

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-293/85-02

Docket No. 50-293

License No. DPR-35 Priority -- Category C

Licensee: Boston Edison Company M/C Nuclear

25 Braintree Hill Office Park

Braintree, Massachusetts 02184

Facility Name: Pilgrim Nuclear Power Station

Inspection At: Plymouth, Massachusetts

Inspection Conducted: January 15-18, 1985

Inspectors: R. L. Nimitz
R. L. Nimitz, Senior Radiation Specialist

2/6/85
date

R. L. Nimitz for
B. Carson, Radiation Specialist

2/6/85
date

Approved by: W. J. Pasciak
W. J. Pasciak, Chief, BWR Radiation
Safety Section

2/6/85
date

Inspection Summary:

Inspection on January 15-18, 1985 (Report No. 50-293/85-02)

Areas Inspected: Special announced radiological controls inspection of the following: licensee action on previous inspection findings; licensee improvement of radiological controls for sludge lancing of the monitor tanks; and review of the circumstances and licensee evaluations of several high reading personnel dosimetry devices (TLDs). The inspection involved 58 inspector hours onsite by two region-based inspectors.

Results: No violation or deviations were identified. The licensee satisfactorily addressed several previous inspection findings. The licensee implemented acceptable corrective actions for resumption of sludge lancing of the monitor tanks. The licensee's evaluation of the high reading TLDs was found to be incomplete. The high reading of the TLDs is an unresolved matter. This report also details an Enforcement conference held in Region I on January 31, 1985. This meeting was attended by NRC and licensee management and lasted about 2 hours.

DETAILS

1.0 Persons Contacted

1.1 Boston Edison

- *J. Crowder, Senior Compliance Engineer
- *E. Graham, Compliance Group Leader
- *W. Hoey, Senior ALARA Engineer
- *A. Oxsen, Vice-President, Nuclear Power
- *A. Trudeau, Chief Radiological Engineer
- *C. Mathis, Nuclear Operations Manager
- *V. Stagliola, Senior Technical Engineer
- *B. Eldridge, Assistant Chief Radiological Engineer
- J. Kane, Senior Radiological Engineer

1.2 Nuclear Regulatory Commission

- *J. Johnson, Senior Resident Inspector

1.3 Consultants (BECO.)

- *G. Smith, Hydro-Nuclear, Inc.

*Denotes those attending the exit meeting on January 18, 1985.

The inspector also contacted other personnel (licensee and contractor).

1.4 Enforcement Conference

An Enforcement Conference was held on January 31, 1985. The following individuals attended the conference:

NRC

- T. E. Murley, Regional Administrator
- J. M. Allan, Deputy Regional Administrator
- W. Kane, Deputy Director, Division of Reactor Projects
- E. C. Wenzinger, Chief, Reactor Projects
Branch No. 3
- L. E. Tripp, Chief, Reactor Projects Section 3A
- G. W. Meyer, Project Engineer
- J. M. Gutierrez, Regional Attorney
- R. R. Bellamy, Chief, Emergency Preparedness and Radiological
Protection Branch
- J. R. Johnson, Senior Resident Inspector, Pilgrim
- W. J. Pascfak, Chief, Boiling Water Radiation Safety Section
- D. L. Holody, Enforcement Specialist
- R. L. Nimitz, Senior Radiation Specialist

BECo

W. D. Harrington, Senior Vice-President, Nuclear
A. L. Oxsen, Vice-President, Nuclear Power
A. R. Trudeau, Chief Radiological Engineer

Consultants

G. Smith, Hydro-Nuclear, Inc.

2.0 Purpose

The purpose of the special, announced radiological controls inspection was to examine the following elements:

- Licensee action on previous NRC findings
- Licensee implementation of improved radiological controls for sludge lancing of the monitor tanks
- Review of circumstances and licensee evaluation of high reading TLDs.

3.0 Licensee Action on Previous NRC Findings

- 3.1 (Closed) Violation (50-293/84-14-02) Licensee did not instruct workers in accordance with the provisions of 10 CFR 19.12. Inspector discussions with personnel, review of on-going work, review of documentation, and review of training records indicated the licensee implemented the corrective actions described in his August 30, 1984 letter to NRC Region I.
- 3.2 (Closed) Violation (50-293/84-14-03) Licensee did not perform radiological surveys in accordance with the provisions of 10 CFR 20.201. Inspector discussions with personnel, review of on-going work, review of documentation, and review of training records indicated the licensee implemented the corrective actions described in his August 30, 1984 letter to NRC Region I.
- 3.3 (Closed) Violation (50-293/84-14-04) Licensee personnel did not adhere to radiation protection procedures. Inspector discussions with personnel, review of on-going work, review of documentation, and review of training records indicated the licensee implemented the corrective actions described in his August 30, 1984 letter to NRC Region I.
- 3.4 (Closed) Follow-up Item (50-293/84-14-01) Licensee to provide an airborne radioactivity intake evaluation for an individual who sustained an intake of radioactive material on May 7, 1984. The licensee performed a comprehensive evaluation of the intake of airborne beta, gamma, and alpha radioactivity of the individual. The inspector review of the report (dated January 15, 1985) indicated the individual sustained an intake of about 25% of the 10 CFR 20 quarterly intake limit.

No deficiencies in the licensee's evaluation were identified.

- 3.5 (Closed) Follow-up Item (50-293/84-14-07) Licensee to evaluate alpha emitters identified at the station and determine the effect on the internal exposure control program. The licensee evaluated the alpha activity identified at the Pilgrim Station. Inspector review of a September 1984 report of the evaluation indicated the report provided evaluation conclusions and recommendation for modifying the Internal Exposure Control Program at Pilgrim Station. Due to time limitations, the inspector was unable to examine the licensee's implementation of the recommendations contained in the report. The licensee's actions on the recommendations will be reviewed during a subsequent inspection (50-293/85-02-01).
 - 3.6 (Closed) Violation (50-293/84-25-04) Licensee did not perform radiological surveys in accordance with the provisions of 10 CFR 20.201. The implementation of corrective actions was reviewed during Inspection No. 50-293/84-29. The licensee implemented the corrective actions as described in his December 28, 1984 letter to the NRC.
 - 3.7 (Closed) Violation (50-293/84-25-05) Licensee did not instruct workers in accordance with the provisions of 10 CFR 19.12. The implementation of corrective actions was reviewed during Inspection No. 50-293/84-29. The licensee implemented the corrective action described in his December 28, 1984 letter to the NRC.
 - 3.8 (Closed) Deviation (50-293/84-25-07) Licensee did not minimize personnel exposure as recommended by 10 CFR 20.1. The implementation of corrective actions was reviewed during Inspection No. 50-293/84-29. The licensee implemented the corrective actions described in his December 28, 1984 letter to the NRC.
 - 3.9 (Closed) Follow-up Item (50-293/84-44-01) NRC to review training records of licensee radiation protection personnel providing radiological controls of sludge lancing operation on December 17, 1984. The licensee provided documentation showing that the individuals were trained and qualified in applicable procedures. These records were maintained at the licensee's offsite training facility. The individuals had been provided this training in June 1984. Inspector review of work histories of the technicians indicated the individuals met Technical Specification work experience requirements.
- 4.0 Implementation of Corrective Actions Following Unauthorized Entry of an Individual Into the 'C' Monitor Tank

The inspector reviewed the adequacy and implementation of licensee corrective actions for resumption of sludge lancing of the monitor tanks. The corrective actions resulted from the licensee's evaluation of the unauthorized personnel entry into the 'C' Monitor Tank on December 17, 1984. The evaluation of licensee performance in this area was based on:

- Discussions with cognizant licensee personnel
- Review of documentation including:
 - radiation surveys
 - radiation work permits and
 - training records
- Observation of on-going work.

Based on the reviews during this inspection and Inspection No. 50-293/84-44, the following was noted:

- Upon notification of the unauthorized entry, the licensee immediately suspended sludge lancing.
- The licensee initiated an investigation of the event within about one hour after becoming aware of it.
- The licensee read the subject individual's TLD and prohibited him from further exposure.
- The licensee made comprehensive radiation surveys inside the tank and performed a preliminary dose evaluation within one day of the event. (Note: The licensee's dose evaluation adequately demonstrated the individual had not received an exposure in excess of regulatory limits.)
- The licensee issued an Radiological Occurrence Report and a Failure and Malfunction Report in accordance with station procedures.
- The licensee notified the NRC of the entry.
- The individual who made the unauthorized tank entry was terminated from the site.
- The radiation protection personnel who were providing radiological coverage of the job were given written reprimands for their failure to adhere to the provisions of the applicable radiation work permit for the task.
- A review of other on-going radiological work was performed by the licensee to identify any other examples of radiation protection personnel not adhering to radiation protection program requirements. Those identified as not adhering to applicable requirements were also given written reprimands.
- The Vice-President, Nuclear Operations issued a letter to all contractor and station personnel which referenced the unauthorized action, specified that failure to adhere to procedures would not be tolerated, and provided guidance regarding verification of personnel

adherence to procedures. This memorandum was temporarily included in the stations General Employee Training Program.

- The licensee initiated action to develop a training video tape, for use in General Employee Training. This tape will specifically discuss adherence to procedures.
- The licensee revised and reissued the radiation work permit for sludge lancing. The permit now clearly describes high radiation area surveillance requirements.
- The licensee installed a continuously indicating radiation monitor in the work area.
- The licensee installed two television cameras in the work area to identify: 1) any attempts at unauthorized entry into the tank and 2) any loitering of personnel near the base of the tank.
- The licensee provided applicable training to personnel performing the tank work prior to resumption of the work.
- The licensee initiated morning meetings with the work crews for the sludge lancing. At the meetings daily work activities, plans, and procedure changes are discussed.
- The licensee replaced the contractor radiation protection personnel overseeing the contractors performing the sludge lancing with licensee radiation protection personnel.
- The licensee reviewed the personnel safety aspects of the sludge lancing and selected alternative access routes based on this evaluation.

Within the scope of the review, no violations were identified. The licensee's actions taken following the unauthorized entry and prior to resumption of sludge lancing were considered effective.

Within the scope of this review, the following was noted:

The licensee was rotating technicians on the sludge lance work. Although the licensee was holding daily meetings prior to work, and was ensuring that of the three technicians covering the job at least one had previously covered the job, it was not clear that those new technicians who were rotated into the job in the future would be informed of the radiological controls deficiencies identified following the unauthorized tank entry. No formal mechanism (e.g. an instruction) had been established for this purpose.

The licensee immediately issued a memorandum to all station and contractor radiation protection personnel which identified the deficiencies and stressed the need to adhere to procedures. The licensee immediately

verified by sign-off that those individual's currently covering the job were cognizant of the deficiencies and the need to adhere to procedures. All other radiation protection personnel were similarly required to perform a similar sign-off. The licensee's action would ensure that all personnel rotating into coverage of sludge lance work would be aware of the previously identified deficiencies and the need to adhere to procedures. The licensee's action on this matter were timely.

5.0 Review of High Reading TLDs

5.1 Description of Identification

On December 14, 1984, at about 7:50 A.M., a worker (Individual A) exiting the drywell discovered his self-reading pocket dosimeter to be missing. This individual had been working under the vessel under RWP No. 84-3147 removing a Control Rod Drive Winch. The licensee initiated a dose evaluation in accordance with applicable procedures. Based on pocket dosimeter results of personnel in the work area and radiation dose rates in the area, the licensee estimated the individual sustained an exposure of about 100 millirem (whole body based on dose to head). The individual's TLD was read-out on the same day as part of the evaluation and indicated an unexplained exposure of about 1.8 rem for the period December 2-14, 1984. This exposure results in a total quarterly whole body exposure to Individual A of about 2.1 rem. (Note: The quarterly whole body dose limit is 3 rem). No skin or extremity exposure above the whole body dose was identified.

The licensee placed controls on the individual to preclude further radiation exposure and initiated an investigation to determine the cause of the high reading TLD.

During the course of the investigation, the licensee elected to read the TLDs of the co-workers who worked with the individual during the period December 2-14, 1984. The licensee read-out the TLDs of these individuals on December 22, 1984. At that time, the licensee identified one individual (Individual B) whose TLD indicated an apparent whole body dose to the individual (Individual B) of about 2.3 rem and a whole body skin exposure of about 9 rem. (Note: The quarterly whole body skin exposure limit is 7.5 rem). The licensee placed controls on this second individual to preclude further radiation exposure and initiated an investigation to determine the cause of the high reading TLDs.

5.2 Description of Licensee TLD Badge

The licensee uses a three chip TLD badge. Chip 1 and 2 are routinely read by the licensee on a monthly basis. The read-out of these chips and analysis of the data provides skin and whole body dose estimates. The actual dose estimates involve the use of a complex algorithm based on read-out of both chips. The read-out data (nano or micro coulombes) is sent via telephone line to the licensee's vendor. The vendor analyzes the data and transmits back

to the licensee dose results. The badges third chip is used as a backup for chip 2 and when it is read out provides a verification of the whole body penetrating dose and skin dose. This third chip is not routinely read out.

5.3 Licensee Evaluation

5.3.1 General Evaluation of Licensee Methodology and Circumstances

The inspector reviewed the general overall methodology used by the licensee to determine the cause of the unexplained high reading of the TLDs for Individuals A and B discussed above. The evaluation of the licensee's performance was based on:

- review of exposure evaluation reports
- discussions with cognizant licensee personnel
- interviews of the two individuals
- review of radiation work permits worked by the two individuals
- review of plant radiation surveys
- performance of a general time and motion study for Individual A for the period December 2-14, 1984.
- performance of a general time and motion study for Individual B for the period December 2-22, 1984.
- review of licensee security access records for the two individuals
- examination of the licensee's dosimetry program including TLD quality assurance methods.

5.3.2 General Findings (Licensee Evaluations)

The inspector review indicated the licensee completed an evaluation of the cause of the high reading TLDs. The licensee's evaluations included:

- interviews with the subject individuals and their available co-workers
- review and discussion of the Radiation Work Permits worked by the individuals:

- testing of the TLD badges including:
 - beta/gamma testing
 - exposure to fluorescent lighting
 - exposure to micro-waves
- read-out of the third TLD chip by the vendor (Note: Read-out by the third chip of the two individuals substantiated exposure of chip 2)
- dosimetry control
- determination of "worst case" dose for all RWP areas entered for Individual B. The licensee's worst case estimate was 1.8 rem whole body for Individual B.

Based on the evaluations, the licensee concluded that the TLD badges worn by the two individuals was exposed by person(s) and/or means unknown during a time when the TLD was not on their person.

5.3.3 Preliminary Findings (NRC Evaluation)

Individual A

The inspector's evaluation of the circumstances and licensee evaluation of Individual A's high reading TLD results in the following preliminary conclusions:

- The TLD badge was worn by Individual A during the period December 2-14, 1984.
- Individual A lost his pocket dosimeter on December 14, 1984. A dose evaluation was initiated at the time of identification.
- During the period December 2-14, 1984, Individual A had not experienced any other lost dosimetry. The individual's TLD was worn on his person during the time period.
- During the period December 2-14, 1984, the individual had not worn any off-scale pocket dosimetry devices. The individual's whole body doses received were comparable to his co-workers for his radiation work permit work.
- The read out of Individual A's TLD indicated the TLD received an unexplained exposure of 1.8 rem sometime during the period December 2-14, 1984. Adding this exposure to the previous quarter results in the TLD sustaining an exposure of 2.15 rem (apparent whole body dose). No skin exposure or extremity exposure over and above that of the whole body was identified.
- Individual A did not work continuously with individual B.

- Individual A had dropped his pocket dosimeter on December 10, 1984 at the Drywell step-off pad. The individual had read the dosimeter prior to dropping it. The individual noted that his pocket dosimeter was off scale. A re-zero form was initiated. No unusual exposure was received.
- During the time period December 2-14, 1984, the individual, based on inspector review of security access documentation, had worked in the process buildings (e.g., Reactor Building) and other locations on site. The licensee was unable to inform the inspector as to what this individual was doing during all the periods he was not signed in on a radiation work permit or what maximum radiation fields the individual may have entered.
- The licensee was not able to clearly show that the individual had not received an unplanned exposure resulting from radiography source use. Such sources were used during the period in review.
- The licensee was unable to show that the pocket dosimetry device worn by the individual had not malfunctioned during the period in review and that the individual may have received the unexplained exposure.

Based on the above, the licensee's evaluation of the cause and/or possibility of the individual receiving the exposure is considered incomplete. The circumstances surrounding the high reading of Individual A's TLD is considered unresolved. The NRC will perform a special inspection to resolve this issue once the licensee has completed their review of their TLD QA program. (50-293/85-02-02)

Individual B

The inspector's evaluation of the circumstances and licensee evaluation of Individual B's high reading TLD results is the following preliminary conclusions:

- The TLD badge in question was worn during the period December 2-22, 1984.
- Individual B had not lost his pocket dosimeter or TLD during the period December 2-22, 1984. The individual's whole body doses received were comparable to his co-workers for his radiation work permit work.
- The individual's TLD was worn on his person during the time period.
- Individual B's TLD was read-out on December 22, 1984. The initial reported results were 2.29 rem whole body and 9.04 rem

skin (for the period December 2-22, 1984). Adding this exposure to the individual's previous exposure for the quarter results in the individual receiving a quarterly exposure of 2.68 rem whole body and 9.43 rem skin of whole body. (Note: The quarterly limits for whole body and skin are specified in 10 CFR 20 and are 3 rem and 7.5 rem, respectively.)

- The licensee's TLD vendor representative reevaluated the sensitivity of the TLD badge chips. The reevaluation of the read-outs on December 28, 1984, resulted in an additional 490 millirem being added to the whole body result and 1.14 rem being subtracted from the skin exposure indicated by the badge. The reevaluation resulted in a possible quarterly dose to individual B of 3.17 rem whole body and 8.29 rem to the skin.
- During the time period December 2-22, 1984, the individual, based on inspector review of security access documentation, had worked in the process buildings (e.g., Reactor Building) and other locations on site. The licensee was unable to inform the inspector as to what this individual was doing during all the periods he was not signed in on a radiation work permit or what maximum radiation fields the individual may have entered.
- The licensee was not able to clearly show that the individual had not received an unplanned exposure resulting from radiography source use. Such sources were used during the period in review and could have accounted for some portion of the whole body exposure.
- The licensee was unable to show that the pocket dosimeter worn by the individual had not malfunctioned during the period in review.
- The licensee was unable to explain the change in sensitivity of the TLD worn by Individual B and 1) why the sensitivity change was not detected by quality assurance, and 2) if other personnel TLDs were also sustaining changes in sensitivity. (Note: The licensee was investigating this matter. See Section 7.0 of this report.)

Based on the above, the licensee's evaluation of the cause and/or possibility of the individual receiving the exposure is considered incomplete. The circumstances surrounding the high reading of Individual B's TLD is considered unresolved. The NRC will perform a special inspection to resolve this issue once the licensee has completed their review of their TLD QA program. (50-293/85-02-03)

6.0 Additional High Reading TLD

While onsite, the licensee informed the inspector that a third individual (Individual C) was identified with a high reading TLD. Due to time

limitations, the inspector was unable to complete the review of this event. Inspector discussions with licensee representatives indicated the following:

- The licensee was in the process of reviewing the circumstances of the high reading.
- The TLD, when read out, indicated an exposure of 1.7 rem whole body.
- The third TLD chip (QA chip) did not indicate any significant exposure to the badge.
- Individual C had not routinely worked in any radiation areas.
- Adding the apparent dose of the TLD to Individual C's previous exposure does not result in an exposure to this individual in excess of regulatory limits.

The circumstances surrounding the exposure of Individual C's TLD is unresolved. The NRC will perform a special inspection to resolve this issue once the licensee has completed their review of the TLD QA program. (50-293/85-02-04).

7.0 TLD Quality Assurance Program

The inspector performed a limited review of the licensee's TLD Quality Assurance Program. The following was noted:

- As discussed in Section 5.3.3 of this report, the licensee was unable to explain the change in sensitivity of the TLD worn by Individual B. When the initial TLD results of Individual B's high reading TLD were reevaluated, it resulted in the addition of about 490 millirem to the individual's whole body dose and a reduction of 1.14 rem of the individual's skin exposure.

(Note: The licensee's current QA program consisted of routine processing of a 1 rem and 5 rem badge, processing of an identified vendor QA badge, and processing of a background badge. This was done with each batch of TLDs read out.)

- The licensee was using an unapproved procedure to perform quarterly sensitivity testing of personnel dosimetry.
- No apparent evaluation (e.g., QA audit) of the capabilities of the licensee's personnel dosimetry vendor to provide accurate read-out results was performed.

The licensee is currently reviewing the above matters. The inspector indicated that the Quality Assurance of personnel dosimetry devices is an unresolved item and will be reviewed by NRC during a special inspection once the licensee's review is complete. (50-293/85-02-05)

8.0 Enforcement Conference

8.1 Purpose

The Enforcement Conference was held at the request of NRC Region I to discuss the December 17, 1984, unauthorized entry of a contractor worker into the 'C' Monitor Tank and the apparent program deficiencies and/or violations associated with the unauthorized entry. The discussions at this conference focused on the identified violations and/or deficiencies; their significance, cause and licensee corrective actions thereof. The licensee also presented his findings relative to a number of high reading TLDs identified on December 14 and 22, 1984.

8.2 Discussions

NRC management discussed with licensee management the purpose of this Enforcement Conference and requested licensee management to provide their perceptions of the finding presented in Inspection Report 50-293/84-44.

8.3 Licensee Presentation

Licensee management presented their perceptions of the findings of Inspection Report 50-293/84-44 and discussed their actions taken to preclude recurrence of the problems identified. The licensee presented their action taken to: improve personnel adherence to procedures; upgrade supervisory oversight of contractor activities; and upgrade radiation protection oversight of on-going radiological work. In addition to other action taken, the licensee has upgraded training of contractor personnel performing current work in high radiation areas, has installed television cameras to monitor on-going high radiation area work, and has implemented a Radiation Work Permit on-going work audit program.

The licensee indicated that the recent contractor audit of the Radiological Controls Program identified a number of concerns and that these concerns would be addressed on a priority basis. The licensee indicated that their Radiological Improvement Program would provide long term corrective action of the identified concerns.

8.4 Concluding Statement

Licensee management indicated that they have implemented interim corrective actions for the identified concerns pending selection and implementation of long term corrective action to be described in the Radiological Improvement Program.

NRC Region I management acknowledged the licensee's plans and actions. NRC staff personnel indicated the licensee's interim actions appeared to adequately address the high radiation area work

control problems identified in Inspection Report 50-293/84-44. However, the licensee was requested to review supervisory oversight of contractor work on a generic basis in order to identify areas needing improvement. NRC staff personnel indicated additional NRC review of the high reading TLDs was needed and that this matter was still unresolved.

NRC Region I management stated that the licensee would be informed of the need for and nature of appropriate enforcement action relative to the identified problems at a later date.

9.0 Exit Interview

The inspector met with licensee personnel (denoted in Section 1) on January 18, 1985. The inspector summarized the purpose, scope and findings of the inspection. At no time during the inspection did the inspector provide written material to the licensee.