



Workshop on Accelerator Operations
August 6-10, 2012

WAO 2012

Bevatron Decommission and Demolition

Jim Morel

Lawrence Berkeley National Laboratory



Welcome to the
San Francisco Bay Area

Thanks goes to :
Joseph Harkins, Lawrence Berkeley Laboratory
And Robert Cronin, CH2M Hill
for much of the technical information used in the
presentation.

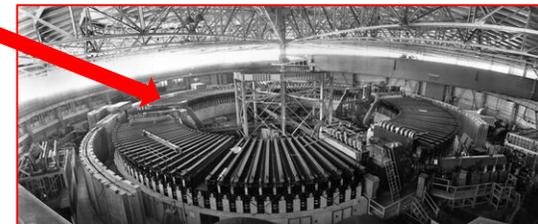
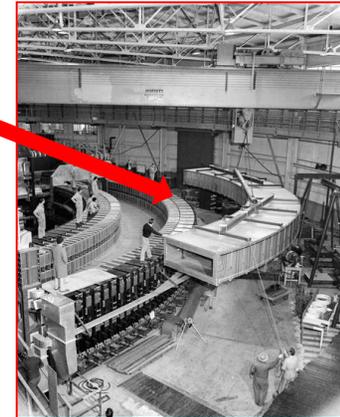
The Bevatron



- The Bevatron was built in the 50' s at the Berkeley' s Rad Lab for a cost of \$9 million (~\$76 million 2012 \$\$).
- It began operation in 1954.
- Bevatron was initially a proton accelerator.
- It was built to discover the **anti-proton** (discovered in 1955).
- They also discovered the anti-neutron.

The Bevatron

- 180 feet diameter accelerator.
- Beam space was 4 square feet in cross section.
- The vacuum system was tremendous.
- The magnet was 12,000 tons.
- Concrete shielding 13,500 tons.
- It was built with no shielding on top, but shielding was added when the sky shine was discovered.



- Motor generators ramped up the magnet in 1.85 seconds for each 5 second cycle.
- It used a **lot of power**, this cost a lot and led to its demise.

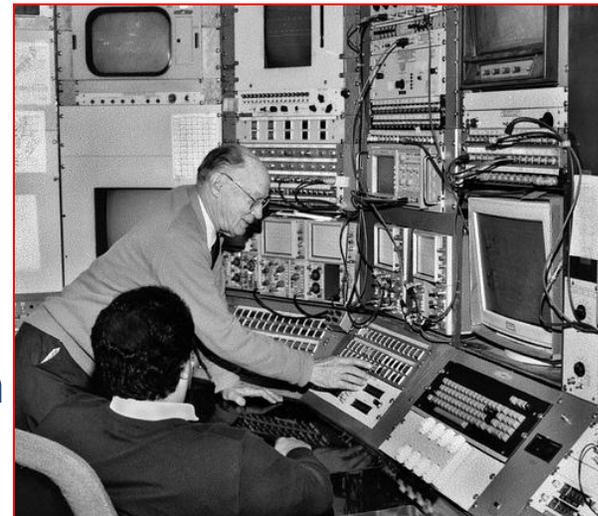


The Life of the **Bevatron** 1953-1993

- The Bevatron experienced several reincarnations over the years.
- Converted from protons to heavy ion accelerator for High Energy Physics experiments.
- It was linked to the HILAC as its ion source.
- Converted to a nuclear medicine treatment center.
- Finally Bevatron was shutdown in 1993.

Ed Lofgren, chief of operations when the Bevatron started up, hitting the "**Accelerator Off**" button to finally turn off the Bevatron.

(HILAC-Heavy Ion Linear Accelerator)





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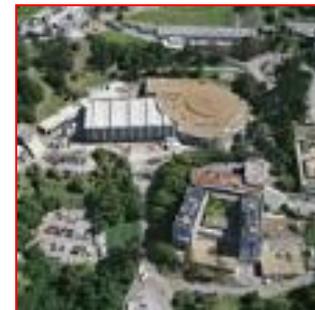


Decommissioning the Bevatron

- The power/utilities were turned off for the accelerator and the building was to be used for its office space.
- Documentation/documents were “archived” off site.

The Bevatron had a lot of cool stuff...

- There was still useful equipment in the facility.
- The equipment was inventoried and distributed to other parts of Berkeley Lab.
- Additionally other Department of Energy (DOE) facilities benefited from this.





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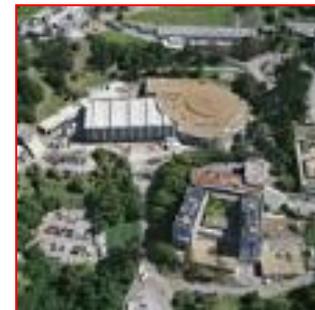


Decommissioning the Bevatron

De-staffing of the Bevatron

- When the Bevatron was shutdown the scientists, technicians and engineers were reassigned elsewhere.
- They walked away and left things as they were.
- Essentially everyone went on the next great project.

- The useful office rooms were used for training.
- The building sat **idle** for **15 years** (1993-2008) while DOE considered what to do with the facility.



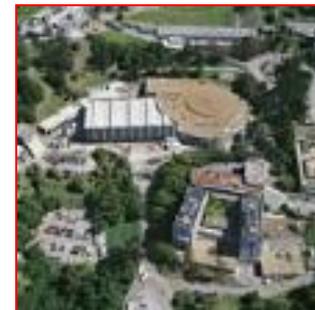
Decommissioning the Bevatron

- The fate of the Bevatron would be decided by the DOE managers at a later date, 15 years later.

Then things changed in 2008

- The DOE decided to resolve the Bevatron problem.
- After a change in administration and with a new DOE secretary, Dr. Chu, the demolition of the Bevatron project was supported and financed.

Surprise? Dr. Chu was an ex-LBNL Director- he knew the problem had to be resolved.





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Demolition of the Bevatron 2008-2012

- The project was scheduled to take 4 years and cost \$50 million. It was going to be a big deal.
- Project Milestones
 - Isolate utilities and remove stored hazards
 - Remove concrete shielding and the accelerator
 - Abate Hazardous Materials
 - Demolish 125,000 square feet metal frame structure
 - Remove shallow foundations and slabs
 - Remediate soils and then backfill



Milestone 1: Isolate Old Utilities and Establish Reliable Utilities



They established a boundary where all utilities had to be severed and then worked outward from there to where isolation breaks could be implemented.

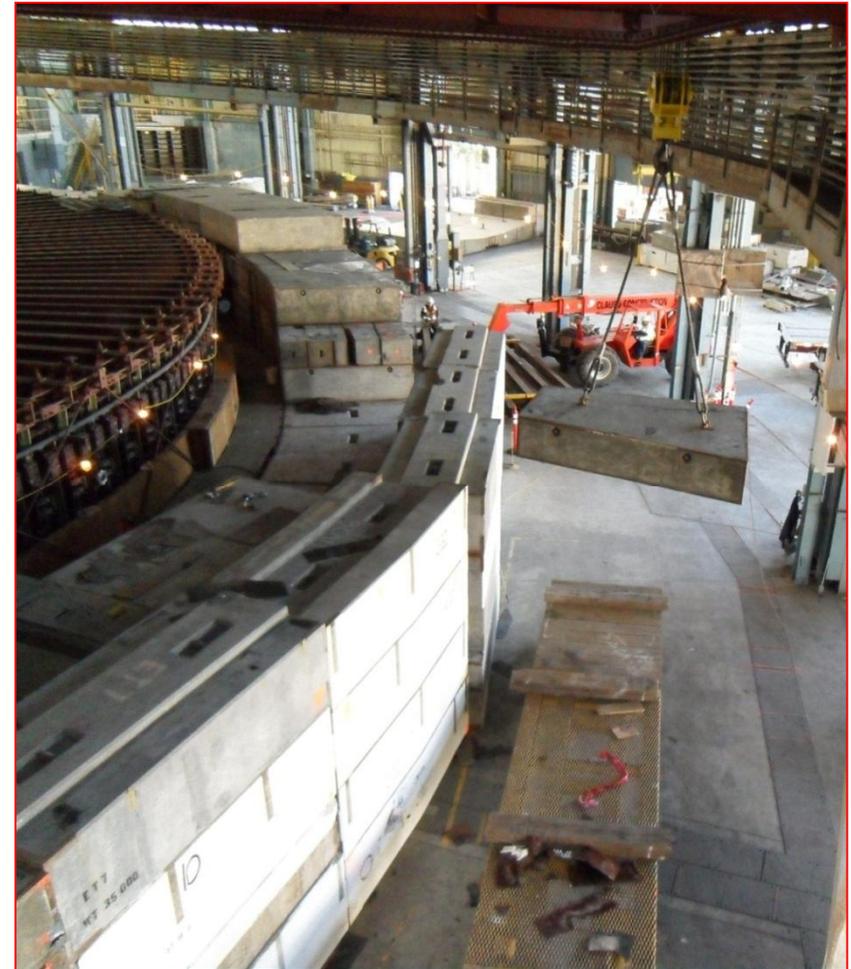


Re-establish Reliable Utilities

In order to work in the building they needed power and other utilities that were reliable and manageable.

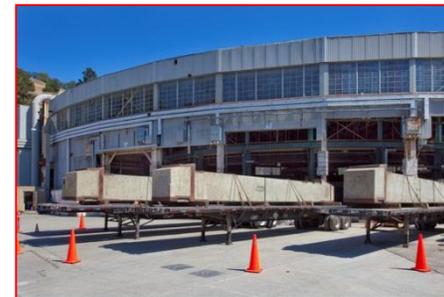
Milestone 2: Remove Shielding Blocks

- Removed shield blocks
- Used existing lift points
- Rad characterized
- Packaged
- Disposed per WMP

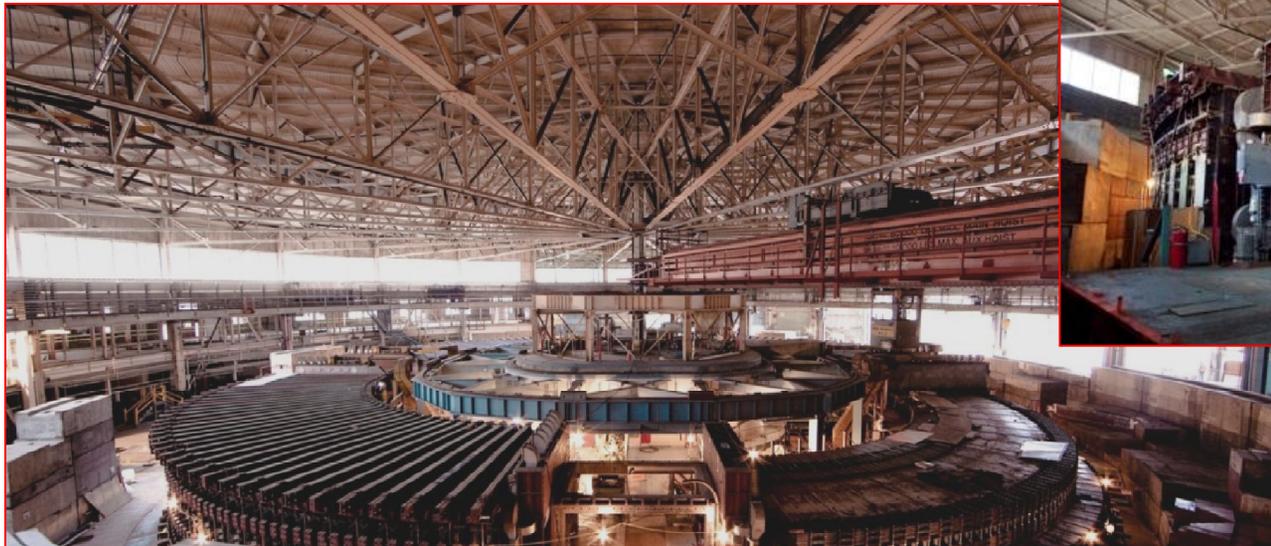


Milestone 2: Remove Shield Blocks

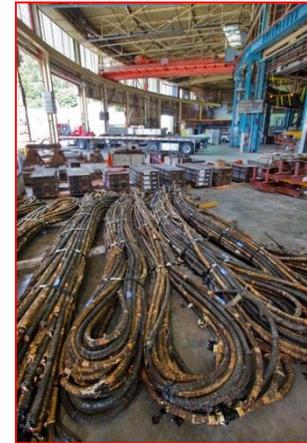
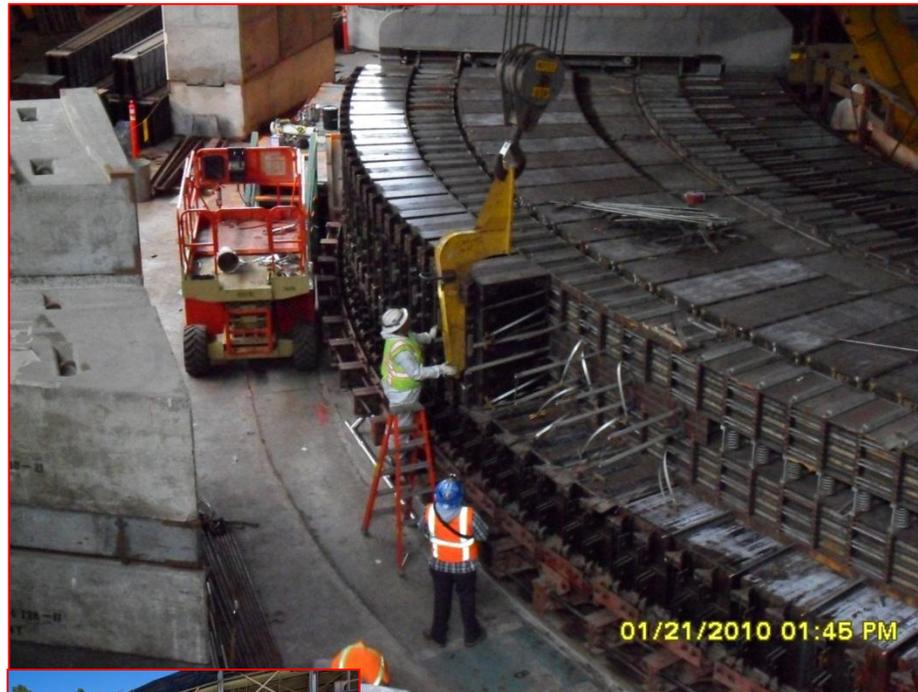
- Removed shield blocks
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- Disposed per WMP



Milestone 2: Remove Bevatron Accelerator



Milestone 2: Remove Bevatron Accelerator



Milestone 2: Remove Bevatron Accelerator



When the Accelerator was removed then the interior of the building was cleared.



Milestone 3: Abate Hazardous Materials



Before the building super-structure was demolished there was abatement of the structure's interior & exterior.

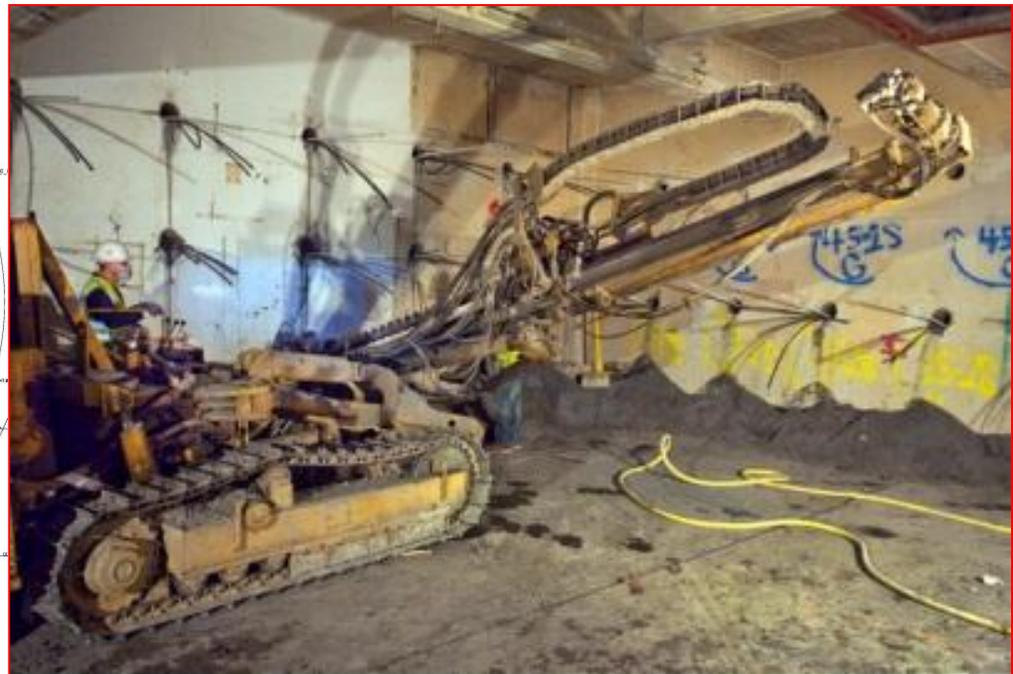
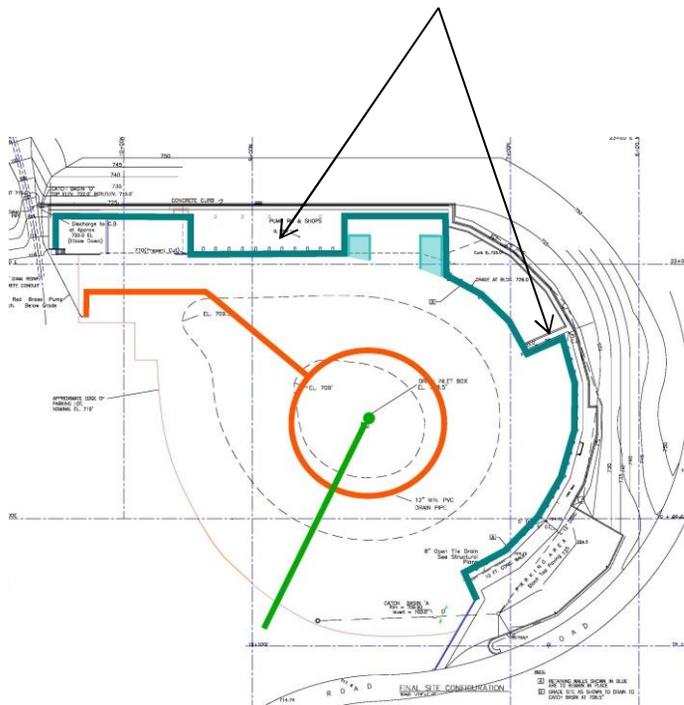


Then they removed stored hazardous materials.



Milestone 4: Demolish the Building Structure

- Retaining walls were reinforced.



Milestone 4: Demolish the Building Structure

- The building super-structure was pre-weakened.



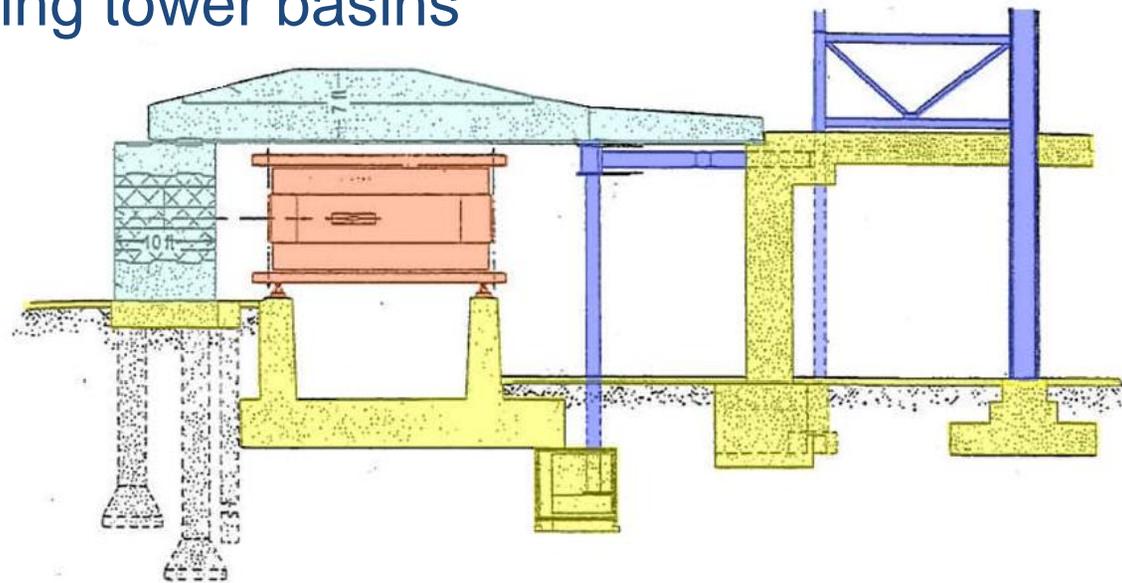
Milestone 4: Demolish the Building Structure

The super-structure was brought down in a controlled drop.



Milestone 5: Remove Foundations and Slabs

- Removed foundation system including pile/caisson caps, grade beams, shallow caissons, and facility floor
- Demolished deep tunnel
- Removed cooling tower basins



Milestone 5: Remove Foundations and Slabs



This process took over a year to complete because they had to methodically manage the hazards in the foundations and the soil.



Milestone 6: Remediate soils and then backfill

In order to remediate the soil they needed a Hazard Map.

- Hazard mapping began early,
- Hazardous materials mapping required “due diligence”,
- Developed at Lawrence Livermore National Laboratory (LLNL),
- Utilized a LLNL consultant to reconstruct hazard history,
- Start with records search
 - Operating conditions
 - Machine changes
 - Emergency events (spills, fires, etc.)
 - Inventory management



Milestone 6: Remediate soils and then backfill

Hazards Mapping (cont.)

- Interview personnel involved during operations
 - Operators
 - Scientists
 - Technicians
 - EH&S
 - Fire Department
 - Construction crafts
- Combine the information into a map of the facility
 - Areas of known contamination
 - Areas of prior clean up
 - Areas of suspected contamination



Milestone 6: Remediate soils and then backfill

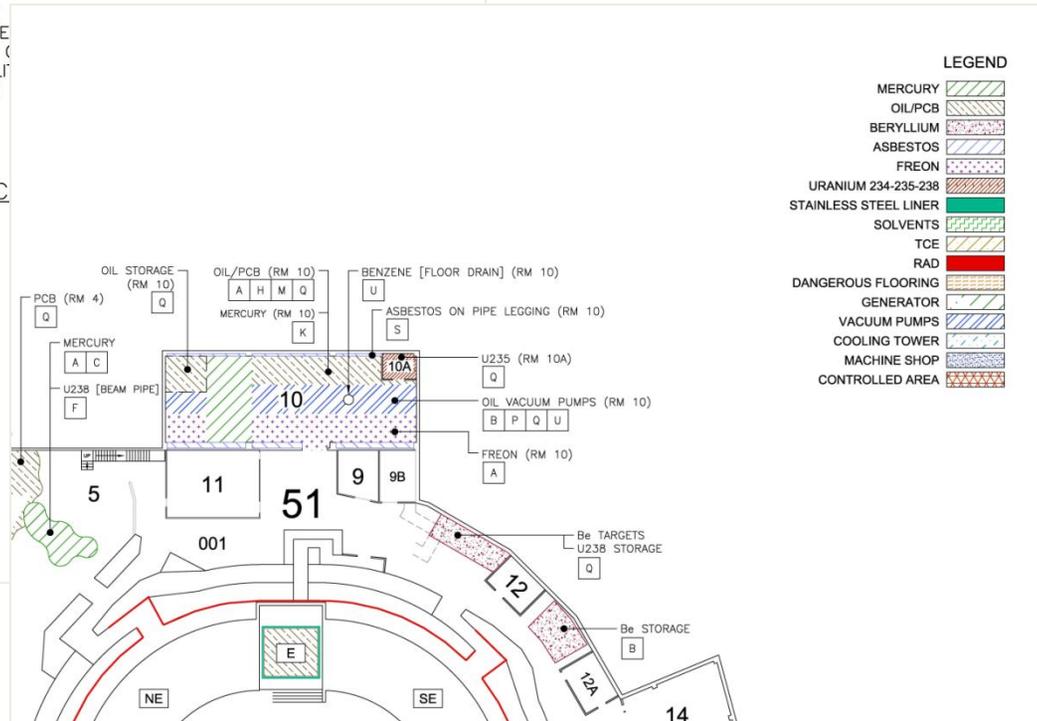
Developed a Hazard Map

GENERAL NOTES:

1. BUILDING 051 HAS SERVED MANY DIFFERENT MISSIONS SINCE USEFUL LIFE, NUMEROUS CHEMICALS AND MATERIALS HAVE BEEN CLEANED UP SEVERAL TIMES. BECAUSE OF SEVERAL CLEANUP EFFORTS OF VARYING DEGREES, BECAUSE CHARACTERIZATION DATA EXISTS, MOST OF THE DATA IS QUALITY INFORMATION DESCRIBING THE CONDITION OF THE FACILITY IS FROM FORMER FACILITY WORKERS.

DRAWING BACKGROUND INFORMATION REFERENCE

A	ROBERT AITA
B	JOSE ALONSO
C	ROB CONNELLY
D	DONALD EAGLING
E	BOB EVERETT
F	ROBERT FAIRCHILD
G	WARREN FAUST
H	BEN FEINBERG
J	JAMES FLOYD
K	JAMES HALEY
L	ORLAND JONES



Milestone 6: Remediate soils and then backfill

Hazards Mapping (cont.)

- Map was provided to the contractor to conduct samples of each area to characterize found hazards.



- Map was provided as a bid document to demolition contractor to inform their remediation efforts.
- The contractor was able to segregate the hazard, reuse material (soil) and backfill the excavation site.



Milestone 6: Remediate soils and then backfill

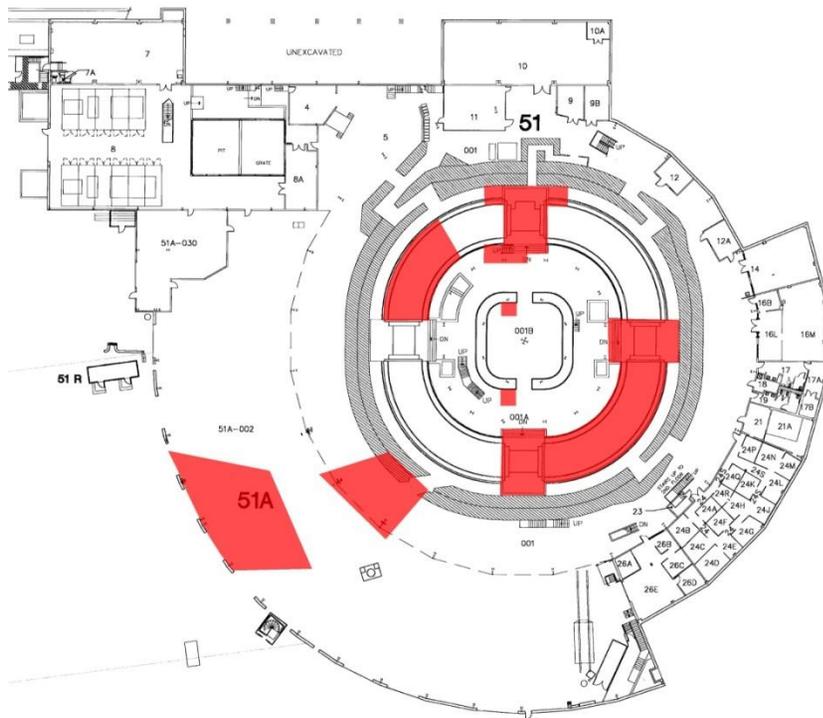
Radiological Evaluation Waste Materials

- They expected very few surface contaminated objects
- Activation products were predicted to be in:
 - Accelerator components, concrete shield blocks, floor slabs and foundations, and steel structures
- For The Blocks
 - Initially DOE OK' d characterization protocol
 - They used handheld Na-I, set a MDC of 2 pCi/g
 - They used a "clean" reference block for a baseline
 - An external lab analyzed the reference block (No MDC)
 - Found activation products < 2 pCi/g in reference block
 - DOE revised the protocol-said had radioactive material

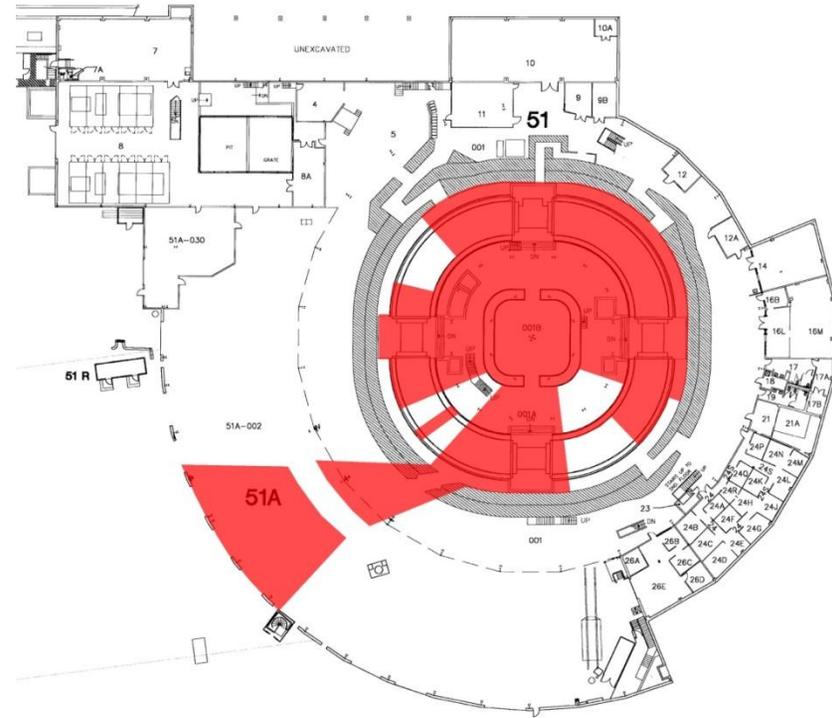
Milestone 6: Remediate soils and then backfill

Rad Evaluation Criteria (cont.)

Initial Protocol Estimate



Revised DOE Protocol





Milestone 6: Remediate soils and then backfill

Rad Evaluation Criteria (cont.)

- Under revised DOE protocol
 - Had expected to **release** 60% of shielding blocks;
 - Actual blocks **release** reduced to 20%

 - Had expected to **release** ~75% of slabs and foundations;
 - Actual slabs and foundations **release** reduced to ~20%
- This impacted remediation of blocks, slabs and foundations and cost several millions (~10) more
- Lesson - Specify MDC early, clearly & oversee analysis



Milestone 6: Remediate soils and then backfill

Tritium Levels

- Tritium History and the Expected Levels
 - Activation produced mainly prior to 1974, (36 years)
 - Significant quantities were not expected
 - It was expected to be found **near** other activation products
 - It was expected to be found in soil and groundwater under **thin** floors
- Found Tritium in unexpected places and concentrations
 - Under 54-inch foundations
 - Was **not** under slabs with highest activation products
 - Levels were at more than 4000 pCi/L
 - Was **inconsistent** with expected equilibrium condition



Milestone 6: Remediate soils and then backfill

Levels Tritium (cont.)

- How did it get there?
- First they discounted possible sources:
 - Adjacent facility, Accelerator experiments
- Historically there were no known tritium releases
- Possible sources
 - Accelerator cooling water spill/leak
 - Movement from high activation areas to low activation areas from groundwater flow

However it got there it had to be remediated.

Milestone 6: Remediate soils and then backfill

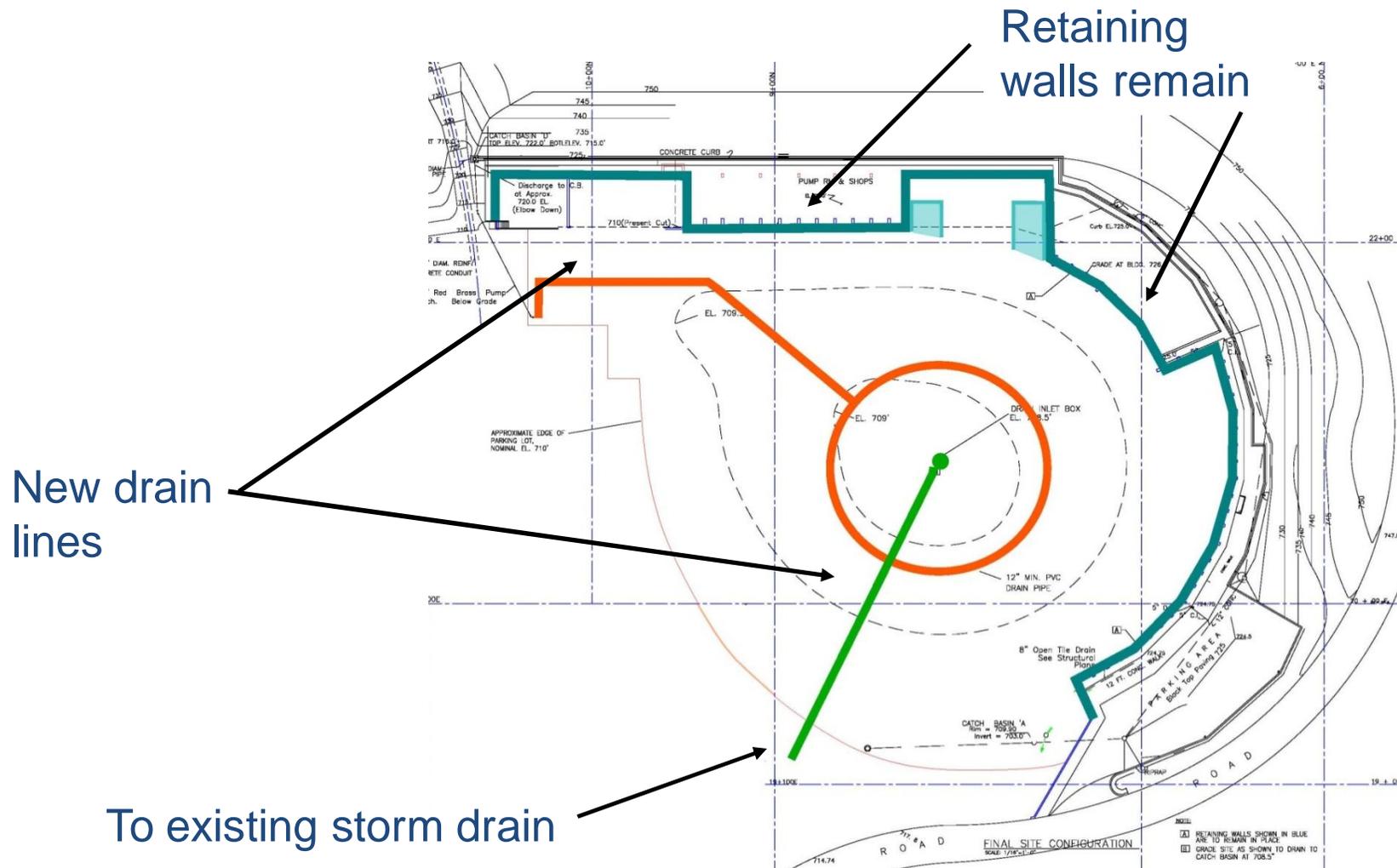


Debris
segregated
for
disposal or
for backfill.





Final Site Configuration



Project Completed

