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UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA ST., N.W., SUITE 3100
ATLANTA, GEORGIA 30303

Report Nos. 50-111/79-03

Licensee. North Carolina State University
Raleigh, North Carolina 27607

Facility Name: R-3 Research Reactor

License No. R-63

Inspection at North Carolina State University at Raleigh, North Carolina

Inspected by: S. C. Ewald

12/21/79
Date Signed

Approved by: A. F. Gibson
A. F. Gibson, Section Chief, FFMS Branch

12/21/79
Date Signed

SUMMARY

Inspection on November 5, 6, and 11, 1979

Areas Inspected

This special, announced inspection involved 20 inspector-hours onsite in the area of preparation and shipment of spent fuel assemblies.

Results

Of the areas inspected, no apparent items of noncompliance or deviations were identified.

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DETAILS

1. Persons Contacted

Licensee Employees

- *R. F. Saxe, Head, Department of Nuclear Engineering
- J. R. Bohannon, Nuclear Operations Administrator
- *R. D. Cross, Reactor Health Physicist
- T. L. Brackin, Health Physics Technician

Other Organizations

- B. Leonard, President, Institute for Resource Management, Inc.
- R. Carter, Director, Nuclear Engineering Institute for Resource Management, Inc.
- T. R. Emswiler, Senior Specialist, Nuclear Packaging and Transportations, Battelle Columbus Laboratories

2. Exit Interview

The inspection scope and findings were summarized on November 6, 1979, with those persons indicated in Paragraph 1 above. In addition, a discussion with Mr. Cross, summarizing findings was held on November 11, 1979.

3. Licensee Action on Previous Inspection Findings

Not inspected.

4. Unresolved Items

Unresolved items were not identified during this inspection.

5. Procedures and Preparations

- a. The inspector reviewed the licensee's Quality Assurance Plan for shipment of the R-3 fuel required by 10 CFR 71.51. The plan was issued September 11, 1979 and approved by the NRC on October 9, 1979 (Approval No. 0331). The inspector noted the Audit section (1.10) discussed a general audit program. Since the shipment will be a one time event, the development of general programs would not be necessary. The inspector stated the QA audit function should be developed to assure the two scheduled shipments, covered by the QA plan, are carried out in accordance with procedures and good practices. The inspector also reviewed QA procedures for the use of the cask and preparation of shipping documents prepared by Battelle, Columbus Laboratories. The inspector discussed these procedures with licensee representatives and stated, while they addressed a number of the procedure requirements of the NRC approved QA program, specific

procedures for radiological surveys and loading of the fuel and cask were not complete. Prior to the shipment on November 11, 1979, specific procedures were developed for these activities and reviewed by the inspector on November 11, 1979. The inspector had no unresolved questions pertaining to procedures.

- b. The inspector reviewed preparations for the fuel "cropping" operation and discussed the operation with licensee representatives. By removing the top and bottom portions of each fuel assembly, it is possible to load the fuel two element high in the shipping cask. The cuts were made using a band saw with special table and stops to assure the cuts were made with no possibility of cutting through the uranium portion of the fuel. A plastic temporary "tent" was assembled to perform the cuts in to help control any airborne release of activity that might have occurred. A high volume air sampler was run in the area of the saw and a continuous air monitor was also used. A special handling tool had been designed and fabricated for handling the fuel and the whole operation was rehearsed using a dummy element. The work was controlled with a Radiation Work Permit and special dosimetry was issued to all involved personnel. The "cropping" procedure called for removing, cutting, rebagging and storing one element followed by a review discussion to improve or revise procedures as necessary. The inspector had no questions relative to preparations for the fuel "cropping" operation.
- c. The inspector reviewed preparations for loading the cropped fuel into the shipping baskets and subsequent loading of the baskets into the shipping cask. The operation was planned to involve removal of an element from dry storage, removal of plastic wrapping, loading the element into one of two baskets, transport the baskets to a loading dock, and loading the basket into the cask using a crane. After reviewing the operation with licensee representatives, the inspector discussed two items relating to the transport of the baskets. The bottom of the baskets are an open mesh to allow for convection cooling flow of elements shipped in water. Since these elements have been cropped, various amounts of contaminated metal shavings are in between the fuel plates and might pose a potential contamination hazard if allowed to fall thru the basket bottom. Licensee representatives agreed to bag the basket as long as possible during transport to catch any such metal shavings. The other item concerned shielding the fuel and baskets during transport to reduce radiation exposures. Licensee representatives agreed to investigate the type and amount of shielding that would be practical (i.e., not exceed crane capacity) and to fabricate the shield prior to the first shipment. The inspector also suggested a complete "dry run" be performed, including loading a basket into the cask, prior to handling fuel. The inspector had no other comments relating to preparations for the fuel loading.

6. Fuel Cropping

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On November 5, 1979, the inspector observed the fuel loading operation described in paragraph 5.b. The inspector measured radiation levels resulting from the spent fuel. These levels ranged from background

(there were several elements with no power history) to as high as 8.5 Rem/hr (gamma). No detectable activity was found in the high volume air samples or the continuous monitor. The highest personnel exposure for the operation, as indicated by self reading pocket dosimeter, was 80 mrem. Some difficulty was encountered in re-bagging the cropped elements. Initially, the element was to be slipped into a plastic tube and the ends taped closed; however, the sharp edges resulting from the saw cuts made this difficult and time consuming. In the review discussion after cutting the first element, alternate means of re-bagging were discussed. The revised technique involved slitting the plastic tube, wrapping the element, and sealing with tape. This technique streamlined operations significantly. The time, using the new wrapping procedures, to remove the element from storage, unwrap, crop, rewrap, and replace in storage averaged less than 3 minutes per element.

7. Fuel Loading

- a. On November 11, 1979, the first of two shipments of spent fuel occurred. The inspector observed all operations as described in paragraph 5.c. The licensee had fabricated a shield to transport the fuel basket to the loading dock and onto the truck. The basket was unshielded only when being lifted into the shipping cask. Exposures for the loading operation, as measured by pocket dosimeter, were less than 15 mrem. During the unwrapping of several elements prior to loading into the basket, the inspector measured beta+gamma/gamma radiation levels using a thin window ionization chamber. The inspector estimated beta:gamma dose rate ratios on the order of 16:1. The inspector discussed the indicated beta dose rate with licensee representatives and stated estimates of hand exposures, measured by ring TLD's may not reflect beta (skin) doses. The inspector requested licensee representatives to expose a test dosimeter to more accurately determine beta:gamma dose ratios and apply this factor to estimate hand beta doses for the fuel cropping and shipping operations. Licensee representatives agreed to perform the test exposure and discuss the results with the inspector when the results are available.
- b. Prior to the shipment departing, the inspector conducted direct radiation and contamination surveys of the cask and reviewed shipping documents. Two areas on the cask indicated detectable levels of contamination (approximately 800-1200 dpm/100 cm²). The inspector verified the licensee was on the approved users list for the specific cask and verified the cask and truck were appropriately labeled and placarded. The inspector had no questions relative to the shipping documents.

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