

U.S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT

## Region I

Report No. 50-320/80-18  
 Docket No. 50-320  
 License No. DPR-73 Priority -- Category c  
 Licensee: Metropolitan Edison Company  
P.O. Box 480  
Middletown, PA 17057

Facility Name: Three Mile Island Nuclear Station Unit 2

Inspection at: Middletown, Pennsylvania

Inspection conducted: October 7, 1980 and November 18-24, 1980

Inspectors: *L. H. Thonus* 2/20/81  
 L. Thonus, Radiation Specialist date signed  
*L. H. Thonus for* 2/20/81  
 T. Moslak, Radiation Specialist date signed  
 Approved by *M. Shanbakey* 2/20/81  
 for A. Fasano, Chief, Site Operations Section date signed  
 TMI Program Office

Inspection Summary:

Inspection on October 7, 1980, and November 18-24, 1980, (Report No. 50-320/80-18)

Areas Inspected: Special, unannounced inspection of the radiation protection program, particularly as it relates to the entry of personnel into the Three Mile Island (TMI) Unit 2 fuel handling building north and south make-up valve rooms on October 6, 1980. Areas inspected included sequence of events, exposure evaluation, instructions to workers, surveys, procedures, and review of corrective actions. The inspection involved 44 inspector-hours by two NRC resident inspectors. Results: Of the six areas inspected, four items of noncompliance were identified (Infractions - failure to instruct workers in precautions to minimize exposure, paragraph 5; failure to perform surveys, paragraph 6; failure to adhere to a radiation work permit, paragraph 7; failure to incorporate radiation protection instructions into written procedures, paragraph 7).

## DETAILS

### 1. Persons Contacted

- \*J. W. Brasher, Manager, Radiation Controls, General Public Utilities (GPU)
- \*J. J. Chwastyk, Supervisor of Operations, Unit 2, Metropolitan Edison Company (Met-Ed)
- W. Craft, Unit 2 Health Physics Supervisor, Nuclear Support Services (NSS)
- T. L. Mulleavy, Manager, Radiological Training, GPU
- R. Perry, Manager, Personnel Dosimetry, GPU
- J. Renshaw, Manager, Radiological Field Operations, Met-Ed
- \*P. E. Ruhter, Manager, Radiological Technical Support, GPU
- W. Zurliene, Manager, Rad Engineering, General Dynamics

The inspectors talked with and interviewed several other personnel in the course of the inspection including members of the health physics staff and personnel dosimetry department.

\*denotes those personnel present at the management exit interview conducted November 24, 1980.

### 2. Inspection Scope

The purpose of this inspection effort was to review licensee actions and evaluations performed as a result of an event on October 6, 1980, at TMI in which two individuals made an entry to unauthorized areas in the Unit 2 fuel handling building north make-up valve room and one of these individuals made a subsequent unauthorized entry into the Unit 2 fuel handling building south make-up valve room.

### 3. Event Description

On October 3, 1980, a meeting was conducted among representatives of the licensee's operations department and radiological controls department to decide what actions need to be taken to evaluate the effectiveness of the make-up system flush. The decision was made to take pictures of valves MU-V-153 and MU-V-154, located in the Unit 2 fuel handling building north make-up valve room, to determine their positions.

In preparation for this job, a radiation work permit (RWP) was completed, an As Low As Reasonably Achievable (ALARA) Review performed, and a briefing conducted. During discussion with licensee representatives, they stated that during the October 3, 1980, briefing it was made clear that the entry was limited to an entry point called the dogleg in the room. The briefing was interrupted by activities related to the seepage of water from the seal injection cubicle. Inability to locate a camera and diversion of resources to the seal injection cubicle problem caused the entry scheduled for October 3, 1980, to be cancelled.

On October 6, 1980, another RWP was written and assignments were made to enter the room to take the pictures. However, the individuals receiving the assignment were not the same individuals designated for the entry on October 3, 1980. No detailed instructions to the entry personnel were given. Instead, the operations foreman briefed the operator on pictures to be taken. In the briefing the foreman used new construction closeup photographs of the valves to brief the assigned operator. According to the foreman, he told the operator to take pictures from the door. No room layout was used to make this briefing, nor was this operator specifically told not to go beyond the dogleg. There was not a discussion on the special beta radiation protection required in that area. The operator stated during the investigation that he was directed to take four pictures whereas the RWP only requested two.

The radiological controls field operations foreman briefed the assigned radiological controls technician. According to the technician, he was instructed to make surveys for the operator, to survey the north and south make-up valve rooms and not to exceed 150 mR on the self-reading dosimeter. According to the technician, no special beta precautions were discussed, nor were any specific locations set for the technician to conduct surveys. The radiological control field operations foreman has never been in the room and was not familiar with the room layout. Discussion with the foreman indicated that the foreman was not well versed on the beta radiation levels in the area of the room where the valves were located, nor did he know the entry team should not go beyond the dogleg. The radiological control field operations foreman stated that he assumed the south make-up valve room survey was part of the work assignment.

The technician and operator entered the north make-up valve room. While in the room, the operator questioned if they were in the right room. The technician informed the operator that he was in the right room. The operator proceeded to take pictures and the technician took gamma surveys. The technician did not perform beta readings in this room.

The individuals exited the north make-up valve room. The operator departed and the health physics technician entered the south make-up valve room. He conducted beta and gamma measurements in the south make-up valve room. The technician went back to the north make-up valve room, left the beta survey instrument outside and conducted only gamma surveys. At this point, the technician's self-reading dosimeter indicated 120 mR. The technician then left the area.

The radiological control engineering supervisor reviewed the survey data and pictures and concluded that the room had been entered in an area not intended.

The thermoluminescent dosimeters (TLD's) worn on the chest of the individuals who had entered the valve room were pulled and read.

The TLD results were reported as follows:

- Health Physics Technician - 0.310 rem, whole body gamma  
1.515 rad, whole body beta
- Auxiliary Operator - 0.08 rem, whole body, gamma  
0.74 rad, whole body, beta

#### 4. Exposure Evaluation

The licensee and the licensee's consultant, Porter Consultants, Inc. (PCI), recognized that certain corrections needed to be applied to the above results. These corrections included but are not limited to beta penetration of the gamma chip of the TLD, corrections for varying layers of protective clothing worn on various parts of the workers body, and corrections for spatial changes in beta to gamma ratio (i.e. higher beta to gamma ratio on the skin of the thigh than at the TLD on the individuals chest due to the difference in air attenuation). The licensee estimated a maximum exposure to the maximally exposed portion of the skin of the whole body of 4.322 rad.

The inspector observed that while the licensee's and PCI's methodology was basically sound, the results contained a great deal of uncertainty. The uncertainty results from the use of calculations and models versus the use of empirical data and the extrapolation of some empirical data which had a great deal of uncertainty associated with it.

The licensee's TLD badges have two chips, one having an "open window" which is exposed to beta and gamma radiation, the other having a "closed window" of 230 mg/cm<sup>2</sup> which sees gamma only.

The licensee's method of obtaining beta exposures from TLD's is to subtract the results of a gamma only chip from the results of an "open window" beta and gamma chip. The result of this subtraction is multiplied by an appropriate calibration factor to obtain beta exposure. The licensee used results from a TLD tree placed in the north make-up valve room on March 28, 1980, for part of the evaluation of correction factors. Two adjacent gamma chips on this TLD tree, which should have indicated the same result, indicated 1120 mr and 385 mr exposure respectively, indicating a great deal of uncertainty in the gamma measurement. Since the beta dose calculations are dependent upon the gamma, the uncertainty propagates to beta measurements, beta to gamma ratios, and extrapolation of this data.

In that the uncertainty of the beta exposure is as high as a factor of three, this item will remain unresolved pending further licensee measurements and evaluation (50-320/80-18-01).

5. Instructions to Workers

The inspector noted that 10 CFR 19.12, "Instructions to Workers," requires the licensee to inform all individuals working in restricted areas of the location and presence of radioactive material and radiation; and to instruct such individuals of the health protection problems associated with exposure to such material and radiation, including precautions and procedures to minimize exposure.

Through interviews with the personnel involved in the event of October 6, 1980, the inspector learned that neither the health physics technician nor the auxiliary operator was instructed of the high beta radiation hazards that could be expected in the north and south make-up valve rooms and neither individual was instructed to not make entry beyond the dogleg of the north make-up valve room.

The inspector identified this failure to instruct the auxiliary operator and the health physics technician sufficiently to assure that they did not enter beyond the dogleg represented noncompliance with 10 CFR 19.12 (50-320/80-18-02).

6. Surveys

10 CFR 20.201(b) states, "Each licensee shall make or cause to be made such surveys as may be necessary for him to comply with the regulations in this part." 10 CFR 20.201(a) states, "As used in the regulations in this part, "survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present."

Contrary to this requirement, such surveys as were necessary to assure compliance with Section 20.101, "Exposure of individuals to radiation in restricted areas," no evaluation of the hazards from beta radiation due to the presence of leaking primary coolant in the Unit 2 fuel handling building north make-up valve room was performed (50-320/80-18-03). Exposure of the skin of the whole body due to beta radiation fields was more limiting than exposure of the whole body to penetrating radiation. No measurements of beta radiation were made during the October 6, 1980, entry, thus no evaluation of the limiting time and mode of exposure could be performed.

## 7. Radiological Procedures

During the course of this inspection, the inspector reviewed the following procedures that were applicable to the work evolution permitted by RWP-80B-5194.

- Administrative Procedure (AP) 1050 - Control of High Radiation Areas.
- AP 1011 - Control Key Locker Control.
- Radiological Control Procedure (RCP) 1613 - Radiation Work Permits.

Except as noted below, the operation appeared to have been conducted in accordance with these procedures.

RCP 1613 - Radiation Work Permits states that, "An RWP is required for any work which would encounter radiation or radioactive materials in excess of the following guidelines:

- a. 5 mR/hr
- b.  $3 \times 10^{-10}$  uCi/ml gross  $\beta\gamma$  airborne activity, provided no Alpha ( $\alpha$ ) is present (special evaluation performed if Alpha is present).
- c. Surface contamination area as defined in HPP 1610...

An RWP will be terminated if conditions in the area degrade significantly from the conditions on the original RWP or if the time designated on the RWP expires. The RWP may be modified based upon surveys made after the RWP was prepared. Changes to RWP's must be approved and reflected on all copies of the RWP by Radiological Controls Field Operations Supervisor/Foreman or the Shift Supervisor or their designees."

The inspector determined that on October 6, 1980, the south make-up valve room, an area where the radiation and contamination levels were in excess of the criteria of RCP 1613, was entered by the health physics technician without issuance of an RWP. Radiation levels in this room, measured by the technician, included readings of 5 R/hr gamma and greater than 180 Rad/hr beta.

Radiation levels encountered by the two individuals entering the north valve room exceeded the levels stated on the RWP by more than a factor of 10. The RWP listed general area exposure rates of 5 to 50 mr/hr and hot spots of 1 R/hr actual general area measurements (gamma only) of 750 mr/hr were found as well as hot spots of up to 15 R/hr. The RWP was not terminated or changed as required by RCP 1613. This constitutes an item of noncompliance (50-320/80-18-04).

10 CFR 50, Appdendix B, Criterion V, states in part: "Activities affecting quality shall be prescribed by documented instructions, procedures...." The accepted Quality Assurance Program (QAP), Section 17.2.10 (Table 17.2-2) lists health physics procedures as procedures used to implement the QAP.

The inspectors reviewed the licensee's restrictions on access to the north make-up valve room. This room and several other plant areas have special access requirements including permission of the manager of radiological controls and an ALARA review. According to the manager of radiological controls his approval for the entry was given on October 3, 1980, and was good for 24 hours. The radiological controls foreman on duty on October 6, 1980, thought that there was no time limit on the approval. An ALARA approval from the radiological technical support organization was obtained on October 6, 1980.

The licensee's procedural controls for the ALARA review and obtaining permission from the manager of radiological controls were examined. The previous manager of radiological controls had distributed a memorandum describing criteria for determining which activities required an ALARA review on November 14, 1979. The guidance in this memorandum was not put into the licensee's controlled document distribution system nor was it incorporated into a procedure. Although several members of the radiological controls organization were aware of the requirement for obtaining the radiological controls managers permission, none of the persons interviewed could produce a document stating the requirement. The lack of properly documented and distributed procedures and instructions contributed to a lack of understanding by the personnel making and supporting the entry as to what requirements were in effect.

The inspectors noted that the failure to document and distribute these instructions were not in compliance with 10 CFR 50, Appendix B, and the licensee's quality assurance program (50-320/80-18-05).

#### 8. Immediate Corrective Actions

The licensee held a critique of the event on October 7, 1980, with the personnel involved. This gathered data while it was still fresh in the minds of the participants. A memorandum to eighteen members of TMI's operations and radiological controls management was distributed on November 3, 1980, detailing the licensee's analysis of the problems which occurred, causes and an outline of corrective actions to prevent recurrence. The licensee issued a memorandum to all Unit 2 radiation area workers on October 20, 1980, describing beta radiation problems (including the October 6, 1980, entry), the areas requiring additional entry controls, and a list of the additional controls required.

9. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. An unresolved item disclosed during the inspection is discussed in paragraph 4.

10. Exit Interview

The inspector met with the licensee representatives (denoted in paragraph 1) at the conclusion of the inspection on November 24, 1980. The inspector summarized the scope and findings of the inspection as presented in this report.