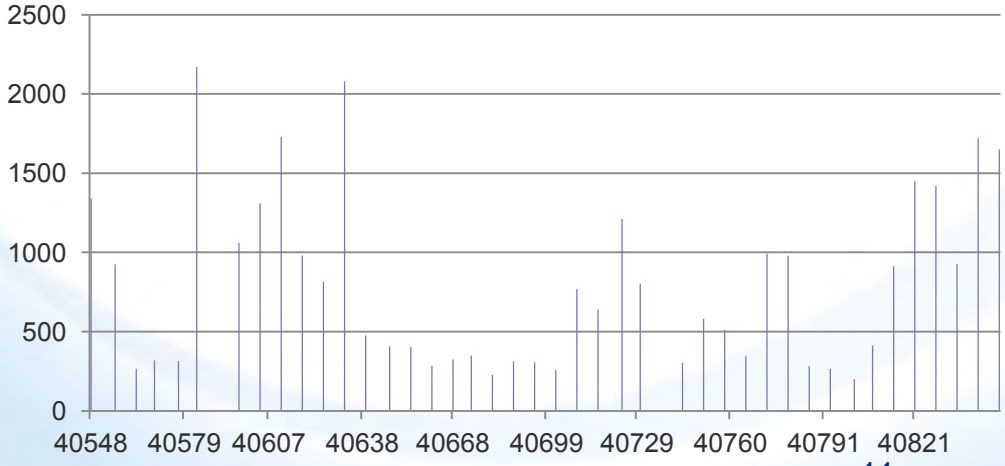
Equipment for Graphite Removal

Remote viewing from outside controlled area

CCE was HEPA Filtered and Monitored

- No particulates detected
- Total 0.34 curies in 2011

2011 BGRR Emissions of Tritium pCi/cubic meter



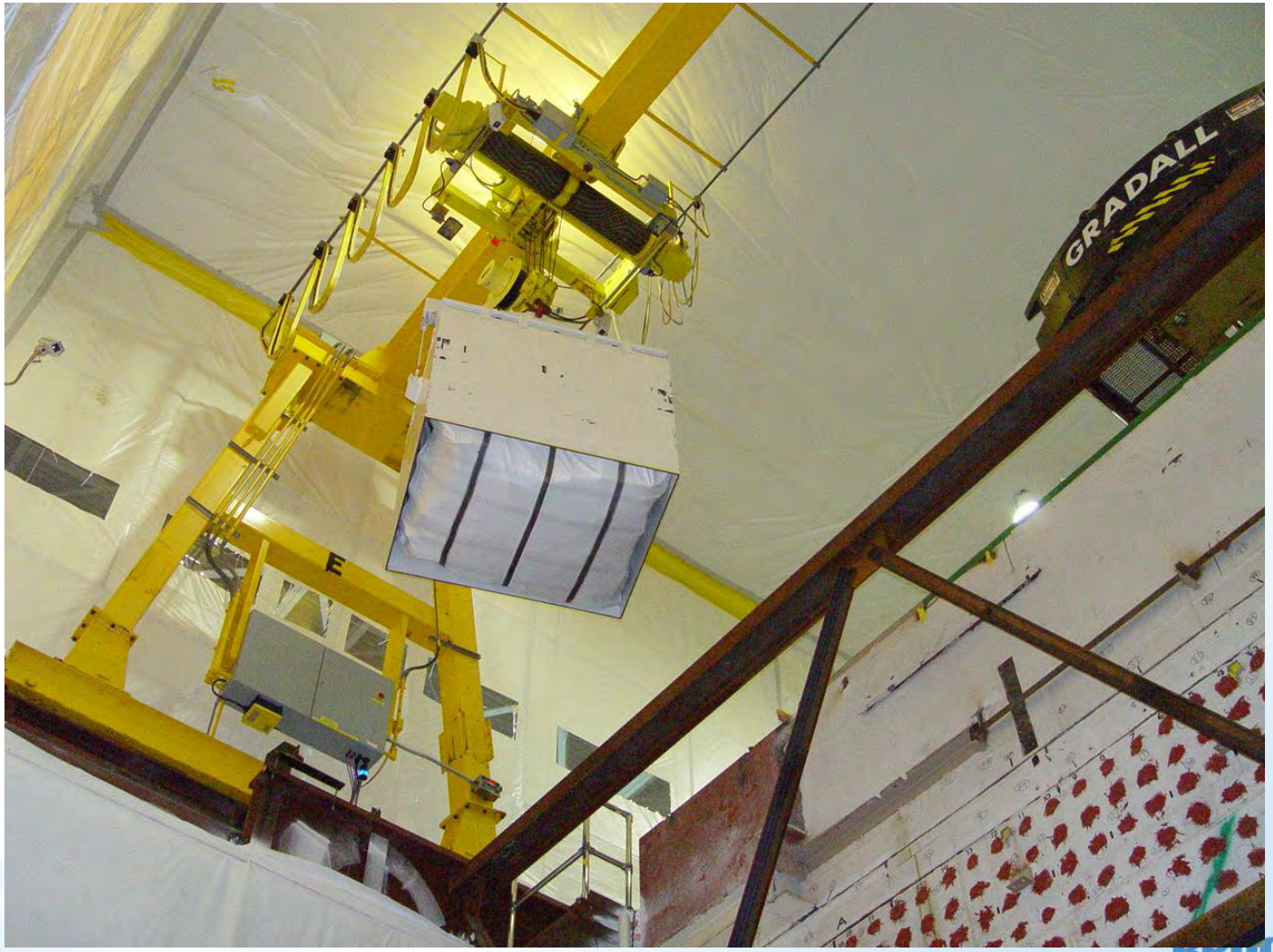
Graphite Removal

Use of fixative for dust/contamination control

Graphite Removal (video)

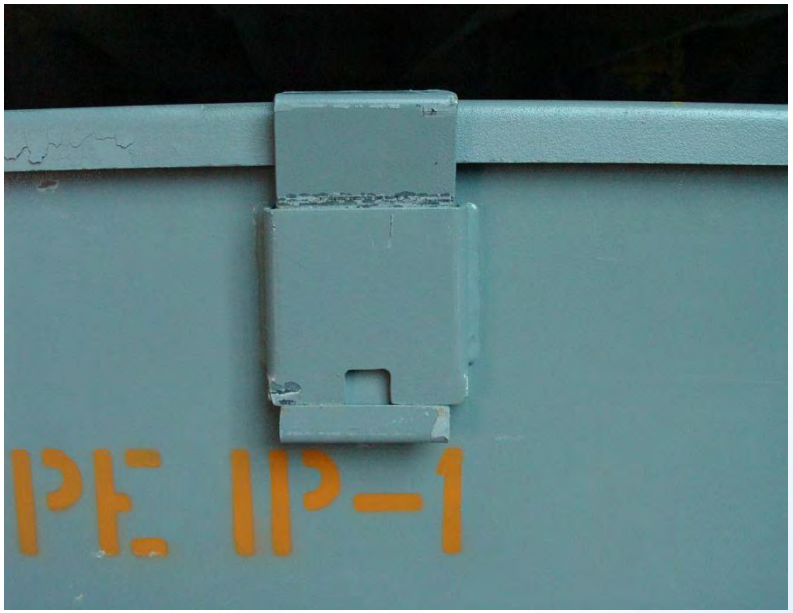
Transfer of Graphite to Supersack
(Video)

Moving Supersack with Graphite to Package



Transfer of Supersack to Box (video)

Box Sealed and Clipped



~ 250 boxes of graphite

Typical box of graphite:
~ 65 mR/hr on contact
~ 0.8 mR/hr at 20 feet

Hottest box of graphite had a spot
~ 7.8 R/hr on contact
~ 1.4 R/hr at 1 foot
~ 300 mR/hr at 1 meter

Shielded Multi-Use Type A Container (SMAC)

- Used shielded packages for boxes with elevated dose readings
  - Expect ~10 boxes greater then 1 R/hr on contact
- SMAC capable of shielding up to 7 R/hr

First Graphite Shipment – February 24, 2010

- 5 to 6 boxes per truck depending on weight
- Curtains provide for closed transport vehicle – if required

Excavator Hammer at West Wall

Wall Cutting with Robot

Not all work was able to be done remotely

Excavator in the Bioshield


JLG


10/2/2011 2:55

Installation of Concrete Cap over Remaining Base Plates

Final Concrete Cap Placement

The addition of 3” of concrete resulted in a dose rate of <0.1 mR/hr (0.01 to 0.08 mR/hr) at waist high from the bioshield cap

Total Dose for BGRR D&D

2009 - 2012 Final	Dose Estimate (person-rem)	Actual EPD Dose (person-rem)
Graphite Removal	4.6	2.3
Bioshield Removal	12.1	9.5
Total	**16.7**	**11.8**

	ERP 2007 BGRR Dose Estimate (person-rem)	B&R 2003 BGRR Dose Estimate (person-rem)
Pile Preps	0.3	-
Pile Removal	7.6	26.7
Bioshield Preps and Removal –	13.9	19.1
Project Total	**21.8**	**45.8**

BGRR As-Left Survey - Radiation

General Area Dose Rates (mrem/hr)			Maximum General Area Dose Rates
Location	**Expected condition ***	**As-left conditions**	**As-left conditions**
Deep pit	10-30	8 - 15	80
High bay	<0.1	<0.01	<0.02
High bay on top of biological shield cap	<0.1	0.01 – 0.07	0.08
Office areas	background	background	background
Yard areas	background	background	background
BGD general area	5	1 - 10	20
South BGD beyond radiation trap	30	1 - 4	5
North BGD below exhaust air plenum	100 - 150	2 - 20	50

* BGRR Decommissioning End Points

BGRR As-Left Survey - Contamination

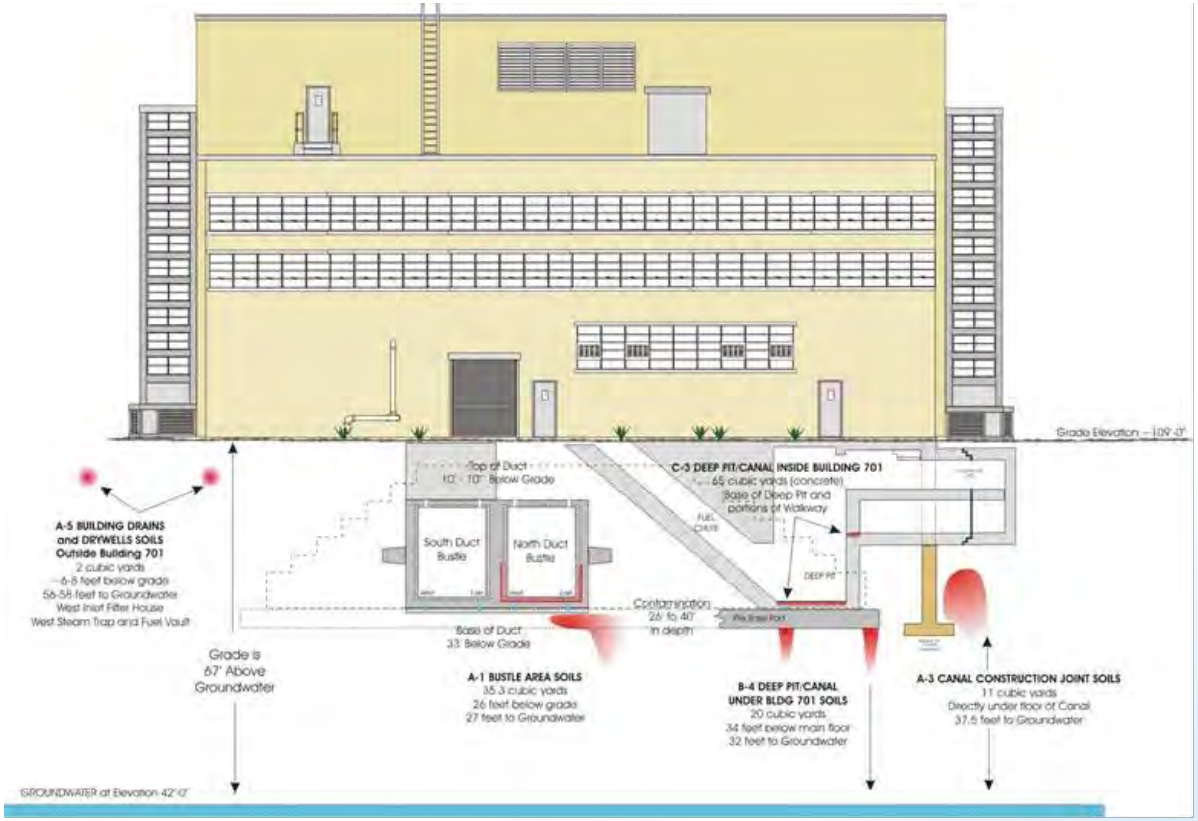
General Area Contamination Levels loose beta/gamma (alpha) (dpm/100cm^2)			Maximum Area Contamination
Deep pit	1,000 – 2,500	1,000 – 5,000 (<20 – 100)	20,000 (724)
High bay – accessible areas (up to 6')	<1,000	<1,000 (<20)	<1,000 (28)
High bay – remote/inaccessible areas (Gantry crane, excavator, support structure, bldg crane and roof supports)	<3,000	West catwalk - <3,000 (<20) Gradall - <1,000 (<20) Truss #2 - <3,000 (<20) NW Column - <3,000 (<20) Gantry - <3,000 (<20) East catwalk - <3,000 (<20) Charging Elev. - <1000 (<20)	1,000 (<20) 500 (<20) 8,600 (33) 1,000 (<20) 7,700 (34) 12,000 (25) 2,800 (<20)
High bay – pile support plate (prior concrete cap)	<10,000	<1,000 (<20)	<1,000 (<20)
Office areas	background	background	background
Yard areas	background	background	Background
BGD inboard of bustle	7,000	3,000 (<20)	76,000 (132)
North BGD exh air plenum	16,000	8,000 (<20)	16,800 (207)

Annual Area TLD Monitoring Results

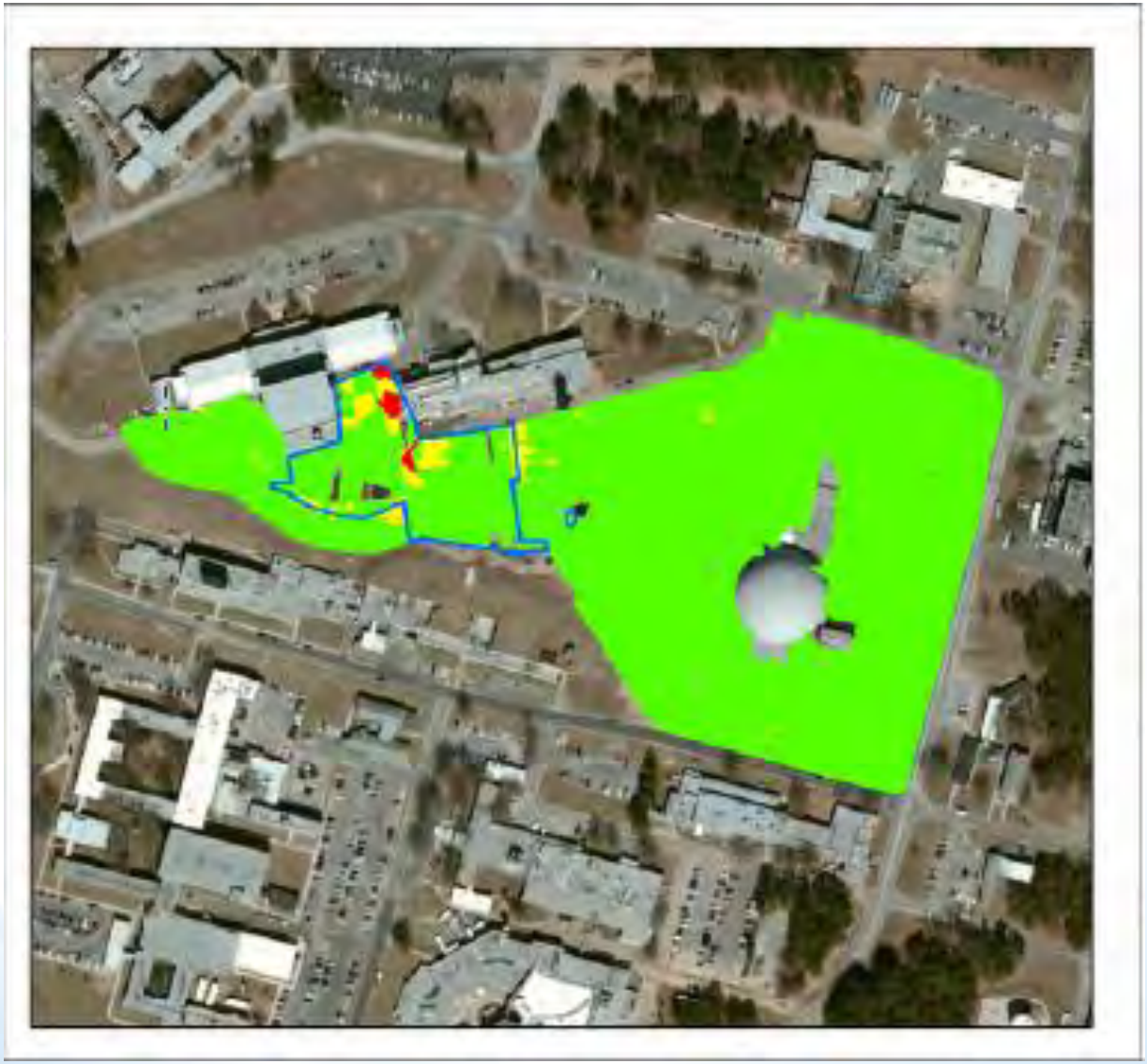
Location	2009 Results (mrem)	2010 Results (mrem)	2011 Results (mrem)
Bldg 701 Occupied Areas	8	5.2	3.8
Bldg 703 Occupied Areas	6.7	6.2	5.8
Bldg 701 Non Occupied Areas	1.5	20.1	40.6
Bldg 703 Non Occupied Areas	2.3	14.3	25.2

Goal was to be <15 mrem/yr in occupied areas

BGRR Contaminated Soil & Subsurface Structures, View to North



Final Status Survey Results



BGRR Final Conditions