

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report Nos. 50-295/94012(DRP); 50-304/94012(DRP)

Docket Nos. 50-295; 50-304

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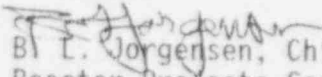
Licensee: Commonwealth Edison Company  
Executive Towers West III  
1400 Opus Place - Suite 300  
Downers Grove, IL 60515

Facility Name: Zion Nuclear Power Station, Units 1 and 2

Inspection At: Zion, IL

Inspection Conducted: April 27 through May 31, 1994

Inspectors: J. D. Smith  
M. J. Miller  
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Approved By:   
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Reactor Projects Section 1A

6-7-94  
Date

Inspection Summary

Inspection from April 27 to May 31, 1994 (Report No. 50-295/304-94012(DRP))

Areas Inspected: This was a routine, resident inspection of licensee action on previous inspection findings, operations, plant support, maintenance and surveillance, engineering, and licensee event reports (LERs).

Results: One non-cited violation was identified during this inspection period as discussed in section 5.

## DETAILS

### 1. Management Summary

The inspectors met with licensee representatives (denoted in section 9) throughout the inspection period and at the conclusion of the inspection on May 31, 1994, to summarize the scope and findings of the inspection activities. The licensee acknowledged the inspectors' comments. The inspectors also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents or processes as proprietary.

#### Safety Assessment of Operations

The lack of logging and turnover of the minor main steam line water hammer was considered a weakness in not identifying basic indicators of a plant problem.

#### Safety Assessment of Plant Support

Good organization and team work were demonstrated during the annual emergency preparedness exercise. An individual found sleeping in the auxiliary building, contrary to NRC and licensee management expectations, received disciplinary action.

#### Safety Assessment of Maintenance and Surveillance

The instrument mechanic's identification of the untested portion of safeguards logic circuitry was considered a positive. The discovery of mop heads and a flashlight inside the #1 component cooling water heat exchanger provided another example of inadequate foreign material exclusion practices during the dual unit outage.

#### Safety Assessment of Engineering

The inspectors concluded that the licensee's task group was adequately pursuing the investigation to determine the initiating cause of the isophase bus fault. The lack of adequate interface between station personnel and outside licensee organizations was considered a weakness.

### 2. Licensee Actions on Previous Inspection Findings (92701, 92702)

- a. (Closed) Inspection Followup Item 50-295/304-92025-03 "Deficiencies Noted in Emergency Diesel Generator (EDG) Preventive Maintenance Program": The inspector reviewed the licensee's actions in response to this item. Significant progress has been made in the last two years in the area of preventive maintenance (PM). Additionally, the licensee is implementing an "outage window" concept where equipment is deliberately scheduled to be taken out-of-service to perform maintenance on a regular basis rather than waiting for a PM flag to show up and then trying to

schedule it in. The inspector also noted that significant improvements were made in EDG reliability and availability since 1992. Based on the review, the inspector had no further concerns. This item is closed.

- b. (Closed) Inspection Followup Item 50-295/304-92025-04 "Negative Trend in EDG Oil Content": The inspector reviewed the licensee's actions in response to this item. The negative trends seen in the EDG oil have been reversed through a complete overhaul of the "0" EDG during the dual unit outage. The dedicated diesel group has resulted in a significant increase in EDG reliability and availability. In addition, the use of outage windows should allow greater ability to respond to adverse trends in a timely fashion. The inspector had no further concerns. This item is closed.
- c. (Open) Violation 93009-01 "Two Examples of Inadequate Safety Evaluations": As corrective actions to this violation, the licensee committed to hold training classes on identification of activities requiring safety evaluations, on NSAC-125 (Guidelines for 10 CFR 50.59 Safety Evaluations) and source documents, and on accident analyses. Additionally, they committed to establish a 10 CFR 50.59 resource library.

All station engineering personnel responsible for preparing and approving safety evaluations were to attend a seminar on the principles contained in NSAC-125 "Guidelines for 10 CFR 50.59 Safety Evaluations." The seminar would also focus on increasing the engineers' awareness of information needed to apply the concepts of NSAC-125 and where this information was located (for example: the updated final safety analyses report (UFSAR), fire protection report, and safety evaluation reports). The first seminar had been held by the end of the inspection period, with all personnel to be trained by mid-June.

A UFSAR accident analysis training course was developed to enhance the understanding of accident initiators, equipment credited for accident mitigation, key assumptions, and predicted consequences of accidents. The training will initially be provided to engineers performing safety related modifications, and will later be expanded to include engineers preparing safety evaluations for other activities. Training classes were underway at the end of the inspection period, and were to be completed by mid-June.

In regard to the 10 CFR 50.59 resource library, as of February 25, 1994, a computer searchable version of the 1993 UFSAR was available on the licensee's local-area-network to all people with computer terminals. There was a complete setup in the system engineering reference center with both the technical specifications (TS) and the fire hazard analysis available. Additionally, the UFSAR was installed in word searchable format on the library's computer. Copies of TS amendments and the onsite dose calculation manual (ODCM) were available. A copy of the fire

protection report was supposed to be available but, in actuality, was almost permanently checked out to the fire protection engineers.

This violation will remain open pending completion and review of the training courses.

- d. (Closed) Violation 93020-01 "Failure to Follow Procedures": As corrective action to this violation, the licensee committed to reinforce the performance standards for the out-of-service system and for control board walkdowns, to revise periodic test PT-14 "Inoperable Equipment Surveillance Tests," and to develop a method for verifying and tracking work requests associated with limiting conditions for operations (LCOs.) The inspectors verified that all corrective actions were completed. This item is closed.
- e. (Closed) Unresolved Item 94006-05 "Low Flow on High Head Safety Injection": This item was incorrectly referred to as Unresolved Item 94006-02 in Inspection Report 94010. Item 94006-02 is a violation on maintenance practices, and is still open. Item 94006-05 is closed, as stated in Inspection Report 94010.
- f. (Open) Inspection Followup Item 94006-06 "Supplemental Report to Licensee Event Report (LER) 89002": The licensee confirmed that no supplemental LER was issued and committed to issuing the report by June 30, 1994. This item remains open.
- g. (Closed) Inspection Followup Item 94009-02 "Supplemental Report to LER 93004": The required supplemental report was issued on July 26, 1994. This item is closed.

No new violations or deviations were identified.

### 3. Operations (71707)

#### a. Operational Status

The inspectors verified that the facility was being operated in conformance with the licenses and regulatory requirements and that the licensee's management control system was effectively carrying out its responsibilities for safe operation. During tours of accessible areas of the plant, the inspectors made note of general plant and equipment conditions, including control of activities in progress.

On a sampling basis the inspectors observed control room staffing and coordination of plant activities; observed operator adherence with procedures and technical specifications; monitored control room indications for abnormalities; verified that electrical power was available and observed the frequency of plant and control room visits by station managers. The inspectors also monitored various administrative and operating records.

The status for each unit during the inspection period was as follows:

Unit 1

The unit remained in a forced outage following the turbine and reactor trip on April 3, 1994.

Unit 2

The unit maintained approximately 100 percent power during the inspection period.

b. Activities

Main Steam Water Hammer: On April 14, 1994, at approximately 3:30 a.m., a minor water hammer occurred in the 2B main steam line (MSL). The noise was heard in the control room and operators were dispatched to investigate. Dust and some loose insulation were found on the floor under the MSL hangers. No damage was identified by operations. The shift foreman's turnover sheet was the only documentation of the problem. The sheet stated, "knocked some insulation loose, please have laborers sweep up." There was no other turnover of the event.

During an early morning tour, the inspector noted the debris in the steam tunnel and determined that a water hammer had occurred. When questioned, the day-shift shift engineer was not aware of the event so he contacted the technical staff to walk down the system. Senior management was also not aware of the event. However, senior management immediately walked down the system and was the first to identify a broken snubber. The snubber was not safety related.

The operations department personnel were counseled on the event and a memorandum concerning department performance expectations was issued which addressed communications and several other areas.

The licensee conducted a level III investigation into the cause of the water hammer and methods to prevent recurrence. The water hammer was due to inadequate draining of the MSL during heatup. While the system was pressurized to less than 100 psig, the large volume of steam pipe was being drained through a 1/32 inch orifice. This resulted in a significant quantity of sub-cooled water trapped in the lower section of the MSL along with steam, which resulted in the water hammer. The MSL heatup procedure will be revised, prior to Unit 1 startup, to require bypassing the drain line orifice allowing increased draining.

c. Safety Assessment of Operations

The lack of logging and turnover of the minor main steam line water hammer was considered a weakness in not identifying basic indicators of a plant problem.

No violations or deviations were identified.

4. Plant Support (71707)

a. Radiation Protection

The inspectors verified that workers were following health physics procedures and randomly examined radiation protection instrumentation for operability and calibration.

Early in the morning of May 16, 1994, the inspector woke a licensee employee who appeared to be asleep in the auxiliary building. Although the employee was inside a radiologically controlled area and demonstrated poor ALARA awareness, the radiation level was low (less than 0.1 mrem). Despite the low safety significance of the issue, the employee did not meet the expectation of the licensee's management or the NRC. Senior management was informed and disciplinary action was taken.

b. Security

During the inspection period, the inspectors monitored the licensee's security program to ensure that observed actions were being implemented according to their approved security plan. Implementation of the new badge drop boxes inside the protected area appeared to be well done.

c. Emergency Preparedness

On May 25, 1994, the inspectors monitored the licensee's annual generating stations emergency plan exercise. Good organization and team work were demonstrated during the exercise.

d. Fire Protection

During routine tours, the inspectors assessed the licensee's fire protection program, including general housekeeping, compensatory measures and fire watch practices. No problems were seen.

e. Safety Assessment of Plant Support

Good organization and team work were demonstrated during the annual emergency preparedness exercise. An individual found sleeping in the auxiliary building, contrary to NRC and licensee management expectations, received disciplinary action.

No violations or deviations were identified.

5. Maintenance and Surveillance (61726, 62703)

Routinely, station maintenance and surveillance activities were observed and reviewed to verify that they were conducted in accordance with applicable regulations. Also considered during the observation and review were: proper obtaining of approvals, meeting of operability requirements, appropriate performance of functional testing and calibrations, resolution of identified discrepancies, maintenance of quality control records, and performance of all activities by qualified personnel.

a. Activities

Incomplete Surveillance: During technical review of a surveillance procedure, PT-10B "Safeguards Logic Test of Containment High and High High Pressure", it was discovered that a portion of the circuitry between the containment high-high pressure bistable and the actuating relay had never been tested. This discovery, on May 19, 1994, at 12:00 a.m. (CDT), put Unit 2 on a 24-hour LCO. The PT-10B procedure was revised and the portion of circuit that had not been tested was performed and the unit was off the LCO clock at 8:11 p.m. on May 19, 1994. This test was also performed on Unit 1. The part of the circuit not tested was the wiring and a fuse between the high-high containment bistable and the actuating relay. The components were previously tested independently but not together. The failure to perform a complete surveillance requirement within the allowed surveillance interval defined by Technical Specification (TS) 4.0.2 constituted a violation of TS 4.0.3. However, this violation is not being cited in accordance with Section VII.B.2 of the "General Statement of Policy and Procedures for the NRC Enforcement Actions" (Enforcement Policy, 10 CFR Part 2, Appendix C), because this violation was identified by the licensee, was classified as a Severity Level V, corrective actions to previous violations would not have prevented this violation, the corrective action and actions to prevent recurrence for this violation were acceptable and the violation was not willful.

Foreign Material Exclusion: On May 13, 1994, following draining of the #1 component cooling water heat exchanger to repair known leaking tubes, the licensee removed the inlet side end bell. Foreign material, in the form of two mop heads and flashlight pieces (lens, batteries, and pieces of plastic) were found in the end bell area. The licensee's investigation determined that the foreign material was most likely introduced in January 1994 during efforts to stop leak-by from the cross-connect valves (discussed in Inspection Report 94002). At that time personnel entered the service water inlet piping to inspect the installed valves. Throughout the dual unit outage the licensee had problems with ensuring foreign material exclusion, as discussed in Inspection

Reports 93023 and 94002. The foreign material found in the component cooling water heat exchanger during this inspection period was introduced during the time period when the licensee was known to have foreign material intrusion problems. As such, it constitutes another example to the violation cited in Inspection Report 94002; however no additional response is necessary.

b. Safety Assessment of Maintenance and Surveillance

The instrument mechanic's identification of the untested portion of safeguards logic circuitry was considered a positive. The discovery of mop heads and a flashlight inside the #1 component cooling water heat exchanger provided another example of inadequate foreign material exclusion practices during the dual unit outage.

One violation (not cited) and no deviations were identified.

6. Engineering

The inspectors evaluated the extent to which engineering principles and evaluations were integrated into daily plant activities. This was accomplished by assessing the technical staff involvement in non-routine events, outage-related activities, and assigned technical specification surveillances; observing on-going maintenance work and troubleshooting; and reviewing deviation investigations and root cause determinations.

a. Unit 1 Reactor Trip Following Isophase Bus Fault

Description of Event: On April 3, 1994, Unit 1 was returning to service following the dual unit outage. The reactor was increasing power from 25 to 28 percent when the generator tripped followed by a reactor trip at 6:18 a.m. Following the generator trip, operating personnel reported a fire emanating from the generator lead box. The fire could not be contained by the onsite fire brigade and offsite assistance was requested. This required declaration of an Unusual Event at 6:30 a.m. Around 9:05 a.m. the generator fire was extinguished and the Unusual Event terminated. While isolating the main generator, incorrect fuses were pulled and the 1A auxiliary feedwater (AFW) pump automatically started. The fuses were reinstalled and the 1A AFW pump was secured.

The licensee assessed the damage to the main generator, the generator lead box, the isolated phase bus, and bus ducts. The licensee also assembled a task group to investigate the event and to determine the probable root cause.

The licensee found that the "C" phase generator bushing was severely damaged. Molten metal was found in the area above the bushing. The "A" and "B" phase bushings also sustained damage. Also, in the neutral bus enclosure, in the vicinity of the lead box, the inspector observed a 5-inch diameter hole, providing



evidence of arcing there. Other significant damage was found on the 90-degree corners of the "A" and "B" phase isophase buses and bus duct enclosures. Approximately a 10-inch diameter section of both corners were either blown out or vaporized as a result of the fault current.

The Unit 1 west (1W) transformer also sustained damage. The licensee saw evidence of a turn-to turn failure on the low voltage winding. A previous transformer failure occurred September 22, 1990, when the Unit 2 west (2W) transformer experienced excessive mechanical damage as a result of a primary to secondary fault. This previous event also caused damage to an isophase bus and bus duct.

Probable Initiating Cause of the Event: At the end of the inspection period, the licensee was still pursuing several initiatives to pinpoint the exact cause of the fault. The transformer, the "C" phase bushing, and molten metal from the generator lead box and from the isophase bus were sent to independent laboratories for examination.

On May 3, 1994, the licensee issued LER 94-005. The LER stated that the exact cause of the electrical fault was not known. The licensee outlined two scenarios which corresponded to the physical evidence documented subsequent to the event. One scenario involved the failure of the "C" phase bushing. The second scenario involved the failure of the 1W transformer. Until the final evaluations and tests have been performed, the exact cause of the electrical fault cannot be known. However, on May 23, 1994, the licensee received information regarding the "C" phase bushing. The independent laboratory informed the licensee that evidence of tracking (conduction paths) were found in three different locations. This would seem to be the most likely initiating cause of the event. The licensee theorized a manufacturing defect caused the tracking in the "C" phase bushing. This resulted in a low current flashover to ground. This flashover increased the "A" and "B" phase generator bus voltages, increasing the potential differences between the conductors and the ductwork. The LER stated that the flashover also occurred as a result of either a decrease in the dielectric strength of the air or a mechanical agitation of the system causing the distance between the duct and the conductor to decrease. As this was occurring, the single-phase-to-ground fault became a three-phase-to-ground fault, which would have generated the currents necessary to create the damage found on the "A" and "B" phase buses and bus ducts and the "C" phase bushing and lead box. The high current arc from the "C" phase to the lead box resulted in the rupture of the bushing internal and external to the lead box. As hydrogen escaped to atmosphere, the hydrogen was ignited by the flashover and started to burn. The fault currents generated were of sufficient magnitude to cause the through fault damage observed on the low side winding of the 1W transformer.

Inadvertent Start of 1A AFW Pump: During isolation of plant equipment following the generator lead box fire, the licensee had an unplanned start of the 1A motor-driven AFW pump. The licensee was in the process of developing written instructions to isolate the generator and take equipment out-of-service (OOS). The Operational Analysis Department (OAD) was asked to assist in identifying additional isolation points. OAD verbally communicated additional points to operations personnel that did not apply to Zion station. In addition, it appeared that OAD used terminology different than used at Zion. Furthermore, the Zion OOS procedures required at least three levels of review before any piece of equipment was taken OOS. Consequently, due to unclear terminology and instructions, the incorrect fuses were pulled, resulting in the start of the 1A AFW pump.

Inadequate Post Modification Testing: The inspectors had concerns that the licensee did not adequately test and update transformer operating instructions to the operations department following transformer modifications. Due to problems with static electrification, which damaged the 2W transformer in 1990, the licensee initiated a modification on both units to allow for transformer cooler bank sequencing. During the last Unit 1 refueling outage, the substation construction department installed fans and pumps on the Unit 1 transformers. On April 3, 1994, as unit startup was commencing, the control room operators received alarms due to problems with the cooling fans and pumps. The operators did not initially respond to the trouble alarms because none of the operating procedures had been updated to reflect the recent modifications to the transformers. In addition, the licensee later discovered that the reason the alarms were being received was that the breakers to the fans and pumps had been opened during functional testing, and not restored when testing was complete. In addition, the inspectors learned that the functional testing performed by OAD was not documented.

Review of a Previous Transformer Failure: The inspectors reviewed the commitments the licensee made as a result of the 2W transformer failure in 1990. The licensee made the commitments to reduce the possibility of equipment failure in the isophase bus and duct as a result of a catastrophic transformer failure. The inspectors were informed that the commitments to install bus duct lightning arresters and a bus duct ground cable had not been implemented due to low priority. Although the implementation of these two modifications would not have prevented damage to the Unit 1 isophase bus, the licensee stated that the damage would not have been as extensive. The licensee considered lack of prompt corrective action a weakness.

Transformer Maintenance: The inspectors had concerns regarding a preventative maintenance program (PM) for the transformers. The last Unit 1 transformer power-factor testing and the last insulation resistance checking were performed in October 1971.

The licensee had no established PM program for the main power transformers. In addition, in the vendor manual for the transformer the vendor recommended that the transformer bushings be tested once every two years; however, the last time the licensee tested the bushings was in 1971. Additionally, the licensee's only vendor manuals for the transformer and the main generator did not provide much useful information regarding equipment maintenance or operation.

b. Safety Assessment of Engineering

The inspectors concluded that the licensee's task group was adequately pursuing the investigation to determine the initiating cause of the isophase bus fault. The lack of adequate interface between station personnel and outside licensee organizations was considered a weakness.

No violations or deviations were identified.

7. Licensee Event Reports (LERs) Followup (92700)

Through direct observations, discussions with licensee personnel, and review of records, the following event reports were reviewed to determine that reportability requirements were fulfilled, immediate corrective action was accomplished, and corrective action to prevent recurrence had been accomplished in accordance with technical specifications. The LERs listed below are considered closed:

**LER 295/94001:** "Insufficient Charging flow Through Cold Leg Injection Due to Mispositioned Throttle Valves." The event was discussed in Special Inspection Report Number 94010 and at the enforcement conference held on May 11, 1994. Corrective actions will be tracked as part of the Special Inspection Report 94010 and the enforcement conference outcome. This LER is closed.

**LER 295/94002:** "Auxiliary Building Ventilation Panels Insufficiently Seismically Mounted." This LER addressed one ventilation panel which was not seismically mounted and three other panels which did not comply with their original design criteria. The licensee processed exempt changes to seismically anchor all four panels to the auxiliary building floor. One exempt change was physically complete as of the end of the inspection period, and the other three were scheduled to be installed by late June. The inspectors reviewed the licensee's corrective actions and had no concerns. This LER is closed.

**LER 295/94003:** "Containment Pressure Sensing Lines Were Inadvertently Capped During Containment Close Out." All immediate corrective actions were completed. The event was discussed in Inspection Report 94010 and at the enforcement conference held May 11, 1994, as documented in Inspection Report 94013. The long term corrective actions will be tracked as part of the final decision on the potential enforcement action. This LER is closed.

LER 295/94004: "Defeated Safeguards Actuation Signal Due to Lifted Leads on Two Motor-Operated Valves." This event was discussed in Inspection Report 94010 and at the enforcement conference held May 11, 1994, as documented in Inspection Report 94013. The long term corrective actions will be tracked as part of the final decision on the potential enforcement action. This LER is closed.

LER 295/94005: "Unit 1 Reactor Trip Main Generator Fire and Isophase Bus Duct Fault." The licensee's root cause program to determine the failure mode for the generator fire has been comprehensive as discussed in Section 6.a above. The initial preventive measures included a thorough inspection of the Unit 2 main generator, bus duct and transformer. The residents observed a good root cause and preventive measures program, which addressed both potential causes identified. This LER is closed.

LER 304/93001-01: "Failure to Meet "As-Found" Requirement for Total Type "B" and "C" Leak Rate Tests." This supplemental LER addressed the root cause for both Unit 1 and Unit 2 exceeding the technical specification allowed local leakage limit. The licensee's root cause investigation revealed that the same valve failed on both units: the nitrogen to pressure relief tank isolation valve 1(2)RC8047. The licensee determined that the cause of the valves failing was a design deficiency: the valves were designed for a 1500 psig application but were used in a 100 psig system. The licensee's corrective action was to replace the valves with ones better suited for the application. The inspectors reviewed the licensee's actions and found them to be acceptable. This LER is closed.

LER 304/93004-01: "Violation of the Inservice Testing Program Required by Technical Specifications." The licensee issued the supplemental report to address a previous inspector finding of an additional missed surveillance on a second valve which also had an increased stroke time. This LER is closed.

LER 304/94001: "Actuation of Unit 2 Station Blackout Loads During Restoration of Buses 147/247 to Offsite Power." The corrective actions have been completed and the inspectors have no further concerns. This LER is closed.

LER 304/94002: "Limiting Condition for Operation Action Statement Exceeded with the Turbine-Driven and One Motor-Driven Auxiliary Feedwater Pumps Inoperable." The event was discussed in Inspection Report 94010 and at the enforcement conference held May 11, 1994, as documented in Inspection Report 94013. Any additional actions relating to this event will be tracked as part of the final decision on the potential enforcement action. Additionally, the licensee is planning to issue a supplemental report to address some of the issues discussed at the enforcement board. This LER is closed.

LER 304/94004: "Entry into Technical Specification 3.0.3 Twice Within Two Hours Due to Problems with Two Auxiliary Feedwater Valves." At the

time the problems with the valves were discovered, the turbine-driven pump was also out of service due to a failed shaft-driven oil cooler (among other problems.) The licensee conservatively decided to return to Mode 4 to repair all the auxiliary feedwater components. The problem with one valve was determined to be sticking electrical contacts. The other problem was determined to actually be a failed square root extractor, rather than a valve fault. This item is closed.

No violations or deviations were identified.

8. Management Meetings (30703)

On May 18, 1994, Mr. J. Zwolinski, Assistant Director, Office of Nuclear Reactor Regulation, toured the site and met with senior management.

No violations or deviations were identified.

9. Persons Contacted

R. Tuetken, Vice President, Zion Station  
\*A. Broccolo, Station Manager  
M. Lohmann, Site Engineer & Construction Manager  
P. LeBlond, Executive Assistant  
\*S. Kaplan, Regulatory Assurance Supervisor  
D. Wozniak, Operations Manager  
R. Link, Technical Superintendent  
L. Simon, Maintenance Supervisor  
J. LaFontaine, Outage Management Manger  
T. Printz, Assistant Superintendent of Operations  
\*R. Cascarano, Services Director  
\*W. Stone, Performance Improvement Director  
\*K. Hansing, Site Quality Verification Director  
R. Chrzanowski, Technical Staff Supervisor  
R. Milne, Security Administrator  
P. Cantwell, Unit 2 Operating Engineer  
W. T'Niemi, Unit 1 Operating Engineer  
K. Mcser, Unit 0 Operating Engineer

K. Dickerson, Regulatory Assurance - NRC Coordinator

\* Indicates persons present at the exit interview on May 31, 1994.

The inspectors also contacted other licensee personnel including members of the operating, maintenance, security, and engineering staff.