GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA GEORGIA 30332

FRANK H. NEELY
NUCLEAR RESEARCH CENTER

September 11, 1978

U.S. Nuclear Regulatory Commission, Region II
101 Marietta Street, N.W.
Atlanta, Georgia 30303

Gentlemen:

REFERENCE: RII: RHW; 50-160/78-3

This letter is in response to your inspection report dated August 23, 1978, regarding an inspection of our facility by your staff. The paragraph designations correspond to those in your report.

A. Written procedures for operation of experimental facilities

A new procedure, designated No. 3101, "Operation of Experimental Facilities" was reviewed and approved by the Nuclear Safeguards Committee on September 7, 1978. This procedure incorporates the definition of "Minor Experiment" and outlines the steps for using those experimental facilities not already covered by existing procedures. A draft copy of the approved procedure is enclosed with this letter.

B. Monthly measurement of shim rod drop time

The scheduling for routine jobs such as the shim rod drop time measurements is done using a master calendar. System Work Sheets (Procedure 4900) are prepared in advance and set to the appropriate unit to do the work. The failure to perform a measurement on rod drop time in June, 1978 was attributed to oversight on the part of the assigned work group and a lack of follow-up to verify that scheduled maintenance work was completed. These matters were discussed by the Nuclear Safeguards Committee at its September 7, 1978 meeting. The Committee requested the following action:

1. Caution all personnel responsible for performing scheduled maintenance work of the importances of completing the work in a timely manner and forwarding the documentation promptly. This has been done.

2. Institute a more vigorous management review and follow up of scheduled work so that appropriate action can be taken prior to my deadline. This is now underway.

A6

C. Daily test of certain instrument channels

Prior to discussions with your staff, we believed our daily checks of some of the instrument circuits were adequate to satisfy the operating license. We now agree they do not completely fulfill the requirement for a "test" of a circuit. Accordingly, we have revised our Procedure 2003, "Daily Startup Check List" to incorporate a test of the four instrument circuits. The tests are identical to those already performed under our Procedure 2002, "Weekly Precritical Startup Check List." The revised Procedure 2003 was reviewed and approved by the Nuclear Safeguards Committee on September 7, 1978. A draft copy is enclosed with this letter.

D. Fuel Handling Procedure

Your inspection report 78-1 identified as an unresolved item, our Procedure 1502, "Fuel Handling in the Core." This Procedure was recently revised to incorporate a criteria for neutron counter operability and other criteria for terminating the movement of fuel. The revised Procedure was reviewed and approved by the Nuclear Safeguards Committee on September 7, 1978. A draft copy is enclosed with this letter.

We believe we have responded to all of the matters in your inspection report. If you would like to discuss any item in more detail, please advise me. None of the material we are submitting is proprietary.

Very truly yours,

Monte V. Davis
Director

MVD:dm

Enclosures: Draft copies of Procedures 1502, 2003, 3101

cc: Nuclear Safeguards Committee w/o enclosures
T.E. Stelson, Vice President/Research
E.E. Renfro, Director/OCA
L.E. Weaver, Director/School of Nuclear Engineering
W.M. Sangster, Dean/College of Engineering

PURPOSE To assure safe and efficient operation of the experimental facilities of the GTRR.

This procedure applies to the use of the following facilities:

A. Horizontal beam ports H1 through H10 except H4

B. Horizontal beam port H4

C. Horizontal tangent tubes H11 and 12

D. Vertical In-core positions V21 through V28

E. Vertical graphite positions V33 through V46

Note: Procedure 3050 covers operation of the Bio-Medical facility and Procedure 3100 the operation of the Pneumatic Transfer System.

GUIDELINES FOR THE USE OF FACILITIES

Approval for use of the experimental facilities will be a completed "Request for Approval" (form II(3-68) delineating the details of the experiment.

Note: An approved major experiment will generally include specific operating and handling procedures.

Definition of Minor Experiment

Minor Experiment is a term applied to a general class of experiments which require approval only by the GTRR management and the Office of Radiological Safety.

Any irradiation of non-fissionable, non-explosive materials which will not evolve hazardous gases may use the pneumatic facilities or the static irradiation facilities if, in the estimation of the GTRR management, the following specifications are met.

Specifications

A. The potential reactivity worth of each secured removable experiment should be less than 0.006 $\Delta k/k$. If this value is exceeded, approval of the Nuclear Safeguards Committee will be obtained before the experiment is performed.

B. The magnitude of the potential reactivity of each unsecured experiment shall be less than 0.002 $\Delta k/k$.

C. The rate of change of reactivity of any unsecured experiment, any movable experiment, or any combination of such experiments having a total reactivity worth in excess of 0.0025 $\Delta k/k$ introduced by intentionally setting the experiment (s) in motion relative to the reactor shall be less than 0.0025 $\Delta k/k$-sec.

D. The sum of the magnitudes of the static reactivity worths of all unsecured experiments which coexist shall be less than 0.015 $\Delta k/k$.

E. The surface temperature of the materials which bounds or supports any experiment in the dry irradiation facilities shall be less than 400°C.

F. Materials of construction and fabrication and assembly techniques utilized in experiments shall be so specified and used that assurance is provided that no stress failure can occur at stresses twice those anticipated in the manipulation and conduct of the experiment or twice those which could occur as a result of unintended but credible changes of, or within, the experiment.

G. The radioactive material content of any singly encapsulated experiment shall be limited so that the complete release of all gaseous, particulate, or volatile components from the encapsulation will not result in doses in excess of 5% of the equivalent annual doses stated in 10 CFR Part 20. This dose limit applies to persons occupying (1) unrestricted areas continuously for two hours starting at time of release or (2) restricted areas during the length of time required to evacuate the restricted area.

H. The radioactive material content, including fission products of any doubly encapsulated or vented experiment shall be limited so that the complete release of all gaseous, particulate, or volatile components from the encapsulation or confining boundary of the experiment could not result in (1) a dose to any person occupying an unrestricted area continuously for a period of two hours starting at the time of release in excess of 0.5 rem to the whole-body or 1.5 rem to the thyroid or (2) a dose to any person occupying a restricted area during the length of time required to evacuate the restricted area in excess of five rem to the whole body or 30 rem to the thyroid.

All experiments outside this envelope will require Reactor Safeguards Committee review.

NORMAL OPERATION OF EXPERIMENTAL FACILITIES

General Instructions

1. Verify that an approved "Request For Minor Experiment Approval" form is on file in the Control Room. Check the requested irradiation on the GTRR Experiment Schedule Card (Yellow Card) to be sure the requested time, position, material etc. do not exceed the approved limits. If any limits would be exceeded, the experiment should not be done.

2. Secure a Radiation Work Permit (RWP) for the job. If the work is to be done under an Approval for Self Monitoring, follow the instructionstherein.

A. Horizontal Beam Ports H1 through H10 except H4

Note: If the experimental use requires only the opening or closing of the lead shutter, skip to step 2. below.

1. Insertion/Removal of graphite plug or collimator

a. Verify reactor has been shutdown (if possible for 48 hours or more)
b. Paper the floor area beneath and directly away from the selected port. Obtain a box for contaminated waste
c. For graphite insertion/removal, secure the special support cradle and aluminum handling rod. To minimize contamination from the graphite, withdraw the stringerinto a length of previously prepared polyethylene tubing
d. Remove the concrete shield plug using the 2-Ton auxiliary
e. Use special tool and open the lead shutter plug from the reactor top

Note: Without graphite, the gamma beam emerging from a port may be tens-of-rad per hour. Use appropriate health physics procedures.

f. Insert/remove the graphite plug. Close the movable lead shutter. Insert the shield plug or special experimental plug in the port.

2. Operation for an Experiment

a. Verify placement of adequate shielding for the emerging beam. If the experiment has not been run before or any changes have been made, request Health Physics monitoring.
b. Use special tool to open/close the movable lead shutter plug from the reactor top

B. Horizontal Beam Port H4

1. Establish communication between reactor operator and field operator at H4 position

[illegible] four ball valves CLOSED

3. Request control room operator to energize the H4 system
4. Open the sample insert port and, using tongs, insert the rabbit into the port and close the seal.

   Note: The rabbits will usually have holes drilled in the plastic capsules to provide cooling to the sample. The rabbit may or may not be buoyant depending upon the sample and its inner container.

5. Inform the reactor operator that the sample is being inserted. He will log initial regulating rod position. Open the appropriate insert valves. Insertion will require 6-8 seconds. Reactor operator will log "final" regulating rod position. If the required compensating regulating rod motion exceeds 2 inches, the reactor operator will shut down the reactor.
6. Sample cooling flow is monitored by the flowmeter with a low flow alarm signal in the control room. If cooling flow for the sample is mandatory-refer to experiment approval-the reactor operator will scram the reactor upon receipt of a low flow alarm. If cooling is not mandatory, continue reactor operation. Determine cause of low flow condition and correct.
7. At completion of irradiation time, CLOSE both insert valves and OPEN both return valves. Use radiation monitoring instruments to determine the return of the rabbit. When rabbit has returned, request reactor operator to secure the pump.
8. If the radiation rate from the sample is very high it may be desirable to let the rabbit decay in the sample tube. If removal is desired, open the receiving port.

   CAUTION: If the rabbit is buoyant the radiation level will sharply increase when the rabbit comes to the surface.

D. Vertical In-Core Position V21 through V28

1. The reactor must be shutdown for all sample insertions or removals from these experimental positions. For sample removal following reactor operation, wait at least 45 minutes before removing the lower top shield plug.
2. Remove the lead cover plug and the upper top shield plug from the selected position
3. Remove the lower top shield plug. The lower end of the plug will be very radioactive. Move the plug away from the working area.

   Note: For positions V27 and V28, it will be necessary to first "unlock" the inner lower top shield plug using a special tool

4. Most samples will be inserted or removed using the special "fishing rod" with the three-prong hook. Utilize a mirror and light source to minimize radiation exposure to personnel.
5. Insert the shield plugs in reverse order. Check that the lower top shield plug is oriented properly to seat fully.
6. Use appropriate health physics practices to clean any possible contamination from the area around the experimental position.

E. Vertical Graphite Positions V35 through V46

1. The reactor should be shutdown for removal of the shield plugs from the graphite positions.

   Note: Some sample irradiations are made without the shielding re-installed. The conditions for such irradiations are:

   a. Reactor power limited to 250 KW or less and
   b. Special Health Physics monitoring required

2. If the selected position has a graphite stringer, it should be removed and stored. Follow the general procedures in Step A.1.
3. Samples are generally handled per D.4. above
4. Use appropriate health physics practices to clean any possible radiactive contamination from the area around the experimental position.

C. Horizontal Tangent Tubes H11 and H12

For use of these facilities, follow the steps given under A.1 for the Horizontal Ports except that ports H11 and H12 do not have a movable lead shutter

Note: These ports are often used for engineering type major experiments. Generally, special job plans will be written for these experiments.

Chapter 4 Normal Operation	GEORGIA TECH RESEARCH REACTOR	Procedure 2003 Approved 5/2/74 Latest Rev. Page 1 of 5
	DAILY STARTUP CHECK LIST	

Check ECCS pump, hoses in place, fuel supply sufficient ____

Check city water supply ≥ 25 psig ____

Check ECCS stainless hose in place ____

Check ECCS Valves 690, 691 closed ____

Check level in spent fuel basin ____

Cooling tower screen clear ____

Vacuum Breaker isol. valves open ____

Check Kanne and Map 1 running ____

Switches in panels LO, LQ, PB ____

MCC Breakers ON ____

Fans GR-1, 2 & 3 ON ____

Sump pumps 1 & 2 on Auto (switch auto selector each week) ____

Inst. air press. ≥ 18 psig ____

Air compressor OK, Blowdown ____

System air press. ≥ 80 psig ____

Emergency lock air ≥ 20 psig ____

Truck lock air ≥ 20 psig ____

Personnel lock air ≥ 30 psig ____

Helium supply OK ____

Gas holder level OK (Compare elec. vs. mech. indicators) ____

Date: _____

Time: _____

Operators: _____

Check for leaks on LO, N2, or helium [illegible] piping pipe tunnel ____

Check pump valve air filter ____

Take data in process equipment room ____

Check "Test" Emergency lights ____

All operating equipment OK ____

Process Equip. Room clear and locked ____

Emergency lights on overhead ____

Emergency air lock ____

Truck door sealed ____

Personnel air lock sealed ____

Thermal column OK ____

Bio-Med OK ____

Shim blade dash pots checked ____

H1 through H22B OK- list abnormal status below ____

Reactor top OK- list abnormal status below ____

Abnormal Conditions or special operating instructions:

_____

_____

_____

Pre-amp power ON _____

Auto-Controller chassis power ON _____

Instrument power ON _____

Shutter Indication power ON _____

DC Power supply ON _____

Breakers AU, AV ON _____

Turn Key switch ON _____

Shim Blades down _____

Annunciator Test OK _____

Annunciator reset OK _____

Building PA test OK _____

Intercom ON _____

Clocks ON _____

Isolation Selector to _____ _____

Do Not Enter sign on "auto" _____

Radiation Control and Power Supply Chassis ON _____

HV _____ Volts
LV _____ Volts

Check following recorders ON; Chart & Ink OK; Date & time stamp

Log N & Period (on slow) _____

Radiation Recorder _____

Channe Recorder _____

Turn on following recorders; chart & Ink OK; Date & time stamp

TR-1 _____

TR-2 _____

CRA-1 _____

TRA-N1 _____

TRA-D1 _____

Power level recorder(on slow) _____

Water & Gas Monitor recorder _____

Check following recorders ON; New chart and ink OK; Date & time stamp

FRA-N1 _____

FRA-D1 _____

60 cps check _____

120 cps check _____

Check the following instruments ON

Log N, Period No. 1 _____

Log N, Period No. 2 _____

Flux Amp. No. 1 _____

Flux Amp. No. 2 _____

Dual High Voltage power supply PS-1 _____

Neg. _____Volts

Pos. _____Volts

Picoammeter No. 1 _____
Picoammeter No. 2 _____

Check the following instruments ON (Cont)

Water Monitor _____

HV ON _____

60 sec. TC _____

Alarm set @ _____ cpm _____

Gas Monitor _____

HV ON _____

20 sec. TC _____

Alarm set @ _____ cpm _____

Filter Bank Monitor _____

HV ON (Nimbin) _____

Ratemeter ON _____

Alarm set @ _____ cpm _____

Test LCRM _____

LCRM HV OFF _____

Function Switch to 10 cps _____

Check Meter reads OK _____

Reset Trip (neutron countrate low) _____

Switch function switch to operate _____

Observe low neutron countrate trip at 2 cps _____

LCRM HV ON _____

Reset trip and annunciator _____

Discriminator set @ _____ _____

Time base/multiplier switch to 1 second _____

Fast/Norm/Hold switch to Norm _____

Multiplier toggle switch to X 1 _____

Is purification valve check list ssary? _____ If "Yes" orm in accordance with GTRR Procedure 2050.

If "No" continue Precritical checklest

Verify sprayblock valve open _____

Verify reactor isolation valves open _____

Establish purification flow _____

Open valve 50 _____

Open valve 36 _____

Open valve 36A (B) _____

Start MD-3 (4) _____

Throttle valve 39 to set 7 gpm flow _____

Close valve 50 _____

Close valve 36 _____

Is primary valve check list necessary? _____ If "Yes" perform in accordance with GTRR Procedure 2150 _____

If "No" continue Precritical checklist

Start MD-2A _____

Observe flow increase to 1800 gpm _____

Is secondary valve check list necessary? _____ If "Yes" perform in accordance with GTRR Procedure 2200.

If "No" continue Precritical checklist

Start MH-2A _____

Start MB-3 ____

Is helium valve check list necessary?

____ If "Yes" perform in accordance with GTRR Procedure 2350.

If "No" continue Precritical checklist

Helium level from 20 to 40 cu. ft. ____

Open valves 230, 231 ____

Start MHe-1 ____

He flow >15 cfm ____

Is shield system valve check list necessary?

____ If "Yes" perform in accordance with GTRR Procedure 2250.

If "No" continue Precritical checklist

Start MS-1 (2) ____

Is Bismuth system valve check list necessary?

____ If "Yes" perform in accordance with GTRR Procedure 2300.

If "No" continue Precritical checklist

Start MB-1 ____

TD-2 full ____

If not full, open valve 92 until level reaches overflow.

Close valve 92 ____

Reset TD-2 low level permissive ____

Check Permissive interlocks clear ____

Safety rods out ____

Instrument Sw. Off Low ____

Bldg. Rad. High ____

Low Neutron Countrate ____

Emerg. Core Coolant Sys. ____

Check all scrams clear ____

Reset magnet actuator amp. ____
Relay current ____ amp.

Energize No. 1 clutch ____
current ____ amp.

Energize No. 2 clutch ____
current ____ amp.

Energize No. 3 clutch ____
current ____ amp.

Energize No. 4 clutch ____
current ____ amp.

Raise No. 1 shim safety rod to 5" ____

Drive down to 3" ____

Drop shim safety rod No. 1 ____

Repeat for No. 2 shim safety rod ____

Repeat for No. 3 shim safety rod ____

Repeat for No. 4 shim safety rod ____

Raise reg. rod to 2 inches ____

Drive down to low limit ____

Energize clutches 1-4 ____

DAILY STARTUP CHECK LIST

Connect cable from calib. unit to "T". Connector on signal cable on rear of Flux Amp. 1 _____

Slowly adjust calibration unit until power trip is received _____

Record Trip point _____ _____

Observe Power Trip plate _____ _____

Magnet act. amp. _____ _____
0.0 magnet current _____ _____
Rod Mag. Ind. 1 & 2 (3 & 4) _____ _____
Shim blades 1-4 on down limit _____ _____

Repeat for Flux Amp. #2 _____ _____

Disconnect cable to Flux Amp. #2 _____

Install jumper from TD 176 to TD 134 _____

Check reading on Log N #1 (2)

± 1/8" in the following position:

Zero 2 _____ _____
Zero 1 _____ _____
150Δ _____ _____
10Δ _____ _____
10^{-3} _____ _____

Go to period position.

Allow unit to stabilize, Reset period trips. Reset actuator amp. Energize clutches 1-4. Go to fixed position on ramp switch (Hold until power level indicates 10^{-3}%)

Obs pos. per. #1 (2) _____ _____

[illegible] Trip plate _____ _____
[illegible] magnet current _____ _____
[illegible] Ind. 1 & 2 (3 & 4), off _____ _____

Release ramp switch _____ _____

Allow period to stabilize _____ _____

Reset Actuator Amp. _____ _____

Energize clutches 1-4 _____ _____

On reset switch go to ramp reset position _____ _____

Observe Neg. Per. #1 (2) _____ _____

Period Trip plate _____ _____
0.18 mag. current _____ _____
Rod. Mag. Ind. 1 & 2 (3 & 4) off _____ _____

Repeat for Log N Period #2 _____ _____

Remove jumper from TD 176 to TD 134 _____ _____

Reset Magnet Actuator Amp. _____

Energize Clutches 1-4

hapter 2 omponent andling	GEORGIA TECH RESEARCH REACTOR	Procedure 1502 Approved 12-6-77 Latest Rev. Page 1 of 3
	FUEL HANDLING IN THE CORE	

I. PURPOSE

To establish guidelines and procedures for fuel handling in the core of the Georgia Tech Research Reactor.

II. LIMITATIONS AND REQUIREMENTS

The Technical Specifications establish certain limitations and requirements for fuel handling. These are listed below:

A. The reactor must be subcritical by more than 0.0275 $\Delta k/k$ during loading changes (see 3.1.b.)

B. Containment isolation must be maintained during movement of irradiated fuel (see 3.3.c.)

C. All grid positions must contain fuel elements, grid plugs or experimental facilities for operation in the forced convection mode (see 3.6.c.)

D. All fuel elements outside of the reactor shall be stored and handled such that the calculated k-effective is less than 0.85 under optimum conditions of water moderation and reflection (see 3.8.a.)

E. No more than four unirradiated fuel elements shall be together in any one room outside of the reactor, shipping containers or fuel storage racks (see 3.8.b.)

F. Provide a minimum of 12 hours cooling after 5 MW operation before removing a fuel element (see 3.8.c.)

G. Shim Safety blade reactivity worth shall be measured and the shutdown margin calculated annually and whenever a core configuration is loaded for which shim safety blade worths have not been measured (see 4.1.a.)

III. APPLICABILITY

This procedure should be implemented for any fuel element change ade involving the core of the reactor. This would include (but not be imited to) the following:

A. Add new fuel only
B. Add irradiated fuel only
C. Remove irradiated fuel only
D. Remove irradiated fuel, add new fuel
E. Remove irradiated fuel, add irradiated fuel

IV. PROCEDURE

A. Operable neutron monitoring channel. Verify that one (or more) of the following neutron monitoring channels are operable:

1. Startup Channel
2. Picoammeter Channel No.1
3. Picoammeter Channel No.2

If the signal from the monitoring channel(s) increase by a factor of 2 during fuel movement, terminate the operation. The reactor supervisor will evaluate and specifically authorize the program to continue. Additionally, fuel handling should be terminated in case of unusual events such as fire, criticality etc.

B. List below, in sequence, the fuel element moves that are to be done. Specify a "from" and "to" location explicitly.

C. For each movement, estimate the reactivity addition to the reactor core (positive or negative).

Note: The maximum worth of a new 188 gm. element is 0.025 $\Delta\kappa/\kappa$.

D. Estimate the critical blade position using the information in IV.B. above and current shim blade worth calibrations.

E. Determine if a measurement of shim blade reactivity worth and shutdown margin are required. If so, they must be done prior to operation of the reactor for any other purpose.

Are measurements required? _____

File this completed procedure. Retention time is 5 years.

V. APPROVAL AND VERIFICATION

A. Procedure reviewed and approved

_____

Reactor Supervisor or Reactor Engineer Date

B. Procedure completed

_____

Reactor Shif Supervisor Date