



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

JAN 16 1985

Report No.: 50-261/84-50

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

Docket No.: 50-261

License No.: DPR-23

Facility Name: H. B. Robinson

Inspection Conducted: November 26 - 28, 1984

Inspector: *R. E. Weddington*
 R. E. Weddington

11/10/85
 Date Signed

Approved by: *G. R. Jenkins*
 G. R. Jenkins, Section Chief
 Division of Radiation Safety and Safeguards

11/10/85
 Date Signed

SUMMARY

Scope: This special, unannounced inspection entailed 22 inspector-hours on site in the area of a potential exposure of a licensee contractor health physics technician in excess of 10 CFR 20.101(a) limits.

Results: No violations or deviations were identified.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees Contacted

- *G. P. Beatty, Manager, H. B. Robinson Nuclear Project
- *R. E. Morgan, Plant General Manager
- *R. M. Smith, Manager, Environmental and Radiation Control
- *R. E. Denny, Radiation Control Supervisor
- B. MacCreedy, Project Specialist, Radiation Control
- *D. C. Stadler, Director, Regulatory Compliance
- *J. C. Sturdavant, Regulatory Compliance Technician
- *H. J. Young, Director, QA/QC
- *A. M. McCauley, Onsite Nuclear Safety

Other licensee employees contacted included radiation safety foremen, technicians and office personnel.

NRC Resident Inspectors

- *H. Krug, Senior Resident Inspector
- *H. Whitcomb, Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on November 28, 1984, with those persons indicated in paragraph 1 above. The investigation into the circumstances concerning the TLD result which indicated an exposure above regulatory limits was discussed in detail (paragraph 3). The licensee stated that they would forward the results of their investigation to Region II for review by December 11, 1984. The inspector stated that this item would be designated an Unresolved Item* pending receipt and review of the licensee report.

3. Investigation of Potential Overexposure

On November 20, 1984, a licensee contractor senior health physics technician terminated his employment. At 1800 hours his TLD was read and was determined to measure an exposure in excess of the limits of 10 CFR 20.101(a) for the whole body and skin of the whole body. The results of the TLD reading, TLD element material and the equivalent shielding for each chip in milligrams per square centimeters (mg/cm^2) is given below:

*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.

<u>TLD CHIP</u>	<u>READING</u>	<u>TLD ELEMENT</u>	<u>SHIELDING (mg/cm²)</u>
1	13.0R	LiB ₄ O ₇	14
2	4.12R	LiB ₄ O ₇	350
3	1.63R	CaSO ₄	350
4	1.17R	CaSO ₄	1000

Licensee management was immediately notified and an investigation committee was formed. The NRC Senior Resident Inspector was notified the following morning.

The contractor technician had left the area but he was located by the licensee and came back to the site the following day to assist in the investigation. He provided the licensee an accounting of the jobs he had worked since the last time his TLD had been read on October 28, 1984, and his recollection of the dose rates and amount of time he had been in the areas. He stated that he did not believe that he had received an exposure of the magnitude indicated by the TLD.

The licensee identified all of the radiation work permits (RWP's) that the technician had worked under since October 28, 1984. Survey records of the work areas during this time frame were reviewed and additional beta surveys were performed in the areas that the technician had worked. No unusual beta radiation levels were detected.

The technician had worn eight different self-reading pocket dosimeters (SRPD's) during the period October 28, 1984 to November 18, 1984. A SRPD was issued whenever a person entered the radiological controlled area and was collected and read by health physics at the exit. The technician's cumulative dose by SRPD during this period was 140 millirem.

The licensee performed a calibration check of the TLD reader. Two checks were performed with badges that had been irradiated with a Cs-137 source of 500 millirem and 4,000 millirem. The acceptance criteria of the check was that the reading must be within fifteen percent of the expected value. If a discrepancy greater than twenty-five percent was obtained, the readings would be adjusted accordingly. Both calibration checks failed with the highest discrepancy being 24.5 percent low. Subsequent tests indicated that the calcium sulfate badge elements (chips 3 and 4) were under responding by approximately twenty percent. The TLD reader was cleaned and subsequent calibration checks were within limits.

The eight SRPD's the technician had worn were response checked by exposure to a known SRPD source to deposit a dose of 250 millirem on the six 0-500 millirem SRPD's and 500 millirem on the two 0-1000 millirem SRPD's. All of the SRPD's responded within the established limits of 250±25 millirem and 500±50 millirem.

A quality control check was performed on the TLD which had indicated the excessive exposure by exposing it to a Cs-137 source to produce a dose of

500 millirem. The TLD was then read and all four elements indicated a dose within 15 percent of the expected value, which was the acceptance criteria of the test.

The subject technician had been employed at the licensee's site since September 18, 1984. The following is a listing of the time period various TLD's were worn and the corresponding exposures:

<u>EXPOSURE PERIOD</u>	<u>TLD NO.</u>	<u>EXPOSURE WHOLE BODY</u>	<u>(MREM) SKIN</u>
9/19/84 - 9/28/84	28842	121	121
9/29/84 - 10/07/84	21173	585	593
10/7/84 - 10/07/84	21173	60	60
10/7/84 - 10/19/84	11633	696	781
10/19/84 - 10/28/84	11633	320	362

The licensee determined that since the calcium sulfate elements had under-responded, the values obtained from elements 3 and 4 should be increased by 20 percent to correct the aforementioned results of the TLD reader calibration check. Normally the value from TLD element 1 is taken as the skin dose and element 2 as the whole body dose. However, the licensee stated, because the technician had worn safety glasses when he was in the radiological controlled area, that the lenses of his eyes were protected and that element 4 would be more representative of the actual whole body exposure. The exposure indicated by the TLD worn during the last exposure period was then determined to be 13.8R skin and 1.4R whole body. These values added to his previous quarterly exposure would result in a cumulative exposure for the quarter of 3.061R whole body and 15.596R skin, both of which are in excess of the limits of 10 CFR 20.101(a).

The inspector stated that he did not agree with using element 4 for the whole body exposure instead of element 2. All plant employees are required to wear safety glasses inside the radiological controlled area and element 2 is normally used to measure whole body exposure. Also the instructions on the reverse side of NRC Form 5 states in item 5 that the element with the 1,000 mg/cm² shield may be used only if the eyes are protected with eye shields having a tissue equivalent thickness of at least 700 mg/cm². The safety glasses in use at the plant had been determined by the licensee to only provide protection equivalent to 404 mg/cm². Using the element 2 results would include a cumulative quarterly exposure of 5.781R whole body.

The possibility that the badge had been tampered with was explored. A review of plant beta radiation surveys indicated that no area had existed at the plant that could have produced the ratio of beta to gamma radiation shown on the TLD. The licensee evaluated the possibility that a sealed source could have been used by exposing TLD's with and without holders (shielded/unshielded elements) to an uranium slab and Sr⁹⁰-Yr⁹⁰ source. The results obtained were not consistent with those observed on the subject

TLD. The licensee's radiation sources are also stored in a locked area which requires that a security representative be present to unlock and record entries. A review of security records indicated that the technician did not have access to the source storage area during the time period in question.

Licensee representatives at the Harris Environmental and Energy Center, New Hill, N.C., were able to cause a TLD to display approximately the same observed ratios by placing the TLD on end against a very small Cs-137 source with element 1 closest to the source. However, the licensee could not duplicate the results with any source found at the Robinson site including the approximately 100 curie Cs-137 radiography source. The licensee concluded that tampering with the TLD was not indicated.

The inspector reviewed all reports of lost TLDs since October 28, 1984, and none indicated that unusual circumstances were involved. The results of all TLD readings during October and November 1984 were reviewed and none indicated a beta exposure significantly greater than the whole body exposure (average beta to gamma ratio was approximately 1:1 with the highest being approximately 1.5:1).

The inspector reviewed records of offsite laboratory waste stream sample analysis that had been performed for 10 CFR 61 implementation to determine if any beta emitting radionuclides had been found in sufficiently large relative concentration to cause the beta and gamma distributions observed on the TLD. The sample results indicated no significant concentrations of beta emitters.

The technician had also been assigned during the period in question to survey equipment and material for release from the protected area. This work was outside the radiological controlled area and he wore no SRPD. The inspector reviewed the records the technician was required to complete describing what he had surveyed and the survey results. Nothing that could have caused a significant exposure was indicated. The licensee performed beta radiation surveys outside the radiological controlled area and in the warehouses and could not identify any abnormal radiation levels.

On October 7, 1984, the technician had reported that he had lost his TLD (number 21173) and security badge inside containment. He was issued a replacement TLD (number 11633) and was assigned a dose of 60 millirem based on his SRPD readings. The lost TLD and security badge were found about an hour later. The security badge was returned to the technician.

The licensee traced the history of the TLD last worn by the technician. Licensee records indicated that the TLD was first sent to the site and issued to the technician on September 19, 1984. It was returned to the New Hill office on September 28, 1984, after being read for the monthly quality control check. The TLD was annealed on October 14, 1984, and sent to the site on October 16, 1984. The TLD was issued to the individual during the period October 28, 1984, to November 20, 1984. Prior to being issued to the

technician, the TLD had been stored in the dosimetry trailer. Records showed that the TLD had been satisfactorily quality control checked on December 10, 1983, and on June 14, 1984. Prior to September 19, 1984, the TLD had been stored at the New Hill office. There was no record of the TLD having been used for any exposure studies while at the New Hill office.

The licensee contacted the TLD vendor to determine if he could identify possible causes of the high TLD reading. The vendor informed the licensee that such a result could have only been caused by radiation exposure.

On September 6, 1984, the NRC Program Office at Three Mile Island was notified by GPU that a TLD had been read which indicated a beta exposure of 28.8R and a whole body exposure of 177 millirem. The same type of TLD was being used. An extensive investigation revealed no explanation for the exposure. The whole body exposure was consistent with the worker's SRPD readings and the exposures of other workers. GPU had requested that the vendor perform a destructive analysis of the TLD and they are awaiting the results. That TLD had on two prior occasions shown unexplained high values on elements 1 and 2 during routine periodic quality control checks while it was in storage. Because of the similarity of the events, the licensee is also requesting the vendor to perform a destructive analysis of their TLD. It should be noted that the whole body exposure on the GPU TLD was consistent with the SRPD, which is not the case in this circumstance.

At the time of the exit interview, the inspector informed the licensee that this matter would be designated an Unresolved Item pending the formal conclusion of their investigation and subsequent review of their findings by Region II. The licensee stated that they would inform Region II of the results of their investigation by December 11, 1984.

On December 11, 1984, a copy of the investigation report was sent to Region II for review. The licensee concluded that the technician did not receive the dose indicated on the TLD. The worker was assigned a whole body and skin dose of 140 millirem based on his SRPD readings for the period October 28 through November 20, 1984. They also concluded that the TLD exposure was caused by radiation, yet that exposure was not received by the worker based on his SRPD readings, work activities and exposures of other employees engaged in similar activities. No explanation could be found for the high TLD reading. Based on the dose assignment, the worker's cumulative quarterly exposure was 1801 millirem whole body and 1936 millirem to the skin of the whole body.

The licensee's investigation report was reviewed by the Region. On December 28, 1984, the inspector informed the licensee that based upon review of their report and the inspection that was conducted, no substantiation could be found that an exposure above regulatory limits had occurred and the Unresolved Item was being closed.

No violations or deviations were noted.