



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

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Report No. 50-261/81-24

Licensee: Carolina Power and Light Company
411 Fayetteville Street
Raleigh, North Carolina 27602

Facility Name: H. B. Robinson 2

Docket No. 50-261

License No. DPR-23

Inspection at H. B. Robinson site in Hartsville, South Carolina

Inspectors:

J. R. Wray
J. R. Wray

10/7/81
Date Signed

J. A. Franklin
J. A. Franklin

10/7/81
Date Signed

Approved by:

C. M. Hosey
C. M. Hosey, Acting Section Chief
Technical Inspection Branch
Engineering and Technical Inspection Division

10/7/81
Date Signed

SUMMARY

Inspection on August 25-26, 1981

Areas Inspected

This special announced inspection involved 24 inspector-hours on site reviewing the circumstances surrounding the exposure of a contract worker to radiation in excess of regulatory limits.

Results

In the area inspected, three violations were identified (exceeding quarterly whole body dose limit as a result of an inadequate survey of radiation hazards; failure to follow procedures; and, inadequate qualifications of a technician in a responsible position).

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

H. B. Starkey, Jr., General Manager
*D. S. Crocker, Manager - Environmental and Radiation Control
*B. MacCready, Radiation Control Supervisor
*F. Gilman, Senior Specialist - Regulatory Compliance
*A. McCauley, Principal Engineer - Corporate Nuclear Safety
J. Pettigout, Senior ALARA Specialist
E. Paine, Engineer

Other licensee employees contacted included three technicians and one radiation control engineer.

NRC Resident Inspector

S. Weise, Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on August 26, 1981 with those persons indicated in paragraph 1 above. The Manager E&RC acknowledged the violations with the exception of failure to provide continuous health physics coverage. He stated that continuous health physics coverage was provided in that a radiation control technician was present on the platform when workers occupied that area. The inspector stated that continuous coverage was not afforded the tube marking job because visual contact with the workers was not maintained 100 percent of the time by a health physics technician. The licensee representatives further stated that a report of the incident will be submitted to the NRC in accordance with 10 CFR 20.405.

3. Licensee Action on Previous Inspection Findings

Not inspected.

4. Unresolved Items

Unresolved items were not identified during this inspection.

5. Overexposure Event

- a. On August 11, 1981, a contract worker arrived on site to assist in specialized outage work on the licensee's steam generators. Based on the exposure limit imposed upon the worker by his employer, the licensee restricted the individual's allowable whole body dose to less than 690 mrem. Since the worker's established dose limit was less than 1.25 rem and an extension above 1.25 rem was deemed unnecessary, a Form NRC-4 or equivalent was not expeditiously completed. When proof of the worker's previous exposure history was furnished the licensee after August 15, 1981, his Form NRC-4 was completed.

Between August 11 and 14, 1981, the individual performed work under Special Radiation Work Permits (SRWP) 811-6, 812-6, 813-6 and 814-6, "Jump, Eddy Current and Plug Steam Generators and Pull S/G Tubes." Reconstruction of the individual's exact work activities could not be made from the available records (e.g. SRWPs, jump logs, respirator issue log, etc.). A jump log is a log used by the licensee to record entries into steam generators. A review of the licensee's jump logs indicated that the worker had not made any entries into the steam generators. Exposure records indicate that his total dose by pocket dosimeter for these dates was 100 mrem. On August 13, 1981, the worker completed health physics, security and respiratory protection training and was authorized unescorted access throughout the plant.

- b. At approximately 11:00 p.m. on August 14, 1981, the contract worker entered the containment building under SRWP 815-6 to mark tubes in B steam generator for subsequent eddy current testing. The worker was issued a full face respirator and multiple thermoluminescent dosimeters (TLDs) for his head, chest and gonad areas as required for platform work by health physics procedure HP-12, "Steam Generator Inspection and Maintenance". The worker was also issued TLD's for his fingers. High (0-5R) and low (0-500mR) range self reading pocket dosimeters were issued and worn on his chest. An earlier evaluation by health physics personnel indicated that the maximum whole body dose would be to the chest area during tube marking activities and indicated that the worker's whole body exposure should be controlled by pocket dosimeters located on the worker's chest. The plant's dose control group established the worker's dose limit for this job at 500 mrem based on the worker's previous dose and total site exposure limit.
- c. Between approximately 3:00 a.m. and 5:15 a.m., the worker marked tubes in B steam generator. A second contract individual provided supervision and assistance. Interviews with licensee representatives revealed that two additional workers were on the B steam generator platform at this time performing sludge lancing work on a scaffold above the channel head manway through which the tube marking operations were being conducted. One health physics technician covered these jobs from approximately 3:00 a.m. to approximately 4:30 a.m. at which time

he was relieved by a second radiation control technician who covered both operations until the jobs were completed at approximately 6:35 a.m. During this time both technicians frequently read each worker's pocket dosimeter. When the tube marker's pocket dosimeter indicated approximately 470 mrem, the health physics technician directed the worker to leave the containment building. Subsequent processing of the worker's head, chest, gonad and finger TLDs indicated doses of 1308 mrem, 544 mrem, 183 mrem, and 3544 mrem, respectively.

- d. 10 CFR 20.101(a) requires licensees to restrict the total occupational dose to the whole body of each individual in a restricted area to 1250 mrem during any calendar quarter if the individual's exposure history has not been authenticated and recorded on a Form NRC-4 or equivalent document. The inspector stated that an individual, receiving a whole body dose of 1308 mrems in the third calendar quarter of 1981 is a violation of 10 CFR 20.101(a) (81-24-01).
- e. The licensee immediately restricted the worker from further exposure until a valid Form NRC-4 could be completed. SRWPs were modified such that workers would be required to wear two pocket dosimeters near their head and chest TLDs during future tube marking operations. The licensee notified the NRC Region II office of the overexposure event by telephone on August 21, 1981. On September 16, 1981, an enforcement conference was held with the Director of Region II and the Vice President, Nuclear Operations CP&L and members of their staffs.

6. Surveys and Dosimetry

- a. The inspector reviewed survey data for the B steam generator channel head and the platform below the manway and discussed with licensee representatives dose control measures. Radiation levels were approximately 50-400 mr/hr on the platform, 1.5 R/hr one foot below the manway, 3 R/hr at the manway, and up to 20 R/hr in the steam generator channel head. TLDs were placed on the worker's head, chest, and near the gonad area; however, exposure on the job was controlled by chest worn pocket dosimeters. The inspector examined the multiple area exposure records for four other workers who had marked steam generator tubes during this outage. These records indicated that the dose to the head was consistently greater than the dose to the chest or gonads, although the difference was never greater than that observed for the overexposed contract worker. Inspection Report 50-261/81-17 dated July 14, 1981, reported doses to the head, chest, and gonads of a worker marking steam generator tubes at the H.B. Robinson facility on May 30, 1981, of 2807 mrem, 1092 mrem, and 163 mrem, respectively, and concluded that placement of pocket dosimeters on the chest during tube marking operations was a contributing factor to the eventual overexposure of that individual. Licensee health physics personnel stated that based on their understanding of tube marking activities, it was believed that the area which would receive the greatest exposure was the chest.

- b. 10 CFR 20.201(b) requires licensee to make or cause to be made such surveys as may be necessary to comply with the regulations in 10 CFR 20. A survey as defined in 10 CFR 20.201(a) is an evaluation of the radiation hazards under a specific set of conditions. The inspector stated that failure to perform an adequate evaluation of the radiation hazard incident to work near the manway entrance to the steam generator channel head such that an individual marking tubes was exposed to radiation in excess of the whole body dose limit specified in 10 CFR 20.101(a), is a violation of 10 CFR 20.201 (81-24-01).

7. Procedure

- a. The inspector discussed procedural controls of steam generator maintenance work with cognizant licensee representatives. An engineer responsible for coordinating steam generator outage work informed the inspector that a number of special procedures had been developed by the contract company performing the repair work and that these procedures had been reviewed and approved by the Plant Nuclear Safety Committee (PNSC) on July 31, 1981. One such procedure was Special Procedure SP-319, "Steam Generator Tube Marking". Responsible health physics personnel indicated that they were unaware of this procedure, although a member of the health physics department initialed the procedure authorization form. Section 3.0 of the procedure states that tubesheet marking is a task much more difficult than is immediately apparent and requires the use of trained personnel. Close cooperation between the marking team and the health physics organization is essential as this is a high exposure task and requires vigilance on the part of the health physics technician to carefully monitor and control dose rate and total worker dose. Section 7.3 of SP-319 states that a minimum of two health physics technicians shall provide continuous coverage of steam generator marking operations. Licensee representatives indicated that only one radiation control technician was providing health physics coverage at any time between 3:00 a.m. and 5:15 a.m. on August 15, 1981, while tubes were being marked on B steam generator.

Technical Specification 6.8.1 states that written procedures that meet or exceed the requirements and recommendations of Appendix A of Regulatory Guide 1.33 dated November 3, 1972, shall be established, implemented, and maintained. Section I and Section G of Appendix A to Regulatory Guide 1.33 state that procedures for repair of PWR steam generator tubes and special radiation work permits should exist. The inspector stated that not providing a minimum of two health physics technicians to cover steam generator tube marking operations is a failure to implement the requirements of Special Procedure SP-319 in violation of Technical Specification 6.8.1 (81-24-02).

- b. The inspector reviewed licensee activities for compliance with Plant Procedure HP-12, "Steam Generator Inspection and Maintenance". A licensee representative informed the inspector that HP-12 covers work

on the steam generator platforms as well as entries into the steam generators. Section 3.5 states that the radiation control technician is responsible for ensuring that high and low range pocket dosimeters are positioned on the body of any person actively engaged in primary side steam generator work at or near the field of the highest exposure rate in the steam generator. Tube marking activities require looking through the manway with a worker's head positioned at the manway opening. Interviews with the health physics technicians indicated that they had been instructed to ensure that high and low range dosimeters were placed on the chest of workers marking tubes. The inspector stated that verbal instructions issued to the technicians precluded them from adhering to the requirement that high and low range dosimeters be positioned on the tube marker's head which was nearest the field of highest dose rate in the steam generator. The inspector further stated that this was a failure to follow Plant Procedure HP-12 in violation of Technical Specification 6.8.1 (81-24-02).

- c. The inspector reviewed SRWP 815-6, "Jump, Eddy Current and Plug Steam Generators and Pull S/G Tubes," written to support steam generator work on all three steam generators. Survey data was available for each pump bay and appeared adequate. The protective clothing, instrumentation and personnel dosimetry requirements specified on the SRWP appeared to be appropriate. A requirement for continuous health physics coverage was clearly stated. The SRWP did not specify the location of the pocket dosimeters required by Plant Procedure HP-12.

Plant workers indicated that SRWP 815-6 was a daily SRWP (valid for 24 hours) used by all contract workers for all steam generator repair work. Between 3:00 a.m. and 6:35 a.m. on August 15, 1981, four workers (two performing sludge lancing work and two marking tubes) were signed in on SRWP 815-6 and consequently required continuous health physics coverage. During this time the technicians frequently read each worker's pocket dosimeter. Because of the different locations of the two jobs, the technicians stated that a total of approximately four minutes may have elapsed without direct visual coverage of the tube marking activities. The overexposed tube marker stated that he had extended his arm up to his shoulder into the channel head approximately four times to mark certain tubes. The 3544 mrem received by his fingers appears to support this statement. Neither radiation control technician was aware of any steam generator entry although cognizant that breaking the plane of the manway opening with any part of the body was considered an entry. The worker stated that he never put his head through the manway. The inspector stated that due to the non-uniform and complex radiation fields around the steam generator manway and the potential for excessive personnel exposure, continuous health physics coverage requires continuous visual contact with the workers. The inspector stated that not providing continuous health physics coverage of steam generator tube marking activities is failure to implement the

requirements of SRWP 815-6 and Section 7.3 of Special Plant Procedure SP-319 in violation of Technical Specification 6.8.1 (81-24-02). The inspector stated that failure of the technician to observe the worker placing his arms in the generator is positive indication that the health physics coverage was not continuous.

The inspector reviewed several SRWPs written in support of steam generator work in an attempt to determine the contract worker's on-site activities prior to August 15, 1981. The permits were so broadly written that accurate exposure times and worker activities could not be ascertained. A licensee representative stated that more definitive explanations of jumper activities are included on a steam generator jumper log. The inspector examined the jumper logs and noted explicit activity and exposure time records. The inspector was informed, however, that contract personnel utilize the Jump, Eddy Current and Plug Steam Generators and Pull S/G Tubes SRWP for activities other than steam generators entries. Exposure time records and dosimeter readings recorded on the SRWP do not appear to reflect actual time spent in a radiation area. The inspector stated that it appeared impossible, for activities other than steam generator jumps, to ascertain a worker's activity, exposure time and total dose and recommended that the licensee generate more specific SRWPs to support various steam generator repair work. Based on interviews and review of the limited available records (e. g. respirator issue log; jumper log, etc.), the inspector concluded that the worker did not receive any appreciable exposure to his head other than the 100 mrem recorded by his pocket dosimeter for work performed before August 15, 1981.

8. Qualifications and Training

- a. The inspector examined training records and reviewed the qualifications for the technicians and workers involved with the overexposure event. The inspector was informed that training on the licensee's steam generator mock-up was not given to either the tube marker nor the health physics technicians. The technicians appeared to be aware of the requirements of HP-12, "Steam Generator Inspection and Maintenance", and of their responsibility to monitor worker doses frequently and record and control any entry through the steam generator manway. The technicians stated that they had been instructed to place the pocket dosimeters (PD) on the chest of workers marking steam generator tubes and did not question that requirement. Repositioning the PDs on the worker's head would probably have prevented the overexposure.

Health physics procedure HP-12 states that the health physics technician is responsible for ensuring that the high and low range pocket dosimeters were positioned on the body which would receive the greatest dose. The inspector stated that the technicians covering steam generator tube marking operations were performing in positions of responsibility and were required by Technical Specification 6.13 to

satisfy the requirements of ANSI N18.1, 1971, with regard to technicians in responsible positions. A review of the technicians' qualifications revealed that the health physics technician covering the tube marking operation between 4:30 a.m. and 6:45 a.m. on August 15, 1981, did not have two years experience in related health physics activities as required by section 4.5.2 of ANSI N18.1, 1971. The technician only had approximately 11 months of health physics experience; most of which was observing personnel frisking themselves as they left the controlled area. The inspector stated that this is a violation of Technical Specification 6.13 (81-24-03).

- b. The inspector reviewed the training records and qualifications of the tube marker. The individual had a history of steam generator work in the nuclear industry. He had received training at the contractor's corporate facility. He received general health physics, security and respiratory protection training on August 13, 1981, but did not receive specialized training on the facility's steam generator mock-up. Furthermore, the worker did not receive training on plant procedures. HP-12 specifies that any part of the body passing through the steam generator manway opening is considered a steam generator jump and must be recorded and controlled by health physics personnel as such. The worker stated that on four separate occasions he had extended his arm up to his shoulder into the channel head without notifying health physics. The inspector stated that any platform worker should be given mock-up training and should be briefed on plant specific procedures. The inspector stated that failure of the worker to notify the radiation control technician prior to entering the steam generator so that the entry could be recorded and controlled as required by Plant Procedure HP-12 is a violation of Technical Specification 6.8.1 (81-24-02).

9. Conclusion and Recommendations

The inspector concluded that the major contributing factor for the exposure of an individual to radiation in excess of the regulatory limit was controlling worker exposures with chest worn pocket dosimeters. If the PDs were relocated to the worker's head, the over exposure event would probably not have occurred. The significance of this occurrence is amplified in that unintentional head entries into the channel head could have been made due to the inadequate continuous health physics coverage, potentially resulting in extreme exposures.

The inspector recommended that tighter controls be implemented for future platform work, particularly tube marking activities including:

- a. placement of pocket dosimeters on head;
- b. coverage of job with senior health physics technicians who have been trained and qualified in steam generator inspection and maintenance;
- c. separate and more specific SRWP;
- d. improve training of platform workers on plant procedures and health physics requirements.