



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

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Report Nos.: 50-276/85-02 and 50-160/85-03

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

Docket Nos.: 50-276/85-02 and 50-160/85-03

License Nos.: R-111 and R-97

Facility Name: Georgia Institute of Technology

Inspection Conducted: August 26-29, 1985

Inspectors:

B. K. Revsin
B. K. Revsin

10/8/85
Date Signed

T. R. Collins
T. R. Collins

10/9/85
Date Signed

Approved by:

C. M. Hosey
C. M. Hosey, Section Chief
Division of Radiation Safety and Safeguards

10/7/85
Date Signed

SUMMARY

Scope: This routine unannounced inspection involved 32 inspector-hours onsite in the areas of radiation control, environmental protection, and transportation for the Georgia Institute of Technology Research Reactor (GTRR). Also inspected were disposition of radioactive material, confirmatory radiation and contamination surveys and review of records associated with the termination of the operating license for the AGN-201 reactor.

Results: Two violations were identified: (1) failure to adequately sample liquid waste during release, and (2) failure to adhere to Technical Specification requirements for monitor setpoints and maximum release rates for gaseous effluents.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

R. A. Karam, Interim Director, Nuclear Research Center
R. M. Boyd, Radiation Safety Officer
S. N. Millspaugh, Health Physics
P. B. Sharpe, Health Physics

2. Exit Interview

The inspection scope and findings were summarized on August 29, 1985, with those persons indicated in paragraph 1 above. An apparent violation for failure to adequately sample liquid waste during release (paragraph 6.a.(2)) and an unresolved item* (UNR) concerning radioactive gaseous effluent release rates (paragraph 6.b(1)) were discussed in detail. Licensee management acknowledged the inspection findings, taking exception only with the UNR to which the licensee expressed the opinion that isolation of the containment vent leading to the stack occurred upon receipt of the actuation signal from the Kanne ion chamber in a time frame sufficient to preclude gaseous effluent release in excess of Technical Specification limits. The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspector during this inspection.

Licensee management was notified in a telephone conversation on October 9, 1985, between C. M. Hosey, of the NRC Region II staff and R. A. Karam, Interim Director of the Nuclear Research Center, that the unresolved item concerning failure to maintain gaseous waste releases below applicable limits, would be considered an apparent violation of Technical Specification 3.5.b. The licensee was also informed that, failure to cease gaseous effluent releases until the cause of the January 6, 1984, release was identified and corrected was identified as another example of an apparent violation of T.S. 3.5.b. Failure to have the Geiger-Muller gas monitor set to alarm and automatically isolate prior to gaseous waste release exceeding the T.S. limit was identified as a third example of an apparent violation of T.S. 3.5.b. Failure to include in the gaseous effluent release procedure methodology for calculating release rates immediately preceding and during exhaust duct isolation and to record actual release rates were identified as an apparent violation of T.S. 6.4.b.(6).

*An unresolved item is a matter about which more information is required to determine whether it is acceptable or may involve a violation or deviation.

3. Closeout Inspection and Survey (83890)

a. Disposition of Special Nuclear Fuel

The inspector verified that all fuel from the AGN-201 reactor (AGN) had been physically relocated to the GTRR fuel vault and that all fuel was accounted for. The AGN fuel had been transferred to the GTRR license (R-97) by Amendment No. 6 which was reviewed by the inspector.

The fuel is to be transferred to the Department of Energy (DOE), Oak Ridge, TN. The licensee is awaiting receipt of a fuel shipping cask from DOE.

A radium-beryllium (RaBe) startup source had been retained by the licensee and was transferred to Georgia Radioactive Material License No. GA-147-1. The inspector reviewed License No. GA-147-1 to insure that the RaBe source could be retained under that license.

b. Confirmatory Surveys

The inspector performed direct gamma, beta and alpha surveys on removed internal reactor components which were stored in the basement of the GTRR building. The AGN, which had been moved from the Emerson Building to the protected area of the GTRR, was surveyed both internally and externally. The room in the Emerson Building which had housed the AGN was surveyed for gamma, beta and alpha radiation and contamination smears of the room were obtained. The smears were returned to the NRC Regional laboratory for analysis. No radiation or contamination levels above natural background levels were found.

Licensee surveys and inspector surveys had shown no loose surface contamination to be present. Additionally, the licensee reported that no loose surface contamination had ever been observed in the room during the history of operation of the AGN. Consequently, environmental surveys were not performed.

c. Reports and Records

The maximum whole body exposure received by personnel during 1984 due to the AGN was 2 mrem which occurred during fuel removal. This exposure will be reported to the NRC in accordance with 10 CFR 20.407 along with exposures received due to the GTRR.

A licensee representative stated that the records required by 10 CFR 20.401(c) would be maintained by the licensee's radiation safety office which continues to have an active radiation safety program associated with License R-97 and other non-NRC licensed activities.

d. Conclusions

The inspector verified by independent surveys that there was no residual radioactivity in the AGN room in the Emerson Building, the reactor components in storage, or the reactor itself. Inspection of records and discussions with licensee representatives verified that all special nuclear material had been transferred to License R-97 and the RaBe startup source had been transferred to a Georgia state license.

4. Radiation Control (83743)

- a. 10 CFR 20.201(b) required 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.

Technical Specification 6.4.b. required that written procedures shall be provided and utilized for radiation and radioactive contamination control.

The inspector reviewed the manual entitled "Health Physics Procedures," November 1983, and found that frequency for routine radiation and contamination control surveys was not addressed by this document. A licensee representative stated that the reactor facility complied with the university-wide "Radiation Safety Manual" which addresses radiation monitoring and control. The inspector noted that on page 1 of the "Radiation Safety Manual" it was stated: "Special procedures apply to nuclear reactors which are present on the campus," which suggested that the campus "Radiation Safety Manual" was not applicable to the GTRR. The licensee acknowledged the comment and committed to revise the "Health Physics Procedures" manual to include a statement which commits the GTRR facility to compliance with campus "Radiation Safety Manual" and its radiation and contamination survey frequency by November 1, 1985 (50-62/85-03-01).

The inspector reviewed the records of surveys for radiation and contamination control from January 1 to August 28, 1985. In general both radiation and contamination survey results were found to be low, i.e., <0.5 mrem/hour and <100 disintegrations/minute removable.

No violations or deviations were identified.

- b. 10 CFR 20.202 required 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.

10 CFR 20.101 stated the quarterly radiation exposure limits to the whole body, skin of the whole body and extremities.

During tours of the facility, the inspector observed personnel monitoring devices being worn. The licensee used film badges supplied

by a National Voluntary Laboratory Accreditation Program (NVLAP) approved contractor for measuring official dose. Beta, gamma and neutron radiation was measured by these devices. In addition, the licensee required personnel entering the reactor control zone to wear a CaF_2 thermoluminescent (TLD) chip which was processed onsite by the licensee. Such devices were used to provide day to day dose control for personnel performing radiation work. Extremity rings were also provided by the licensee in the form of TLD chips which were processed onsite. Should an individual approach 25 percent of the quarterly limit, a licensee representative stated that extremity monitoring devices were then requested from its contractor for measurement of official dose.

The inspector examined selected personnel exposure records from January 1 to June 30, 1985, and verified that exposures were being maintained below applicable limits. For 1985, the highest whole body exposure through the month of June was 260 mrem.

No violations or deviations were identified.

- c. 10 CFR 19.12 required that each employee who works in or frequents the licensee restricted area be given instruction in radiation protection commensurate with their duties and potential hazard.

The inspector reviewed the radiation worker course outline and hand-out material. Selected records of personnel training were also reviewed.

No violations or deviations were identified.

- d. 10 CFR 20.203 stated the requirements for posting radiation areas, high radiation areas and radioactive material areas.

During tours of the facility, the inspector noted the posting of radiological areas and material and verified by independent survey that such areas were adequately posted.

No violations or deviations were identified.

- e. Technical Specification 6.4.b. stated that written procedures shall be provided and utilized for radiation control.

Health Physics Procedure 8 required that any work involving the penetration of any port hole in the biological shield must be authorized by use of Form RS-23, "Radiation Work Permit" (RWP).

The inspector observed an irradiation being performed at the thermal neutron port under RWP No. 6245. The irradiation proceeded under supervision of a health physics technician who performed gamma and neutron surveys as specified by the RWP.

No violations or deviations were identified.

5. Transportation (86740)

10 CFR 71.5 required that each licensee who transports licensed material outside the confines of its plant or other place of use shall comply with the applicable requirements of the Department of Transportation in 49 CFR, Parts 170 through 189.

The inspector determined that the licensee generated only small amounts of waste from the reactor facility so that only 1-2 shipments are made each year for burial purposes. The licensee had contracted their waste disposal program with an offsite contractor who, upon arrival at the site, took possession of the waste and acted as shipper and classifier based on data provided by the licensee. The licensee provided data to the contractor regarding quantities of radionuclides using isotope accountability methodology.

No violations or deviations were identified.

6. Environmental Protection (80745)

a. Liquid Effluents

- (1) Technical Specification 3.5.a.(1) specified that the concentration of gross radioactivity, above background, in liquid effluents discharged from the Reactor Building, excluding tritium, shall not exceed 3×10^{-6} $\mu\text{Ci/ml}$.

Technical Specification 3.5.a.(4) required that the total annual quantity of gross radioactivity to be released in liquid effluents from the reactor facility shall not exceed one curie to the sanitary sewage system.

The inspector reviewed the records of liquid releases from October 4, 1984, to August 15, 1985, and verified that liquid releases had not exceeded the above limits. In 1984, approximately 42 mCi had been released to the sanitary sewer from the reactor facility.

No violations or deviations were identified.

- (2) Technical Specification 3.5.a.(5) required that during release of liquid radioactive effluents, two independent samples of each tank shall be taken, one prior to release and one during release; and that an independent sample shall be taken from the discharge line during release.

Examination of liquid effluent release records from October 4, 1984, to August 15, 1985, and discussions with licensee representatives revealed that tank sampling prior to release had been performed routinely; however, no sample had been taken from the tank during releases. Failure to sample the tank during release

was identified as an apparent violation of Technical Specification 3.5.a.(5) (50-160/85-03-01).

The inspector determined from liquid release records between October 4, 1984, and August 15, 1985, that on October 4, 1984, November 9, 1984, April 24, 1985, June 10, 1985, and June 11, 1985, samples from the discharge line were not taken during release.

Failure to sample the discharge line during the releases was identified as a second example of an apparent violation of Technical Specification 3.5.a.(5)(50-160/85-03-01).

b. Gaseous Effluents

Technical Specification 3.5.b specified the requirements for the release of gaseous radioactive effluents from the facility.

- (1) Technical Specification 3.5.b.(1) required that the maximum rates of gross radioactivity in gaseous effluents not exceed 585 μCi per second of Argon-41 equivalent.

Technical Specification 3.5.b.(4) required that if the maximum release rate of Argon-41 equivalent gaseous effluent is exceeded, the gaseous discharge from the facility shall not be resumed until the cause of the excessive discharge is identified and corrected.

Technical Specification 6.4.b.(6) required that radiation control procedures be provided and utilized.

Technical Specification 6.5.b.(1) required that records and logs of gaseous waste released to the environs be prepared and retained at the facility for the life of the facility.

The inspector reviewed the atmospheric waste log for January 1, 1984, through July 1985, and noted that based on the concentration (microcuries per cubic centimeter) and the exhaust flow rate on January 6, 1984, March 9, 1984, September 21, 1984, December 11, 1984, and January 16, 1985, concentrations of radioactivity in gaseous effluents in excess of 585 μCi per second were determined. The release rate on January 6, 1984, was estimated to be approximately 1323 $\mu\text{Ci}/\text{second}$. The licensee informed the inspector that the rates recorded in the log were calculated for release at the tip of the stack and took into account dilution flow from the stack fan. Examination of strip chart recordings from the Kanne ion chamber used to monitor gaseous releases showed peaks corresponding to activity in excess of 585 μCi per second for these dates and that in each incident, containment isolation had occurred on actuation signal from the Kanne detector.

The licensee had conducted an investigation of the January 6, 1984, event and determined that containment isolation had been achieved on an actuation signal from the Kanne ion chamber. Tests conducted by the licensee demonstrated that an actuation signal was initiated at the correct setpoint of 585 μCi per second resulting in containment isolation. During the test, the licensee noted that the strip chart recording from the Kanne detector exhibited a continuing rise after isolation had been achieved, which was attributed to an over-response of the Kanne detector. The licensee concluded that with the containment building isolated, Ar-41 could not be released regardless of the apparent activity rate shown on the chart recordings. None of the other release events were investigated.

Through reviews of records and discussions with licensee representatives, the inspector determined that when the GTRR was operating at 100% power under normal conditions, the gaseous release rate approaches the T.S. limit of 585 μCi per second. The inspector noted that any perturbation in the system (i.e., withdrawal or insertion of a plug in the reactor) could result in an increased release rate. The inspector also stated that since the Kanne detector sampling point for gaseous effluents was downstream from the isolation valves, even if containment isolation were initiated by a signal from the Kanne detector, the higher activity gas already present downstream from the isolation valves would be vented to the stack. Main exhaust duct and Kanne sampling line velocity calculations performed by the inspector revealed that the main exhaust duct velocity was approximately 350 feet per minute greater than that of the ion chamber sampling line. Therefore, the radioactivity would have already passed downstream of the exhaust duct isolation valve prior to transmission of an isolation signal from the Kanne detector. After isolation occurred, radioactivity present in the approximately 20 foot run of exhaust duct between the isolation valve and point of introduction into the main stack would continue to be discharged into the stack. The gaseous effluent thus released would be due to the inertia of the air in the exhaust duct and the suction drawn on the exhaust line by the main stack flow.

A licensee representative stated that due to the action of the dilution fan in the stack it was felt that the Technical Specification limit had not been exceeded. No data were available to substantiate this view. Under normal operating conditions, the licensee applied a dilution factor to the radioactive effluent concentration indicated by the effluent monitor to account for dilution of the radioactivity in the main stack. Whenever isolation occurred due to an isolation signal from the Kanne detector, the licensee noted in their effluent log that the release rate had been 585 μCi per second. Though this latter release rate may be less than indicated by the effluent monitor,

the licensee had no means of establishing what the true release rate was immediately preceeding and during exhaust duct isolation.

Failure to maintain gaseous effluent release rates below 585 $\mu\text{Ci}/\text{second}$ on five occasions between January 6, 1984, and January 16, 1985, would be a violation of T.S. 3.5.(b). During further reviews of licensee records, the inspector noted that the licensee did not initiate an investigation of the January 6, 1984, exhaust system isolation based on high release rate until late February 1984.

Gaseous releases continued between January 6 and late February 1984. Failure to cease gaseous effluent releases until the cause of excessive releases was determined and corrected would be another example of an apparent violation of T.S. 3.5.(b).

The inspector also noted that the licensee's procedure for gaseous effluent releases did not contain the methodology for determining the gaseous effluent release rates immediately preceeding and during exhaust duct isolation. Nor did the procedure require the actual release rate to be recorded. As previously stated, the licensee recorded 585 $\mu\text{Ci}/\text{second}$ when isolation occurred even though evidence was available to indicate the rate was higher. Failure to have an adequate procedure for determining gaseous release rates and documenting the results under all conditions would be an apparent violation of T.S. 6.4.b.(6).

- (2) Technical Specification 3.5.b.(5)(b) required that during release of gaseous radioactive effluents, both gross radioactivity monitors shall be set to alarm and automatically isolate the gaseous waste releases prior to exceeding the release rates of 585 μCi per second.

The containment building exhaust was monitored by two devices, a Geiger-Muller detector (gas monitor), which samples the containment exhaust between the containment and the isolation valves, and a Kanne ion chamber, which samples the exhaust between the isolation valves and the stack. Both monitors have the capability of isolating containment when their setpoint is reached. The Kanne detector isolates at an absolute value (concentration of radioactivity) while the gas monitor initiates isolation at 90% of full scale regardless of the range setting. From an investigation conducted by the licensee's staff, it was determined that on January 6, 1984, operations personnel had ranged the gas monitor up by two decades such that the gas monitor was incapable of alarming and automatically providing isolation of the gaseous waste release prior to exceeding the release rate of 585 μCi per second of Ar-41 equivalent.

Failure to have the Geiger-Muller gas monitor set to alarm and automatically isolate the gaseous waste release prior to exceeding

the release limit would be an apparent violation of Technical Specification 3.5.b.

The inspector stated that failure to meet the requirements for release of gaseous radioactivity discussed above would be considered an unresolved item pending further review by the Regional Technical Staff and Management (160/85-03-02).

- (3) Technical Specification 4.2.e. and 4.2.f. required that the charcoal cartridge sampler on the containment building exhaust shall have a radioisotopic analysis performed biweekly and that grab samples of the exhaust stack effluent shall be obtained and have a radioisotopic analysis performed monthly.

Technical Specification 4.4.d. specified that samples of the secondary coolant system shall be analyzed for tritium on a monthly bases.

The inspector reviewed the licensee records for the above samples from January 1, 1985, to August 20, 1985, and determined that timely samples had been obtained and analyzed as required.

No violations or deviations were identified.