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

Region I

Report No. 50-320/80-13

Docket No. 50-320

License No. DPR-73 Priority -- Category C

Licensee: Metropolitan Edison Company

P. O. Box 542

Reading, Pennsylvania 19603

Facility Name: Three Mile Island Nuclear Station, Unit 2

Inspection at: Middletown, Pennsylvania

Inspection conducted: July 18 - August 5, 1980

Inspector: W. H. Barley — 8/26/80
W. H. Barley, Radiation Specialist — date signed

Reviewed: M. Shanbaky — 8/26/80
M. M. Shanbaky, Senior Radiation Specialist — date signed

Approved by: A. N. Fasano — 8/29/80
A. N. Fasano, Chief, Site Operations Section, TMI Program Office — date signed

Inspection Summary:

Inspection on July 18 - August 5, 1980, (Inspection Report No. 50-320/80-13). Areas Inspected: Special announced inspection by one resident inspector at TMI of the August 28, 1979, event involving exposure received by six workers in excess of regulatory limits. Areas inspected included review and examination of the data provided in the independent NRC evaluation of the event as submitted by U.S. Department of Energy in a report dated June 1980, evaluation of licensee's records, and investigation of the event and interviews with licensee's personnel. The inspection involved 40 inspector hours onsite by one resident inspector.

Results: Of the three areas inspected, six items of noncompliance were identified (Violation - Exposure of six workers in excess of 10 CFR 20.101(a), paragraph 4; Infraction - Failure to survey in accordance with 10 CFR 20.201(b) to assure compliance with 10 CFR 20.101, paragraph 6; Infraction - Failure to use appropriate extremity dose monitoring equipment as required by 10 CFR 20.202, paragraph 7; Deficiency - Failure to maintain exposure records as required by 10 CFR 20.401(a), paragraph 10; Infraction - Failure to provide exposure reports to exposed individuals as required by 10 CFR 19.13(d), paragraph 9; Infraction - Failure to use a radiation monitoring device which continuously indicates dose rate in a high radiation area, paragraph 6).

Details

1. Persons Contacted

*R. C. Arnold, Senior Vice President, Metropolitan Edison Company
*J. W. Brasher, Manager, Radiation Controls, General Public Utilities Service Corporation
*J. J. Chwastyk, Supervisor of Operations, Unit 2, Metropolitan Edison Company
*R. W. Dubiel, Supervisor Radiological Engineering, Unit 1, Metropolitan Edison Company
*E. D. Fuller, Supervisor of Licensing, Unit 2, General Public Utilities Service Corporation
*R. Heward, Director, Radiation Controls, General Public Utilities Service Corporation
*D. F. Limroth, Superintendent, Administrative and Technical Support, Metropolitan Edison Company
*S. W. Porter, Jr., Effluent and Dose Assessment for Metropolitan Edison Company
*P. E. Reuther, Manager, Radiological Technical Support, General Public Utilities Service Corporation

The inspector contacted several other licensee employees of the radiation protection staff.

*Denotes those individauls attending the exit interview on August 5, 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 August 28, 1979, at Three Mile Island Nuclear Station in which six individuals sustained exposures to the skin in excess of 10 CFR 20 limits while performing maintenance functions on valves in the TMI-2 fuel handling building north make-up valve room. This was considered as an open item (50-320/79-23-09) pending review of licensee's evaluation and NRC independent examination of this event.

3. Event Description. On August 28, 1979, following abnormally high airborne contaminations in the fuel handling building, a health physics technician (HP) entered the valve alley on the 280' elevation of the fuel handling building. This HP identified MUV-155 and MUV-233A valves to have reactor coolant leaks through their packing. An air sample was obtained as well as a rapid area survey by use of a teletector during this entry.

Two operators were dispatched to the valve alley to tighten the packing and stop the leaks. Operator #1 entered the room and was unable to stop the leak from MUV-233A during an estimated stay time in the room of approximately 4 minutes.

Following discussions of what remained to be done with operator #1, operator #2 entered the room. This second operator was able to close valve MUV-155 during about 3 minutes in the room.

These two operators reported they were unable to completely stop the leakage from MUV-233A. Operator #3 was then sent into the room to attempt to tighten the packing of MUV-233A.

Operator #3 remained in the room for just over 3 minutes. During this entry, the leak on MUV-233A was secured.

Due to uncertainty surrounding the status of leakage from MUV-155, the HP, while entering the auxiliary building to retrieve air samples, again entered the room. At this time he found MUV-233A leak secured but MUV-155 still leaking at the rate initially reported by the HP.

Two more operators were dispatched to secure the leakage from MUV-155. Operator #4 remained in the room for about 3 minutes but only completed a portion of the job.

Following discussions with operator #4, operator #5 entered the room and was able to stop the leak. This operator was also in the room about 3 minutes.

4. Personnel Exposures. The following is a summary of preliminary exposures reported to the Commission on September 28, 1979:

Person	Penetrating	Non-Penetrating	Total Skin	Penetrating Extremity	Non-Penetrating Extremity
HP	0.72	16.14	16.86	No Extremity Dosimetry Worn	
OP #1	0.29	3.41	3.70	1.74	38.64
OP #2	----------No Data Submitted on September 28, 1979----------				
OP #3	0.26	8.58	8.84	.59	8.58
OP #4	1.07	52.37	53.44	6.69	148.07
OP #5	0.47	4.92	5.39	6.16	143.66

All of the above reported exposures are in rem.

In order to completely assess exposures to various areas and organs of the bodies of the six individuals that entered the make-up valve room on August 28, 1979, an evaluation of source terms, operator stay times and orientations, protective clothing worn, and beta response of the TLD used had to be conducted. The licensee results of this evaluation were submitted to the Commission on December 5, 1979.

Subsequent to the December 5, 1979, submittal to the Commission, an independent review of the final dose evaluations was performed by personnel from the U.S. Department of Energy, Idaho Operations Office (see EGG-SD-5159). This independent review verified that the assigned doses to the skin of the legs and hands, as reported by the licensee, were limiting and were conservatively assigned.

DOSES TO UNIT 2 WORKERS FROM MAKE-UP VALVE ROOM FIELDS
AS CALCULATED BY THE TMI STAFF
AND SUBMITTED TO THE COMMISSION ON DECEMBER 5, 1979

WORKER		H.P.	Operator 1	Operator 2	Operator 3	Operator 4	Operator 5
Left Hand	γ	0.6	0.6	0.5	0.5	0.8	0.5
	β	7.0	6.7	12.0	5.0	81.0	37.0
Right Hand	γ	0.6	0.6	0.5	0.5	0.8	0.5
	β	7.0	15.0	4.1	2.1	55.0	6.1
Chest	γ	0.6	0.6	0.5	0.5	0.8	0.5
	β	12.0	2.5	1.2	6.4	51.0	32.0
Eyes	γ	0.6	0.6	0.5	0.5	0.8	0.5
	β	0.0	0.0	0.0	0.0	0.1	0.1
Left Leg	γ	0.6	1.0	0.8	0.8	0.8	0.5
	β	39.0	25.0	12.0	3.2	128.0	74.0
Right Leg	γ	0.6	1.0	0.8	0.8	0.8	0.5
	β	39.0	4.0	7.1	28.0	165.0	160.0
*Left Foot	γ	0.6	1.0	0.8	0.8	0.8	0.5
	β	3.6	5.1	1.5	0.4	13.0	7.4
*Right Foot	γ	0.6	1.0	0.8	0.8	0.8	0.5
	β	3.6	0.8	0.8	3.3	16.0	16.0
Gonads	γ	0.6	1.0	0.8	0.8	0.8	0.5
	β	0.4	0.3	0.1	0.3	1.5	1.4

Doses in Rads

Beta doses are skin doses except for gonad and eye beta dose.

*Beta dose is dose to skin of ankles since all operators wore street shoes in addition to protective clothing.

The inspector indicated to licensee representatives that exceeding 18.75 Rems to the extremities and 7.5 Rems to the skin constituted noncompliance with 10 CFR 20.101(a) (50-320/80-13-01).

5. Preplanning and Engineering Controls to Maintain Exposures as Low as Reasonably Achievable (ALARA). Preplanning was inadequate prior to the initial entry for visual inspection for the leaks, in that, extremity monitoring and use of survey instrumentation were not performed as required (details, paragraphs 6 and 7). The inspector determined, through examination of records (Radiation Work Permit (RWP)) and discussion with licensee representatives, that assessment of possible hazards to be encountered was not adequately performed, and no ALARA review of the initial entry was performed.

There was also inadequate ALARA review for the entry teams based on dose rates and air sample analysis. No use of actual photographs of the area with the leaking valves or actual instruction on similar valves in a clean area was used to limit exposures during the course of the work.

It was noted by the inspector, through examination of licensee procedures, that no procedural requirement for an ALARA review existed on August 28, 1979. On November 14, 1979, a memorandum was issued to all Unit 2 recovery effort supervisors from R. W. Heward, Jr., Manager of Radiological Controls addressing criteria for activities requiring radiological engineering review. However, still as of July 1980, no procedural requirement for ALARA review exists. An ALARA procedure is currently in a draft form and circulating for approval.

This is considered an unresolved issue pending approval and issuance of an ALARA procedure (50-320/80-13-02).

6. Surveys. As a direct result of failure to recognize the potential hazards due to the leaking primary coolant in the north make-up valve room, no beta measurements were performed during or subsequent to the initial entry. The first indications of excessive beta dose rates were upon processing of the TLD's worn by the individuals that entered the room.

The inspector stated to licensee representatives that failure to survey for beta radiation as necessary to comply with 10 CFR 20.201 (50-320/80-13-03).

Initial air sampling indicated airborne radioactivity concentrations in areas of the fuel handling building above the north make-up valve room were measured to be 65 times 10 CFR 20, Appendix B, Table 1, Column 1 limits (MPC). A general sample taken within the north make-up valve room during the initial entry indicated airborne radioactivity concentrations of 380 times MPC. Although no measurements were taken during subsequent entries, through discussions with licensee representatives and review of ventilation within the room, it was determined that the initial general sample provided adequate measurements for controlling the worker exposure to airborne radioactive material. Later bioassay of involved individuals also indicated that adequate protective measures for airborne contamination were taken.

Examination of records and discussion with the licensee showed that the five of the six individuals who entered the fuel handling building north make-up valve room on August 28, 1979, did not have continuously indicating dose rate instrument. Also there was no radiation protection qualified individual, with positive control, monitoring their doses. Thus, no method was present to alert the individuals to any unforseen changes in the radiation dose rates within the room.

The inspector indicated to licensee representatives that failure to use the above precautionary dose control measures constituted noncompliance with Commission Order dated July 20, 1979, and Administrative Procedure 1003 (50-320/80-13-04).

7. Personnel Monitoring. The HP on the initial entry to the room wore a thermoluminescent dosimeter (TLD) monitoring device and two self reading dosimeters, one on his chest and one taped to his wrist. He wore no extremity monitoring device capable of measuring beta exposure and subsequent dose assessment estimated his extremity dose to the hands to be 7.6 Rems.

The inspector indicated to the licensee representatives that failure to provide appropriate extremity dosimetry constituted noncompliance with 10 CFR 20.202 (50-320/80-13-05).

The five operators that entered the room to secure the leakage wore a TLD on the chest area and additional monitoring TLD's on each leg. No direction was given as to placement of these additional TLD's and as a result, two men wore the TLD's on their knees and the remaining three wore the TLD's on their feet. These five men also wore extremity TLD's on their hands and two self reading dosimeters (one on the chest and one on the wrist).

A review of the basic TLD data indicates problems with the response of the present dose monitoring equipment in the beta fields produced by reactor coolant contaminants present at Three Mile Island. Penetrating (gamma) exposure is overestimated due to the inadequate shield thickness over the gamma chip. Non-penetrating (beta) exposure measurements using TLD's are very orientation and energy dependant. This appears to be a generic problem, it is of more concern at Three Mile Island than at most power reactors due to the fission product contamination levels (i.e. Sr-90). The licensee has committed to review this dosimetry problem and provide a solution by December 1, 1980. This item will be followed in a subsequent inspection (50-320/80-13-06).

8. Instructions to Workers. Instructions about gamma radiation levels and stay times were given to the five operation individuals that entered the north make-up valve room. Due to unknown beta radiation levels within the room, no direction was given as to beta dose rates or hazards of highly contaminated water. The inspector reviewed current instructions to workers entering significant beta radiation fields (i.e., containment or reactor coolant bleed tank room) and has verified licensee corrective action to discuss applicable beta radiation hazards. The current actions appear to be satisfactory. The inspector has no further questions in this area at this time.

9. Reports to Workers. A review of the individual dosimetry history file for each of the six people that received exposures in excess of 10 CFR 20 limits on August 28, 1979, was performed. The licensee's records indicate each individual was issued a report dated November 30, 1979, of exposures received on August 28, 1979. The report filed with

the Commission pursuant to 10 CFR 20.405 was dated September 28, 1979. The report to the involved individual is required to be transmitted to the individual at a time not later than the transmittal to the Commission. Further, a review of exposure records for two individuals involved in sampling of reactor primary coolant on March 29, 1979, indicated that there was no documented report issued to the individuals concerning their exposures to their extremities in excess of 10 CFR 20.101 limits until June 1980.

The inspector also noted that the report issued to the individuals on November 30, 1979, contained some of the information submitted to the Commission in a followup report dated December 5, 1979. However, the report to the individuals did not include all of the information transmitted to the Commission in that no information was provided concerning gonadal, eye, or extremity exposures. Licensee representatives stated that two meetings were held with the involved individuals both just after the exposures and prior to issuance of the December 5, 1979, final dose assessment. During these meetings all data was verbally explained to the involved individuals, questions were answered, and copies of some portions of the December 5, 1979, submittal to the Commission were provided to the individuals involved.

The inspector indicated to licensee representatives that failure to provide a report to individuals at a time not later than the transmittal to the Commission constitutes noncompliance with 10 CFR 19.13(d) (50-320/80-13-07).

10. Exposure Records. For each of the six individuals involved, the NRC-form 5 equivalent reports dated June 27, 1980, were reviewed by the inspector. The whole body exposure doses for the period August 1, 1979, to August 29, 1979, ranged from a low of 0.5 Rem to a high of 1.0 Rem. These doses recorded were in agreement with the penetrating doses reported in the December 5, 1979, submission. However, the total doses reported to the gonads ranged from 0.9 Rem to 2.3 Rem and were not recorded as whole body exposures.

For the above individuals, the extremity doses to the hands ranged from 2.6 Rem to 81.8 Rem and extremity doses to the feet ranged from 1.2 Rem to 16.8 Rem. In each individual's NRC Form 5 equivalent report, no extremity doses were recorded for the time period August 1, 1979, to August 29, 1979.

The inspector indicated to licensee representatives that failure to maintain correct whole body and extremity doses constituted noncompliance with 10 CFR 20.401(a) (50-320/80-13-08).

11. 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 this inspection is described in paragraph 5.

12. Exit Interview. The inspector met with the licensee management (denoted in paragraph 1) at the conclusion of the inspection on August 5, 1980, at the TMI site. The inspector summarized the inspection findings. The licensee management acknowledged the inspection findings.

13. References and Documents Review

During this inspection, the inspector reviewed several documents pertaining to the August 28, 1979, event including the following:

-- August 30, 1979, J. B. Logan to Mr. Boyce H. Grier, subject: 10 CFR 20 Report of Exposure.

-- September 28, 1979, GQL 1188, J. G. Herbein, to Office of Inspection and Enforcement, Radiation Exposure to Personnel.

-- December 5, 1979, GQL 1499, R. F. Wilson to Mr. B. H. Grier, August 29, 1979 Radiation Exposure.

-- Technical Assessment of Radiation Overexposures at Three Mile Island from August 28, 1979, Entry Into the Unit 2 Fuel Handling Make-up Valve Room, Bryce L. Rich and Steven R. Adams, U.S. Department of Energy, Idaho Operations Office, EGG-SD-5159.