UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

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Report No.: 50-160/90-01

Licensee: Georgia Institute of Technology
225 North Avenue
Atlanta, GA 30332

Docket No.: 50-160 License No.: R-97

Facility Name: Georgia Institute of Technology Research Reactor

Inspection Conducted: January 16-19, 1990

Inspector: C. H. Bassett
C. H. Bassett, Radiation Specialist — Date Signed: 2/5/90

Approved by: for E. J. McAlpine
E. J. McAlpine, Chief
Radiation Safety Projects Section
Nuclear Material Safety and Safeguards Branch
Division of Radiation Safety and Safeguards — Date Signed: 2/5/90

SUMMARY

Scope:

This routine, unnanounced inspection involved onsite review of radiation protection program activities including radiation control activities, transportation, and followup and review of licensee actions concerning Inspector Followup Items and NRC Information Notices.

Results:

The staffing and current organizational structure were adequate to meet Technical Specification requirements and to implement the licensee's radiation protection program. The former Manager of the Office of Radiation Safety has been promoted to the position of Associate Director, Neely Nuclear Research Center. No one has been found to fill the position of Manager, Office of Radiation Safety to date. The licensee has continued to improve the radiation protection program at the facility and has completed revision of approximately eighty percent of the procedures in this area. Strengths in the licensee's program were noted in the areas of external and internal exposure control, a radiation work permit program, low facility radioactive contamination levels, low radiation exposure to personnel, and air sampling on all three levels inside the reactor containment. No specific weaknesses were noted and no

violations were identified during the inspection. One Inspector Followup Item was established concerning revision of Procedure 9017 which deals with the method of obtaining a grab sample from the facility ventilation exhaust stack (Paragraph 7.b).

REPORT DETAILS

1. Persons Contacted

*R. Karam, Director, Neely Nuclear Research Center
*B. Revsin, Associate Director, Neely Nuclear Research Center and Acting Manager, Office of Radiation Safety
W. Downs, Acting Manager, Reactor Operations

Other licensee employees contacted during this inspection included operators, technicians, and administrative personnel.

*Attended the exit interview

2. Organization and Management Control - Radiation Control (83743)

a. Orgainzation, Staffing, and Qualifications

Technical Specification (TS) Section 6.1 details the organizational structure, selected position responsibilities, and the reporting chain of command for safety, safety policy, and radiation control at the Georgia Institute of Technology Research Reactor (GTRR) facility.

The inspector reviewed and discussed, with cognizant licensee personnel, the current staffing at the facility involved in conducting routine and nonroutine radiation protection activities at the GTRR. The inspector noted that the former Manager of Radiation Safety (MORS) had been promoted and is currently filling the position of Associate Director of the Neely Nuclear Research Center (NNRC). Because no replacement has yet been found, the Associate Director is also currently the acting MORS. The licensee indicated that various candidates for the position have been interviewed but no one has been selected to date.

During a previous inspection, the inspector determined that the permanent staff performing health physics (HP) duties at the facility and reporting to the MORS consisted of two individuals, a Senior Safety Engineering Assistant and a Research Scientist I. The inspector determined that the licensee has since hired one other full-time individual to assist in the HP area. In addition, the licensee has two part-time student technicians, one graduate research assistant and one undergraduate assistant, who help perform routine surveys and job coverage at the facility and throughout the campus. The inspector reviewed the training and qualifications of all these individuals and found that the training provided was adequate and documented and that the individuals were well qualified to perform their jobs based on previous experience and/or education completed.

The inspector noted during this inspection that the current staffing appeared to be adequate to conduct routine and nonroutine radiation protection activities for the facility. The inspector also discussed the possibilities of increased reactor usage at the facility and verified that the licensee would hire more personnel in the HP area should the work load increase substantially.

b. Nuclear Safeguards Committee

TS Section 6.2 details the composition of the Nuclear Safeguards Committee (NSC), qualifications of its members, required documentation of its responsibilities and authority, rules, and also meeting frequency.

The inspector discussed the technical areas of expertise and qualifications of those who are members of the NSC with the Associate Director of the NNRC. The inspector verified that the various members included personnel with a diversity of backgrounds as specified in the TS. The inspector also reviewed the minutes of the meetings held by the NSC since the last inspection. The inspector verified that the group was functioning as outlined in the TS and that issues reviewed and discussed were appropriate. These issues included audits, procedure revisions, NRC inspections and results, radioactive waste generation, and unusual events that occurred at the NNRC. The inspector also verified that the meetings were being held even more frequently than required.

c. Audits and Procedure Reviews

TS Section 6.2.e requires that the NSC audit the safety aspects of reactor facility operations in order to provide management with an independent review of these aspects. This section also requires the NSC to review and approve proposed changes to procedures.

The inspector reviewed the audit conducted by the NSC for the 1989 calendar year. Audit areas included the emergency preparedness plan and procedures, routine surveys of the facility, terminated radiation work permits (RWPs), 10 CFR 50.59 reviews, and HP operational records. In the areas covered, the audit appeared to be adequate. The auditors found various discrepancies which were outlined for management attention. The responses to the audit findings appeared to be adequate.

The inspector discussed with cognizant licensee personnel the status of their program to review the HP procedures and have them approved by the NSC. The inspector noted that, of the 49 HP procedures at the facility, 26, or approximately 53 percent (%), had been revised and approved by the NSC during the last quarter of 1988. Thirteen HP procedures, or approximately 27% of the total number, had been revised and approved during 1989. Of the 10 procedures remaining to

be revised, the inspector noted that 6 dealt with calibration of instruments. They were generic calibration procedures, calibration procedures that were no longer used, or calibration procedures that had been replaced by other procedures but which had not yet been deleted. Also, one of the remaining procedures, covering the environmental monitoring program, was in the process of being revised. Therefore, only three procedures remain which need to be revised in the short term. The licensee indicated that a draft procedure had been written to provide guidance in the transportation of radioactive material but no final version was available to date.

No violations or deviations were identified.

3. External Exposure Review - Radiation Control (83743)

a. Exposure Control

10 CFR 20.101 delineates the quarterly radiation exposure limits to the whole body, skin of the whole body and the extremities for individuals in restricted areas.

10 CFR 20.202 requires that appropriate personnel monitoring devices be worn by personnel likely to receive exposure in excess of 25 percent of the limits specified in 10 CFR 20.101 or who enter high radiation areas.

The inspector reviewed and discussed with licensee representatives the exposure records for persons permanently assigned to work at the NNRC for the period from January 1, 1989 through November 30, 1989. The licensee uses film badges supplied by a National Voluntary Laboratory Accreditation Program (NVLAP) approved vendor for measuring official dose. Vendor specifications reported a detection limit of 10 millirem (mrem) for the dosimetry supplied. The highest accumulated individual exposure for the year was 1,100 mrem. The licensee indicated that the majority of this exposure was attributable to a job which involved repair work on a shield block located near the reactor (see Paragraph 3.b below). The inspector noted that three other individuals had exposures ranging from 510 to 550 mrem for the same period. These individuals had also been involved with the shield block repair work. All other annual cumulative exposures for those not involved in the shield block job were approximately 150 mrem or less.

After reviewing the exposure records, the inspector also noted that one individual's exposure was being recorded monthly, as required, but no quarterly or annual exposure totals were listed. The exposure records had been reviewed by licensee representatives, including the MORS, and they were aware of the monthly exposure of the individual, which never exceeded 40 mrem during any one month or quarter. However, no one had questioned why no quarterly or annual totals were

listed on the exposure records. Following discussion of this issue, the licensee reviewed the records and determined that the total exposure for the individual through November for 1989 was 130 mrem. Subsequently, the licensee corrected the problem by calling the dosimetry vendor and requesting that the individual's exposure be totaled quarterly and annually as well as monthly.

During tours of the facility, the inspector observed personnel monitoring devices being worn as required.

b. Radiation Work Permit (RWP) Program

The inspector reviewed the licensee's procedure dealing with control of work on radioactive systems or in radiation areas. The procedure, Procedure 9306, Preparation and Maintenance of RWP's, Rev. 0, dated September 9, 1989, appeared to be adequate.

The inspector also reviewed selected RWPs used during 1989. Several RWPs dealt with repair of a leaking shield block near the reactor. The shield block, generally referred to as the bismuth block because of its compositon, was located within an area called the Biomedical facility. The facility had been constructed so that the bismuth block could be used to attenuate gamma radiation from the core while allowing thermal neutrons to pass through. The thermal neutrons could then be used for medical therapy. The block was cooled by light water to remove heat deposited by gamma, neutron, and activation product radiation. A leak developed in the system used to cool the block and the licensee initially attempted to repair the leak by applying epoxy over the leak area. This failed and the licensee then proposed to install a catch system which would collect the leaking water and channel it to a condensate pump. The pump would circulate the water through a 5 micron filter and return it to the cooling water storage tank. The cooling water would also be deionized by an ion exchange column.

This approach was subsequently approved by the NSC following some tests of the system. The NSC stipulated that the temperature would have to be monitored during limited operation of the reactor to ensure that it did not increase to a level which would cause the bismuth block to melt. The NSC also required that the cooling water be analyzed to determine the radioactivity present, with emphasis on tritium. The limited testing was performed and the temperature did not increase above the temperature that had been stipulated by the NSC. Analysis of the cooling water showed tritium activity of 1.79 E-3 microcuries per milliliter (uCi/ml) and Zinc-65 activity of 2.19 E-6 uCi/ml. The NSC has since authorized further testing of the system during operation of the reactor in step increases from 1 megawatt (Mw) to the maximum power operational level of the reactor of 5Mw.

The inspector reviewed all the various RWPs written to control work during the bismuth block repair work. No skin contaminations or internal exposures resulted and radiation exposure was kept within predetermined limits. Through review and discussions with licensee representatives, the inspector determined that the RWPs used for the bismuth block repair work and those reviewed covering other work were appropriate to control work, keep exposures as low as reasonable, and eliminate or control contamination. The radiation protection requirements specified by the RWPs, including dosimetry, surveys, protective clothing, air sampling, and HP coverage of the jobs, appeared to be adequate.

No violations or deviations were identified.

4. Internal Exposure Review - Radiation Control (83743)

10 CFR 20.103 establishes the limits for exposure of individuals to concentrations of radioactive materials in air in restricted areas. Section 20.103 also requires that suitable measurements of concentrations of radioactive material in air be performed to detect and evaluate the airborne radioactivity in restricted areas and that appropriate bioassays be performed to detect and assess individual intakes of radioactivity.

a. Bioassay Program

The inspector reviewed the licensee's procedure for assessing the amount of tritium in a person's system following an intake. The procedure, Procedure 9037, Tritium Determination In Urine, Rev. 0, dated April 28, 1989, described the distillation process, the isotopic analyses, and the calculational method used in this determination. The procedure appeared to be adequate.

The inspector reviewed the log book containing the results of the analyses that had been performed during 1989. All the results had been reviewed by the individual assigned oversight responsibility, as well as by the MORS. During that period the highest intake was calculated to have been 28.3 microcuries (uCi) of tritium. This exposure had occurred during compaction of contaminated waste. As a result of this exposure, 4.72 Maximum Permissible Concentration-hours (MPC-hrs) were assigned to the individual. The licensee indicated that MPC-hrs were not tracked formally but are tracked informally by those reviewing the results of the analyses.

b. Air Sampling

The inspector discussed the air sampling program with licensee representatives. The program involves continuous air sampling performed by air samplers located on top of the reactor, on the main floor of the reactor building, and in the basement of the reactor building. The filters from each of these air samplers are changed

weekly and qualitatively analyzed to determine the concentration of alpha and beta-gamma radioactivity in the air.

The inspector reviewed the results of selected air samples taken since the last inspection. The air sample log indicated that the airborne concentration had seldom been above 25% of the MPC of the radionuclides specified in 10 CFR 20, Appendix B, Table 1, Column 1. When airborne activity exceeded such a concentration, decay counting the sample and/or isotopic analysis showed that the activity was generally attributable to Radon. Airborne concentrations were typically generally in the range of 1 E-11 to 1 E-12 µCi/ml beta-gamma and lower for alpha.

No violations or deviations were identified.

5. Surveys, Posting and Labeling - Radiation Control (83743)

a. Surveys

10 CFR 20.201(b) requires that the licensee perform such surveys as may be necessary and are reasonable under the circumstances to evaluate the extent of radiation hazards that may be present.

Licensee procedures, Procedure 9250, Facility Contamination Surveys, Rev. 1, dated September 9, 1988 and Procedure 9304, Routine Facility Radiation Surveys, Rev. 0, dated September 9, 1988, specify the frequency and location of the surveys to be performed.

The inspector reviewed selected records of daily, twice weekly, and fortnightly contamination and radiation surveys performed in the Reactor Control Zone (RCZ). The survey results were discussed with licensee representatives. In general, the radiation and contamination survey results were below any action points specified by the procedures. When action points were reached, as indicated by survey results, actions were taken to quickly resolve the problem. Resurvey results of the areas indicated that licensee actions had been effective.

The inspector also performed radiation level surveys of various areas in the reactor building using NRC instrumentation. The inspector verified the radiation levels indicated on licensee surveys.

b. Posting

10 CFR 19.11 requires each licensee to conspicuously post current copies of (1) 10 CFR Parts 19 and 20, (2) the license, (3) operating procedures, and (4) Form NRC-3, in sufficient places to permit individuals engaged in licensed activity to observe them on the way to and from any licensed activity location. If posting of the documents specified in (1), (2), and (3) is not practicable, the

licensee may post a notice which describes the documents and states where they may be examined.

10 CFR 20.203 specifies the requirements for posting radiation areas, high radiation areas, and radioactive material areas.

During tours of the facility, the inspector noted that the applicable documents and/or references to their location were posted on a bulletin board near the facility Director's office. This is near the main entrance to the controlled area. The posted documentation indicated that copies of regulations and procedures were maintained in the control room and the NNRC Director's office.

Posting of entrances into the controlled area and labeling of containers were observed and discussed with licensee representatives. The postings appeared to be adequate. The labeling of radioactive material appeared to be in compliance with the regulations. Although no item descriptions, radiation levels, or date and HP technician initials were listed on the labels (and were not required due to the circumstances), the inspector suggested that such things be listed to give those working in or passing through the area further information concerning the material present. The licensee indicated that they would evaluate the suggestion.

No violations or deviations were identified.

6. Transportation (86740)

10 CFR 71.5 requires each licensee who transports licensed material outside the confines of its plant or other place of use to comply with the applicable requirements of the Department of Transportation (DOT) in 49 CFR Parts 170 through 189.

The inspector discussed the transportation of radioactive material with the licensee representatives. The licensee indicated that radioactive waste is transferred to a waste broker who completes all shipping documentation with information supplied by tne licensee. Radioactive waste is generally compacted and then transferred to the broker for disposal. Other types of radioactive material to be shipped are handled on a case basis. The inspector verified that no radioactive material shipments had been made since the last inspection.

During the previous inspection, the licensee had agreed to evaluate the need for a shipping procedure. Although a draft procedure had been prepared, no final procedure was available for NSC review and approval.

7. Action on Previous Inspection Findings (92701)

a. (Closed) Inspector Followup Item (IFI) 50-160/88-01-02: Beam Port Shielding Calculations

This IFI was established following concerns expressed by an HP technician over reactor beam port experiments. Since that time the licensee has written and/or revised the procedures governing irradiation of experiments. The inspector reviewed Procedure 3100, Instructions for Preparation of GTRR Experiment Approval and Report Form, Rev. 6, dated August 8, 1989. It specified the requirements for completion of a form for irradiation of samples. It included a form which required the calculation of the anticipated dose rate at 18 inches from the sample after irradiation. Reactor power level, maximum duration of the experiment and the potential reactivity worth were required to be calculated as well. The procedure also specified that changing the experimental facility (i.e. beam port) was not the prerogative of reactor operations. If a change needed to be made in the experimental facility, the procedure required the approval of management. The inspector also reviewed Procedure 3200, Radiological Aspects of Experiment Irradiations, Rev. 0, dated September 29, 1989. This procedure specified a conservative method to be used in calculating dose rates that could be expected from irradiated samples and their containers.

The licensee stated that shielding is not used as extensively as it was in the past. If sample radiation levels are calculated to be too high, or if levels are found to be too high by the remote radiation monitors installed in the sample transfer system, the sample is required to undergo a cooldown period. This cooldown period can last from several hours to several days. Only when then can the sample be removed from the experiment port to the reactor top or sent to a laboratory via the "rabbit" transfer system. In areas on the main floor around the reactor where beam ports may be used to conduct experiments, shielding is installed and surveyed to ensure safety. Any entrances to these areas are locked and posted.

These procedures and safety practices appeared to provide sufficient guidance to control exposures that may be received following irradiation of samples.

b. (Closed) IFI 50-160/88-02-08: Stack Grab Sampling

This IFI was established due to the potential occupational hazards associated with climbing the exhaust stack while carrying sampling equipment. The licensee agreed to evaluate the stack sampling method and consider another possible method for obtaining the sample.

The inspector discussed the sampling process with licensee representatives including those who actually climb the stack to obtain the sample. Although management and workers alike felt that

climbing the stack posed only a limited safety hazard, the licensee has decided to change the method used to sample the air from the exhaust stack. This IFI will be closed but another established to follow and review the revised procedure. The NRC will track revision of Procedure 9017, Stack Grab Sample Analysis, Rev. 2, dated October 14, 1988, as an IFI (50-160/90-01-01).

c. (Closed) IFI 50-160/88-02-12: Specify a Dead Time Limit for the Multichannel Analyzer - Procedure 9154

The inspector reviewed Procedure 9154, Operation and Daily Check of the Gamma Analysis Systems for Effluent Monitoring, Rev. 1, dated October 14, 1988. The procedure has been revised and now specifies a dead time limit. The procedure requires that dead time for counting shall not exceed 10 percent. This procedure is currently under review by the NSC.

d. (Open) IFI 50-160/89-03-01: Procedure for Transportation of Radioactive Material

The inspector verified that a draft procedures has been written for handling radioactive waste and completing radioactive material shipments. The licensee indicated, however, that the procedure still needs to be revised before being submitted to the NSC for review and approval.

8. Exit Interview (30703)

The inspection scope and results were summarized on January 19, 1990, with those persons indicated in Paragraph 1 above. The inspector discussed and detailed the findings for each area reviewed. The adequacy of the licensee's organization and staffing in radiation protection was discussed. Internal and external exposure controls employed by the licensee apparently have been effective in maintaining exposures as low as practicable. Posting, surveys and labeling of radioactive material throughout the facility appeared to be adequate. One IFI was established to follow the revision of the procedure providing guidance in obtaining a stack grab sample.

Item Number	Description and Reference
50-160/90-01-01	IFI - Follow the revision of Procedure 9017, Stack Grab Sample Analysis, Rev. 1, dated October 14, 1988 (Paragraph 7.b).

Licensee management was informed that three of the four IFIs discussed in Paragraph 7 were closed during this inspection.