

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-293/85-29

Docket No. 50-293

License No. DPR-35

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

Facility Name: Pilgrim Nuclear Power Station

Inspection At: Plymouth, Massachusetts

Inspection Conducted: September 28, 1985 - October 2, 1985

Inspectors: L. Briggs 10/16/85
L. Briggs, Lead Reactor Engineer date
G. Smith 10-17-85
G. Smith, Safeguards Specialist date
Jon R. Johnson 10/16/85
J. Johnson, Chief, Operational Programs date
Section, OB, DRS
Approved by: L. Bettenhausen 10/17/85
L. Bettenhausen, Chief, Operations Branch, date
DRS

Inspection Summary: Inspection on September 28, 1985 - October 2, 1985
(Report No. 50-293/85-29)

Areas Inspected: Special reactive inspection of licensee activities related to the movement of spent fuel within the spent fuel pool and the condition of refueling equipment. The inspection involved 114 hours on site by two region-based inspectors and one supervisor.

Results: No violations were identified.

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DETAILS

1.0 Key Persons Contacted

- *B. Eldredge, Chief Radiological Engineer
- *F. Famulari, Quality Control Group Leader
- J. Kehoe, Corporate Security Officer
- *P. Mastrangelo, Chief Operating Engineer
- *,**C. Mathis, Nuclear Operations Manager
- R. Mattos, Station Services Engineer
- T. Nicholson, Security Supervisor
- *,**A. Oxsen, Vice President - Nuclear Operation
- *,**E. Ziemianski, Nuclear Operations Support Manager

The inspector also interviewed other members of the licensee and contractor staff involved with operations, maintenance, security and fire protection.

*,** Denotes personnel present at exit meetings on October 1, 1985 and October 2, 1985 respectively.

2.0 Background and Scope

2.1 Background

At about 9:00 a.m. on September 27, 1985, licensee personnel were securing equipment on the refueling floor (117 foot elevation reactor building) in preparation for the impending passage of hurricane Gloria and noticed that the main mast on the refueling bridge (over the spent fuel pool) was fully extended and bent. The mast grapple was attached to a spent fuel assembly handle.

Authorized fuel handling activities were last conducted on the afternoon of September 26, 1985 and the equipment was reportedly secured at about 2:50 p.m. with the mast in the full-up position.

The licensee's operations and security management initiated actions to verify plant safety and to investigate the circumstances surrounding the possible unauthorized operation of refueling equipment. The licensee notified the NRC of these activities at about 12:46 p.m., on September 27, 1985.

2.2 Scope

The purpose of this special NRC inspection was to provide an onsite independent safety assessment of the facility status and to evaluate the need for any further actions.

In addition to evaluating the licensee's internal investigation, the inspectors made independent observations of plant equipment and held discussions and interviews with licensee and contractor personnel.

These actions included a review of the licensee's immediate actions following discovery of the bent refueling mast as well as the licensee's planned followup actions.

3.0 Review of Licensee Actions in Response to Fuel Handling Events of September 26 - 27, 1985

3.1 Licensee Immediate Action

As described in Section 2.1 above, upon discovery of the damaged mast at about 9:00 a.m. on September 27, 1985, corrective actions were immediately initiated by the licensee. These actions included 1) unlatching the grapple and returning the refueling bridge to the edge of the spent fuel pool (in preparation for hurricane Gloria), 2) performing an inventory of spent fuel bundles in the spent fuel pool 3) locking the gates to the refueling floor, and 4) implementing special access restrictions (two man rule) to certain plant process buildings and rooms.

The licensee also initiated an investigation into the cause of the damaged mast and assigned corporate security personnel to perform independent interviews.

Operations personnel performed operability tests of the Reactor Core Isolation Cooling and High Pressure Coolant Injection systems. In addition to demonstrating the operability of the two Emergency Diesel Generators, the licensee also performed inspections of electrical distribution equipment.

3.2 Discussions and Interviews with Personnel

The inspectors interviewed the four Boston Edison Company (BECo) personnel that performed the fuel movement operations on the 7 a.m. - 3 p.m. shift on September 26, 1985 and the two maintenance and two health physics contractor personnel that performed maintenance operations on the refuel floor on the 3 p.m. - 11 p.m. shift on September 26, 1985. The two maintenance personnel on the 3 p.m. - 11 p.m. shift were working on equipment in the spent fuel pool and they stated that at approximately 4:15 p.m. they noticed that the mast on the crane was fully extended and bent. They did not notify anyone of the condition of the mast because they assumed it had been left that way during the fuel move on the previous shift. The two health physics personnel on the 3 p.m. - 11 p.m. shift were providing technician coverage at a radiation control point approximately thirty feet from the fuel pool and did not notice the condition of the mast. It was also noted during the interviews with the contractor personnel that only the health physics personnel were authorized the key to the refuel floor and that maintenance personnel had to be accompanied while in the area by health physics personnel.

During interviews, the BECo operations personnel described the fuel movement process and the manner in which the crane is to be secured. The BECo personnel stated that they had ungrappled the last fuel bundle, withdrawn the mast, and centered the trolley on the bridge at the end of the shift. However, after observing a re-enactment on October 2, 1985, (centering the trolley on the bridge with the grapple still engaged to a blade guide to simulate a fuel bundle) they noted that the trolley and mast were in approximately the same condition as they would have been if the last bundle moved was not ungrappled prior to the trolley being centered on the bridge. At that time, they conceded that it was possible that the damage to the mast was caused by failure to ungrapple the last fuel bundle moved.

The results of the interviews support the licensee's conclusion that the damage to the spent fuel pool main mast was most probably a result of operator error.

3.3 Access Control for Security and Radiation Protection

3.3.1 Special Access Control - Two Man Rule

During the investigation of the incident involving the refuel bridge the licensee implemented a requirement that there be at least two persons present and that they remain in visual contact at all times during access to the reactor building, cable spreading room, salt service water bays, the diesel generator rooms, and the 4160v switch gear rooms. The two-man rule applied to all personnel onsite with the exception of selected management personnel and NRC personnel. In addition to the two-man rule the licensee also posted security personnel at the entrances of the areas covered by the two-man rule to log personnel into and out of the areas. The inspectors toured the areas and verified that the logging of personnel into and out of the areas was in compliance with the two-man rule as specified by Temporary Procedure No. 85-94, Special Access Restriction, dated September 29, 1985.

3.3.2 Radiation Area Key Audit

The inspector performed an audit of radiological protection keys designated as "R" keys that are controlled by the Health Physics Supervisor and the Operations Supervisor. The "R" key was the only key required for access to the refueling floor prior to the event. The inspector found that all "R" keys in the two areas inspected were accounted for at least once per shift and that no "R" keys were missing.

No violations were identified.

3.4 Fuel Handling Bridge and Fuel Movement Records

Subsequent to the initial briefing by the licensee on September 28, 1985, the inspector toured the refueling floor and the fuel handling platform (FHP) to observe the reported damage to the FHP mast. The FHP is a typical arrangement for a boiling water reactor consisting, basically, of 1) a bridge that traverses in an East-West direction (see Attachment B) over the spent fuel pool and the reactor vessel, 2) a trolley (operator platform) attached to the bridge that moves North and South, 3) a control panel attached to the upper section of the mast that can be rotated along with the mast and, 4) the mast which consists of telescoping (up and down) triangular sections that are raised and lowered via a motor driven cable arrangement. During normal operations the bridge and trolley are moved to position the mast over a selected fuel bundle. The mast is then lowered onto the bail handle of the fuel bundle and the grapple fingers on the lower section of the mast are closed under the bail handle. The fuel bundle is then raised vertically until it is clear of the core or spent fuel storage racks and then it can be moved underwater to its new location.

The inspectors observed that the mast had been turned 45 degrees clockwise (facing West) to grapple a bail handle with its axis in a Northeast Southwest orientation; and the trolley had been moved North about 4 to 5 feet (reported by the licensee) resulting in a permanent deformation of the mast of about one foot.

As reported by the licensee, the FHP was located at approximately the X-30 location (see Attachment B) on Friday, September 27, 1985. This appeared to be the same location that it was left on September 26 at 2:50 p.m. when authorized fuel movement was terminated for the day. The mast was down and grappled to the bail handle of a fuel bundle located approximately 4 to 5 feet to the left of the trolley location. The Senior Reactor Operator (SRO) moved the trolley over the fuel bundle, upgrappled and raised the mast as much as the bend would allow and then moved the bridge and trolley to about location A-30 (see Attachment B) in preparation for the approaching hurricane Gloria. The SRO did not note which fuel bundle the grapple had been attached to.

The inspector made several inspections of the FHP area which included a walk through of the FHP operation and a check of the Operational Review Committee (ORC) switch (discussed below) circuit operation. The inspector also performed a visual inspection of fuel bundles in the suspected locations in the X row (bundles X-22 through X-25) that had the correct bail handle orientation. Binoculars and a water box were used to limit distortion. Other locations were also checked to observe grapple marks on the bail handles. Grapple marks were apparent on several bundles; however, bundle X-22 had the most prominent grapple marks which were easily discernable from the trolley without the aid of binoculars.

The inspector also reviewed several documents relating to the FHP mechanical and electrical tests performed prior to the latest authorized fuel moves. All records indicated that the FHP was in satisfactory condition to handle fuel in the spent fuel pool. Documents reviewed are listed in Attachment C.

As a result of an incident in 1980 the licensee installed an additional interlock (switch) on the FHP. The switch is called the Operational Review Committee (ORC) switch and can be locked in a defeat position to prevent fuel movement. Since the ORC switch was not locked on September 26, 1985 when fuel movement was secured (not procedurally required or addressed), and its final position was in question, the inspector reviewed the wiring schematic to determine its function.

The intent of the ORC switch is to prevent FHP mast movement (UP) if the mast is loaded to 480 pounds with the ORC switch in the defeat (open) position. The switch is connected in the Normal Mast Up Control Circuit and will give a Normal Up indication if the mast is loaded while the ORC switch in the defeat position and will also prevent upward movement of the mast. The Hoist Loaded light would also energize in that condition.

The inspector requested the licensee to verify proper functioning of the bridge and mast control circuit. During the test the inspector noted that although the circuit gave the proper indication per the schematic, movement of the control panel would cause both lights to go out indicating an electrical problem. The nature and time of occurrence of the electrical fault is unknown and may be the result of the bent mast since previous FHP checks indicated satisfactory performance.

The licensee committed to procedurally address the ORC switch although the type of damage sustained during this event would not have been prevented since trolley and bridge movement are not affected by the ORC switch. However, if the ORC switch had been locked in the defeat position there would be assurance that no fuel had been moved eliminating the need to verify that all fuel assemblies are in their proper location. Video taping of fuel bundle locations is planned by the licensee to further verify proper location of fuel bundles within the spent fuel pool.

3.5 Plant Tours and Condition of Safety Systems

The inspectors conducted tours of the facility to observe both security access controls and the condition of safety systems. Tours of the reactor building, turbine building, intake structure (including salt service water pump rooms), the 'A' 4160v switchgear room, the 'A' battery room, the main control room, the 'A' and 'B' emergency diesel generator rooms, and the protected area (station yard) were conducted.

The inspectors held discussions with licensee management regarding housekeeping conditions in the diesel generator rooms, the status of testing additional safety related equipment, and method of implementing special access restrictions.

Subsequently, the licensee took action to resolve the concerns in these three areas by cleaning the diesel rooms, performing operability tests of the core spray, residual heat removal, and containment cooling systems, and issuing a station procedure regarding the special access controls.

The inspector had no further questions.

4.0 Quality Assurance (QA) and Quality Control (QC) Involvement

The inspector questioned the licensee concerning QA/QC involvement in the recent activities occurring on the refueling floor, and in particular, fuel movement in the spent fuel pool. The licensee informed the inspector that very limited activity affecting safety had taken place on the refueling floor. A review of QA Department Procedure No. 18.04, Conduct of Reporting of Nuclear Operations Surveillance Monitoring Activities, indicated that surveillance of spent fuel movement in the spent fuel pool was not required. No QC inspection or surveillance was in progress during the refueling bridge operations on September 26-27, 1985. The licensee did note that a recent QC Surveillance of the Spent Fuel Rack Lifting Rig (Report No. I-85-49-3A) had been conducted on September 24, 1985. No abnormal activities relating to fuel movement had been observed by the QC inspector at that time.

5.0 Independent Verification

The inspector performed independent verification of plant conditions and the licensee's actions. Areas and actions verified included the following:

- temporary special access restrictions to vital areas (two man rule),
- additional chain and padlock control for the three entrances to the refueling floor,
- observation of the spent fuel pool and the condition of the refueling bridge equipment,
- discussions and interviews with licensee and contractor personnel in the vicinity of the refueling floor on September 26-27, 1985, and
- the condition of safety equipment including system testing and electrical panel walk-downs.

No violations were identified.

6.0 Findings and Conclusions

The inspector determined that there was no apparent damage to any safety equipment. In addition, there was no evidence of other abnormal equipment condition (other than the bent refueling mast) or evidence of unauthorized activities or disturbances.

The inspectors confirmed the operability of safety systems through discussions with operators, a review of system surveillance test and verification data, and direct observation of a sampling of system valve and switch positions and electrical distribution equipment.

The inspectors confirmed that there was no unusual or unauthorized release of, or damage to, radioactive material; nor was there evidence of any unusual radiation levels, instrumentation indications, or other adverse radiological consequences.

The last known movement of spent fuel 1) had been properly authorized by plant management, 2) was being documented via the proper fuel movement procedure (No. 4.3, OPER 25) and associated material balance accounting form (R.E.1), and 3) was being supervised by a licensee representative with an SRO license.

Although no specific violations of the fuel movement procedure were identified, the inspector noted that the procedure had no provisions for administrative control of a key lock switch (the "ORC" switch) for the main mast normal up relay, or specifying the status of refueling bridge equipment when no longer in use at the end of the day.

The licensee made a commitment to revise the fuel handling procedure (OPER 25) to include instructions for administrative control of the ORC switch and for securing the refueling equipment when not in use. The licensee stated that these revisions would be made prior to the next movement of fuel.

The licensee also stated that additional procedures were expected to be revised following the (unrelated and unplanned) replacement of the refueling bridge in February, 1986.

No violations of radiological area access control or key control procedures were identified. However, the inspector noted that the licensee has had a history of problems with the control of radiation area keys.

This area had been under review by the Radiological Oversight Committee but no major changes had resulted prior to this inspection. At the exit meeting the licensee committed to initiate plans to install a closed circuit television camera to monitor conditions on the refueling floor. The inspector verified that (in the interim) the licensee had installed additional chain and padlock controls for the three accesses to the refueling floor. The licensee also initiated additional improvements for

control of radiation area keys in general including moving the key cabinet, using large plastic attachments to keep from losing the keys, and minimizing the number of keys.

The licensee's investigation results had not been formally documented by the end of the inspection. However, the licensee's preliminary results indicated that the most probable cause of the bent mast was due to operator error. The licensee further stated that the training and qualifications of the personnel involved would be reviewed in addition to the procedural changes described above.

No violations were identified.

7.0 Exit Meeting

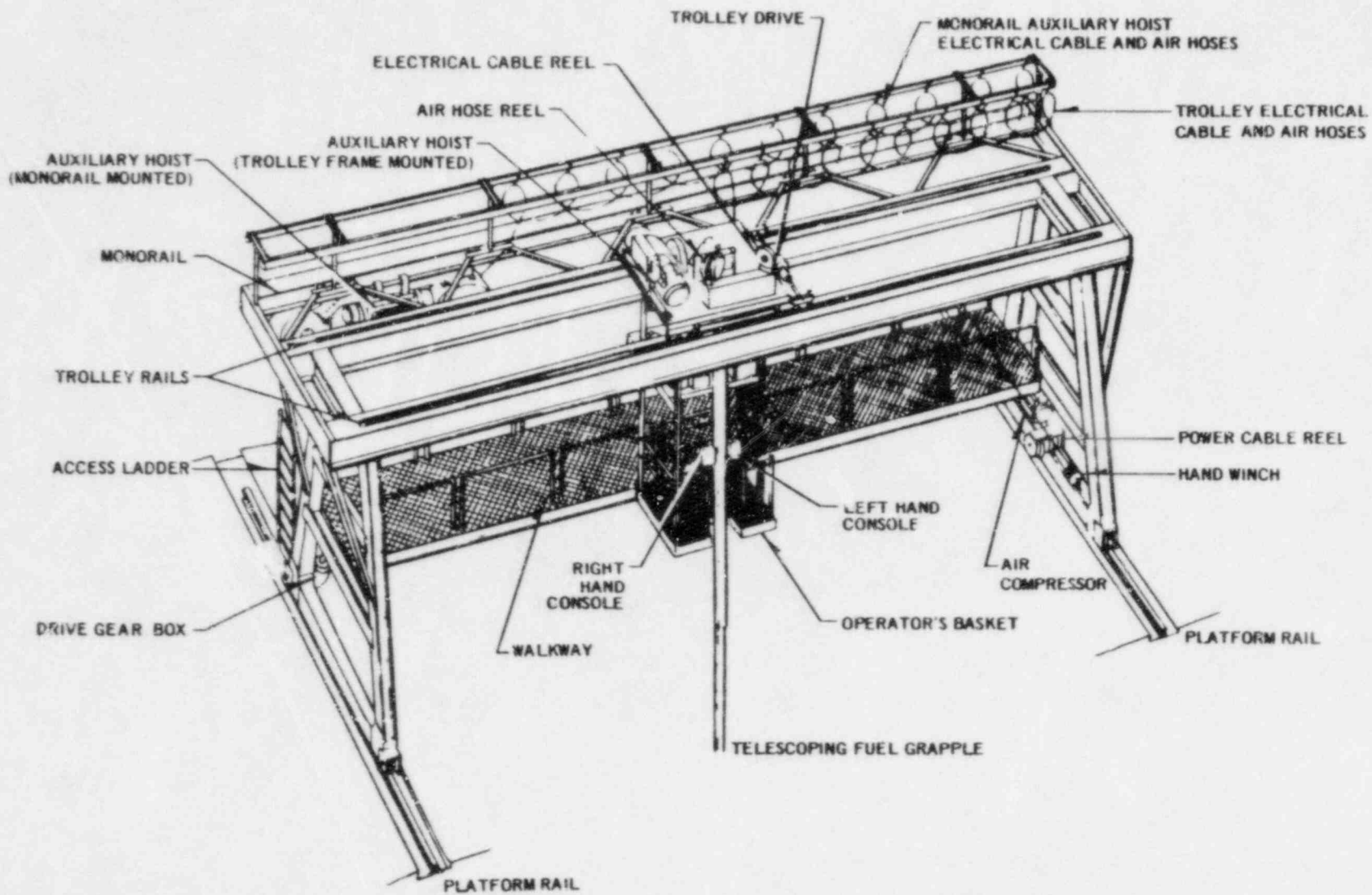
Meetings were held on October 1, 1985 and October 2, 1985 with licensee management personnel (denoted in Section 1) to summarize the purpose, scope, and inspection findings. At no time during the inspection was written material provided to the licensee by the inspector.

ATTACHMENTS TO INSPECTION REPORT NO. 50-293/85-29

ATTACHMENT A - Pictures and Drawing of Refueling Equipment and Area Gate

ATTACHMENT B - Spent Fuel Pool Location Grid Diagram

ATTACHMENT C - List of Documents and Tests Reviewed



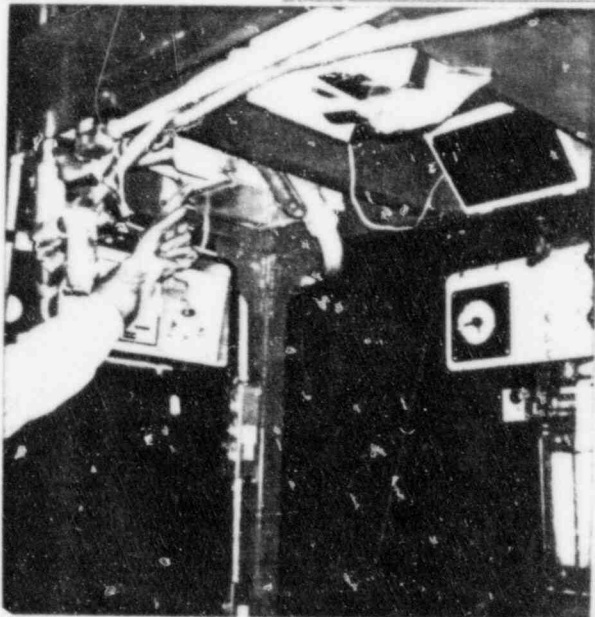
ATTACHMENT A (50-203/85-29)

Refueling Platform with Fuel Grapple Installed

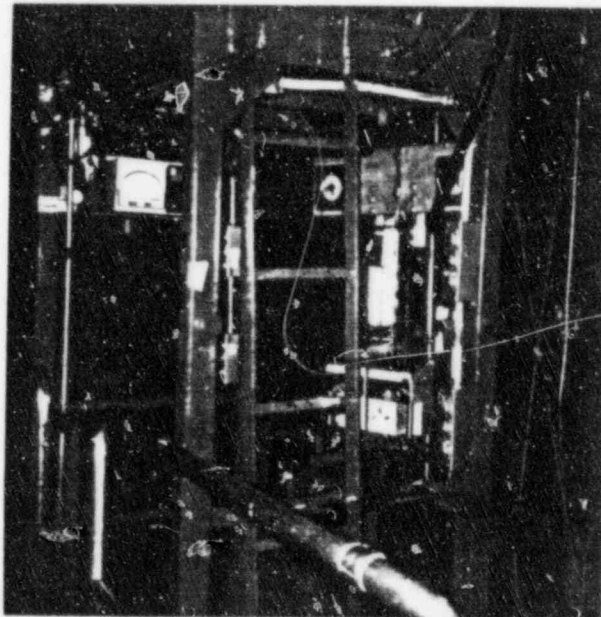
ATTACHMENT A

(50-293/85-29)

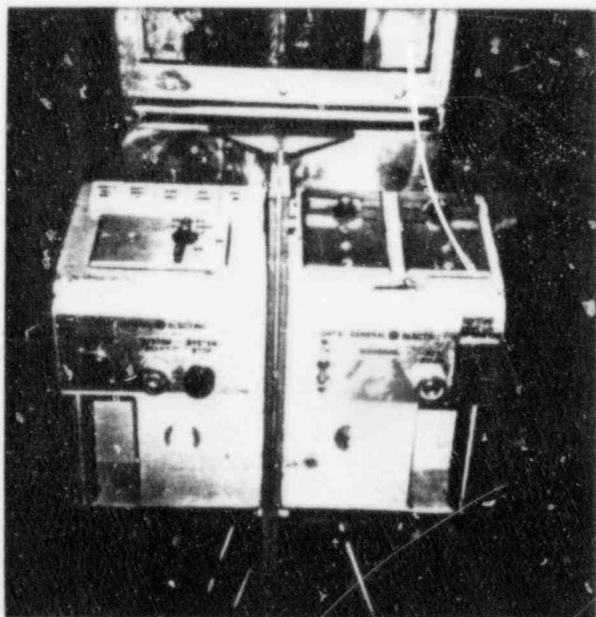
REFUELING FLOOR EQUIPMENT



EQUIPMENT INSIDE REFUELING CONSOLE



REFUELING OPERATIONS TROLLEY AND BRIDGE



MAIN MAST OPERATING CONSOLE

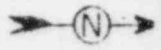
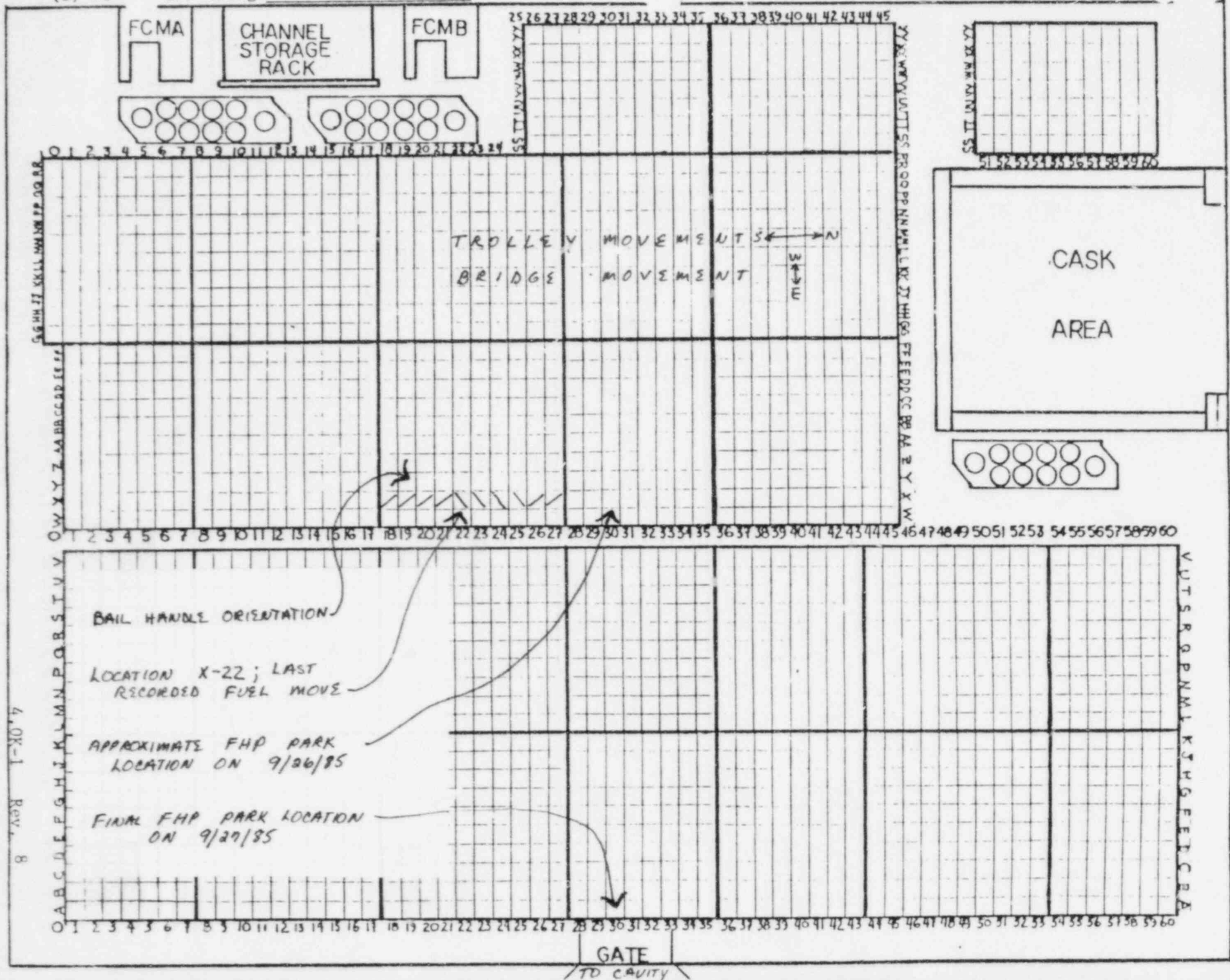


ENTRANCE GATE TO REFUELING FLOOR

(1) Nr _____ (2) Date _____
(3) Re _____ for Change

MBA INVENT' ACCOUNT
SPENT FL JOL

(4) Prepared by _____
(5) Approved by _____



SPENT FUEL POOL LOCATION GRID DIAGRAM - (50-293/85-29)

ATTACHMENT B

ATTACHMENT C

LIST OF DOCUMENTS AND TESTS REVIEWED

- Failure and Malfunction Report dated September 27, 1985 describing initial discovery of the damaged mast and latched fuel bundle
- Initial Special Instructions regarding access control dated September 27, 1985
- Temporary Procedure No. 85-94, Special Access Restrictions, dated September 29, 1985
- Radiation Survey Form (Map No. 170 - Refueling Floor) completed at 9:00 a.m. on September 27, 1985
- Fuel Movement Material Balance Accounting Form (RE.1) No. 1054
- Temporary Procedure No. 85-95, Re-enactment of Fuel Pool Incident of September 26, 1985, DRAFT
- Control Room Operations Log (documenting actions on September 27, 1985 to verify electrical circuit breaker relays, and both AC and DC vital power supplies
- 3.M.3-8A-1, Inspection/Troubleshooting Electrical Circuits Check List, dated September 27, 1985
- Radio-Chemistry Analysis Records (Form CH-2) documenting results of both influent and effluent sampling of the spent fuel pool water on September 27, 1985

(continued)

ATTACHMENT C

- Memo from the Reactor Engineer to the Chief Operating Engineer dated September 27, 1985 documenting an inventory of fuel bundles in the spent fuel pool
- Surveillance Test Results as follows:
 - Reactor Core Isolation Cooling Pump Operability and Flow Rate Test (9/27/85)
 - High Pressure Coolant Injection Pump Operability and Flow Rate Test (9/27/85)
 - Core Spray Pump Operability Test (9/30/85)
 - Core Spray Motor Operated Valve (MOV) Operability (9/30/85)
 - Core Spray System Integrity Surveillance (9/30/85)
 - Low Pressure Coolant Injection (LPCI) Pump Operability (9/30/85)
 - LPCI MOV Operability (9/30/85)
 - Residual Heat Removal System Integrity Surveillance (9/30/85)
 - Containment Cooling Valve Operability (9/30/85)
- Refueling Floor Health Physics Technician log (9/26/85 - 9/27/85)
- Hourly Fire Watch Patrol Log - Refueling Floor (9/26/85 - 9/27/85)
- Procedure No. 4.3, Fuel Handling, Revision 31, dated October 17, 1984
- OPER-25, Revision 31, part of Procedure No. 4.3, a checklist to assure proper safeguards have been taken prior to fuel movement in the spent fuel pool (9/18/85)

(continued)

ATTACHMENT C

- Procedure No. 8.10.5, Refueling Platform Main Mast Interlock Functional Test, Revision 8, April 11, 1984
- Attachment No. 8.10.5A-1, Refueling Platform Main Mast Interlock Functional Test Signoff Sheet, Revision 8 (9/12/85)
- Maintenance Request 85-49-2, Perform Preventive Maintenance and Repair Refuel Bridge and Jib Cranes (9/13/85)