

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-293/84-44

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: December 18-19, 1984

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

1/10/85
date

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

1/16/85
date

Inspection Summary: Inspection on December 18-19, 1984 (Report No. 50-293/84-44)

Areas Inspected: Special announced inspection of the circumstances associated with and licensee actions taken following an unauthorized personnel entry into the 'c' Monitor Tank including: description of event; personnel exposure estimates; training; special considerations; and licensee actions. The inspection involved 13 inspector-hours onsite by one region-based inspector.

Results: Several problems involving implementation of radiological controls for desludging of the 'c' Monitor Tank were identified (Failure of individual to adhere to procedural requirements; failure to revise a radiation work permit in accordance with procedural requirements; failure to establish procedures for use of remote read-out dosimetry in accordance with Technical Specification requirements; and failure to collect air samples in accordance with radiation work permit requirements). A concern was also identified regarding safety of personnel who access the 'c' Monitor Tank.

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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

1.2 NRC

- * J. Johnson, Senior Resident Inspector
- M. McBride, Resident Inspector

- * denotes those individuals attending the exit meeting on December 19, 1984.

The inspector also contacted other licensee personnel.

2.0 Purpose of Inspection

The purpose of this special inspection was to review the circumstances associated with and licensee actions taken following an unauthorized entry of an individual into the 'c' Monitor Tank on December 17, 1984.

3.0 Description of Event

3.1 General

On December 17, 1984 at about 3:00 p.m., a contractor worker made an unauthorized entry into the 'c' Monitor Tank (-1' elevation of the Radwaste Building). The licensee became aware of the entry at about 6:00 p.m. on December 17, 1984. The licensee suspended all work in the area at that time and initiated an investigation. The NRC was notified of this matter on the morning of December 18, 1984. An NRC Senior Radiation Specialist was dispatched to the site on December 18, 1984.

3.2 Description

On December 17, 1984, at about 7:00 a.m., work involving use of a robot to hydro-blast the inside of 'c' Monitor Tank on the -1' elevation of Radwaste was initiated. The work involved placement of a water-powered robot into the tank via a man-way and activation of a high pressure pump connected to the robot by water lines. The pump produced high pressure water which passed to the robot via the water lines and emanated from jets on the robot. The water jets served to break-up and disperse clumps of sludge in the tank. In addition to the hydroblasting done by means of the robot, some manual hydroblasting was necessary. The entries to the tank area

were made under the control of Radiation Work Permit No. 84-3057, dated November 19, 1984. The RWP provided for work on top of the tank involving robot setup and manual hydroblasting. The RWP disallowed entries to be made inside the tank or to the floor level near the tank without health physics supervisory approval. The hydroblasting operation in the area was directed by a contractor decontamination supervisor (Individual E) who was in contact via head sets with personnel. Radiation protection technicians monitored the accumulated exposure of the personnel performing the hydroblasting by use of a tele-dosimetry system. When a particular individual's exposure reached a pre-determined value, (determined for each entry) the individual was directed via a page system or via his head-set to leave the area and report to the area control point. (Note: The RWP specified that periodic checks were to be made every one-half hour. Inspector review of procedures and discussions with technicians indicated this was to be an entry by a technician with a survey meter into the area for purposes of high radiation area surveillance. However, on or about December 14, 1984, the RWP was verbally changed to not require routine entries but rather periodic check of the tele-dosimetry system. No RWP change to this effect was made.)

Figure 1 (attached) depicts the general work area.

The first entry into the area on December 17, 1984 involved a contractor decontamination technician (Individual A) and a radiation protection technician (Individual B). Individual A remained in the area from 0930 to 1130. Individual B remained in the area from 0930 to 1000. (Note: This was the last routine entry by a radiation protection technician that day.) Individual B performed radiation surveys in the area and set up an air sampler. A second contractor decontamination technician (Individual C) made an entry to the area from 1010 to about 1300. This individual monitored operation of the robot. A third contractor decontamination technician (Individual D) entered the area from 1115 to about 1315. This individual (Individual D) removed the air sampler and brought it out of the area. None of the aforementioned individuals entered the tank. Because Individual D determined that the robot was "jamming" and was ineffective in the thick sludge of the tank, it was decided to use a manual hydroblaster gun (with extensions) to blast the sludge in the tank instead of using the robot.

At about 1400, the contractor decontamination supervisor (Individual E) requested a fourth contractor decontamination technician (Individual F) to prepare to enter the area to perform manual hydro-blasting. The individual wore standard whole body dosimetry which consisted of a self-reading dosimeter, a TLD Badge, and a tele-dosimetry device all worn on the chest area. No extremity dosimetry was required by the RWP. The individual wore respiratory protection equipment (full face filter respirator) in accordance with the RWP requirements. The individual was not supplied an air sampler.

The individual (Individual F) entered the area at about 1430, assembled the hand held manual hydro-blaster, inserted the blaster with about 15' of extension into the man-way and commenced blasting. After a short period

of time, Individual F determined that he could not reach a large "clump" of sludge on the opposite side of the tank floor and stopped blasting. This was attributed to the lack of sufficient extension to reach the other side of the tank. At this point, he told Individual E via the head set that he was going to try something and to turn off the pressure to the blaster. The individual (Individual F) then put aside the head set and removed his tele-dosimetry system and placed it in a relatively low radiation field (about 100-200 mR/hr). Individual F then climbed into the tank using the permanent ladder in the tank to see if it was possible to blast the sludge from the area of the ladder. The individual descended about 8 feet into the tank. At this point, the individual realized that he could not blast the sludge from the ladder due to short extensions on the blaster but would need to enter to the floor of the tank. The individual exited the tank, put the head set back on, and notified Individual E to provide pressure to the blaster. The individual did not notify anyone that he entered the tank or was going to enter the tank again, nor did he put on his tele-dosimetry device. The individual (Individual F) then removed this head set, set it aside, entered into the tank, descended to the floor and blasted sludge for about 5 minutes. The individual (Individual F) then exited the tank and commenced wrapping up the hoses for the equipment. At this point (about 1500) Individual E started paging Individual F to exit the area. Individual F put on his tele-dosimetry device, climbed down the outside ladder of the tank to the floor level and slipped and tore his protective clothing. The individual (Individual F) then climbed over the wall at the tank and removed his outer layer of protective clothing at the step-off pad near the wall. He proceeded to the final step-off pad and removed his final layer of protective clothing. At this point (about 1520) radiation protection personnel at the step-off pad found that the tele-dosimetry device was missing from Individual F and that his pocket self-reading dosimetry was off-scale. Individual E was sent into the area to retrieve the tele-dosimetry device. The device was found near the inner step-off pad. The device indicated 213 millirem. Individual F did not inform the radiation protection personnel at that time that he had entered the tank. The dosimetry personnel, believing the dosimeter was off scale due to the fall, credited to Individual F 213 millirem. A Radiological Occurrence Report (No. 84-12-17-1396) was filed to this effect because of the off-scale dosimeter.

After leaving the step-off pad area, the individual (Individual F) performed a personal frisk. He found himself to be contaminated at low levels. Radiation protection personnel subsequently decontaminated Individual F with one soap and water shower.

The individual (Individual F) then left the area and went to the location of the hydro-blaster pump. He encountered another radiation protection technician (Individual G). Individual F informed this technician at about 1600 that he had entered the tank. This technician subsequently notified another technician who informed licensee radiation protection supervisory personnel. An investigation was initiated at about 1800 on December 17, 1984. All work was stopped in the area at that time.

4.0 Exposure Evaluation

4.1 External

The inspector reviewed the licensee's external dose estimate for the contractor decontamination technician (Individual F) who made the unauthorized entry into the 'c' monitor tank. The inspector's evaluation of the licensee's performance was based on:

- independent radiation surveys performed in the area by the inspector
- review of documentation and
- discussions with personnel

General Methodology (Preliminary Dose Estimate)

Because the individual only wore a single whole body badge during the entry, the licensee was unable to adequately quantify the dose to the extremities (i.e. hands and feet) or the other portions of the whole body (i.e. knees and above) using the single badge data. As a result, the licensee constructed a "TLD tree" with knee and waist height measurements equal to those of the individual. TLDs were placed inside the same types of feet protective clothing (i.e. rubber boots) worn during the entry. This TLD tree was then inserted into the tank on December 18, 1984, in the location where the individual worked. No changes in the radiological conditions in the tank were noted between entry of the individual and TLD tree insertion. Utilizing ratios from the read out data, the licensee estimated the highest whole body dose sustained during the entry was about 790 millirem to the knees. Using a similar ratio technique, the licensee estimated the maximum dose to the extremities was about 1.5 rem to the feet during the entry. Because of the use of protective clothing, no skin dose, over and above the whole body and extremity doses, was sustained. Although the individual was slightly contaminated, this did not cause any significant skin dose.

The inspector considered the licensee's general methodology for determining the dose to the whole body and extremities acceptable.

Using the estimated doses derived above, the licensee estimated the following doses for the fourth quarter of 1984:

<u>Dose Value</u>	<u>% of 10 CFR 20 Limit</u>
• Whole body - 1.8 rem	60
• skin - (same as whole body)	24
• extremities - 3.3 (includes 1.8 rem whole body)	17

Based on the above preliminary data, no external exposure in excess of regulatory limits occurred to the individual who made the unauthorized entry into the 'c' Monitor Tank.

4.2 Internal Exposure

The inspector reviewed the licensee's radioactive material intake estimate for the contractor decontamination technician (Individual F) who made the unauthorized entry into the 'c' Monitor Tank. The licensee's performance in the area was based on:

- review of air sample data
- review of whole body count data and
- discussions with personnel.

The review indicated the individual sustained no significant intake of radioactive material. Whole body count data identified the presence of cobalt-60. Utilizing methodology referenced in Regulatory Guide 8.9, 1973, "Acceptable Concepts, Models, Equations, and Assumptions for A Bioassay Program," the activity present would represent < 1% of the quarterly quantity intake limit specified in 10 CFR 20.

Based on the above, no internal exposure in excess of regulatory limits occurred to the individual who made the unauthorized entry into 'c' Monitor Tank.

5.0 Training of Individual Who Made Unauthorized Entry Into The 'C' Monitor Tank

The inspector reviewed the licensee training provided to the contractor decontamination technician (Individual F) who made the unauthorized entry into the 'c' Monitor Tank. The evaluation of the licensee's performance in this area was based on:

- review of training records
- interviews of the subject technician and other decontamination technicians
- discussions with other personnel.

Inspector review found that the individual had arrived on site toward the end of November 1984. At that time, the individual received training to satisfy requirements of 10 CFR 19.12, "Instructions to Workers". The individual performed satisfactorily on an examination to demonstrate his knowledge of the material covered. With respect to hydro-blasting, inspector review found that individuals performing this work, including the subject individual, had been provided training prior to hydro-blasting on a procedure for this purpose (Procedure No. TP 84-262, "Desludging Monitor Tanks A, B, and C", dated October 31, 1984). This procedure contained specific precautionary statements not to enter the tank without special instructions from health physics and ALARA (Steps V.E., VI.P). Inspector discussion with the individual and other technicians indicated they were

aware of the procedure statements. Also, the individual had been briefed and was aware of the Radiation Work Permit (RWP) requirement not to enter any tank without health physics supervisor approval (RWP No. 84-3057, De-sludge Monitor Tanks, A, B, C and Support Required, dated November 19, 1984).

The inspector concluded that the individual had been provided sufficient training as to the requirement not to enter any tank without specific approval prior to his performance of hydro-blasting. Regarding the individuals instruction in radiological conditions in his work area (top of 'c' Monitor Tank) inspector review found that adequate surveys had been performed by the licensee and that the individual was aware of the radiological conditions in his work area.

Regarding radiological conditions inside the tank, inspector review found that no radiological surveys were performed by the licensee inside the tank nor were they needed at the current stage of work. The inspector concluded the individual was aware of the radiological hazard inside the tank prior to his entry into the tank, although he did not know what the magnitude of the hazard was. Since it was not planned for him to enter the tank, radiological survey instrumentation was not provided to him for radiological conditions in the tank.

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

- No records had been generated regarding special training provided to personnel performing hydro-blasting. The licensee should consider generation of such training records to demonstrate training was provided.

Licensee representatives acknowledged the above and indicated this matter will be reviewed and appropriate action taken.

6.0 Special Considerations

6.1 General

The inspector reviewed several special considerations associated with this inspection. These are discussed below.

6.2 Coercion By Supervisory Personnel

The inspector interviewed numerous personnel including decontamination technicians and supervisors, and other personnel to determine if the individual who entered the 'c' Monitor Tank had been coerced into the entry.

The inspector was unable to identify any indication that this individual or other individuals were coerced into making unauthorized entries. Inspector review did not identify any other unauthorized entries by personnel during this review.

6.3 Misuse of Dosimetry Devices

The inspector interviewed numerous personnel to determine if personnel associated with this decontamination contractor were taking measures to misuse their dosimetry devices to underestimate their radiation exposure.

Inspector review did not identify any indication of misuse of dosimetry devices. At the time of this inspection, no unusual exposures were sustained by personnel of this contractor, no other off-scale dosimetry was observed, and no personnel monitoring devices were lost by the contractor personnel. The inspector noted that during the unauthorized entry, the individual had removed his tele-dosimetry device but not his assigned whole body monitoring device.

6.4 Training of Radiation Protection Technicians Monitoring Entry of Individual

The inspector reviewed the training and qualification of the radiation protection technicians monitoring entry of the contractor decontamination technician into the 'c' Monitor Tank area.

Inspector discussions with licensee representatives and discussions with the technicians indicated the individuals were qualified in accordance with Technical Specification 6.3, Qualifications. At the time of the inspection, records were not readily available to demonstrate this training and qualification. These records will be reviewed during a subsequent inspection (50-293/84-44-01).

6.5 Personnel Safety

The inspector and the NRC Senior Resident Inspector entered on-to and visually observed the man-way of the 'c' Monitor Tank through which an individual made an unauthorized entry.

The inspector review found the means of entry to the area, as routinely used by personnel, to be an undesirable route. The inspector noted that personnel (fully suited in several layers of protective clothing and respiratory protective equipment) were required to: climb about a 15 foot high wall, walk about 15 to 20 feet along a narrow walkway on top of the wall, drop down onto various valves and piping and walk on the narrow piping, and reach out over a 15 foot drop and grab a ladder on the side of the tank to ascend to the man-way. The inspector noted the piping appeared to exhibit an oily-residue making it slippery to walk on with rubber boots. Inspector discussions with licensee personnel indicated this route was selected in order to minimize personnel exposure.

The inspector discussed the above with station management at the exit meeting and expressed concern regarding the means of access to the man-way.

Licensee representatives stated that this matter would be reviewed and appropriate action taken.

7.0 Licensee Actions Following Entry

The inspector reviewed the licensee's actions following the entry. Because the licensee had not completed his investigation of the incident, the licensee was unable to indicate all actions to be taken. The following actions were noted:

- Upon notification, the licensee immediately suspended the hydroblasting and de-activated the applicable radiation work permit
- The licensee initiated an investigation of the event appropriately one hour after becoming aware of it
- The licensee read the individual's TLD and prohibited him from further exposure
- The licensee made radiation surveys inside the tank and a performed preliminary dose evaluation within one day of the event
- The licensee issued a Radiological Occurrence Report and a Failure and Malfunction Report in accordance with station procedures
- The licensee notified the NRC of the event.

The licensee has yet to select his final actions to be taken.

Based on the above, the inspector considers the licensee's initial actions timely and appropriate.

8.0 Conclusions

Evaluation of the information acquired during this inspection results in the following preliminary conclusions:

- On December 17, 1984 at about 3:00 p.m., a contractor decontamination technician, performing sludge lancing of the 'c' Monitor Tank, made an unauthorized entry into the Tank. Prior to the entry, the individual removed his tele-dosimetry device. The licensee's Technical Specification 6.11 and procedure 6.1-022 specify that radiation work permits be adhered to. The radiation work permit for the lancing (RWⁿ No. 84-3057) specified that a radiation protection supervisor's approval is needed to enter the tank and that a tele-dosimetry device is to be worn. The individual's unauthorized entry into the tank, resulted in the individual subjecting himself to a substantial potential for personnel exposure in excess of the limits specified in 10 CFR 20.101, "Radiation Dose Standards for Individuals in Restricted Areas." In addition, the individual's removal of the tele-dosimetry device prior to the entry precluded timely licensee identification of the entry. (50-293/84-44-02)

- On or about December 14, 1984, a verbal change was made to the RWP which provided radiological controls for sludge lancing 'c' Monitor Tank. Although, the verbal change deleted the requirements to perform periodic high radiation area surveillance required by Procedure No. 6.1-022, no revision was made to the RWP to specify alternate surveillance or instructions for its implementation. The lack of generation of an RWP revision sheet resulted in the use of an RWP with unclear high radiation area surveillance requirements for a period of at least three days. (50-293/84-44-03)
- The licensee used a tele-dosimetry system to monitor workers accumulated exposure in the 'c' Monitor Tank Area instead of making periodic checks as specified on the RWP. Although the dosimeters did not alarm on the individual, the accumulated exposure was monitored by radiation protection personnel and the individual was notified via a paging system or a head-set to leave the 'c' Monitor Tank Area. This technique appears to meet the intent of licensee Technical Specification 6.13. However, no procedures were established to provide guidance for use of the tele-dosimetry system to satisfy Technical Specification High Radiation Control requirements as specified in Technical Specification 6.8. (50-293/84-44-04). For example, no instructions were provided regarding removal or loss of the device while in an area, selection of permissible accumulated exposure when using the device, or periodic verification of proper operation of the device while being used in a high radiation area.
- On December 17, 1984, at about 2:00 p.m., a contractor decontamination technician was authorized by radiation protection personnel to perform sludge lancing of the 'c' Monitor Tank but was not provided a breathing zone air sampler as required by the radiation work permit (RWP No. 84-3057). (50-293/84-44-05)

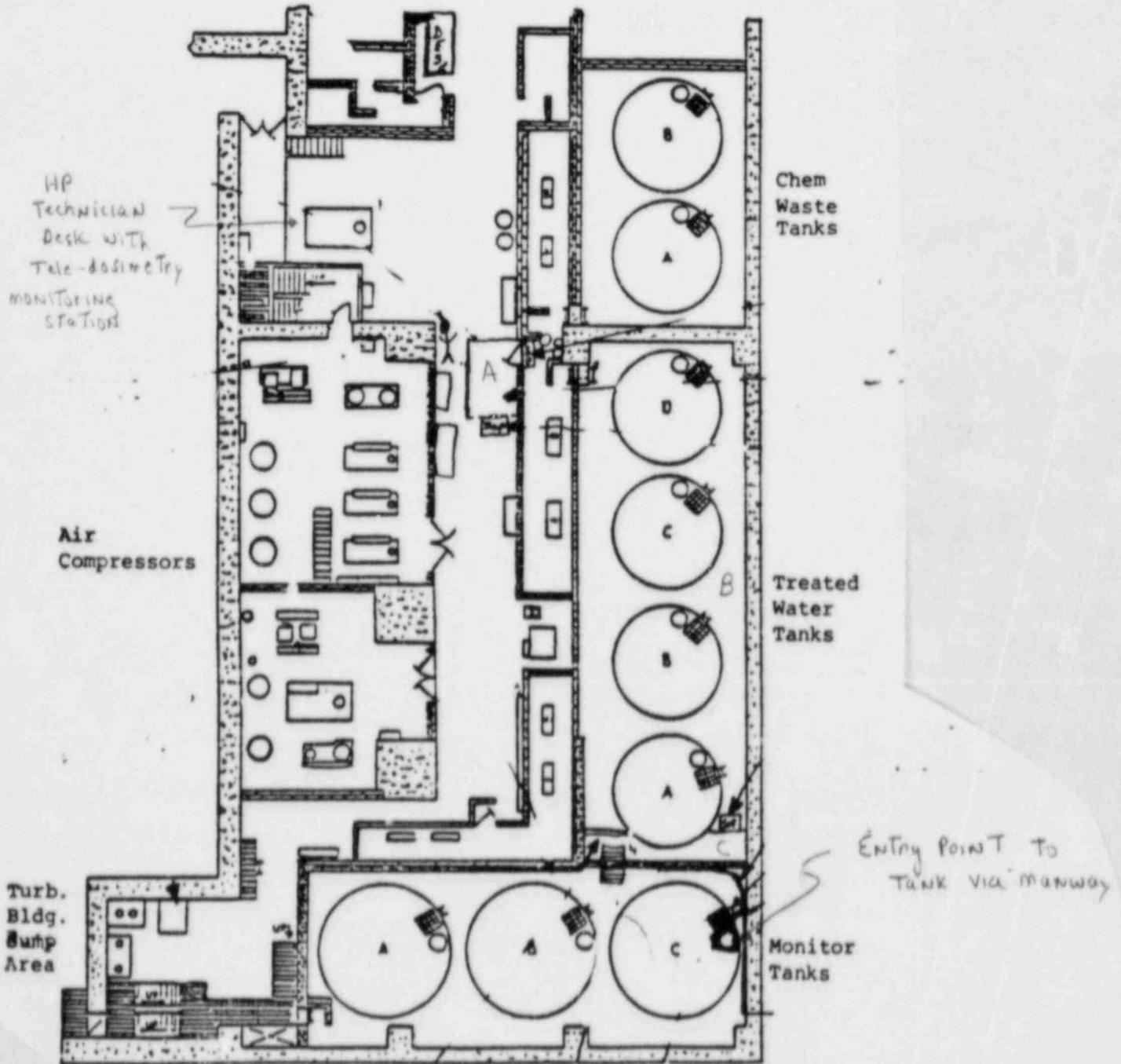
9.0 Exit Meeting

The inspector met with licensee representatives (denoted in section 1 of this report) on December 19, 1984. 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.

Figure 1

PILGRIM NUCLEAR POWER STATION

RADWASTE -1' SOUTH END *



- A ≡ Access Point To Area (outer stop-off pad)
- B ≡ Walkway used To Access Monitor Tank Area
- C ≡ Inner stop-off pad where Tele-dosimetry device WAS FOUND

* From Survey
MAP 302