History of the Georgia Tech Research Reactor

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NE 50\textsuperscript{th} Anniversary Celebration:
Colloquium on History and Contributions of Nuclear Engineering at Georgia Tech
November 2, 2012
The Beginning

- 1956 -- Southern governors gathered to determine what could be done to move the South into the nuclear age.
- The building of the reactor was a cooperative endeavor of civic leadership headed by Frank Neely and the Tech Reactor Project under Dr. W. B. Harrison of the Engineering Experiment Station.
- At the 1957 meeting of the Georgia Legislature, the Georgia Nuclear Advisory Commission was created and Mr. Neely was named chairperson.
This commission endorsed the maximum possible state support for the nuclear facilities at Tech.

- $2.5 million of state surplus funds were promised to the project.
- NSF contributed a $750,000 grant.
- The Atomic Energy Commission and other sources gave materials and financial aid.
- These contributions totaled $4.5 million to build the reactor.
- To that date, the largest single building project ever undertaken on campus.
The next thing I said to Griffin, or Bob Arnold, I’ve forgotten which, was “I want to get the best designer in the world, if he’s alive.” They said “Well, who is it?” I said “We..., Mr. Einstein, Dr. Fermi, and Dr. Zinn were the three men who developed atomic energy for Roosevelt before we turned one (a bomb) loose on Japan.” Griffin said “What’s it going to cost?” Funny thing about him --- “What’s it going to cost?” --- that’s his middle name; so after a while I said “What’s it going to cost? Forty or fifty thousand dollars, I think, because we don’t want anything but the best designer.” … This has got to be made good; so here we are, with a facility that was designed by the best man in the United States, Dr. Zinn, one of the three men who went to see Mr. Roosevelt when this thing first came up. Of course, Mr. Einstein was the world’s greatest mathematician; Dr. Fermi was an Italian, and has had a great deal of interest in studying in that field, and Dr. Zinn likewise.

So we got Dr. Zinn, and locked him up down there outside Tampa in a warehouse like this --- this reminds me of it --- an orange warehouse. They cut off a little space, and put Dr. Zinn in there with four or five men to design this facility that you are going to see.

NOTE: The original nuclear engineering on the project was done by the General Nuclear Corporation.
Georgia Tech Research Reactor

- Reactor similar to CP-5.
  - Designed by the General Nuclear Engineering Corporation (Walter Zinn)
- Licensed in 1964 for 1 MW operations
- Initial Criticality December 31, 1964
- Reactor converted to 5MW in 1974
- D$_2$O moderated and cooled
- Reactor Core
  - Up to 19 MTR type fuel elements
  - 2’ High x 2’ Diameter
- Reactor Tank
  - 6 foot diameter aluminum vessel
- Biological Shield
  - Multilayered Shield made of Boral, Steel, Lead, and High Density Concrete
Cutaway of Reactor
Cross Section at Midplane
Reactor Control Room
In Its Heyday
Aerial Photo of Reactor Site (1996)
And Rich's has Empress Chinchilla, the precious fur for the precious few, in jackets and stoles created by Leo Ritter of Ritter Bros.

Rich's Atlanta
Georgia Tech Research Reactor

- 1994 License Renewal
- GANE intervenors
  - Management
  - Safety concerns
- Ceased Operations on November 17, 1995 for the Olympics
  - Fuel removed
  - Fuel shipped to SRS February 1995
- NRC Renewed license in May 1997
- Decommissioning announcement July 1, 1997
Conspiracy Theory
Operational History (MW-hr) 1965-1995
Decision to Decommission

- Design life-time of 30 years
- Underutilization of reactor
- Cost of renovation and upkeep
- Decline in NE enrollment
- HEU Fuel already removed for conversion to LEU fuel assemblies and the 1996 Olympic games
HEU Fuel Removal

- 23 Fuel elements were removed from the reactor core and dry storage areas and moved to the Hot Cell Area by the Reactor Operations and Health Physics staff.
The Hot Cell was used to cut the fuel section from each element.
HEU Fuel Removal

- A BMI Cask was used to ship the fuel elements back to the Savannah River Site

- Personnel from NAC International helped with the loading and shipment of the cask
D₂O Shipment

- Additional Piping with quick connects was installed onto existing overflow pumps to fill the shipping drums.
- Drums were filled by the reactor operations and health physics staff.
- 98% of the original amount of heavy water was returned to the DOE
Decommissioning

- Executive Engineer – CH₂M Hill
- Decommissioning Contractor – IT Corporation and GTS Duratek
- Office of Radiological Safety
- Neely Nuclear Research Center Staff
- Technical Safety Review Committee
Initial Work

- Organize, clean and/or dispose of various experimental assemblies on main floor.
- Core Sample of Biological Shield to determine the depth of activation and the best method of removing the shield.
Process Room and Systems

- All reactor systems were removed from the process room and basement.
- Clean components (secondary side) were packaged for recycling.
- All other parts were sent to GTS Duratek for processing.
Process Room and Systems

- Residual liquid in the Heat Exchangers and D$_2$O Storage Tank was drained.
- Large components were lifted from their supports via hand chains anchored into the ceiling.
- All parts were lifted through the ceiling opening and place into SeaLand containers.
Startup Source

- 50 Ci SbBe startup source was removed from the reactor tank with the GTRR fuel transfer cask.

- Source was transferred to a temporary storage container until it could be packed in it’s appropriate shipping container.
Horizontal Beam Plugs

- Remove outer shield plugs
- Remove graphite strainers
- Dismantle “Guppy System” and Defractometer
- Pull horizontal beam gates
Reactor Tank

- Upper and lower shield were removed.
- 3.5” lead layer was removed from lower top shield by diamond wire cutting.
- Shim Blades and Shafts were removed and packaged.
- Horizontal Tubes were cut from the tank using long handled tools.
- Upper segment of the tank was disposed as low level waste.
- Lower segment was removed and packaged in a shielded shipping container.
Graphite Reflector

- Entering through the thermal column the blocks of graphite were removed by hand.

- The majority of the project dose (11.15 Person-Rem) was received from the Eu-152 and Co-60 activation in the graphite blocks.
Worker Dose from Decommissioning Activities

Cumulative TEDE (person-mrem)

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<th>ALARA Budget Estimate</th>
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- **Remove Graphite Stringers**
- **Remove Lead Tank**
Concrete Shield

- The metal on the outside of the biological shielding was removed by cutting torch.
- A containment tent was raised around the shielding to prevent the spread of contamination.
- Mechanical equipment with pneumatic hammers was used to remove all of the concrete shielding.
- Exhaust from the equipment was piped out of the containment building.
The 100 ton lead, steel, and boral thermal shield was removed in two pieces.

The top of the shield was removed and shipped.

The remaining shield (80 tons) was lifted from the floor, wrapped and taken outside of containment by forklift to an awaiting truck.
Additional Areas

- The old suspect waste tanks and system were removed and replaced.
- Contamination at the bottom of the spent fuel hole had to be removed by bringing a Brock hammer into the basement.
- Streaming radiation from the reactor inlet and outlet pipes caused activation in the alcove area that was removed by Brock hammer and by hand.
Georgia Tech Research Reactor

- 6 Years 46 Days since decision to decommission.
- 7 Years 271 Days since final shutdown.
- ~8 Million Dollars
- 60,000 Contractor Manhours
- 11.15 Person Rem
Dose to on Fenceline Decommissioning Activities


- D&d
- Baseline (1st 200 Points)
- Baseline (30-Day Dec 1999)
Cobalt-60 Removal
Neely Building

- Just Underwent Final D&D And Asbestos Remediation
- Awaiting Release from DNR
- Demolition Should Start Soon