U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-293/84-14

Docket No. 50-293

License No. DPR-35 Priority -- Category C

Licensee: Boston Edison Company
800 Boylston Street
Boston, Massachusetts 02199

Facility Name: Pilgrim Nuclear Power Station

Inspection At: Plymouth, Massachusetts

Inspection Conducted: May 9-11, 14-16, 1984

Inspectors: J. R. White
J. R. White, Senior Radiation Specialist — 7/24/84 date

for James Kottan
James Kottan, Senior Radiation Laboratory Specialist — 7/24/84 date

Approved by: M. Shanbaky
Dr. M. M. Shanbaky, Chief
Facilities Radiation Protection Section — 7/26/84 date

Inspection Summary:

Inspection on May 9-11, 1984 (Report No. 50-293/84-14)

Areas Inspected: Routine, unannounced safety inspection of the Radiation Protection Program. Areas inspected included follow-up on allegations concerning the use of respirators in the drywell, Whole Body Counter operation, reactive investigation of events resulting in personnel contamination, and review of selected Radiological Occurence Reports. The inspection involved 59 inspector-hours on-site by three regionally based inspectors.
Results: Three violations were identified: Failure to adhere to procedures in accordance with Technical Specification 6.11 (one example); Failure to perform surveys in accordance with 10 CFR20.201 (two examples); Failure to adequately instruct workers in accordance with 10 CFR19.12 (one example).

DETAILS

1.0 Persons Contacted

**Mr. C. Mathis, Station Manager
*Mr. P. Misterangelo, Assistant Plant Superintendent
**Mr. A. Trudeau, Chief Radiological Engineer
Mr. W. Hoey, Technical Engineer - ALARA
Mr. T. Sowden, Manager, Environmental and Radiological Health Services
Mr. B. Eldridge, Assistant Chief Radiological Engineer
Mr. J. Kane, Health Physics Supervisor
Mr. M. Oliver, Operations Watch Engineer
Mr. E. Hinxman, Operator
Mr. M. Chochoms, Health Physics Technician (Bartlett Nuclear)
Mr. J. Price, Health Physics Supervisor
Mr. D. Harman, Whole Body Counter Operator (Rad Services, Inc.)
Mr. L. Giunta, Health Physics Supervisor (Rad Services, Inc.)

*Attended the Exit Interview on May 11, 1984. **Attended the Exit Interview on May 16, 1984.

Other licensee and contractor personnel were also contacted or interviewed during this inspection.

2.0 Radiological Occurrences

Personnel Contamination Event-May 7, 1984

The adequacy, effectiveness and implementation of the licensee's program relative to the control of work in radiologically controlled areas, adherence to procedures, assessment of occupational exposure to radioactive materials and radiological surveillance was reviewed against applicable criteria in respect to certain radiological occurrences.

The licensee's performance relative to these criteria was determined by interviews with the Chief Radiological Engineer and other PNPS management personnel responsible for the review and resolution of occurrences, and the individuals directly involved. Additionally, applicable radiological surveys, bioassey reports and procedures were reviewed and evaluated.

Within the scope of this review the following was identified.

2.1 Personnel Contamination Event (Licensee Radiological Occurrence Report 84-5-7-460)

On May 7, 1984, at about 7:55 p.m. an auxiliary operator performed a routine surveillance tour of the "A" Residual Heat Removal Quadrant (A-RHR quad). The health physics (HP) technician responsible for coverage in the area and the operator failed to communicate effectively relative to the location and type of work to be performed, i.e, specific radiological conditions in the area and the manipulation of the RHR Heat Exchanger Outlet Valve (1001-17A) by the operator (Attachment A) were not discussed. The HP technician elected to use RWP 84-1250, "Activities to Support Class 2 and 3 Hydros - 'A' RHR Quad" to detail the protective clothing requirements and precautions to be used by the operator. However, based on radiological survey information compiled on May 4, 1984, the HP technician indicated that respiratory protective equipment and a plastic suit as indicated by the RWP would not be required, but failed to revise the RWP to show this change. The HP technician was unaware that just two hours previously, a survey had been performed in the A-RHR quad, including the area of the valve on May 7, 1984. The survey depicted substantial differences in the radiological conditions as compared to the May 4, 1984 survey. For example:

Parameter	May 4 Survey	May 7 Survey
Airborne Activity	1.7% MPC (1.49 E-10 uCi/ml)	30% MPC (3.22 E-9 uCi/ml)
Airborne Posting	No	Yes
Surface Contamination	150,000 dpm/100 cm^2 (in vicinity of valve 1001-17A)	180 mrad/hr/100 cm^2, β 8 mr/hr/100 cm^2, γ (on valve 1001-17A)

While performing the surveillance tour of the A-RHR quad, the operator manipulated the RHR heat exchanger outlet valve (No. 1001-17A).

The operator signed out of the area at 8:55 p.m. and returned to the control room. However, the individual failed to perform adequate personnel monitoring to determine the presence of contamination. In the remainder of his shift the individual showered and changed his clothes in a nonradiological controlled portion of the facility and attempted to exit the plant at about 12:00 p.m. The personnel portal monitoring device at the main gate access alarmed and the individual was detained.

Followup surveys by H.P. personnel revealed substantial contamination of the individual's skin (about 80,000 dpm/100 cm^2) and clothing (about 200,000 dpm/100 cm^2).

A bioassay program was initiated on May 8, 1984 to determine internal deposition. Initial results indicated that the lungs had about 12% of the Maximum Permissible Organ Burden (MPOB) with the greater portion of the

activity being deposited in the gastrointestinal tract. As of May 18, 1984, the licensee had accounted for about 0.7 uCi of activity (primarily Cobalt 60) as being deposited in the individual. Assuming that 25% of the activity was exhaled and a breathing rate of 1.2 E6 ml of air per hour, and that the individual was in the area for 45 minutes, such activity is indicative of an air concentration of 9.7 E-7, or about 108 times the value specified in 10 CFR 20, Appendix B, Table 1, Column I, i.e., 108 MPC-hrs.

As of May 25, 1984, the individual had essentially eliminated all activity from his body with the exception of about 0.03 uCi still remaining in the lungs. The licensee is committed to continue bioassay of the individual until the deposition remaining is negligible; and will submit a report of final exposure evaluation and assessment (293/84-14-01). Preliminary exposure assessment is detailed in Section 2.3 of this report.

Relative to this event, the following items of noncompliance were identified:

- 10 CFR 19.12, "Instructions to Workers", requires that individuals working in portions of the restricted area be kept informed of the presence of radioactive materials or of radiation and instructed in the associated health protection problems and in procedures and precautions to minimize exposures.

  Contrary to this requirement on May 7, 1984, the licensee failed to adequately instruct a worker on the presence and extent of radioactive contamination and radiation levels in the A-RHR quad; and failed to identify to the worker precautions procedures and protective measures to minimize exposure to such contamination and radiation. Consequently the worker was not advised to use respiratory protective equipment and plastic anticontamination clothing and subsequently was subjected to extensive internal and external personal contamination. (293/84-14-02)

- 10 CFR 20.201, "Surveys", requires the licensee to make evaluations as necessary for the licensee to comply with 10 CFR Part 20, "Standards for Protection Against Radiation".

  Contrary to this requirement, on May 7, 1984 the licensee failed to make an evaluation of the A-RHR quad to support the entry of a worker performing operations in the area. Specifically, the radiological conditions of the area were not evaluated sufficiently to identify the need for respiratory protective measures in accordance with 10 CFR 20.103 and provisions for controlling personnel occupational exposure in accordance with 10 CFR 20.101, and protective clothing to prevent personnel contamination. (293/84-14-03)

- Technical Specification 6.11, "Radiation Protection Program", requires the licensee to adhere to procedures developed consistent

with the requirements of 10 CFR 20. Procedure No. 6.4-067, "Operation of the Eberline RM-14 Radiation Monitor", provides instructions for the use of the instrument as a monitoring device to determine personnel contamination. Such instructions describe proper procedures for performing self-frisking.

Contrary to this requirement, on May 7, 1984, an individual who was significantly contaminated from work performed in the A-RHR quad failed to frisk in accordance with the directions of Procedure 6.4-067, sufficient to detect and properly respond to the presence of significant levels (as high as 200,000 dpm/100 cm^2) of radioactive contamination on skin and clothing. (293/84-14-04)

2.2 Licensee Radiological Occurrences Reports 84-4-19-341 and 84-4-29-439

Previous to the occurrence described in Section 2.1, the licensee experienced events caused by similar deficiencies.

- Report 84-4-19-341

  On April 19, 1984, personnel performed work in the drywell, i.e., the removal of a spool piece from the 'B' Recirculation Loop, in accordance with RWP 84-1169, "Machine cutting of recirc piping on 9'El". The HP technician controlling access to the job site was unaware that a specific RWP (RWP 84-1216, "Rig discharge valves (4A&B; 5A&B) and pump suction spool pieces to equipment hatch") had been established for this function which required specific protective measures and controls, including the requirements for constant HP coverage, special surveys and extremity monitoring.

  As a result of the wrong RWP being used to control the job, the activity was accomplished without HP coverage, radiological surveys and extremity dosimetry.

  The licensee's investigation and evaluation of the consequences of this deficiency indicated that personnel exposure of the individuals involved was not significantly affected by the failure to implement the measures specified in RWP 84-1216, since the personnel were previously trained and practiced in the activity. However, the licensee failed to provide radiological surveys to support the activities associated with the spool piece removal. This was an essential radiological control measure since the radiological condition of the spool piece and recirculation pipe was unknown. Such failure to provide surveys constitutes an item of noncompliance relative to 10 CFR 20.201. (293/84-14-05)

- Report 84-4-29-439

  Following the occurrence involving the spool piece on the 'B' Recirculation Loop, on April 29, 1984, personnel performed other similar

work in the drywell, i.e., the removal of a spool piece from the 'A' Recirculation Loop. Due to inadequate corrective measures being implemented relative to Occurrence 84-4-19-341, again the wrong RWP (RWP 84-1169) was used to establish radiological protective measures and control, even though RWP 84-1216 was still in effect and intended for spool piece removal.

Fortunately, since the job was expected, the protective measures and controls specified in RWP 84-1216 were implemented, i.e., constant coverage, special surveys and extremity monitoring, though the RWP the individuals were assigned to (RWP 84-1169) did not require any of those types of protective actions. In this case the implementation of the proper protective measures was fortuitous as opposed to by design.

Inadequate communication between the HP providing access control to the work site and the work party appears to be the cause of this occurrence. Such communication failure was compounded by the fact that once an individual has been briefed on an RWP, subsequent entries on the same RWP may be made without a briefing. During this inspection effort, the licensee initiated corrective measures to resolve communication problems at the control point. Procedural modifications and personnel training are being considered. The licensee's actions in this area will be reviewed in a subsequent inspection. (293/84-14-06)

2.3 Preliminary Personnel Exposure Assessment

Relative to the personnel exposure assessment of the individual involved in Radiological Occurrence 84-5-7-460, the following preliminary information was determined:

- Exposure to skin due to contamination

  The licensee estimates that the total accumulated skin exposure will be less than 20 mrad.

- Exposure to airborne radioactivity

  As previously discussed in Section 2.1 exposure to β-γ activity, predominantly Cobolt-60 appears to be at least 108 MPC-hrs. This assessment does not account for any alpha activity which may have been a component of the airborne activity. The licensee's analysis of smears of loose surface contamination in the area appears to indicate the presence of alpha activity in a ratio of about 5000:1, beta-gamma to alpha. Such proportion indicates that the contribution of alpha activity may effect the assessment of the individuals exposure to airborne radioactivity.

  The licensee has initiated a program to qualify and quantify the

presence a alpha activity and determine effect on personnel exposure. Independent assessment is being made by NRC Region I. Further details are reported in IE, Inspection Report 50-293/84-12. This item will be reviewed in a subsequent inspection (293/84-14-07).

- Exposure to Gastrointestinal (GI) Tract

  Bioassay analysis indicates that the majority of the activity encountered by the individual was deposited in the (GI) tract. The licensee's preliminary results based on excretion indicate 43 mrem to the GI and 15 mrem to Whole Body from this occurrence.

- Whole Body External Exposure

  The individuals personnel dosimetry indicated about 180 mrem was received during the entry.

The licensee is continuing followup on the individual and is expected to submit a final report of dose assessment including MPC-hours incurred by the individual by July 30, 1984.

3.0 Whole Body Counter Operation

During this inspection the licensee's capability to adequately perform radiological bioassay using a whole body counting system was reviewed. A NRC whole body counting phantom containing radioactive sources traceable to the National Bureau of Standards (NBS) was submitted to the licensee for analysis.

The phantom duplicated the nuclides and the organ burdens that the licensee might encounter during normal operation. The phantom was analyzed using the licensee's normal methods and equipment.

Results Comparison

The licensee currently has two separate whole body counting chair systems in operation: one chair which is used for lung and thyroid counting and another chair which is used for whole body and thyroid counting. The chair which is used for lung and thyroid counting also has a detector for GI tract counting. However, the software being used by the licensee cannot accommodate three detectors, and, therefore, the licensee has chosen not to use the GI tract detector. During this inspection the licensee did disconnect the thyroid detector and put the GI tract detector into service so that results for the GI tract could be intercompared. Also the licensee repositioned and recalibrated the detector in the whole body counting chair after the initial intercomparisons. This was done at the request of the inspectors who noted that the detector appeared to be protruding too far into the collimator when compared to drawings in the licensee's procedures and the literature. The results of the sample intercomparisons are presented in Table I.

Based on the results of the intercomparisons the inspectors suggested that the licensee use the whole body counting chair with the detector all the way back in the collimator, as the chair appeared to be designed for this type of operation, and the collimator should be positioned to ensure that the lungs are within the view of the collimator. When the whole body counting chair is used in this manner, the licensee's results were within a factor of two or less from the NRC values.

No violations were identified in this area.

Procedures and Data

The inspector reviewed the licensee's procedure for the operation and calibration of the whole body counting systems. The inspector also reviewed the licensee's QA program for the whole body counting systems. The QA program consists of daily source checks, plots of the daily source checks, daily gain checks, daily background checks, and monthly efficiency checks. The QA program contains acceptance/rejection criteria for the various checks which are performed. All checks and calibrations were performed in accordance with the licensee's procedures. No violations were identified in this area.

4.0 Exit Interview

The inspector met with licensee management (denoted in section 1.0) on May 11, 1984, and at the conclusion of the inspection on May 16, 1984, to discuss the scope and finding of the inspection as detailed in this report.

At no time during this inspection effort was written material provided to the licensee by the NRC inspector.

TABLE I

Type of Counting System: Whole Body Chair

Isotope	Organ		NRC Value	Licensee Value	Licensee Value / NRC Value
		RESULTS IN TOTAL NANOCURIES			
Cs-137	GI Tract		90	338	3.76
Co-60	GI Tract	1173 (keV)	86	348	4.04
		1332 (keV)	86	319	3.70
Cs-137	Lung		100	75	0.75
Co-60	Lung	1173 (keV)	96	78	0.81
		1332 (keV)	96	80	0.83
		RESULTS WITH DETECTOR REPOSITIONED			
Cs-137	GI Tract		90	188	2.09
Co-60	GI Tract	1173 (keV)	86	184	2.14
		1332 (keV)	86	142	1.65
Cs-137	Lung		100	160	1.60
Co-60	Lung	1173 (keV)	96	166	1.72
		1332 (keV)	96	150	1.56

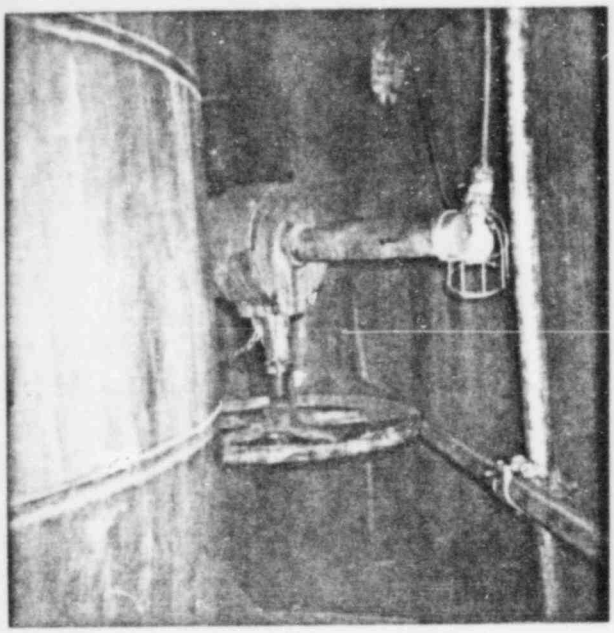
TABLE I

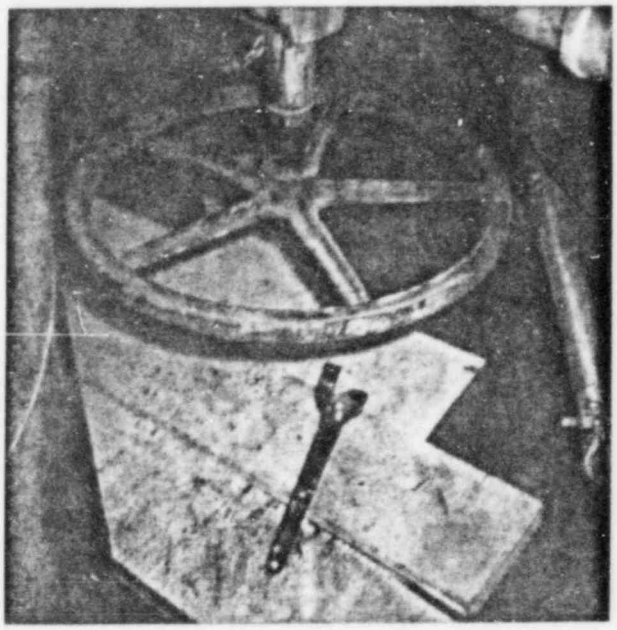
Type of Counting System: Lung Chair

Isotope	Organ	NRC Value	Licensee Value	Licensee Value / NRC Value
		RESULTS IN TOTAL NANOCURIES		
Cs-137	Lung	100	126	1.26
Co-60	Lung (1173 keV)	96	115	1.20
	Lung (1332 keV)	96	110	1.14
		WITH GI TRACT DETECTOR IN SERVICE MASONITE PHANTOM CALIBRATION		
Cs-137	GI Tract	90	226	2.51
Co-60	GI Tract (1173 keV)	86	226	2.62
	(1332 keV)	86	243	2.82
		LUCITE PHANTOM CALIBRATION		
Cs-137	GI Tract	90	181	2.01
Co-60	GI Tract (1173 keV)	86	188	2.18
	(1332 keV)	86	195	2.26

5/9/84

"ATTACHMENT A"





"A" RHR Heat Exchanger Outlet Valve, 1001-17A