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

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George —
Action. Let's get ready to discuss this issue with R.II.

MEMORANDUM FOR: Charles J. Haughney, Chief
Fuel Cycle Safety Branch
Division of Industrial and Medical
Nuclear Safety

FROM: Douglas M. Collins, Chief
Radiological Protection and Emergency
Preparedness Branch
Division of Radiation Safety and Safeguards

SUBJECT: REGULATORY POSITION ON GENERAL ELECTRIC WILMINGTON EXTREMITY MONITORING RESULTS

This memorandum transmits selected extremity monitoring data and a review of results for a comparison study of monitor placement conducted in regard to commitments made by General Electric representatives during an August 27, 1990 Enforcement Conference. The monitoring and comparison study were conducted to verify compliance with specific 10 CFR Part 20 extremity monitoring requirements.

The enclosed study indicates a borderline need for extremity monitoring. We believe GE should either provide this monitoring or else discontinue borderline practices through job rotation or other means, so that no one is likely to violate the quarterly monitoring threshold of 4.69 rem. It appears now that, based on a four week study, one of 30 workers exceeded the monitoring threshold and five others exceeded 70% of the monitoring threshold.

During the Enforcement Conference, the licensee committed to implement thermoluminescent dosimetry (TLD) monitoring to verify extremity dose received by personnel handling unclad uranium material. Licensee representatives indicated that the routine monitoring required ring-mounted TLDs in that, placement of a TLD on the fingertip was not practicable for the large numbers of employees requiring extremity dosimetry. NRC representatives detailed concerns that by using ring-mounted TLDs areas of the extremities in direct contact with the unclad uranium materials during process operations, skin of the fingertips, may not be adequately monitored. Licensee representatives agreed to conduct a comparative study of exposure results for ring-mounted relative to fingertip-mounted TLDs to evaluate the monitoring conducted. The comparative study involved 30 workers with TLDs mounted simultaneously at the tip and the first distal joint of the index finger.

The licensee has completed the monitoring and the results have been reviewed by Region II staff (Enclosure). The licensee has discussed with NRC Region II personnel the extremity dose as measured by ring-mounted TLDs located at the

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first distal joint of the index finger and requested that these exposure data be utilized to evaluate the monitoring requirements. Based on these data, routine extremity dosimetry monitoring will not be needed. However, the study results indicated consistent differences between doses measured for the two locations on the index finger. Correcting for these differences, a limited number of individuals working at grinding operations may require extremity dosimetry based on a calculated dose at the fingertip. The inspector informed licensee representatives that their request to use the ring-mounted TLD exposure results as the assigned dose would be reviewed by RII management and Nuclear Material Safety and Safeguards personnel prior to any final decision regarding extremity dose assessment.

We request that you and your staff review the attached information. Subsequently we plan to discuss the data with you and your staff so that a decision can be made regarding requirements for the licensee's extremity monitoring program. Any technical questions regarding the data should be addressed to Mr. George B. Kuzo at FTS 841-2560.

for Douglas M. Collins

Enclosure:
Extremity Monitoring

cc w/encl:
S. D. Ebeneter
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ENCLOSURE

EXTREMITY MONITORING

1. Requirement

10 CFR 20.202(a)(1) requires each licensee to supply and to require the use of appropriate monitoring equipment by each individual who enters a restricted area under such circumstances that he receives, or is likely to receive a dose in any calendar quarter in excess of 25 percent of the applicable values specified in 10 CFR 20.101(a).

2. Extremity Monitoring Concerns

During an Enforcement Conference conducted on August 20, 1990, concerns regarding the appropriateness of index finger TLD location to monitor maximum extremity skin dose to verify compliance with 10 CFR 20.202(a) was discussed. NRC representatives stated that their observations of operators handling unclad material indicated pellets were grasped between the tips of the thumb and index finger. Thus the usual monitoring area, first distal joint of worker's index finger required for placement of the relatively large plastic ring-mounted thermoluminescent dosimeter (TLD), may not be subjected to the maximum exposure from handling the unclad uranium materials. Licensee representatives stated that although the exposure may be somewhat greater at the tip of the finger, the practicality of monitoring approximately 100 employees during work conditions precluded the routine mounting of TLDs on the tip of the index finger and necessitated use of the ring-mounted TLDs.

General Electric (GE) representatives agreed to conduct a study comparing extremity exposure received at two locations on the index finger, that is at the tip and at the first distal joint of the finger, from handling unclad uranium materials. Licensee and NRC representatives agreed that the study should utilize approximately 30 individuals.

Licensee concerns included which TLD location would be utilized for assigning the exposure if monitoring was determined to be necessary to meet 10 CFR 20.202(a) requirements. Potential scenarios resulting from the study included, monitoring not necessary, monitoring necessary but differences between the TLD placement not significant, and monitoring necessary and significant differences observed between the two monitoring locations. NRC representatives stated that the data would be reviewed by both NRC headquarters and Region II personnel regarding the adequacy of utilizing ring-mounted TLDs.

3. Extremity TLD Location Study

a. Monitoring Details

The licensee conducted 30 comparisons of weekly TLD data for individual workers simultaneous monitored at two separate extremity

locations, the tip and the first distal joint of the index finger. The exposure data were collected for the following work station areas: grinder, automatic rod loader, manual rod loader, rotary press, hydromet press, test press, B&W packer, and quality control. The data were collected from approximately four individuals assigned to each work station.

In addition to the comparison data for the TLD placement, ring-mounted TLDs were provided to all personnel routinely handling unclad uranium materials. A total of approximately 100 ring-mounted TLDs were issued and exposures results evaluated weekly from August 20 through September 26, 1990, the six weeks remaining in the calendar quarter. The issuance of ring-mounted TLDs was utilized to evaluate the potential quarterly extremity exposure for all workers handling unclad uranium materials.

b. Results

On October 10-11, 1990, an NRC Region II (RII) inspector reviewed the preliminary data for the initial four weeks of the study. Data reviewed included the TLD exposure results for the placement comparison study and the average weekly exposure for all monitored personnel.

The weekly dose monitoring comparison results (Table 1) confirmed that, excluding one individual comparison, doses received at the fingertip were equal to, or greater than doses monitored at the first distal joint of the index finger. For the individual exposure data reviewed, the ratio of exposure results between fingertip-mounted to ring-mounted TLDs ranged from 0.80 to 2.33. For the seven work stations, average ratios ranged from approximately 1.00 to 1.55. Based on comparisons conducted for all work stations, an overall ratio of 1.38 was calculated.

As of October 11, 1990, four weeks of exposure data were available for review. The average weekly shallow dose as measured by TLDs located at the first digit of the index finger ranged from below detection to approximately 255 millirem (mrem). For these data, the nine highest extremity doses, ranging from approximately 168 to 250 mrem per week, were reported for personnel assigned, either entirely or part-time, to work stations involved with grinding activities. Table 2 presents the range of individual extremity doses for the selected work station activities monitored.

The inspector reviewed the need for using extremity monitoring for handling the unclad uranium materials. Based on the 20.202(a)(1) limit of 4.69 rem per quarter, that is 25 percent of the 10 CFR 20.101(a) quarterly limit, a weekly average of 360 mrem requires use of extremity monitoring equipment. Assuming the maximum weekly average extremity dose of 255 mrem as measured by ring-mounted TLD and an average ratio of fingertip-mounted to ring-mounted TLD

results of 1.40 determined in the comparison study for the grinder operations, the inspector calculated a maximum weekly dose of 357 mrem. This value was approximately 99 percent of the applicable weekly limit.

During an October 23, 1990 teleconference between the licensee and a NRC RII inspector, the licensee detailed the final weekly average extremity exposure results from the monitoring study. For the study the five highest weekly average extremity exposures as measured by the ring-mounted TLDs ranged from 185 to 277 mrem. The maximum average weekly exposure of 277 mrem was assigned to a worker involved in grinding operations. However, licensee representatives stated that this result involved approximately 10 overtime hours and, in addition, was less than the weekly limit of 360 mrem requiring issuance of extremity monitoring equipment. Licensee representatives planned to use the ring-mounted TLD results without any correction factor to assign dose to the tip of the index finger for the evaluation and/or assignment, if applicable, of extremity exposure. Thus, based on the monitoring results the licensee planned to discontinue all extremity monitoring. No additional licensee actions to limit extremity exposure, such as rotating workers into the potentially higher exposure task such as grinding operations, were planned.

The inspector adjusted the ring-mounted TLD data by the correction factor of 1.4 to calculate expected dose to the tip of the finger for grinding operations. The calculated fingertip exposure for the five maximally exposed individuals exceeded 70 percent of the limit requiring monitoring. Only the maximally exposed individual exceeded the actual limit requiring extremity monitoring. The inspector informed licensee representatives that if extremity monitoring was to be discontinued, persons involved in operations where exposure results approached 25 percent of 10 CFR 20.101(a) limit should be rotated to other work stations to minimize the potential for extremity exposure requiring monitoring. The inspector informed licensee representatives that the data would be reviewed by NRC RII and NMSS personnel prior to a final decision regarding the appropriate assessment of extremity dose and the need for continued monitoring requirements.

TABLE 1

*RATIOS OF PRELIMINARY EXTREMITY MONITORING RESULTS FOR TLDs COMPARISON STUDY LOCATED RESULTS

Work Station	Shift Z Week 1	Shift Z Week 2	Shift Y Week 3	Shift X Week 4	Average Ratio
Grinder	1.2	1.67	1.27	1.47	1.40
Auto Rod Loader	1.22	1.00	2.33	1.40	1.48
Manual Rod Loader	1.27	**NC	1.40	0.80	1.15
Rotary Press	1.89	1.50	1.00	1.81	1.55
Hydromet Press	1.80	1.60	1.00	1.62	1.50
Test Press	1.43	1.00	1.00	1.00	1.10
B&W Packer	1.00	1.43	1.23	1.27	1.23
QC			1.00	1.00	1.00
OVERALL AVERAGE					1.34

* Ratio of results for simultaneous ring-mounted to fingertip-mounted TLDs located on worker's index finger

** Not compared - cracked TLD chip

TABLE 2

*RANGE OF SELECTED WORK STATION EMPLOYEE
WEEKLY EXTREMITY EXPOSURE RESULTS

WORK STATION	EXPOSURE RANGE (mrem)
Grinder	20 - 280
Rotary Press	20 - 270
B&W Packer	20 - 180
Hydromet Press	10 - 210
Automatic Rod Loader	20 - 140
Quality Control	10 - 180
Manual Rod Loader	10 - 110
Test Press	20 - 100

*Based on 100 individuals monitored for approximately five weeks, week six not processed.