Georgia Institute of Technology
SCHOOL OF NUCLEAR ENGINEERING AND HEALTH PHYSICS
ATLANTA, GEORGIA 30332

NEELY NUCLEAR RESEARCH CENTER

(404) 894-3600

May 25, 1984

Mr. Cecil O. Thomas, Chief
Standardization Special Project Branch
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Thomas:

RE: DOCKET #50-276

The Georgia Institute of Technology holds License #R-111 to operate an AGN-201 training reactor on its campus at Atlanta, Georgia. The continued use of this reactor in the Institute programs is no longer justified, so the decision has been made to shut down, decommission, and dispose of the reactor. Some attempts have been made to locate another possible user to whom the reactor might be transferred, but up to this time no likely candidate has been identified.

The decision of the Institute is to remove all components of the reactor which contain special nuclear materials, and to return this fuel to its owner, the U.S. Department of Energy. The purpose of this letter is to inform NRC of our plan.

The reactor may still be in operable condition, but has not been operated since 1979. It contains all of the U-235 fuel of the core, and the fueled control rods. All control instrumentation is connected.

Available records show that the AGN-201 was operated at Georgia Tech for a total of 683.75 hours. Assuming that all operations were performed at a power level of 100 milliwatts the total energy generated is 68.4 watt-hours. The total radioactivity of fission products in the fuel is estimated to be 0.03 μCi per gram which is about two orders of magnitude less than the natural radioactivity in U-235.

We plan to remove the fuel from the reactor following the procedures outlined in the Dismantling Plan, package it in approved containers (to be specified by DOE representatives at ORNL, Mr. William Pryor, in accordance with NRC and DOT requirements), and move it to the storage vault of the GTRR, Georgia Tech Research Reactor.

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After the fuel has been removed, the Institute will perform a comprehensive radiation survey, will transmit the results to NRC, and will ultimately request termination of license #R-111 and residual reactor hardware and facilities. The Ra-Be neutron source will be retained.

The enclosed Dismantling Plan discusses in detail the procedures to be used, and the precautions to be employed to protect the general public. During the defueling of the reactor, the Institute will utilize the services of a re-licensed AGN-201 senior operator, Dr. J. Narl Davidson of Georgia Tech.

Review of the license #R-111 and Technical Specifications documentation reveals no requirement for an amendment to remove fuel from the Georgia Tech AGN reactor. Furthermore, review by the Georgia Tech Nuclear Safeguards Committee concludes that removal of the fuel is consistent with the Technical Specifications and that it does not constitute an unreviewed safety question.

Sincerely yours,

R. A. Karam

R.A. Karam
Interim Director
Nuclear Research Center

RAK/jlr

pc: President Pettit
Dr. T.E. Stelson
Dr. J. Spurlock
Nuclear Safeguards Committee

DISMANTLING AND DISPOSAL PLAN

I. Introduction

The Georgia Institute of Technology currently possesses an AGN-201 Training Nuclear Reactor under License No. R-111 (Docket No. 50-276). This facility is being defueled in preparation for ultimate disposal of the entire reactor. However, only the fuel will be removed and relocated at this time. To permit the transfer of the fuel, this document provides for the dismantling of the component parts and disposal of the fuel as prescribed by the NRC Regulatory Guide 1.86, "Termination of Operating Licenses of Nuclear Reactors."

The procedure for disassembly will be to remove the reactor control rods, the Ra-Be startup source and then the separate sections of the core assembly. The Ra-Be source will be placed in the source container (a Pb pig). The fission plate, fuel sections of the control rods and fuel assemblies (polyethylene discs) will be separated into two, approximately equal amounts (according to U-235 content), wrapped in polyethylene bags, and placed in NRC and DOT approved shipping containers for storage. After all fuel and the startup neutron source are removed, the electrical connections for the control rod drives and other instrumentation will be disconnected. All components and areas will be checked for contamination and decontaminated where required.

The fuel will be temporarily stored in the GTRR vault. When all approvals are received the fuel will be shipped off-site to DOE, Oak Ridge, Tennessee in accordance with all Federal and State Regulations. All used filter papers, wiping papers and rags, and gloves will be disposed of as rad-waste, according to the Georgia Tech and other applicable regulations. All protective clothing will be handled according to Georgia Tech procedures. No effluents will be disposed of through cold-drains or normal waste procedures until shown to be within applicable limits. During the entire operation, great care will be taken to protect both the operations personnel and the general public from exposure to ionizing radiations, and to keep any necessary exposure as low as reasonably practicable.

II. Dismantling Procedure

A. General Procedures

For the accomplishment of the defueling operations, Dr. R.A. Karam will be present at all times. A licensed operator will be present as a consultant. In addition the Institute Radiation Safety Officer, Mr. Robert Boyd, will monitor the operations for radiological safety aspects. All personnel involved in the operation will receive instructions of the operation at a pre-defueling meeting. A radiation work permit will be issued for the job.

B. Hazard Evaluation

1. Nuclear Safety. A nuclear excursion would be the most serious type of accident that could occur during the disassembly and removal of the reactor core. However, it is one of the least likely of all credible accidents. To obtain criticality, the complete core assembly, including all fuel discs, the two fueled safety rods and the fueled coarse control rod must be assembled within a nearly optimum reflector.

Nuclear Safety will be maintained by first removing the fuel from safety and control rods and storing it in the shipping container. The combined fuel content of the rods is approximately 45 grams of U-235.

The core itself contains approximately 620 grams of U-235 and, with the rods removed, has a negative reactivity in excess of three percent (3%) in Δ k/k.

The core disassembly will be done in the reactor room area. As the fuel discs are removed, they will be placed on a workbench covered with clean protective paper. Discs from the two halves of the core will be stored in separate shipping containers, approximately 350g U-235 per container.

A portable fast neutron survey meter will be in continuous operation during the disassembly of the core as an indicator of neutron multiplication. However, a detailed critical mass determination by neutron multiplication measurements will not be performed since the maximum reactivity increase that can be achieved by repositioning the fuel discs is less than the worth of the control rods.

As a further precaution, a temporary cadmium safety rod will be inserted into the core tank glory hole tube prior to disassembly of the core. This cadmium rod will remain in place during the disassembly of the top half of the core. The rod will be removed then by pushing it out as the glory hole liner tube is removed.

The removal and disassembly of the reactor core will be performed under the supervision of Dr. R.A. Karam. Whenever left unattended, the reactor facility will be locked, with access controlled by Dr. R.A. Karam.

2. Radiation Safety. Radioactive contamination could arise from three sources: the reactor core, activation products outside the core and the Ra-Be startup source. Fixed surface contamination produces external radiation exposures; airborne contamination adds an inhalation hazard. Thorough surveys of the reactor and core components and comprehensive monitoring of air and personnel during disassembly will prevent accidental and/or excessive exposures to contamination hazards. Such monitoring

will be supervised by the Institute's Radiation Safety Officer, and/or the health physics technologist.

Respiratory protective equipment and coveralls will be worn by all persons in the reactor room when the core tank is initially opened, and until the absence of airborne contamination has been definitely established.

The 10 mCi Ra-Be startup source will be removed from the reactor after the removal of the safety and control rods. The source will be wipe-tested immediately after removal and stored in a shielded container.

Personal monitoring devices are worn by all individuals entering the AGN reactor room under any condition. This regulation will continue to be strictly enforced during all of the procedures contained in this Dismantling Plan.

3. Mechanical Safety. The most probable type of accident is that which might be called mechanical and may result from either human error or mechanical failure. The probability of human error will be minimized by making adequate preparation for the work (see Section C) and by following a predetermined plan of action (see Section D). The probability of mechanical failure will be minimized by thorough inspection of all equipment in advance.

C. Preparation (Check List)

1. Radiation Protection

a. The following instruments will be checked for proper operation, then placed in the reactor room for use.

1. Air sampler
2. Fast neutron survey meter
3. Gamma dose rate survey meter (Cutie Pie or Radector)
4. Contamination survey meter (End-window Geiger Counter)

b. The following supplies will be collected and placed in the reactor room:

1. Glass fiber filters and filter holders for air sampling.
2. Whatman filters or Nucon smears for wipe tests.
3. Individual containers for air sample and wipe test filters.
4. Shielded storage container for storing the Ra-Be startup source.
5. Appropriate breathing apparatus (face

mask) will be worn as required by the Radiation Safety Officer.

6. Coveralls, lab coats and gloves.
7. Radioactive waste container.
8. Cadmium safety rod.

2. Work Area and Tools

a. Clear reactor room of extraneous large items and clean the work area with vacuum cleaner.

b. Collect the following tools and place in reactor room:

1. Hand tools (socket and allen wrenches) required for disassembly.
2. Handling tool for removing the Ra-Be source.
3. Fuel storage and shipping containers.
4. Operating crane for lifting the thermal column, core tank and upper graphite reflector.

c. The following items will also be placed in the reactor room:

1. Plastic bags or sheeting on which to place control rods and fuel components, and for packaging such components.
2. Labels for dismantled core components.

D. Procedures

Disassembly

1. Removal of the Thermal Tank, Part No. 2-000139.

a. Remove bolts that secure the thermal tank assembly to the water tank.

b. Attach lifting frame, T-000458, to the flange of the thermal tank with the bolts provided, and hoist carefully from the water tank.

2. Removal of control and safety rod capsules (part No. 2-000184).

a. Insert temporary cadmium safety rod into glory hole.

b. Remove the bottom cover plate (2-000169) by loosening and turning the latching dogs, Part No. 2-000358. (Note: Gasket Part No. 2-000593, should come off with the cover.)

c. Remove Dash Pot assembly (Part No. 2-000510 shown on 2-000184) by grasping the knurled surface and unscrew by hand (right-hand thread), then lower carefully out of the main frame assembly.

d. Remove the rod capsule-and-tube assembly by unscrewing (right-hand thread) cap 2-000195, using a 1/2" socket wrench, until detached, and lower carefully out of the control rod main frame assembly.

e. Remove rod capsule from rod tube by gripping the two tubes by hand and unscrewing. This thread is LEFT HAND; if the other direction is used, the capsule O-ring seal will be opened and the active material will be exposed.

f. Remove U-fuel from control rods, wipe-test for removable radioactivity wrap in plastic and place in shipping container.

g. Remove and wipe-test the Ra-Be start-up source. Place it in the portable storage container.

3. Core Disassembly

The entire disassembly of the reactor core will be performed in the presence of Professor R.A. Karam with a minimum of two persons present during each step of the operation. However, the total number of people present will be minimized. The following procedure will be followed in the sequence indicated:

a. Start membrane filter air sampler operating in close proximity to reactor core.

b. The two individuals to be in the reactor room as the core is opened will wear the appropriate face masks and gloves.

c. The upper end plate of the core tank will be removed, with special care being taken of the O-ring gasket.

d. After the air sampler has been allowed to run several minutes, the filter will be removed and counted on the low background gamma ray detector. Another filter will be placed in the air sampler and collection of a second sample will started. As soon as the absence of an airborne contamination hazard is established, the face masks will be dispensed with.

e. Lifting lugs will be screwed into the threaded sockets in the upper main reflector and this reflector will then be lifted out of the core tank.

f. As each piece of the core assembly is removed, a representative area of approximately 100 cm will be wiped with a filter paper or Nucon smear. The smears will be retained for later analysis to determine quantities of removable contamination throughout the core. Each core component will then be completely wiped with "wiping tissues" and these wipings will be disposed of as radioactive wastes.

g. The fuel discs will be removed one at a time, beginning with the tip of the core and working downward through disc No. 4. Each disc must be removed carefully to avoid jostling, and thereby shifting, the remaining discs. NOTE: Fuel from the top half of the core will be placed in one of the two shipping casks provided.

h. After removal of all fuel discs in the upper half of the core, the peripheral reflector sections will be inspected for possible removal.

i. The temporary Cd control rod will be removed, followed by removal of the Glory Hole tube.

j. The core tank will now be removed from the reactor and lowered to floor level.

k. The lower main reflector, together with fuel discs 1, 2, and 3 and the thermal fuse assembly will now be removed.

l. The lower half of the core will be disassembled by compressing the support spring recessed in the base of the lower main reflector. The thermal fuse assembly will then be exposed above fuel disc No. 2 and may be released by removing the clip ring. The fuel discs from the lower half of the core, and the thermal fuse will be wrapped for placement in the second shipping container.

m. All parts, components, etc., will be decontaminated to acceptable levels before the shipping containers are finally closed and secured.

n. Following removal of all of the fuel, the reactor reflector components will be reinserted, and the tank system reassembled for future disposition. Based on prior experience, it is expected that the tank system will contain no measurable radioactivity.

o. The Ra-Be startup source will be retained and will be stored according to applicable regulations by Georgia Tech.

III. Criticality and Security Safeguards During Storage of of Fuel Awaiting Shipment

A. Storage Location of Fuel and Control Rods

As indicatd above, the fuel and fuel portions of the control and safety rods will be wrapped in polyethylene and placed in the two NRC, and DOT approved shipping containers which will ultimately be used to transport the Special Nuclear Material to Oak Ridge, Tennessee. The containers will be sealed and properly labeled. The containers will be stored in the vault of the GTRR until shipment.

B. Criticality Monitoring

With half of the fuel stored in each of the two shipping containers, inadvertent criticality is impossible. A remote radiation monitoring instrument exists in the vault.