U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 85-04

Docket No. 50-289

License No. DPR-50 Priority ____ Category C

Licensee: GPU Nuclear Corporation
PO Box 480
Middletown, Pa 17057

Facility Name: Three Mile Island, Unit 1

Inspection At: Middletown, Pa

Inspection Conducted: January 29, 1985

Inspectors: _____ 2/25/85
J. R. White date
Senior Radiation Specialist

Approved by: M. Shanbaky 3/7/85
M. M. Shanbaky, Chief date
PWR Radiation Safety Section

Inspection Summary: Inspection on January 29, 1985 (Report No. 50-289/85-04)

Areas Inspected: Special, announced safety inspection to review worker concerns relative to performing operations in a steam generator without respiratory protective equipment.

This inspection involved 8 hours on-site by one regionally based inspector.

Results: No violations were identified.

Details

1.0 Persons Contacted

Mr. George A. Kuehn, Manager, Radiological Controls, TMI-1
Mr. Roger P. Shaw, Radiological Engineering Manager, TMI-1
Mr. Arthur J. Palmer, Radiological Engineer, TMI-1
Mr. Robert Szczeck, Licensing Engineer, GPU
Mr. Robert Knight, Licensing Engineer, GPU

The personnel identified also attended the exit interview conducted on January 29, 1985.

2.0 Scope

The purpose of the inspection was to review concerns expressed by certain anonymous workers relative to working without respiratory protective devices while performing operations inside steam generators. (Allegation No. RI-85-A-0007)

3.0 Inspection Findings, Allegation No. RI-85-A-0007

3.1 Initial Findings

On January 15, 1985, two anonymous workers expressed concern to a NRC inspector that they were subject to internal depositions of radioactive material due to the licensee refusing to provide respiratory protective equipment for work in steam generators. The workers indicated that four individuals had been subject to internal deposition of Co-60 ranging from 23 to 73 nanocuries after recent steam generator work.

This event was reported by the licensee to the NRC Resident Inspector on the same day. The licensee identified that on December 27, 1984, work was performed in one of the steam generators to free some stuck eddy current test probes; and that by direction, respiratory protection was not required.

Subsequent Whole Body Counts (WBC) performed by the licensee revealed unexpectedly high results on five of the individuals involved, i.e., 50 to 100 nanocuries, predominantly Co-60. Such levels required the assignment of personnel exposure due to internal deposition of radioactive material.

Consequently, the licensee initiated a radiological investigation to determine the cause of this occurrence. Additionally, the Manager Radiological Controls directed that respiratory protective devices would be used for subsequent entries into the steam generators.

3.2 Details

On December 21, 1984, an ALARA/Radiological review was performed to support the task of removing stuck eddy current test probes from tubes in Once-Through-Steam-Generators (OTSG), A and B. Previous steam generator work required the use of respiratory protection equipment, i.e., supplied-air "Bubble-hoods", which provide a protection factor of 2000, and full plastic wet-suits.

In conducting the ALARA/Radiological Review, the cognizant radiological engineer considered previous radiological surveillance data. Normal samples of airborne radioactive material, collected by the means depicted in Figure 1, and conducted while the most energetic work was being done in the steam generators (i.e., extensive eddy current testing of 6000 tubes in the period between November 14 and December 9, 1984) indicated that airborne activity was consistently less than the values specified in 10 CFR 20, Appendix B, Table 1, Column 1, for the predominant isotope identified, Co-60. The radiological engineer also considered loose surface contamination surveys performed inside the steam generators on December 12, 1984, which indicated only moderate activity (5000 to 20,000 dpm/100 cm^2).

In an effort to reduce total occupational exposure the radiological engineer elected not to encumber the workers with protective equipment that appeared unnecessary in view of the expected radiological conditions. Consequently, respiratory protective equipment and full wet-suits were not specified as protective requirements on the associated Radiological Work Permit (RWP No. 028472) and the associated ALARA Review No. 84-12-54. To assure adequate personnel monitoring, the ALARA Review did indicate the requirement for personnel to use "clip-on air samplers", i.e., breathing zone air-sampling equipment (BZA).

On December 27, 1984, five workers were involved in efforts to remove stuck eddy current probes from OTSG-B. The effort required no more than 27 minutes total time in the generator by any individual worker. Evaluation of the BZA devices upon completion of the job revealed the following:

Worker	BZA Time	BZA activity (uCi/cc)	Normal Air Sampler Activity (uCi/cc)
A	1040-1042	5.43E-8, Co-60 1.70E-10, alpha	2.16E-10, Co-60 1.96E-13, alpha
B	1008-1029	4.94E-8, Co-60 6.06E-11, alpha	
C	1104-1108	3.63E-9, Co-60 4.4E-12, alpha	
D	1008-1029	4.94E-8, Co-60 6.06E-11, alpha	
	1028-1043	1.36E-7, Co-60 1.23E-10, alpha	
E	0958-1001	2.46E-8, Co-60 4.5E-11, alpha	
	1051-1059	2.15E-8, Co-60 3.23E-11, alpha	

The discrepancy between the BZA devices and the normal air sampling device was not expected by the licensee. Since the BZA provided the most representative sample, it was used to assign personnel intake as follows:

Worker	Assigned "MPC-hours"	Approximate Percent of Quarterly Quantity Limit-10CFR20
A	3.0	~0.5%
B	11.9	~2.0%
C	0.2	~0.04%
D	19.5	~3.7%
E	4.0	~0.8%

These "MPC-Hour" assignments were based on 9.0 E-9 uCi/cc, Co-60; and 2.0 E-12 uCi/cc, Pu-239 (the most restrictive alpha emitter expected based on previous analysis and evaluation).

None of the workers exceeded more than 4% of the Quarterly Quantity Limit (QQL) specified in 10 CFR 20.

Subsequent Whole body Counting immediately after the occurrence indicated values as high as 110 nCi, Co-60. However, within 17 hours the highest value indicated was 13.1 nCi, Co-60, indicating the activity was largely skin contamination rather than actual deposition; and generally confirmed that the calculated intake to the workers was conservative.

External Whole body exposure to the individuals ranged from 50 to 260 mrem, as measured by dosimetric devices.

Follow-up surveys in the steam generator head areas indicated that surface contamination ranged from 10,000 to 600,000 dpm/100cm^2, substantially higher than what was expected as a result of this evaluation.

3.3 Casual Factor Analysis

From discussion with cognizant personnel and documentation relative to this occurrence the following is apparent:

1. The licensee in an effort to reduce personnel exposure by elimination of encumbering respiratory protection equipment, failed to realize that the normal air sampling arrangement did not provide representative indication of workers breathing zone. This deficiency in air sampling was never recognized since all other previous entries were made with respiratory protective devices which afforded a protection factor of at least 2000.

2. The licensee failed to fully realize and understand the nature of the work that was performed, and that radiological conditions might be subject to change as a result of task performance.

3. The licensee failed to evaluate actual air activity and surface contamination in the head area under conditions similar to what the workers were expected to encounter.

While it is apparent that the licensee acted in good faith when determining the radiological controls to be applied for this task, poor judgment was used in evaluation of the radiological hazard, in that the radiological controls utilized were not commensurate with the actual conditions that were created when the task was performed. However, no regulatory limit was exceeded nor was there substantial potential to do so.

The licensee immediately recognized the problem and effected corrective measures to compensate as follows:

Immediate Corrective Actions

1. Work within the OTSG without respirators was suspended. The RWP issued for the task was terminated.

2. The five workers were given whole body counts (WBC's). As indicated, several initial and follow-up individual counts indicated low level external contamination.

3. The task was re-evaluated and an ALARA Review initiated. This review altered the original review that 1) respiratory protection was required, 2) full wet suits were required, and 3) in-head air sampling in the worker's breathing zone was continued.

4. The five workers were briefed as to the significance of the assigned MPC-Hours.

5. Follow-up OTSG-B surveys were conducted. As indicated by this survey, the loose surface contamination levels found in the OTSG Heads were significantly higher than the levels anticipated or indicated on the original RWP survey.

6. A Radiological Investigation Report was initiated to assemble, review and evaluate all data pertinent to this occurrence; and identify corrective measures to be implemented to prevent recurrence.

Long Term Corrective Actions

1. Radiological Engineering will ensure that in-head air samples, representative of worker breathing zones, are collected to support future OTSG entries by February 15, 1985.

2. Radiological Engineering will re-evaluate past OTSG entries and determine if the respirator protection afforded was commensurate with measured concentrations, considering past sampling techniques by March 1, 1985.

3. Radiological Engineering will have OTSG samples analyzed for alpha emitters and adjust "MPC-Hour" assignments as appropriate by March 31, 1985.

4. Radiological Engineering will re-assess the validity of the 2.0E-12 uCi/cc, alpha permissable concentration value as it pertains to the assignment of personnel "MPC-Hours" by March 31, 1985.

Additionally, the licensee indicated that applicable procedures would be revised as necessary in an effort to preclude recurrence of misjudgment of radiological conditions.

These items will be reviewed in a subsequent inspection of the licensee's program. (50-289/85-04-01)

Exit Interview

On January 29, 1985, the inspector met with the individuals identified in section 1.0 of this report. At that meeting the scope and findings of the inspection were identified. The licensee provided the commitment as specified in section 3.3 of this report.

Figure 1

"B" OTSG AIR SAMPLING ARRANGEMENT