UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report No.: 50-160/96-01

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 17 and 18, 24 and 25, 29 and 30, February 5-7, 9, 15-18, and March 15, 1996

Inspectors: C Bassett 4/19/96
C. H. Bassett, Senior Radiation Specialist Date Signed

for C Bassett 4/19/96
W. J. Tobin, Senior Safeguards Inspector Date Signed

J J Lenahan 4/19/96
J. J. Lenahan, Reactor Inspector Date Signed

Approved by: J R Hucker for 4/19/96
E. J. McAlpine, Chief Date Signed
Fuel Facilities Branch
Division of Nuclear Materials Safety

SUMMARY

Scope:

This announced inspection involved onsite review of radiation protection program activities during the removal of irradiated fuel from the GTRR and preparations of the fuel for shipment offsite. It also involved review of the adequacy of the equipment being used and the shipping papers associated with the shipment of fuel.

Enclosure

Results:

The controls implemented by the licensee and the precautions taken during fuel movement, cutting, and preparation for shipment were adequate to protect licensee personnel and contractors helping in the operation. Doses received by these individuals were well within the limits specified in licensee procedures and regulatory guidance. The equipment used by the licensee had been inspected and tested prior to use.

REPORT DETAILS

1. Persons Contacted

*R. Karam, Director, Neely Nuclear Research Center (NNRC)
R. Ice, Manager, Office of Radiation Safety (MORS)
D. Parker, Reactor Supervisor
E. Jawdeh, Health Physicist
H. Speigner, Officer, Campus Police Department
J. Vickery, Chief of Police, Campus Police Department

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

Other Organizations

A. Algier, Lieutenant, State Public Service Commission (PSC)
B. Bugg, Lieutenant, State PSC
J. Hardeman, Georgia State Department of Natural Resources (DNR)
B. Simonton, Georgia State DNR
W. Rucker, Director, TriState Motor Transit Inc.
D. Fields, Driver, TriState Motor Transit Inc.
J. Fields, Driver, TriState Motor Transit Inc.
E. Davis, Chairman, Nuclear Assurance Corporation (NAC) International
J. Patterson, Account Executive, NAC International
D. Steiner, Engineer, NAC International
B. Lee, Executive, NAC International
T. Shelton, Supervisor, NAC International
M. Miles, Technician, NAC International
D. Olson, Technician, High-Tech Manufacturing, NAC
C. Kraus, Chief Rigger, Williams Crane and Rigging
B. Durrough, Crane Operator, All Crane Rental of Georgia
J. Scott, Brookhaven National Laboratory
B. Chambers, Department of Energy, Savannah River Site
M. Beckman, Westinghouse, Savannah River Company
H. Brooks, Westinghouse, Savannah River Company
T. Cowlam, Westinghouse, Savannah River Company
J. Guy, Westinghouse, Savannah River Company
A. Holloway, Westinghouse, Savannah River Company
D. Lewis, Environmental Specialist, Southern Technology

*Attended the exit interview on March 15, 1996.

2. Planning for Fuel Processing Operations (60745, 61745, 83743, 86740)

a. Procedures

Technical Specification (TS) 6.4.b stipulates that written procedures be provided and utilized for such operations as installation and removal of fuel elements, radiation and radioactive contamination control, and physical security of the facility and associated special nuclear material.

The licensee had written or revised various procedures for the operations involving removal and disposal of the irradiated fuel elements that had been used in the GTRR. The following is a listing of the procedures:

- Procedure 1500, Irradiated Fuel Transfer to Storage Pool, Revision (Rev.) 1, dated December 13, 1995.

- Procedure 1501, Lower Top Shield Plug Removal from Irradiated Fuel Elements, Rev. 2, dated January 17, 1996.

- Procedure 1505, Preparation of Irradiated Fuel for Off-site Shipment, Rev. 2, dated January 17, 1996.

- Procedure 1508, Inspection, Testing, and Operating Procedure for 6-M Drums, Rev. 0, dated December 13, 1995.

- Procedure 1512, Irradiated Fuel Shipment by NAC-LWT Cask, Rev. 0, dated December 13, 1995.

- Procedure 9510, Radioactive Material Shipment, Rev. 2, dated March 17, 1994.

The inspector reviewed the procedures that had been prepared and/or revised and verified that they had been forwarded to and reviewed and approved by the Nuclear Safeguards Committee (NSC). The procedures appeared to be adequate for the transfer, processing, and shipment of the irradiated fuel elements.

The inspector also reviewed the procedures supplied by the vendor hired to help with the fuel shipment. These procedures were referenced in licensee Procedure 1512. The procedures reviewed appeared to be adequate and were entitled:

- Document Number (Doc. No.) 315-P-02, LWT Cask Generic Operating Procedure, Rev. 1, dated February 27, 1991.

- Doc. No. 432-P-01, MTR Fuel Dry Transfer System Generic Operating Procedure, Rev. 0, dated August 17, 1995.

- Doc. No. 315-P-03, NAC-LET Annual Maintenance Procedure, Rev. 1, dated January 2, 1991.

b. Documentation of Shipping Program

10 CFR 71.12(b) requires the licensee to establish a Quality Assurance (QA) Program for shipping licensed material in an NRC approved package.

10 CFR 71.12(c)(1) requires that when a licensee transports, or delivers to a carrier who transports, licensed material in a package for which a certificate of complaince has been issued by

the NRC, to have a copy of the certificate of compliance and the drawings and other documents of referenced in the approval relating to the use and maintenance of the packaging and to the actions to be taken prior to shipment.

10 CFR 71.12(c)(3) requires the licensee to register with the NRC to use NRC approved packages.

(1) Quality Assurance Program

The inspector verified that the licensee had established a QA Program in accordance with the regulations. By letter dated October 2, 1995, the licensee forwarded their QA Program to the NRC for review and approval. The licensee sought approval of the program for the shipping of irradiated and unirradiated nuclear reactor fuel using NRC approved containers. By letter dated October 17, 1995, the NRC approved the QA Program outlined by the licensee and stipulated that the licensee must register for use of the packaging with the NRC.

(2) NRC Approved Package

After considering the options available, the licensee decided to use the Nuclear Assurance Corporation-Legal Weight Truck (NAC-LWT) cask. The inspector verified that the NAC-LWT cask had been approved by the NRC for shipping fuel elements. By letter dated December 8, 1995, Nuclear Assurance Corporation International applied to the NRC for authorization to transport 25 high enriched uranium (HEU) Materials Test Reactor (MTR)-type fuel elements from the GTRR in the NAC-LWT cask. NAC International based their application on decay heat, power density, burnup modelling and source term calculations, and a 90-day cooling period for the GTRR fuel. By letter dated December 21, 1995, the NRC approved and authorized transport of the 25 fuel elements in the NAC-LWT cask. The letter also indicated that, pursuant to 10 CFR 71, the Certificate of Compliance (COC) for the NAC-LWT cask, COC 9225, Rev. 8, would be amended to allow transport of the 25 GTRR fuel elements with a 90-day cooling time. All other conditions of the COC were to remain the same.

(3) Certificate of Compliance

The inspector verified that the licensee was registered to use the NAC-LWT cask. By letter dated November 8, 1995, the NRC notified the licensee that the licensee was listed as a register user of COC 9225 in accordance with the general

provisions of 10 CFR 71.12. The inspector also verified that the licensee had the drawings and other documents referenced in the approval relating to the use and maintenance of the package.

The inspector also reviewed the COC to ensure that the licensee was in compliance with the requirements contained therein. The inspector noted that the COC allowed for shipment of up to 42 fuel assemblies of the MTR-type when positioned in an MTR fuel assembly basket.

(4) Criticality Safety

By a letter dated January 11, 1996, NAC International provided the licensee with information concerning a criticality evaluation of the NAC-LWT MTR fuel baskets in the licensee's storage pool. The baskets were the equipment that would be used to load the fuel into the NAC-LWT cask. The criticality evaluation was performed using KENO-Va and the criticality model of the NAC-LWT with MTR fuel minus the cask shields. The evaluation was done to determine that the baskets, once loaded with fuel elements and stored in the storage pool, would be safe from a criticality point of view. The evaluation indicated that the k_{eff} of an infinite array of baskets touching would be much less than 1.00. However, the letter also indicated that the results had not been independently checked.

The NRC discussed the lack of an independent check with licensee management. The licensee decided to have NAC International provide independent verification of the results of the evaluation. By letter dated February 5, 1996, NAC International forwarded an independent evaluation of the results of the original criticality evaluation. The inspector reviewed the criticality evaluation and the independent evaluation and discussed the results with NAC International personnel. The results indicated that there would be no criticality safety problems with the baskets when stored in the storage pool even under conditions that brought the baskets into close proximity (touching). However, as an added precaution, the licensee stipulated by procedure that the baskets would be stored in the pool with at least a foot spacing between them.

c. Training

10 CFR 19.12 requires, in part, that the licensee instruct all individuals working in or frequenting any portion of a restricted area in the health protection aspects associated with exposure to

radioactive material or radiation; in precautions or procedures to minimize exposure; in the purpose and function of protection devices employed; in the applicable provisions of the Commission regulations; in the individual's responsibilities; and in the availability of radiation exposure data.

The inspector performed a review of the training that was done by the licensee in preparation for the fuel movement and processing operation. The licensee indicated that the training had not been formally documented but that all individuals who would be taking part in the fuel movement and processing had been involved in developing and reviewing procedures, discussions of the work involved, and "walk throughs" of every portion of the operation. As a demonstration of the adequacy of the training that had been done, the licensee held a "dry run" of the entire fuel movement and processing operation on January 24, 1996. The inspector observed the "dry run" in its entirety.

The fuel transfer cask was used to move a "dummy" fuel element from the reactor building to the high bay of the adjacent administration building and into the storage pool. The "dummy" fuel element was then moved by transfer chute into the Hot Cell where it was mounted on the device that had been set up to cut off the top and bottom ends of the element and leave just a section of the element with the "meat" of the fuel remaining. The cutting operation was performed and the cutoff or remaining section of the element was transferred back into the storage pool through the transfer chute. The cutoff section was then loaded into an NAC-LWT basket completing the "dry run" of the fuel movement and processing operation.

The inspector noted that the "dry run" proceeded without problem and that, although areas were noted for improvement, the overall operation was accomplished without any concerns. The inspector also discussed equipment usage and operation with those involved and reviewed the planned radiation protection coverage that would be provided. The inspector noted that this also served as a functional test of all the equipment that would be used during the fuel movement and processing operation. Technician and operator training was discussed with personnel involved and all felt that they had received adequate training to accomplish the operation. The inspector also discussed the operation with management and related some observations on improvements that the licensee could consider.

Based on the success of the "dry run", the satisfactory functioning of the equipment, and the demonstrated acceptable performance of the personnel involved, the inspector concluded that the licensee had made adequate preparations for the upcoming operation, had provided adequate training for the staff, and had established appropriate controls for the work evolution.

d. Radiation Work Permits

Technical Specification (TS) 6.4.b(6) requires that procedures be provided and utilized for radiation and radioactive contamination control.

Procedure 9306, Preparation and Maintenance of RWPs, Rev. 1, dated June 28, 1990, requires the licensee to have Radiation Work Permits (RWPs) for various work evolutions including those involving radioactive material with high levels of contamination or which could produce radiation readings in excess of 100 millirem per hour.

The inspector reviewed the RWPs that had been written to cover the fuel processing operation. The RWPs each covered a separate portion of the operation as follows:

- RWP 96-05, Irradiated Fuel Transfer from the Reactor Building to the Storage Pool, dated January 25, 1996.

- RWP 96-06, Removal of the Lower Top Shield Plug from the Fuel Elements, dated January 25 1996.

- RWP 96-07, Cutting of Fuel Elements, dated January 25, 1996.

The RWPs specified the dosimetry, surveys, protective clothing, water sampling, bioassays, and health physics (HP) coverage that would be required for each phase of the operation. Each RWP required that other records be maintained during the jobs including exposure accumulation, localized and general area radiation surveys, cask radiation surveys, contamination surveys, bioassay results, and water sample analysis results. The inspector noted that the radiation protection requirements specified by the RWPs appeared to be adequate.

No violations or deviations were identified.

3. Fuel Element Transfer and Processing (60745, 61745, 80745, 83743, 86740)

10 CFR 20.1201(a) requires each licensee to control the occupational dose to individual adults, except for planned special exposures under 10 CFR 20.1206, to the following dose limits:

(a) An annual limit, which is more limiting of: (i) the total effective dose equivalent (TEDE) being equal to 5 rems: or (ii) the sum of the deep-dose equivalent and the committed dose equivalent to any organ or tissue other than the lens of the eye being equal to 50 rems.

(b) The annual limits to the lens of the eye, to the skin, and to the extremities, which are: (i) an eye dose equivalent of 15 rems; and (ii) a shallow-dose equivalent of 50 rems to the skin or to any extremity.

10 CFR 20.1502(a) requires each licensee to monitor occupational exposure to radiation and to supply and require the use of individual monitoring devices for adults likely to receive an annual dose in excess of 10 percent of the limits in 10 CFR 20.1201(a).

10 CFR 20.1204 states that for purposes of assessing dose used to determine compliance with occupational dose equivalent limits, the licensee, when required to monitor internal exposure, shall take suitable and timely measurements of concentrations of radioactive materials in air, quantities of radionuclides in the body, quantities of radionuclides excreted from the body, or combinations of these measurements to determine compliance with the occupational dose equivalent limits specified in 10 CFR 20.1502. When specific information on the behavior of the material in an individual is known that information may be used to calculate the Committed Effective Dose Equivalent (CEDE).

10 CFR 20.1502(b) requires each licensee to monitor the occupational intake of radioactive material by and assess the committed effective dose equivalent to:

1) Adults likely to receive, in one year, an intake in excess of 10 percent of the applicable ALI in Table 1, Columns 1 and 2 of Appendix B to 10 CFR 20.1001-20.2401; and
2) Minors and declared pregnant women likely to receive, in one year, a committed effective dose equivalent in excess of 0.05 rem.

a. Transfer of Elements from the Reactor Building

On January 29, 1996, as the inspector observed, licensee personnel initiated the transfer of irradiated HEU fuel elements from the reactor containment building to the administration building high bay storage pool. This was accomplished by using the licensee's transfer cask. The first fuel element was removed from the storage area in the floor of the containment building. Once the fuel element was retrieved up into the transfer cask, the cask was placed on a trailer and hauled out of the containment building and into the administration building high bay area. The cask was removed from the trailer and lowered several inches into the water of the storage pool. The fuel element was then lowered from the transfer cask into the pool and placed on a storage rack secured to the side of the pool. Two other fuel elements were removed from the floor storage area and placed in the rack in the storage pool during that day.

The inspector noted that, during the operation, proper dosimetry and protective clothing were worn by the operators and technicians, radiation surveys were conducted as required by the procedure and the RWP, contamination surveys were conducted as required by the procedure and the RWP, personal surveys were conducted by those participating in the operation, and whole body exposure was tracked using a pocket ionization chamber (PIC) for each individual. The inspector also noted that the coverage by both HP technicians and reactor operators was in accordance with the procedure and the RWP. The inspector noted as well that a log was maintained of the fuel transfer and each element was identified by visually verifying the identification number inscribed on the side of the element.

Following completion of all transfers, the inspector reviewed the records associated with this portion of the operation and with RWP 96-05. Fuel had been transferred on January 29-31, February 1 and 2, and 5-9. The inspector noted that the records indicated that the highest accumulated dose for the job was 6 millirem (mr) and was received by an operator. The highest dose rate measured on a fuel element by an in-core instrument was 300 rem per hour (r/hr) as measured at approximately 24 inches from the element. During the fuel transfer, the highest dose rate measured at contact with the bottom of the transfer cask was 70 mr/hr and 35 mr/hr at 18 inches. The highest dose rate measured in the general work area of the technicians and operators was 2.5 mr/hr. The highest dose rate measured at contact with the pool wall at the floor was 200 mr/hr. No contamination was detected on surveys of the top of the reactor, the containment building, the cask, or the administration building high bay area. Air sample results from the basement, first floor, and reactor top in the containment building for the period from January 31 through February 14 were all less than 5.89 E-13 microCuries per milliliter (μCi/ml) alpha and less than 1.63 E-12 μCi/ml beta-gamma.

b. Removal of the Lower Top Shield Plug

On January 30, 1996, the inspector observed the initial removal of the lower top shield plug (LTSP) from the first two elements removed from the containment the previous day. The transfer of two other fuel elements was also observed. The process of removing the LTSP involved raising the fuel element up and placing the lower end into a fixture in the pool to hold it steady. The upper portion of the fuel element is attached to the LTSP by small bolts. This portion would thus be at a height such that an operator could reach down into the water and loosen the bolts so that the LTSP could be removed. This operation proceeded without problems and the LTSP was removed and placed in a designated storage location by the pool after being wiped down and surveyed by HP personnel.

The inspector noted that, during this operation, proper dosimetry (including finger ring dosimetry) and protective clothing was worn by the operators and technicians, radiation surveys were conducted as required by the procedure and the RWP, contamination surveys were conducted as required by the procedure and the RWP, personal surveys were conducted by those participating in the operation, and whole body exposure was tracked using a pocket ionization chamber (PIC) for each individual. The inspector also noted that the coverage by both HP technicians and reactor operators was in accordance with the procedure and the RWP. As in the transfer operation, a log was maintained of each element as the LTSP was removed and the element was placed back into the storage rack.

Following completion of the removal of all LTSPs, the inspector reviewed the records associated with this portion of the operation and with RWP 96-06. LTSPs had been removed on January 30 and 31, February 2, 6, and 12. The inspector noted that the records indicated that the highest accumulated dose for the job was 2 mr to the whole body and was received by an operator. The results of the extremity monitoring were not available at the conclusion of the inspection but were anticipated to be approximately 200-300 mr to the hands of an operator. The highest dose rate measured on the bottom end of an LTSP was 200 mr/hr. The highest dose rate measured in the general work area of the technicians and operators was 4 mr/hr. The highest whole body dose rate measured was 12 mr/hr to the head. Following wipe down of the LTSPs, no contamination was detected on any of them. Water sample results of samples taken in the storage pool for tritium increased from a concentration of 1.39E-5 μCi/ml on January 30 to 1.25E-3 μCi/ml on February 12. Since February 12 the concentration had decreased somewhat and was approximately 9.5E-4 μCi/ml on April 4. The inspector noted that the highest concentration detected was less than the limit allowed by 10 CFR 20, Appendix B, Table 3, for release to the sewer which is 1E-2 μCi/ml.

c. Cutting Operation

On February 5, 1996, the inspector observed the initial fuel element cutting operation in the licensee's Hot Cell. The cutting took place after controls described in the procedure had been established. These controls included ensuring that: 1) the CO_2 bottle was full and in place for fire protection, 2) both cell exhaust blowers were operating, 3) the gamma monitor installed in the exhaust duct was operating, 4) the RWP was established and the required controls were in place, and 5) HP coverage in the high bay and in the Hot Cell gallery was in place. With the controls verified, an operator moved a designated fuel element from the storage rack in the pool to the transfer chute. The element was then raised into the Hot Cell and was moved from the chute to the cutting table by means of the Hot Cell manipulators. The element was verified to be the correct one by means of reading the identification code that had been inscribed on the side and was

marked for later identification. The element then was placed on the table, clamped in position, and the cutting operation initiated. The lower portion of the element was cut off without any problem. When the upper portion was partially cut, the saw blade broke and the operation was discontinued. An operator was able to replace the saw blade using the remote manipulators and the upper cut was completed without problem. The element was left in the Hot Cell over night and moved back to the pool on February 6. The inspector observed the movement of the element from the Hot Cell and the placement of the cut-off element into the basket. Also on that date the inspector observed cutting of another fuel element and placement of the second cut-off fuel element in the basket. No problems were noted.

After all fuel cutting operation had been completed, the inspector reviewed the records associated with this portion of the operation and with RWP 96-07. Cutting of fuel elements had taken place on February 5-9 and 12-15. The inspector noted that the records indicated that the highest accumulated dose for the job was 22 mr to the whole body and was received by an HP technician. The highest dose rate measured in the general work area of the technicians and operators was less than 0.2 mr/hr. No contamination was detected in the storage pool area or in the Hot Cell gallery during the operation. Results of the analyses of air samples taken of the Hot Cell during cutting operations did not exceed 1.7E-13 alpha and 5.7E-13 beta-gamma.

No violations or deviations were identified.

4. Preparations for Fuel Shipment (60745, 80745, 82745, 83743, 86740)

a. Radiation Work Permit

TS 6.4.b(6) requires that procedures be provided and utilized for radiation and radioactive contamination control.

Procedure 9306, Preparation and Maintenance of RWPs, Rev. 1, dated June 28, 1990, requires the licensee to have RWPs for various work evolutions including those involving radioactive material with high levels of contamination or which could produce radiation readings in excess of 100 millirem per hour.

The inspector reviewed the RWP that had been written to cover the fuel transfer and shipping operation.

- RWP 96-08, Shipping Cask Loading of Irradiated Fuel, dated January 13, 1996.

The inspector noted that the RWP specified the dosimetry, surveys, protective clothing, bioassays, area postings, and health physics (HP) coverage that would be required for the operation. Additional instructions for the set up of controlled areas,

monitoring of personnel, and movement of radioactive material were also included. The RWP required that records be maintained during the job including exposure accumulation, localized and general area radiation surveys, cask radiation surveys, contamination surveys, and bioassay results. The inspector noted that the radiation protection requirements specified by the RWPs appeared to be adequate.

b. Training

10 CFR 19.12 requires, in part, that the licensee instruct all individuals working in or frequenting any portion of a restricted area in the health protection aspects associated with exposure to radioactive material or radiation; in precautions or procedures to minimize exposure; in the purpose and function of protection devices employed; in the applicable provisions of the Commission regulations; in the individual's responsibilities; and in the availability of radiation exposure data.

The inspector reviewed documentation and verified that the various vendor personnel who would be participating in transferring and shipping the irradiated fuel had received the proper radiation worker training. These personnel included: 1) the individuals who were to drive the truck and trailer transporting the shipping cask to the Savannah River Site, 2) NAC International personnel, and 3) the crane operator and the rigger. The documentation included certificates provided by the individuals of current training status or certification by the licensee that the personnel had received radiation worker and site specific training at the licensee's site.

c. Mobile Crane

Once all the fuel elements had been cut and placed in baskets, the licensee was ready to begin loading the fuel into the shipping cask for shipment to the Savannah River Site. On February 15, 1996, a mobile crane was brought on site to perform this portion of the operation. The inspector reviewed the documentation of the inspections and lifting capacity of the crane. The crane was manufactured by Krupp and owned by All Crane Rental of Georgia, Inc. The crane was leased by Williams Crane Company to perform this operation and had a lifting capacity of 85 tons. The inspector also reviewed the records of the annual OSHA-required inspection that was performed and provided by All Crane. The inspection appeared to be adequate and included inspection of the truck inside and outside, as well as the crane superstructure including winches, limit switches, and rigging. The inspector verified that the crane had been load tested and observed an additional load test that was performed on site. This was done by lifting or "floating" the shipping container, which included the shipping cask, about one inch above the trailer to verify the crane lifting capacity and the crane position. The load lifted

was 60,000 pounds, which exceeded the weight of the shipping cask containing the irradiated fuel that would be lifted later in the operation.

d. NAC-LWT Shipping Cask Loading

Once the lifting capacity of the crane had been verified, the inspector observed as the shipping container, which was similar to a "sea van," was removed from the transport trailer and positioned on the ground. The NAC-LWT shipping cask was then removed from the container and positioned next to the exterior of the reactor containment building on a base plate and secured in place by rigging. Scaffolding was then installed around the cask to allow personnel access to the cask. On February 16, 1996, the inspector observed as a dry run of the fuel transfer operation was completed. It involved transferring an empty basket from the storage pool to the NAC-LWT shipping cask by means of a vendor-provided transfer cask and lowering the basket into the shipping cask. A second empty basket was also transferred from the storage pool to the NAC-LWT shipping cask.

On February 17, 1996, the inspector observed as the four baskets loaded with irradiated fuel were loaded into the NAC-LWT shipping cask. Surveys by the licensee and NRC indicated that the radiation levels on the vendor-provided transfer cask ranged from 4.5 to 55 mr/hr depending on which basket was loaded into the cask. Some radiation streaming from 1 to 13 r/hr was noted as the baskets were drawn out of the storage pool and into the transfer cask but personnel were warned of the problem and remained out of those areas.

As the baskets were being lowered into the shipping cask, State of Georgia, licensee, and NRC personnel surveyed the immediate and surrounding areas. Once all the baskets had been loaded into the shipping cask, the top end plug was positioned on the top of the cask.

e. Fuel Shipment

(1) Certificate of Compliance

10 CFR 71.12(c)(2) requires the licensee to comply with the terms and conditions of the COC and the applicable general provisions and requirements of subpart A of this part.

On February 18, 1996, the inspector observed as the top end plug was bolted in place on the NAC-LWT shipping cask and the bolts were torqued as required. Other operations also were performed to ensure that the requirements of the COC were met and the inspector verified these actions. Some of these included: 1) evacuation of water from the cask, 2) helium leak testing of the cask by an individual from

Southern Technology and ensuring the leak rate was within the range specified by the COC, 3) replacement of the metallic O-ring seal, and 4) placing the shipping cask in the ISO shipping container.

(2) Shipping Records

10 CFR 71.5(a) requires each licensee who transports licensed material outside the confines of its plant or other place of use, or who delivers licensed material to a carrier for transport, to comply with the applicable requirements of the regulations appropriate to the mode of transport of the Department of Transportation (DOT) in 49 CFR Parts 170-189.

After completing other preparatory operations including removing the scaffolding from around the cask, the inspector observed as the loaded NAC-LWT shipping cask was lifted and placed back into the shipping container. Surveys were performed and the final shipping preparations completed. The licensee finalized the shipping papers and completed labeling the container and placarding the vehicle. The inspector reviewed the shipping documentation and determined that it was adequate and in compliance with 49 CFR requirements. The shipment of irradiated fuel left the site at approximately 7:00 p.m. and arrived at the Savannah River Site at approximately 11:30 p.m. (see Paragraph 6 below).

f. Shipping Operation Review

Following completion of the fuel shipment, the inspector reviewed the records associated with this portion of the operation and with RWP 96-08. The inspector noted that the records indicated that the highest accumulated dose for the job by a contractor was 41 mr to the whole body and the highest accumulated dose for the job by licensee personnel was 31 mr to the whole body and was received by a HP technician. The highest dose rate on the loaded shipping cask was measured at the top end plug and was 75 mr/hr. The highest dose rate measured in the general work area of the technicians and contractors was 15 mr/hr. Radiation readings up to 12 mr/hr were noted in the office area near the cask but these levels only lasted for about one minute. Once the baskets were inside the shipping cask, no radiation readings above background were noted in the immediate or adjacent areas. State of Georgia personnel measured an integrated dose at the fence of 0.06 mr. Following loading of the cask, no contamination was detected on the cask or in any of the work areas. The highest intake from tritium was measured as 2.57 μCi which resulted in an exposure of 1.6E-1 mr to an operator.

No violations or deviations were identified.

5. Security During Fuel Processing (81310)

The inspector reviewed the licensee's actions to provide increased security during the course of the fuel processing and fuel shipment. The inspector observed that, during the fuel processing, a guard was stationed in the administration building from approximately 6:00 p.m. until approximately 6:00 a.m. the next morning. The guard had ready access to viewing windows and could view activities in the reactor building and in the high bay area of the administration building. The normal security system was also in place and functional during this period. During the period when the NAC-LWT shipping cask was being loaded, the inspector also observed that a guard was stationed in a vehicle in a parking lot adjacent to the facility with full view of the shipping cask and the work area.

No violations or deviations were identified.

6. Physical Protection of Shipments of Irradiated Fuel (81310)

10 CFR Part 73.37, Requirements for Physical Protection of Irradiated Reactor Fuel in Transit, and Part 73.72, Advance Notification of Shipments, required the licensee to inform the Commission 10 days in advance of a shipment of irradiated fuel, providing to the Commission the intended routes, schedules and mode of transportation. The appropriate state governor was to be furnished a seven day advance notification of the shipment, to include a description of the shipment, the intended route, the estimated schedule of the shipment, and the identity of shipper, carrier, and receiver. Additionally, the licensee was required by Part 73.37 to provide for safeguard procedures to cope with emergencies, theft, and attempted diversion of the shipment. It was the licensee's responsibility to train drivers and escorts on these safeguards procedures. Escorts were to be armed when the shipment entered "heavily populated areas" (greater than 100,000 people) such as, in this case, the cities of Atlanta and Augusta. Two means of communication were required in the event the driver or escort needed to summon local law enforcement agencies. A log was required to document the 2-hour communications checks completed by the driver. A vehicle immobilization device was required in the cab to preclude diversion of the cargo.

By letter dated September 27, 1995, the licensee requested from the Commission approval to transport spent fuel from it's Neely Research Center Reactor to the Savannah River Site. The Commission responded favorably on December 6, 1995, approving the route through the states of Georgia and South Carolina as proposed by the licensee. By letter dated February 7, 1996, the licensee formally notified the appropriate governor designee of the shipment schedule, mode of transportation, routes, description of the contents and identity of shipper, carrier, and receiver.

Prior to the shipment on February 18, 1996, the inspector monitored the licensee's coordination with the Campus Police Department, the State of Georgia's Public Service Commission (the Governor's designee for such matters), and with the State of Georgia Department of Natural Resources relative to this shipment. The inspector verified that the requirements of 10 CFR 73.37 and 10 CFR 73.73 applied to the licensee's shipment of 25 assemblies of irradiated fuel (93 percent enrichment) to the U. S. Department of Energy's Savannah River Site in Aiken, South Carolina.

On the day of the shipment, the inspector, through interviews with cognizant individuals, review of procedures and records, and observation during licensee and State of Georgia inspections of the vehicle, verified compliance with the above enumerated requirements. The inspector reviewed the licensee's procedures, Procedure 1506, Physical Protection of Irradiated Fuel In Transit, and Procedure 1507, Emergency Threats to Irradiated Fuel in Transit, and verified that the procedures provided adequate guidance (and accurate telephone numbers) to drivers and escorts. The inspector also verified that the drivers and escorts had been trained on these documents by the licensee the day before the shipment. The inspector verified that the drivers were aware of and capable of using the immobilization device of their vehicle, as well as their communications equipment which provided redundant capabilities to state and local authorities. Armed escorts were provided by officers of the Georgia Public Service Commission who accompanied the shipment in their patrol vehicles equipped with emergency strobe lights. The escorts also had varied communications capabilities with the Highway Patrol and local county police departments. Additional (unarmed) escorts were provided by authorities from the Georgia Department of Natural Resources. The cab of the vehicle was equipped with a satellite tracking device monitored in Joplin, Missouri. At the outset of this shipment, the inspector was present when this device and communications were established.

The inspector observed that the irradiated fuel shipment started at 7:08 p.m. on Sunday evening, February 18, and concluded at 11:30 p.m. that same night. The inspector, who had inspected the shipment and discussed the shipment route with associated personnel earlier that day, accompanied the shipment from point of origin (the Georgia Tech campus) until delivery at Security Checkpoint #1 at the Savannah River Site. As required, the assistant driver was present in the cab of the vehicle while the shipment was in South Carolina. At the conclusion of this shipment the inspector verified that the required 2-hour communication log was current.

The inspector verified that the licensee adequately met the requirements for protection of the transportation of the irradiated fuel to the Savannah River Site. Prior notification to the appropriate state and Commission offices was in compliance with the regulations. NRC

requirements for procedures, training, escorts, communications, and vehicle disabling were satisfied by the licensee in concert with it's contractor and various state officials.

No violations or deviations were noted.

7. Related Issues (39745, 61745)

The inspector reviewed the safety or adequacy of specific items of equipment or portions of the licensee's program related to the fuel movement and use of the storage pool and hot cells.

a. Crane Load Tests

The inspector reviewed procedures and records documenting inspection of the reactor containment building polar and administration building high bay cranes. The inspector reviewed procedure number 4150, Crane Maintenance, Inspection, and Testing. This procedure provides the requirements for annual inspections and testing of the cranes. The inspections include electrical components, mechanical inspections of operating mechanisms, inspection of rails, limit switches, hooks, cables, and slings and tackles. A load test is performed by lifting the heaviest object, within the crane's capacity, that the crane will lift in normal operations. The load test includes moving the load in all directions to verify the crane performs properly under load and that the crane brakes hold. The inspector examined records documenting completion of the annual inspections and load testing of both cranes between 1989 and 1995. The inspector noted that there were no records of either crane being inspected in 1992. This deficiency was also identified during an internal audit performed in 1995, and corrective action was implemented. Therefore, a violation was not identified. The inspector also inspected the administration building high bay crane. The inspection included the crane structure, rails, cable, operation of the limit switch, and proper operation of mechanical equipment. No deficiencies were identified.

The inspector concluded that the overall condition of both cranes was good. Annual inspections had been performed on the cranes. Maintenance was performed as required to correct identified deficiencies. The load testing did not test the cranes to rated capacities, however it demonstrated the cranes were capable of handling the maximum loads they were required to lift during normal operations.

b. Storage Pool and Related Equipment

(1) Structural Adequacy

The inspector reviewed the storage pool structural adequacy. A crawl space area is located under the section of the administration building adjacent to the hot cell between column lines A and C and column lines 1 and 5. The spent fuel pool is located between column lines B and midway between column lines A-B and column lines 2 and 4. The exterior walls of the spent fuel pool are visible in the crawl space area. The elevation of the crawl space is at approximately 895 while the foundation basemat for the spent fuel pool is at elevation 888. The inspector examined the crawl space area. The crawl space area showed evidence of flooding apparently caused by recent rainfalls. The rainfall runoff flows under the grade beam between column lines B and C on column line 1, and flows parallel to column line C, exiting the crawl space in the proximity of column lines C and 4. The soil foundation material has eroded from under a portion of the grade beam. This is near the area where the hole was reported to had been located that an individual had possibly stepped into (see paragraph 8.d, below). The hole was probably caused by washing out of the backfill adjacent to the wall. The rainfall runoff and erosion does not affect the spent fuel pool structure or foundation. This is a routine maintenance problem which does not affect any structure important to nuclear safety. The inspector also examined the walls of the spent fuel pool. The water level in the pool at the time of the inspection was at approximately elevation 910. There were no indications of seepage of water through the walls of the spent fuel pool. The inspector did not identify any cracks in the concrete in the fuel pool walls.

The inspector concluded that the seepage of rainfall runoff into the crawl space area did not have a detrimental effect on the reactor building or spent fuel pool.

(2) Pool Level Sensor and Alarm

Procedure 0005, Criticality Alarm Testing, Rev. 0, dated February 25, 1993, lists the requirements for testing the alarms at the facility. One of the requirements is a monthly test of the alarm associated with the storage pool.

The inspector reviewed the licensee's program for testing and verifying the operability of the storage pool level sensor and alarm. The inspector determined that the licensee checks the alarm on a monthly basis. The inspector reviewed the records of the alarm checks for the past two

years and noted that the checks had been performed as required. The level sensor was not routinely checked according to the licensee. During the inspection, the inspector asked the licensee to perform a test of the level sensor. This was accomplished by pushing down on the level sensor which consisted of a float device in the pool. The float device was pressed down and the alarm sounded as designed. It was noted that the float device was not stuck in place and move freely such that it would function properly if the pool level dropped. The inspector also noted that the float device was located approximately 10-12 inches below the water surface in the pool. No problems were noted with the alarm checks, the level sensor, or the location of the level sensor.

(3) Resin Column

Section 4.2.4, Liquid Waste Handling Systems, of the licensee's Safety Analysis Report for the 5 Mw Georgia Tech Research Reactor, GT-NE-7, dated December 1967, refers to a pump and deionizer which is used to re-circulate the contents of the storage pool in order to maintain the water quality.

The inspector reviewed the licensee's program for checking and changing the resin in the deionizer or resin column associated with the storage pool. The licensee indicated that the resin is not changed on a routine basis but on an "as needed" basis. Water from the storage pool is recirculated through the resin column as needed, i.e. if the water gets cloudy due to the presence of foreign material in the pool. It was noted that, if radioactive contaminants were present in the water, the resin column would help to remove the majority of them. The inspector checked the radiation levels on the resin column and noted that the levels are checked on a monthly basis. The inspector reviewed the survey records of the monthly checks for the past year. The radiation surveys indicated that the highest level noted during that period was 0.2 mr/hr. The licensee indicated that the resin had been changed in January of 1996. The inspector surveyed the resin column during the inspection and found a radiation level of 0.3 mr/hr at contact with the column. No problems were noted with the resin change or the radiation levels.

(4) Levels of Radioactivity in the Pool

Procedure 9041, Storage Pool Water Sampling and Analysis, Rev. 0, dated April 30, 1992, lists the requirements for sampling the water in the storage pool.

The inspector reviewed the results of the water sample analyses of samples taken from the storage pool. The licensee's program required that the samples be taken on a monthly basis. The inspector noted that the samples were taken at the required frequency during 1995, and to date in 1996. It was also noted that the samples were not analyzed for tritium in 1995. The results indicated that the level of cobalt-60 in the pool was always less than 6.34E-7 μCi/ml for 1995. In 1996 the licensee began analyzing the pool water for tritium because of the fuel processing that was taking place. To date in 1996, the levels of cobalt-60 in the pool have been less than minimum detectable activity (MDA). As noted previously, the levels of tritium increased from a concentration of 1.39E-5 μCi/ml on January 30 to 1.25E-3 μCi/ml on February 12. Since February 12, the concentration has decreased slightly and was 9.63E-4 μCi/ml on April 3, 1996. The inspector noted that the highest concentration detected was less than the limit, 1E-2 μCi/ml, allowed by 10 CFR 20, Appendix B, Table 3, for release to the sewer. Although the recent levels of tritium are higher than normal, no unexpectedly high level of tritium or any other isotope was noted.

c. Hot Cell Work

The inspector discussed the work that had occurred in the Hot Cell with licensee representatives including operations personnel, health physics personnel, and management. It was noted that work had not been conducted during other than routine operating hours at the facility. Such activities would have involved operators and HP technicians and neither group indicated that they had been involved in after-hours work. Management also indicated that no work had been done except during normal working hours. The Technical Specifications do not require workers to be supervised while performing such activities but an RWP would be required and it would stipulate such a requirement if one were necessary.

The inspector noted that the end pieces that were cut off the fuel elements were stored in the Hot Cell. A review of the survey records for the Hot Cell gallery and high bay area indicated routine radiation readings. No elevated readings were noted on the surveys for these areas. The inspector performed a radiation survey of the Hot Cell gallery and the high bay area behind the Hot Cell and noted no levels of radiation above that noted on survey records from the past several months.

The inspector also discussed the storage of the end pieces with licensee personnel. They indicated that, at first, they had planned to store the end pieces in another portion of the facility but this had not been done. A review of survey records for the containment building and for the storage building behind the containment building did not indicate any levels of radiation

higher than noted in the past three months. The inspector performed a survey of the interior and exterior of the containment building and the perimeter of the storage building. No radiation levels above those indicated on survey records of the past three months were noted. No other problems were noted with the radiation levels in those areas.

d. Waste Storage Tanks

The record of the minutes from a Nuclear Safeguards Committee (NSC) meeting held October 27, 1989, indicated that the waste tank had developed a leak. The NSC asked the Facility Director to weld a patch on the tank to plug the leak. The inspector reviewed this problem with the licensee. The Facility Director and a Senior Reactor Operator were the only two individuals who remembered the situation. They both indicated that the patch welding was most likely performed by personnel from Physical Plant/Plant Services. The patch had to be rolled to fit the shape of the tank and Plant Services was the only group at the university who could do that job. No records had been kept of the work. The inspector observed the patch weld area and noted that another tank had been patched as well. The patches were currently in place, no leakage was observed, and the welding appeared to be effective.

No violations or deviations were identified.

8. Meeting with the Licensee

On March 11, 1996, the inspector attended a meeting with the licensee and a group called Georgians Against Nuclear Energy (GANE). GANE representatives had requested the meeting to discuss the removal of fuel, both irradiated and unirradiated, from the premises and tour the facility. The Facility Director reviewed with GANE the paperwork used to transfer the fuel to the Savannah River Site and the forms used to track SNM (NRC Form 741 and NRC Form 742). The representatives, which included Glenn Carroll and Dave Cox, a former reactor operator at Tech, concluded that there was no irradiated or unirradiated fuel left at the facility. C. Evans from the NRC also participated in the meeting.

9. Exit Interview

The inspection scope and results were summarized on March 18, 1996, with the licensee representatives indicated in Paragraph 1 above. The inspector discussed the findings for each area reviewed. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector during this inspection.