

ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION,
REGION IV

Docket Nos.: 50-528
50-529
50-530

License Nos.: NPF-41
NPF-51
NPF-74

Report No.: 50-528/99-16
50-529/99-16
50-530/99-16

Licensee: Arizona Public Service Company

Facility: Palo Verde Nuclear Generating Station, Units 1, 2, and 3

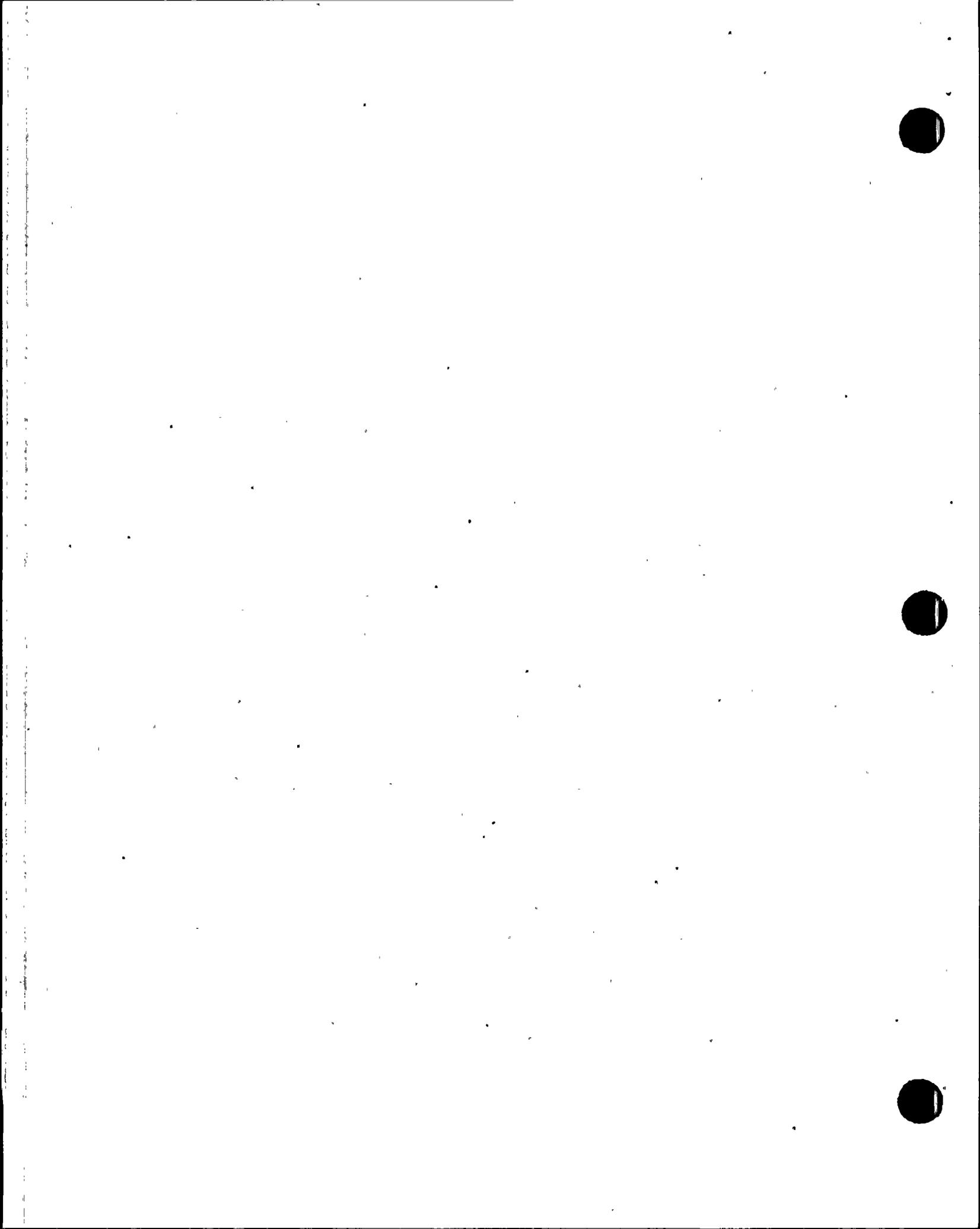
Location: 5951 S. Wintersburg Road
Tonopah, Arizona

Dates: July 25 through September 4, 1999

Inspectors: J. H. Moorman, III, Senior Resident Inspector
D. R. Carter, Resident Inspector
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Approved By: P. Harrell, Chief, Project Branch D

ATTACHMENT: Supplemental Information



EXECUTIVE SUMMARY

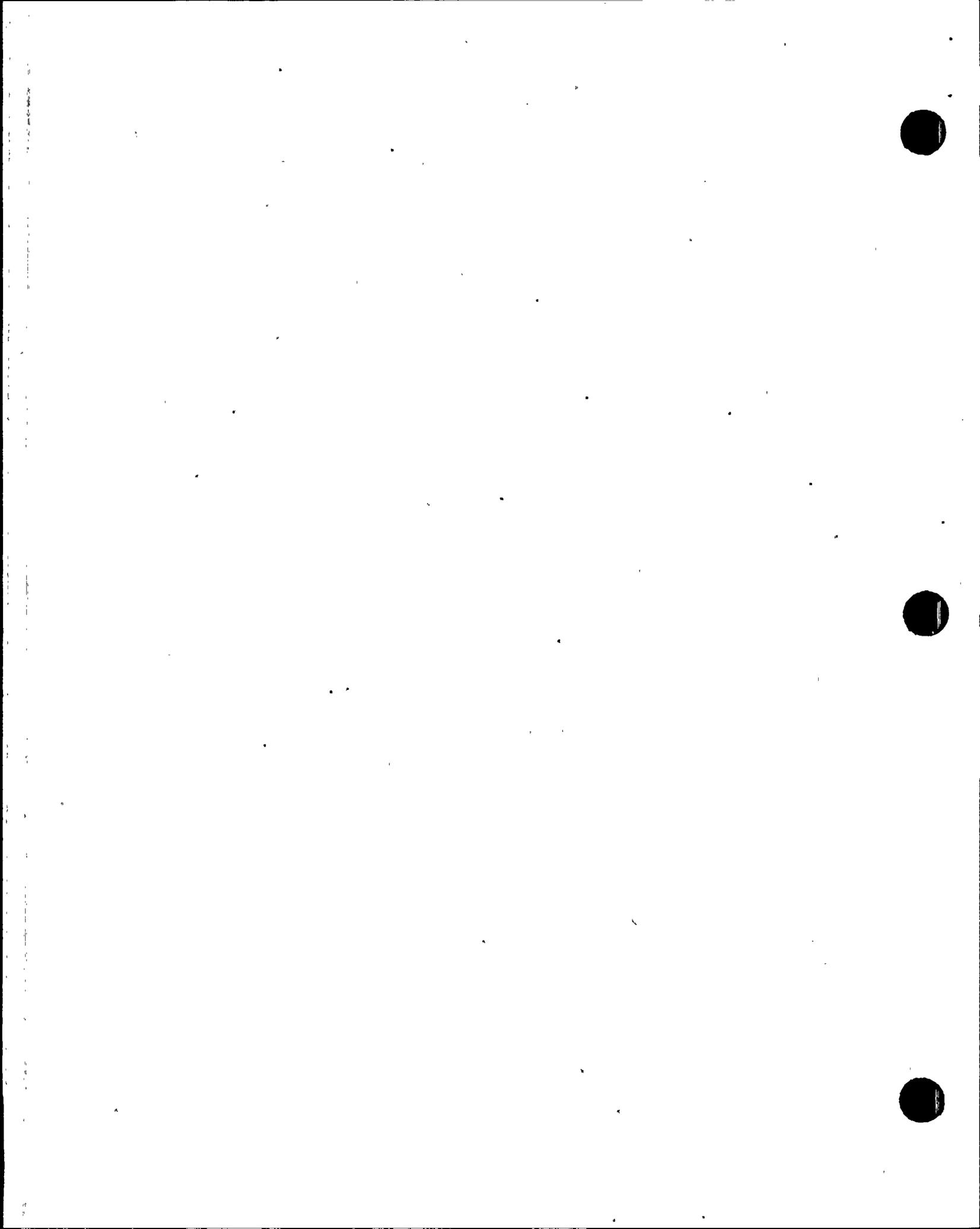
Palo Verde Nuclear Generating Station, Units 1, 2, and 3
NRC Inspection Report No. 50-528/99-16; 50-529/99-16; 50-530/99-16

Operations

- Unit 3 control room operators appropriately tripped main feedwater Pump B in response to increasing pump vibration. Their response to the resultant automatic reactor power cutback was good. Support from the Systems and Reactor Engineering groups was good (Section O1.1).
- The licensee assessment and proactive response to resolve an emergent jacket water leak on Unit 2 Emergency Diesel Generator A was good (Section O2.1).
- A lack of attention to detail and inadequate independent verification by control room operators when entering a point into the plant computer rendered the Unit 2 Power Dependent Insertion Limit alarm inoperable and is a violation of Technical Specification 3.1.7.D. This event was reported in Licensee Event Report 50-529/99-001-00. This Severity Level IV violation is being treated as a noncited violation consistent with Appendix C of the NRC Enforcement Policy. This issue is in the licensee's corrective action program as Condition Report/Disposition Request 2-9-0009 (Section O8.1).

Maintenance

- Knowledgeable technicians used approved procedures to perform routine maintenance activities in a safety conscious manner. Good work and foreign material control practices were observed (Section M1.1).
- Knowledgeable technicians used approved procedures to conduct surveillance activities in a safety conscious manner (Section M1.2).
- Observable material condition of the three units was good (Section M2.1).
- The licensee identified that, prior to April 1996, testing had not been performed on emergency diesel generator output breaker test mode trip relays. The licensee effectively addressed this issue (Section M3.1).
- The licensee effectively implemented a predictive maintenance program to identify and investigate issues to resolution. This was evidenced by the resolution of the predictive maintenance alert status of Unit 2 Emergency Diesel Generator A for the increasing trend of iron and chromium identified in lube oil samples. The licensee's actions represented a good example of an integrated effort to resolve a potentially significant emerging maintenance issue (Section M4.1).



Engineering

- The licensee's actions to assess degradation of underground essential spray pond system piping were good (Section E2.1).

Plant Support

- Properly briefed and knowledgeable technicians performed resin transfer operations in an effective manner. Good radiation protection practices were observed. Radiation protection management provided commensurate oversight of the resin transfer operation (Section R4.1).



Report Details

Summary of Plant Status

Units 1 and 2 operated at essentially 100 percent power for the duration of this inspection period.

Unit 3 operated at 100 percent power until September 3, 1999, when the unit experienced an automatic reactor power cutback after operators tripped main feedwater (MFW) Pump B due to increased pump vibration. The unit was stabilized at 75 percent power and remained at that power level for the duration of this inspection period. See Section O1.1 for details.

I. Operations

O1 Conduct of Operations

O1.1 Manual Trip of Main Feedwater Pump B and Automatic Reactor Power Cutback (Unit 3)

a. Scope (92901, 93702)

On September 3, 1999, the licensee manually tripped MFW Pump B due to increased pump outboard bearing oil temperature and vibration. The inspectors observed the licensee's performance leading up to and during the automatic reactor power cutback when MFW Pump B was tripped. The inspectors also reviewed logs, pump data, and Condition Report/Disposition Request (CRDR) 100703 and interviewed personnel.

b. Observations and Findings

At 7:13 a.m., the control room received an MFW Pump B outboard bearing high temperature alarm. The temperature indication was erratic with temperature swings of +/-300°F. Control room personnel responded to the alarm and performed the actions specified by Procedure 43AL-3RK6A, "FWPT B Lube Oil System Trouble," Revision 14. The area operator was directed to investigate the alarm. The shift manager requested assistance from the systems engineers and vibration technicians.

At 7:20 a.m., the shift manager conducted a control room briefing in anticipation of a reactor power cutback. Control room operators discussed expected plant response and reviewed Procedure 40AO-9ZZ09, "Reactor Power Cutback (Loss of Feedpump)." At 7:32 a.m., the control room received an MFW Pump B high pressure bearing oil drain temperature high alarm and the area operator reported a noticeable increase in pump vibration. At 7:50 a.m., the vibration technician reported that pump vibration had increased from 0.3 to 1.5 mils. This was considered an abnormally high vibration for MFW Pump B, even though it was below the MFW pump trip criteria of 5 mils.

Operations management and system engineering discussed the option of expeditiously reducing power to remove the pump from service or tripping the pump. Due to the significant rate of increase in pump vibration, the licensee decided to trip the pump. At 8:01 a.m., an operator tripped MFW Pump B and entered Procedure 40AO-9ZZ09. The



plant responded, as designed, to the pump trip and automatic reactor power cutback. No significant complications resulted from the pump trip and cutback. The inspectors observed good three-way communications between control room personnel. Control room operators were focused and attentive to their required actions. The control room supervisor exhibited good oversight and direction of the event and conducted frequent briefings to ensure all control room operators were kept informed of overall plant status. Shift manager oversight of the event was good.

The shift manager requested and expeditiously received support from reactor engineering. In a timely manner, the reactor engineer calculated the boron addition necessary to withdraw control element assemblies above their insertion limits and to maintain axial shape index within the Technical Specification (TS) limits.

c. Conclusions

Unit 3 control room operators appropriately tripped main feedwater Pump B in response to increasing pump vibration. Their response to the resultant automatic reactor power cutback was good. Support from the Systems and Reactor Engineering groups was good.

O2 Operational Status of Facilities and Equipment

O2.1 Emergency Diesel Generator (EDG) A Jacket Water Leak (Unit 2)

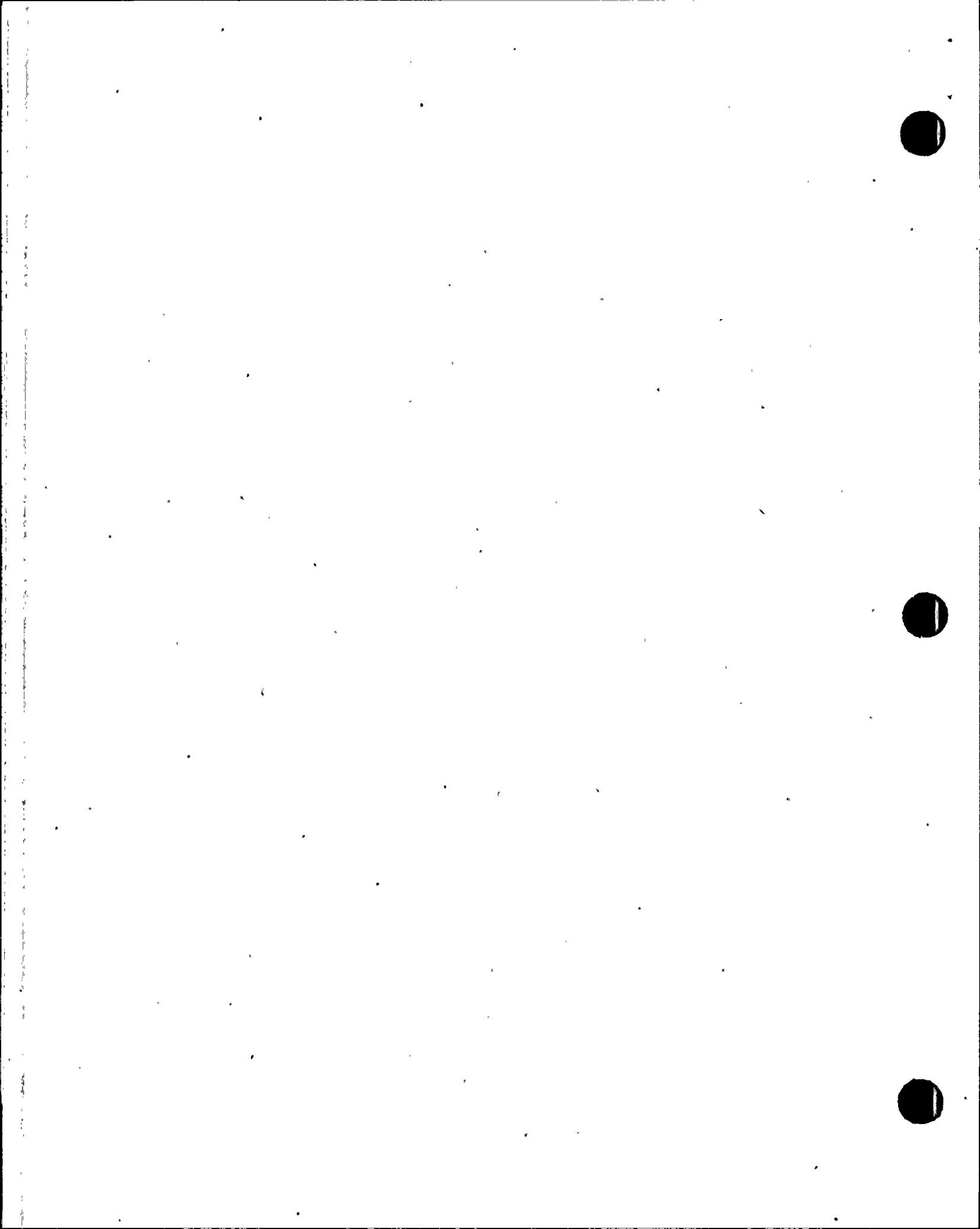
a. Inspection Scope (71707,62707,37551)

The inspectors observed the licensee's actions to resolve a jacket water leak that developed during the break-in operation of EDG A after scheduled maintenance. The inspectors observed the maintenance, reviewed unit logs and CRDRs, and held discussions with the licensee.

b. Observations and Findings

On September 1, 1999, at 4:47 a.m., the licensee declared EDG A inoperable for planned maintenance and entered TS Limiting Condition for Operation 3.8.1, Condition B. At 3:30 p.m., during boroscope inspection of the EDG, being performed to determine the source of chromium and iron contaminants in the lube oil (refer to Section M4.1), the licensee identified that the Cylinder 3R liner was scored. The licensee generated and implemented Work Order (WO) 895515 to replace the liner, piston, and cylinder head.

Following the completion of WO 895515, the inspectors observed the operators start the EDG for the required 9-hour break-in run and for the performance of Procedure 40ST-9DG01, "Diesel Generator A Test," Revision 10. On September 3, at 10 a.m., the control room operators were informed that a jacket water leak had developed at the inlet flange connection to Cylinder 2L. The inspectors observed the licensee as they quantified the leak. The leak rate was approximately 3.2 gph, which exceeded the



Appendix R allowable leak rate of 1.6 gph. The licensee satisfactorily completed the 9-hour break-in run, the required engine analysis, and Procedure 40ST-9DG01. The reactor operators delayed declaring the EDG operable until completion of the jacket water leak repair and completion of an inservice leak test on Cylinder 2L. Clearances were established to drain the jacket water header, and the licensee proceeded with the repairs. The licensee generated CRDR 100306 to evaluate the root cause of the failed gasket at the inlet flanged connection.

The inspectors attended a Plant Review Board (PRB) meeting, which was convened to review a request for Notice of Enforcement Discretion (NOED) for TS 3.8.1.B to exceed the 72-hour Limiting Condition for Operation to allow for the EDG jacket water leak repairs. The PRB approved the NOED request. At 5 p.m., the licensee requested and was granted the NOED from NRC Region IV. The licensee provided the documented NOED request soon thereafter. The licensee declared EDG A operable at 9:45 p.m., after completion of the maintenance to repair the jacket water leak and successful performance of an inservice leak test. Therefore, the licensee did not need to invoke the NOED. In a letter dated September 8, the licensee informed the NRC that the 72-hour completion time was met and that the NOED was unnecessary.

c. Conclusions

The licensee assessment and proactive response to resolve an emergent jacket water leak on Unit 2 Emergency Diesel Generator A was good.

O8 Miscellaneous Operations Issues

O8.1 (Closed) Licensee Event Report (LER) 50-529/99-001-00: TS Violation for Power Dependent Insertion Limit (PDIL) Alarm Inoperable Due to Personnel Error

On January 31, 1999, while performing Procedure 40ST-9ZZ35, "PDIL Alarm Circuit Operability Surveillance," Revision 1, step 8.2.6, operators found a computer point in an abnormal condition that rendered the PDIL alarm inoperable. The operators entered TS 3.1.7.D, corrected the computer point, restored the PDIL alarm, and exited the TS. The licensee determined that on January 3, during the performance of Procedure 40ST-9ZZ35, reactor operators failed to restore the computer point for regulating Group 5 position to scan mode. With the computer point having an inserted value instead of being in the scan mode, the plant computer was incapable of determining the lowest position control element assembly in regulating Group 5. The licensee determined the error resulted from control room operators' lack of attention to detail and inadequate independent verification.

TS 3.1.7.D requires the verification of each control element assembly regulating group position be within its insertion limits within 1 hour after determining the PDIL alarm circuit is inoperable and once every 4 hours thereafter. The failure to perform required actions for TS 3.1.7.D is a violation of the TS. This Severity Level IV violation is being treated



as a noncited violation, consistent with Appendix C of the NRC Enforcement Policy. This violation is in the licensee's corrective action program as CRDR 2-9-0009 (50-529/99-16-01).

The inspectors reviewed the licensee's corrective actions, including the revision of Procedure 40ST-9ZZ35, which clarified how computer points are to be returned to scan mode, and the event was incorporated into the licensed operator continuing training.

Conclusions

A lack of attention to detail and inadequate independent verification by control room operators when entering a point into the plant computer rendered the Unit 2 PDIL alarm inoperable and is a violation of TS 3.1.7.D. This event was reported in LER 50-529/99-001-00. This Severity Level IV violation is being treated as a noncited violation consistent with Appendix C of the NRC Enforcement Policy. This issue is in the licensee's corrective action program as CRDR 2-9-0009.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Comments on Maintenance Activities (Units 1, 2, and 3)

a. Inspection Scope (62707)

The inspectors observed all or portions of the following activities performed per the listed work document:

- | | |
|--------|--|
| 894830 | "Inspect Lube Oil Lines at Cylinders 6-R, 7-R, and 8-R on Emergency Diesel Generator B" (Unit 1) |
| 894838 | "Measure and Record the Lube Oil Temperature at the Exhaust Rocker Arms and Exhaust Lifters of Cylinders 6-R, 7-R, and 8-R on Emergency Diesel Generator B" (Unit 1) |
| 879878 | "Inspect/Test Containment Hydrogen Control Return Isolation Valve JHPUV0005A" (Unit 1) |
| 893146 | "Troubleshoot/Repair generator field temperature transducer" (Unit 1) |
| 882864 | "Setup/Replace The "DSL" DC Sensing Low Voltage Board on Battery Charger A, 1EPKAH11" (Unit 1) |
| 891247 | "Troubleshoot and Rework the Problem With SG 1 Supply Isolation Solenoid Bypass Valve, 2JSGAUV0134A Having Dual Indication" (Unit 2) |



891662 "Troubleshoot/Rework/Replace components as required to restore proper governor control power to Main Feed Water Pump A" (Unit 3)

b. Observations and Findings

The inspectors found the work performed under these activities to be properly completed. All work observed was performed with the work package present and in active use. The observed work and foreign material exclusion practices were good. Technicians were experienced and knowledgeable of their assigned tasks.

c. Conclusions

Knowledgeable technicians used approved procedures to perform routine maintenance activities in a safety conscious manner. Good work and foreign material control practices were observed.

M1.2 General Comments on Surveillance Activities (Units 1, 2, and 3)

a. Inspection Scope (61726)

The inspectors observed all or portions of the following activities performed per the listed surveillance procedures:

73ST-9AF02 "AFA-PO1 - Inservice Test," Revision 12 (Unit 2)

36ST-9SB13 "Supplemental Protection Logic Actuation Test," Revision 11 (Unit 3)

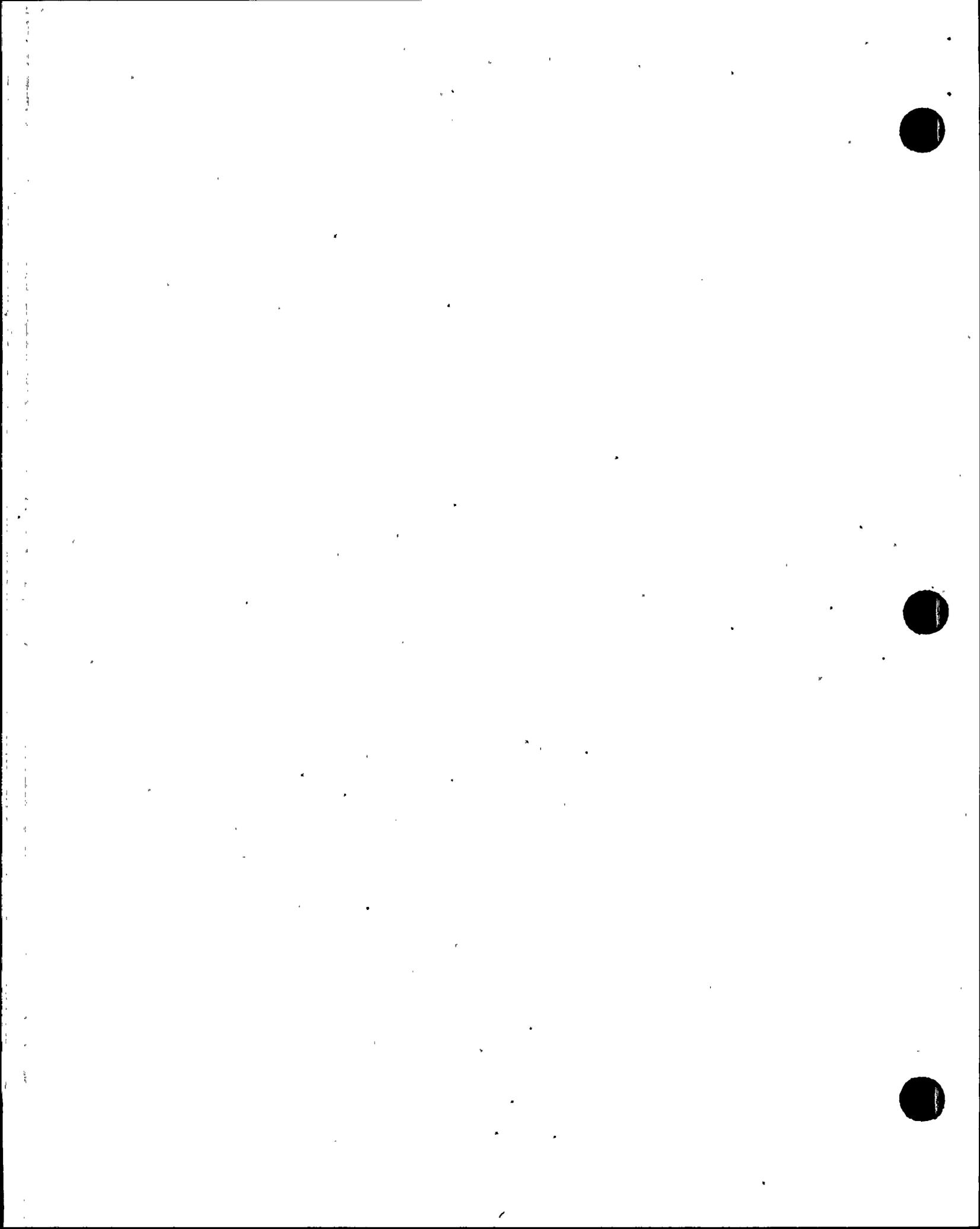
36ST-9SA05 "FBEVAS, CREFAS, and CRVIS 18 Month Functional Test," Revision 12 (Unit 1)

b. Observations and Findings

The inspectors found that knowledgeable personnel performed these surveillances satisfactorily, as specified by applicable procedures.

c. Conclusions

Knowledgeable technicians used approved procedures to conduct surveillance activities in a safety conscious manner.



M2 Maintenance and Material Condition of Facilities and Equipment

M2.1 Review of Material Condition During Plant Tours (Units 1, 2, and 3)

a. Inspection Scope (62707)

During this inspection period, routine tours of all units were conducted to evaluate plant material condition.

b. Observations and Findings

Observation of plant material condition during this inspection period identified no major observable material condition deficiencies.

c. Conclusions

Observable material condition of the three units was good.

M3 Maintenance Procedures and Documentation

M3.1 Failure to Conduct Surveillance Testing of EDG Output Breaker Safety-Related Relays (Units 1, 2, and 3)

a. Inspection Scope (62707)

The inspectors reviewed the circumstances concerning entry into TS Surveillance Requirement (SR) 3.0.3, for all three units, when it was determined that surveillance testing had not been performed on safety-related EDG output breaker test mode trip relays. The inspectors interviewed engineers and reviewed operator logs and CRDRs.

b. Observations and Findings

During a review of industry LERs pertaining to Generic Letter 96-01, "Testing of Safety-Related Logic Circuits," dated January 10, 1996, the licensee identified an LER that described safety-related relays associated with EDG output breakers that had not been surveillance tested. The licensee compared the described LER condition with the installed plant configuration, surveillance requirements, and test procedures. The licensee determined that the current surveillance test procedures did not verify that the test mode trips of the EDG output breakers were capable of being bypassed during the emergency mode of operations, as required by TS SR 3.8.1.13.

The EDG output breaker test mode trips are generator trips that open the output breaker on load unbalance, phase overcurrent, and neutral overvoltage. These trips are enabled when the EDG is run in the test mode of operation to provide desired protection during test conditions. When the EDG is running in the emergency mode of operation, these trips are bypassed to preclude inadvertent trips of the EDG.



On July 30, 1999, at 3:30 p.m., the licensee entered TS SR 3.0.3 for all three units. A PRB meeting was convened to evaluate whether surveillance test credit could be given for the performance of maintenance Procedure 32MT-9PE01, "18 Month Cleaning, Inspection, and Testing of the Class 1E Diesel Generator." At 4:39 p.m., the licensee exited SR 3.0.3 after the PRB granted surveillance test credit for the previous performances of Procedure 32MT-9PE01 on each EDG breaker. The inspectors reviewed Procedure 32MT-9PE01 testing requirements and were satisfied with the licensee's assessment.

The licensee initiated several CRDRs throughout 1996 and 1997 to address procedure deficiencies discovered during the Generic Letter 96-01 review process. From this review, the licensee initiated CRDR 97-0078, dated January 23, 1997, to address several procedure deficiencies that needed to be corrected. As part of CRDR 97-0078 corrective actions, steps were added to Surveillance Procedure 32ST-9PE01, "18 Month Surveillance Test of Diesel Generator," Revision 10, to verify that each EDG control circuit performed all safety-related functions.

During the licensee's conversion to the improved TS, the licensee performed a review of TS SRs and concluded that the EDG output breaker test mode trip relays did not require testing to be performed by Procedure 32ST-9PE01. The procedure for testing the EDG output breaker test mode trip relays was moved from Procedure 32ST-9PE01 to Procedure 32MT-9PE01. The engineering assessment identified that, since April 1996, the bypass function of the test mode trips had been tested by maintenance Procedure 32MT-9PE01. However, prior to April 1996, testing of the EDG output breaker test mode bypass trips, as required by previous TS 4.8.1.1.2.d.6, had not been performed.

b. Conclusions

The licensee identified that, prior to April 1996, testing had not been performed on emergency diesel generator output breaker test mode trip relays. The licensee effectively addressed this issue.

M4 Maintenance Staff Knowledge and Performance

M4.1 Predictive Maintenance Alert Status For EDG A (Unit 2)

a. Inspection Scope (62707,61726,71707)

The inspectors reviewed the licensee's actions associated with evaluating the increasing trend of iron and chromium wear products in EDG A lube oil samples. The inspectors observed the performance of an engine analysis, reviewed trend data and an action plan, and held discussions with the responsible engineers.

b. Observations and Findings

Since May 20, 1999, iron and chromium had shown an increasing trend in lube oil samples taken from EDG A. On July 8, the licensee upgraded Condition Notification Report 2688 for this trend, to a predictive maintenance alert. The licensee's basis for the predictive maintenance alert was an increase of approximately 25 percent in the current analysis (chromium 15.73 ppm and iron 14.73 ppm) from the previous analysis. The licensee contacted the EDG vendor and concluded that there was no immediate operability concern.

The inspectors reviewed an action plan, dated July 13, which described the predictive maintenance alert for EDG A. The plan included possible causes, such as piston ring/liner wear or foreign material entering the engine during outage maintenance, and present/pending actions. On August 4, during the performance of Procedure 40ST-9DG01, "Diesel Generator A Test," Revision 11, the inspectors observed the performance of an engine analysis conducted in accordance with WO 887204. The licensee's review of the engine analysis data indicated that there were no gross performance problems that would affect engine operability. The licensee also sampled the EDG A lube oil. The lube oil analysis indicated that the degrading trend had arrested (chromium 13.7 ppm and iron 14.7 ppm) and that a new baseline may have been established. Afterwards, the licensee kept the EDG in the predictive maintenance alert status and continued with the action plan. On September 1, during a scheduled EDG train outage, the licensee performed boroscope inspections of the cylinder liners in accordance with WO 893048 and inspected the lube oil filter elements in accordance with WO 893060. The licensee identified that the Cylinder 3R liner was scored and needed replacement. CRDR 100306 was generated to determine the root cause of the cylinder liner scoring. Refer to Section O2.1 for discussion of issues that emerged during the EDG break-in run following replacement of the Cylinder 3R liner. The lube oil analysis performed at the completion of the maintenance had normal results for iron and chromium.

c. Conclusions

The licensee effectively implemented a predictive maintenance program to identify and investigate issues to resolution. This was evidenced by the resolution of the predictive maintenance alert status of Unit 2 EDG A for the increasing trend of iron and chromium identified in lube oil samples. The licensee's actions represented a good example of an integrated effort to resolve a potentially significant emerging maintenance issue.



III. Engineering

E2 Engineering Support of Facilities and Equipment

E2.1 Essential Spray Pond (ESP) System Underground Piping Evaluation (Units 1, 2, and 3)

a. Scope (37551)

The inspectors reviewed the licensee's program to evaluate the integrity of underground ESP system piping. The inspectors interviewed system engineers and reviewed piping drawings, records, CRDRs, and system health reports.

b. Observations and Findings

The licensee has experienced degradation of several nonsafety-related underground piping systems that have led to incidents of actual pipe failure. The ESP system is a safety-related system that has portions of the system buried underground. From 1988 to 1998, the system has experienced several pinhole leaks on welds of numerous instrument, drain, and pressure relief valve lines. These leaks were located in stagnate sections of the system piping. The majority of the leaks have occurred in Unit 1 piping. This is believed to have resulted from the system being left idle and full of untreated water during long delays in the construction of Unit 1.

The inspectors examined cathodic protection records for the ESP system for all units and determined that the licensee had a program to monitor all buried piping systems. The records indicated sufficient voltage potential at measured test points to ensure proper operation of the cathodic protection system.

The licensee has developed and implemented an ESP system underground piping inspection program to identify and evaluate piping corrosion conditions. The ESP system is currently experiencing very low general corrosion rates; however, pitting corrosion has occurred at sporadic locations due to defects in the internal pipe coating. Water chemistry in the ESP system has been adjusted to optimize corrosion resistance of the piping.

The licensee has implemented a preventive maintenance program that visually inspects piping sections on a regular basis during planned outages. The licensee is scheduled to excavate and remove a 28-foot section of 10-inch diameter pipe that supplies EDG A during the upcoming Unit 1 outage. The pipe section will be replaced with a new section of pipe and the removed section will be destructively examined to determine the extent of internal and external corrosion. After the licensee has evaluated the corrosion results, a solution to prolong the life span of the pipe will likely be implemented.

c. Conclusions

The licensee's actions to assess degradation of underground ESP system piping were good.



IV. Plant Support

R1 Radiological Protection and Chemistry Controls

R4.1 Transfer of High Activity Spent Resin (Unit 3)

a. Scope (71750)

The inspectors observed the licensee transfer high activity spent resin from a storage tank to a high integrity container in preparation for shipment offsite. The inspectors attended the prejob briefing and observed the resin transfer operation, reviewed the resin transfer procedure and radiation work permit (RWP) 9-0219, and interviewed technicians.

b. Observations and Findings

The resin transfer prejob brief was detailed and complete. Personnel openly asked questions and discussed previous plant and industry lesson-learned events related to resin transfer operations. RWP hold points were emphasized along with the need for proper and clear communications between the resin transfer station and radwaste operators.

The inspectors verified that all affected areas that had the potential to increase in dose rate were administratively locked and controlled during the resin transfer operation. Radiation protection (RP) technicians continuously monitored remote electronic dosimetry located at key locations throughout the transfer system flow path. Radiation surveys and air samples were continuously performed to verify posted boundaries.

RP technicians were knowledgeable of their assigned tasks. At the completion of the resin transfer operation, while flushing the transfer line, the technicians properly stopped operations when it was observed that the dewatering line sight glass turned dark, which is an indication of possible retention element failure. This situation had been discussed during the prejob brief as an RWP hold point. The dark sight glass was evaluated and determined to be dirty water, with no evidence of resin contained in the dewatering line. Flushing operations were continued without further complications. RP management provided oversight throughout the prejob brief and the resin transfer operation.

c. Conclusions

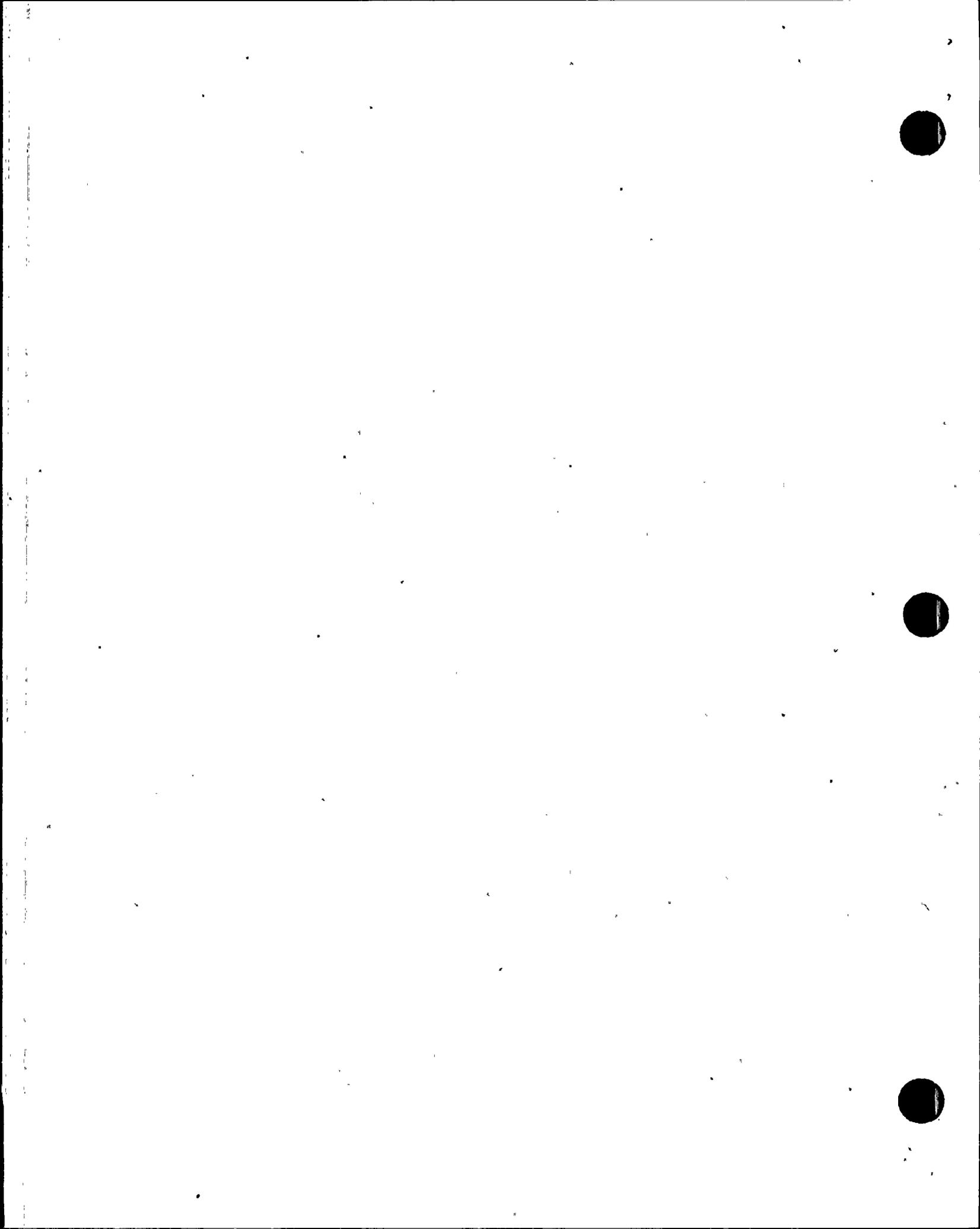
Properly briefed and knowledgeable technicians performed resin transfer operations in an effective manner. Good radiation protection practices were observed. Radiation protection management provided commensurate oversight of the resin transfer operation.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of the licensee's staff after the conclusion of the inspection on September 9, 1999. The licensee acknowledged the findings presented.

The inspectors asked the licensee whether any material examined during the inspection should be considered proprietary. No proprietary information was identified.



ATTACHMENT

PARTIAL LIST OF PERSONS CONTACTED

Licensee

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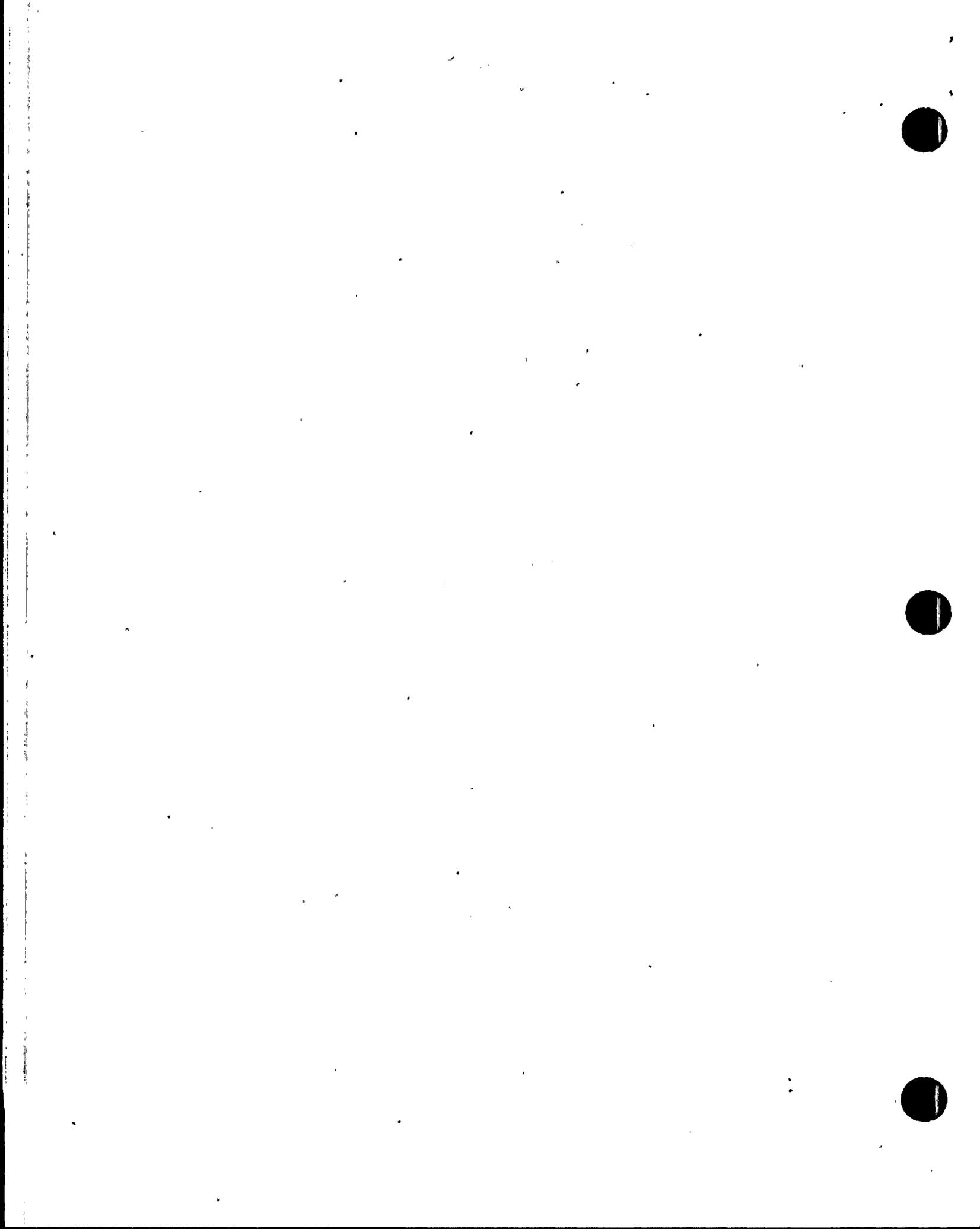
INSPECTION PROCEDURES USED

37551	Onsite Engineering
61726	Surveillance Observations
62707	Maintenance Observations
71707	Plant Operations
71750	Plant Support Activities
92901	Plant Operations Follow-up
93702	Prompt Onsite Response to Events

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-529/99-16-01	NCV	Failure to comply with TS 3.1.7 for an inoperable PDIL alarm. (Section O8.1)
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Closed

50-529/99-16-01	NCV	Failure to comply with TS 3.1.7 for an inoperable PDIL alarm. (Section O8.1)
50-529/99-001-00	LER	Technical Specification Violation for Power Dependent Insertion Limit Alarm Inoperable Due to Personnel Error (Section O8.1)

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
CRDR	Condition Report/Disposition Request
EDG	Emergency Diesel Generator
ESP	Essential Spray Pond
LER	Licensee Event Report
MFW	Main Feedwater
NOED	Notice of Enforcement Discretion
NRC	Nuclear Regulatory Commission
PDIL	Power Dependent Insertion Limit
PDR	Public Document Room
PRB	Plant Review Board
RP	Radiation Protection
RWP	Radiation Work Permit
SR	Surveillance Requirement
TS	Technical Specifications
WO	Work Order

