ENCLOSURE 2

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-382/95-09

License: NPF-38

Licensee: Entergy Operations, Inc.
P.O. Box B
Killona, Louisiana 70066

Facility Name: Waterford Steam Electric Station, Unit 3

Inspection At: Taft, LA

Inspection Conducted: October 1 through November 11, 1995

Inspectors: W. F. Smith, Acting Senior Resident Inspector
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Approved: P. H. Harrell, Acting Chief, Project Branch D — Date 12-20-95

Inspection Summary

Areas Inspected: Routine, unannounced inspection of licensee response to events, plant operations, maintenance and surveillance observations, onsite engineering, plant support activities, followup of previously identified items, and review of a licensee event report.

Results:

Plant Operations

- Control room formality and controls over distractions require additional management attention. The plant startup from Refueling Outage (RFO) 7 was effectively completed by the operators (Section 3.1).

- The addition of the shift support center was successful in meeting its intended purpose of allowing operators to focus on plant conditions rather than administrative responsibilities (Section 3.3).

- Because of poor communications between the shift support center and the operations staff, system configuration control was not maintained, which resulted in several personnel skin and clothing contaminations. The licensee implemented actions to address this issue (Section 3.3).

Maintenance

- Electricians implemented excellent independent verification techniques during removal and installation of motor-driven relays by using a third technician rather than a technician involved with the work (Section 4.1).

- The inspectors identified a failure of maintenance personnel to remove measuring and test equipment (M&TE) from service immediately after noting that the functioning of the equipment was suspect. This is a violation of Technical Specification (TS) 6.8.1.a (Section 4.2).

- Flow balance and inservice testing of the safety injection pumps was properly performed, the procedures were followed without error, and acceptance criteria were ultimately met. However, testing was disrupted when a flow instrument did not function because the root valves were unexpectedly tagged closed by the shift support center. This is another example of inadequate communications between the shift support center and the control room (Sections 5.1 and 5.2).

Engineering

- The licensee provided good engineering support in response to the crankcase explosion that occurred on Emergency Diesel Generator (EDG) A. The root cause determination was thorough and the corrective actions taken to prevent recurrence were appropriate and conservatively applied to EDG B (Section 2).

- Operational testing of turbine-driven Emergency Feedwater (EFW) Pump AB was disrupted, which caused delays in the plant startup evolution because of improper adjustment in the turbine governor valve linkage. The delays were attributed to the incomplete instructions provided for replacement of the governor stem (Section 5.3).

Plant Support

- Throughout RFO 7, a number of instances of poor housekeeping were noted. The inspectors noted poor housekeeping practices around the refueling cavity, in various contaminated areas, and in the EDG A room while the EDG was disassembled. The licensee responded adequately to these concerns as they were identified by the inspectors (Section 3.2).

- Security management failed to provide oversight, appropriate barriers, or instructions to the security officers tasked to ensure positive controls for access to a vital area. This is a violation of 10 CFR 73.55 (Section 6.1).

- The licensee exceeded their outage goals for skin and clothing contamination events during RFO 7. The increase in contamination events

were attributed, in part, to poor radiological work practices and man-rem reduction initiatives such as reduced respirator usage, radioactive waste reduction, and less protective clothing to minimize heat stress (Section 6.2).

- The inspectors identified an improvement item to place more prominent radiological postings for temporary areas. This was an example of inattention to detail by health physics personnel (Section 6.3).

Management Oversight

- A number of unsafe personnel safety practices identified by the inspectors were discussed with licensee management. Additionally, the implementation of effective corrective actions to ensure that personnel safety practices were followed by plant personnel was not timely (Section 3.2).

- Concerns were identified with the use of M&TE, which was a concern that was also identified in NRC Inspection Report 50-382/95-08. It did not appear that sufficient actions had been taken to address this issue (Section 4.2).

- Concerns were identified with the quality of communications between the control room and the shift support center in that system configuration was not maintained. This concern was also identified in NRC Inspection Report 50-382/95-08 and it did not appear actions had been taken to address this concern (Sections 3.3, 5.1, and 5.2).

Summary of Inspection Findings:

New Items

Violation 382/9509-01: Failure to report or immediately return suspect measuring and test equipment to the M&TE facility (Section 4.2).

Violation 382/9509-02: Failure to provide positive control of personnel access to a vital area (Section 6.1).

Closed Items

Inspection Followup Item 382/9418-01 (Section 7.1)
Violation 382/9504-01 (Section 7.2)
Violation 382/9504-02 (Section 7.3)
Unresolved Item 328/9504-03 (Section 7.4)
Inspection Followup Item 382/9505-03 (Section 7.5)
Unresolved Item 382/9505-04 (Section 7.6)
Licensee Event Report 382/94-016 (Section 8)

Attachment:

- Persons Contacted and Exit Meeting

DETAILS

1 PLANT STATUS

At the beginning of this inspection period, the plant was shut down for RFO 7, which commenced on September 22, 1995. The plant entered Mode 4 (hot shutdown) on October 31 and achieved reactor criticality on November 3. The 44-day refueling outage ended on November 5 when the main generator was placed on the power distribution grid. At the end of this inspection period, the plant was operating at 100 percent power.

2 LICENSEE RESPONSE TO EVENTS (93702, 37551)

On October 10, 1995, during the 110 percent load test of EDG A, a crankcase overpressurization event (crankcase explosion) occurred. The EDGs are Cooper-Bessemer, Model KSV-16-T, V-16, turbocharged, 4-stroke cycle, 600 rpm engines. The licensee was in the process of conducting a 24-hour surveillance test of EDG A in accordance with Surveillance Procedure OP-903-115, Revision 3, "Train A Integrated Emergency Diesel Generator/Engineering Safety Features Test." The first 2 hours of the test required that the EDG be operated at 110 percent of rated load, which was at approximately 4700 kW.

The EDG ran at 4700 kW for about 32 minutes, when the operator in the EDG room reported an explosion to the control room and requested the control room operator to secure the EDG. The shift supervisor dispatched the fire brigade leader to the scene, and within 3 minutes, the fire brigade leader reported that there had been a crankcase explosion followed by smoke emanating from the crankcase relief ports. The smoke was quickly dispersed by the EDG room ventilation system. The fire brigade leader reported that there was no fire external to the crankcase, but there was a large amount of oil spilled onto the floor. The brigade leader also reported that cleanup efforts were implemented and, as a precaution, a reflash watch was established.

The inspectors interviewed the nuclear auxiliary operator on the scene and the shift supervisor on duty at the time of the explosion and questioned why a fire was not declared and why the entire fire brigade was not called out to respond to the fire. Both responded that the smoke cleared out so quickly that it was clearly visible that there were no open flames in the EDG room.

The licensee commenced troubleshooting and inspection of the EDG to determine the extent of damage and the cause of the event. CR 95-0962 was initiated to document the event. The licensee found evidence of scoring and burned oil deposits on Cylinder 5L. This cylinder appeared to be the source of ignition in the crankcase.

The piston and cylinder were removed and placed in the shop, where the inspectors examined them. There were burned oil deposits and excessive scoring on the piston and cylinder liner. The piston rings did not appear to have hardened deposits behind them, which was determined to be the cause of a crankcase explosion in the same cylinder on EDG A on March 18, 1991. The

previous crankcase explosion was described in NRC Inspection Reports 50-382/91-09 and 91-13 and Licensee Special Report 91-002-03. The Cylinder 5L piston and cylinder were shipped intact to the vendor, Cooper-Bessemer, for root cause analysis. In addition, the licensee contracted an independent firm, MPR Associates, Inc., to perform a concurrent root cause analysis.

On October 20, the licensee published a root cause analysis report. The inspectors reviewed the report and found that it addressed the appropriate areas: (1) the EDG design as it related to the event, (2) a comprehensive event narrative with detailed descriptions of the pretest and posttest inspections of the EDG, (3) reference to the history of crankcase explosions on Model KSV engines at Waterford 3 and other plants, (4) a description of the root causes, and (5) corrective actions to preclude recurrences.

The licensee determined the root cause to be equipment design. Piston geometry and poor lubricating conditions during startup and rapid loading resulted in tin transfer from the piston to the cylinder liner. Tin transfer is the wear or removal of tin plate material from the nonthrust side of the cast iron piston skirt, originating primarily at the skirt upper ridge. The tin was transferred to the chromium-plated cylinder liner surface and became embedded in the porous surface of the liner. The embedded tin, combined with iron wear particles, reduced the design porosity. The design porosity was engineered to retain oil to support lubrication of the piston skirt to cylinder liner interface. With the porosity reduced, lubrication was reduced, which resulted in heat generation as a result of increased friction and ignition of crankcase oil vapors. The tin transfer observed on Cylinder 5L was consistent with that observed at other plants that experienced similar crankcase explosions.

NRC Information Notice 92-78 and Cooper-Bessemer Service Bulletin 752 of July 1992 addressed the above phenomena. The service bulletin stated that it was recommended, but not required, to remove the lower oil piston ring and the piston wrist pin caps to assist in flushing wear particles from the skirt so the particles did not become embedded in the liner pores or skirt surface. Removal of the lower ring and end caps should assist in maintaining a lubricating oil film on the skirt and reduce the possibility of scuffing and overheating. The bulletin did not recommend disassembling the engines, only to remove the end caps and rings when there was no indication of problems with inadequate lubrication. Because the licensee did not have any indications (i.e., a visual inspection noted no wear marks on any of the cylinders) of inadequate lubrication, the modifications were not completed.

As immediate corrective action, the licensee replaced the liner and piston for Cylinders 5L and 8R. The Cylinder 8R parts were replaced because, when the licensee performed an underside inspection in the crankcase after Cylinder 5L failed, Cylinder 8R exhibited light, vertical scoring on the nonthrust side, which was considered by the vendor to be a precursor to the type of failure experienced on Cylinder 5L.

To prevent recurrence of this problem, the licensee removed the lower oil piston ring and the wrist pin end caps from all pistons on EDGs A and B. The licensee stated that they would be evaluating an additional proposed modification to minimize the potential for a crankcase explosion. The modification would alter the profile of the Model KSV piston skirt to a barrel shape by chamfering the top piston skirt radius and providing a gradual taper transition to the full piston skirt radius. The licensee was also evaluating a proposed modification to replace the existing governor with a dual-program, slow-start governor.

To measure the effectiveness of the corrective actions taken, the licensee stated that they intended to perform periodic underside inspections of the EDGs for evidence of liner wear during planned EDG outages of sufficient duration. Also, through the Cooper-Bessemer Owners Group, the licensee stated that they intended to monitor the condition of Model KSV EDGs throughout the nuclear industry, with particular emphasis on those that have had the lower oil piston ring and wrist pin end caps removed.

The inspectors considered the root cause determination performed by the licensee to have been thorough and that the licensee appeared to take good, conservative corrective actions to resolve this issue and to prevent recurrence.

3 PLANT OPERATIONS (71707, 93001)

3.1 Control Room Observations

Overall, the control room operators appeared to be attentive to plant controls and indications and responded to alarms in an appropriate manner. However, the controls of access of nonoperating personnel into the control room were poorly implemented and communications were not always concise. The licensee agreed with the inspectors' observations and were working on improvements in this area. During discussions with the licensee, and again at the exit meeting of November 14, 1995, the inspectors explained that the intent was not to impose formality, to the extent that additional stress was introduced, but rather that control room formality should be commensurate with the safety significance and number of activities in progress. The inspectors will continue to observe the results of the licensee's actions taken to address this issue during future inspections.

During the plant startup from RFO 7, between November 1 and 9, operator performance was judged by the inspectors as being good. The shift supervisors maintained appropriate access controls, operators were particularly vigilant over the controls and indications, and procedures appeared to be followed at all times. Anomalies were dealt with in a prompt and conservative manner. The startup was executed in a good manner.

3.2 Plant Tours

Throughout the outage the inspectors noted that housekeeping practices in contaminated areas were poor. Most active and inactive work sites in the reactor auxiliary building and containment building were cluttered with debris, tools, and other support items used during maintenance activities.

On October 11, the inspectors noted numerous unattended items in containment above the refueling cavity that had the potential to fall into the cavity. In response to the inspectors' concerns, the licensee removed the items that could potentially fall into the cavity.

During the period following the crankcase explosion in EDG A (Section 2), housekeeping in the EDG A room was poor. Although there was to be a final closure inspection of the EDG, the inspectors expressed concern that the quality of work performed could be adversely affected by the poor working environment. This was discussed with the mechanical maintenance supervisor, and as a result, improved housekeeping practices were observed during the EDG B outage that followed the EDG A outage. The inspectors concluded that the licensee's housekeeping practices during the outage were poor.

On October 7, 11, 16, and 19, the inspectors observed several examples of unsafe fall protection practices for work being performed around the refueling cavity. Personnel were not using safety harnesses in an appropriate manner. The harnesses were not clipped to a safety cable and personnel were not wearing harnesses when required. On each occasion that the safety concerns were identified, the inspectors notified licensee management of the observations. In response to the inspector-identified problems, plant management instructed supervisors to ensure management expectations for personnel safety were being implemented. However, due to the repeat observations made by the inspectors, it did not appear that actions taken to address personnel safety issues were effective.

3.3 Shift Support Center

The licensee implemented a shift support center, at the beginning of RFO 7, to assist control room personnel in performing administrative tasks and control of work associated with the outage. Overall, the shift support center was successful in performing its intended function because the number of distractions of the operations staff was reduced and control room operators were better able to focus on plant conditions.

Although the shift support center was established to assist the operations shift, a number of poor work practices were observed with the performance of the support center. The most significant poor work practice involved control of the safety injection system during RFO 7, which resulted in the unplanned discharge of contaminated water through system openings. The unplanned discharges caused the spread of contamination in plant spaces and several personnel skin and clothing contamination events. Specifically, the shift support center did not routinely provide the operations shift with a system

status and as a result, system configuration control was not maintained by the operations staff. The licensee determined that the unplanned discharges could have been prevented had adequate communications existed between the shift support center and the control room.

To improve communications between the shift support center and the control room, the operations department implemented several administrative corrective actions, which included: (1) attendance of the shift support center personnel at shift meetings, (2) development of a status board to aid control room and shift support center personnel in communicating equipment status, (3) development of a system availability checklist, (4) development of a reactor coolant system (RCS) level control request form, and (5) shift training sessions with operations department personnel to address the need for improved communications. Because several of the work control deficiencies involved the safety injection system, the licensee planned to develop procedural guidance controlling the safety injection system during outages. The procedure should address reactor vessel levels and plant conditions for which specific maintenance activities can be safely performed.

4 MAINTENANCE OBSERVATIONS (62703)

The station maintenance activities affecting the safety-related structures, systems, and components listed below were observed to ascertain that the activities were conducted safely and in accordance with regulatory requirements:

WA 99000416	Motor-Driven Relay Replacements
WA 01140057	3AB313 Feeder Breaker 74HR Relay
ME-004-121	4.16-kV AB Switchgear Maintenance

4.1 Motor-Driven Relay Replacements

Maintenance personnel replaced motor-driven relays used for the control of safety-related components. Due to the complexity of the activity, it required two persons to perform the task. Normally, the second person would independently verify that the work performed by the first person was correct; however, since the second person was involved with the work, the two technicians determined it would not be appropriate to have the second technician perform the task of independent verifier. As a result, a third technician was summoned to the work site to verify proper completion of the work.

The inspectors noted that the use of the third person for task verification was an excellent implementation of the requirement for independent verification.

4.2 Improper Use of M&TE

The inspectors observed testing on the 3AB313 Feeder Breaker 74HR alarm relay in accordance with Work Authorization 01140057 on October 13, 1995. During

testing of the relay, the dc voltage supply from a testing instrument (Doble 2500) indicated an error signal. After several unsuccessful attempts to obtain a satisfactory supply voltage, the technicians obtained a separate power supply and instrument to complete the relay test. Upon returning to the maintenance shop, the technicians informed the electrical foreman of the apparently inoperable instrument.

On October 17, four days after initially identifying the Doble 2500 as potentially inoperable, the inspectors questioned the electrical foreman to determine how the suspect Doble 2500 had been dispositioned. The inspectors noted that the Doble 2500 had not been removed from service and that it had been used to perform a dc ampere test for another relay on October 16.

Procedure UNT-005-009 states that the M&TE user is responsible for timely reporting of suspect, damaged, lost, inoperative, or misplaced M&TE to the M&TE issue facility. Procedure UNT-005-011 states that M&TE users are responsible for immediate return of suspect M&TE. The inspectors concluded that the failure to remove the Doble 2500 from service immediately after identifying it was potentially inoperable is a violation of TS 6.8.1.a (382/9509-01).

Following the inspectors' questioning, the electrical foreman requested the calibration facility to verify the adequacy of the Doble 2500. The calibration facility determined that only the dc voltage was affected and placed a limited-use tag on the device to caution users of the defect.

The licensee stated that several factors occurred that resulted in the failure to remove the Doble 2500 from service. Specifically, the foreman was involved with the Train AB electrical bus outage on the day the Doble 2500 was determined to be suspect and was involved with supervision of additional crews during weekend coverage. When informed about the suspect M&TE, the foreman updated the electrical department M&TE equivalency document for Procedure ME-007-036, "G. E. Auxiliary Relays 12HFA51B," to indicate that the Doble 2500 was not to be used to test the relay. However, the foreman failed to update all other procedures that use dc voltage and failed to determine if the problem with the Doble 2500 affected the dc amperes, ac amperes, ac voltage, or the timer function.

The inspectors concluded that recent NRC identified deficiencies, as documented in NRC Inspection Report 50-382/95-08, combined with the current deficiency, indicated a potential decline in the control of M&TE. In response to the deficiencies, an electrical foreman briefed the electricians during a shop meeting on the proper use and dispositioning of M&TE. The maintenance superintendent stated that a review of the uses of M&TE could be performed to determine if the improper uses of M&TE were isolated examples or an indication of a generic decline in performance.

4.3 Poor Maintenance Work Practices

The licensee identified several poor maintenance work practices during RFO 7 that were similar to problems that had been previously identified, as documented on CR 94-0929. The quality assurance organization identified, as a result of the completion of a root cause analysis on March 31, 1995, that the extent of the poor maintenance work practices constituted an adverse trend in the performance of the maintenance organization. Based on continuing problems with poor maintenance work practices during RFO 7, quality assurance considered that the concern with work practices did not indicate any discernable improvement since the root cause analysis had been completed in March. Additionally, during RFO 7, the quality assurance department also noted degrading trends involving: (1) mechanical work practices, (2) foreign material exclusion controls, (3) contamination events, and (4) quality assurance hold points.

The inspectors discussed this issue with the maintenance superintendent and determined that he was aware of the degrading trends in the maintenance area but had not reviewed CRs generated during the outage to determine what poor work practices needed to be corrected. The maintenance superintendent stated that he believed the number of poor work practices identified in 1995 were lower than the number of poor practices identified during 1994. It was later determined by the inspectors that the number of concerns was higher for 1995 than for 1994, which was contrary to the impression of the maintenance superintendent.

The inspectors also discussed this issue with the quality assurance manager to determine what actions were being taken to correct adverse work practice trends, considering that performance continued to decline after corrective actions, specified by CR 94-929, had been implemented. The quality assurance manager stated that the effectiveness of planned corrective actions were typically reviewed at some interval following initial implementation. When questioned about the degrading trends in several areas related to poor maintenance work practices, the quality assurance manager stated that each of the degrading trends would have to be reviewed to determine if additional actions would need to be implemented prior to a formal review of the planned corrective actions for the identified adverse trend.

5 SURVEILLANCE OBSERVATIONS (61726)

The inspectors observed the surveillance testing of safety-related systems and components addressed below to verify that the activities were being performed in accordance with regulatory requirements.

5.1 Low Pressure Safety Injection Header A Test

On October 17, 1995, the inspectors observed the operators perform the low pressure safety injection flow balance test in accordance with Surveillance Procedure OP-903-108, "SI Flow Balance Test," Revision 3. The test director maintained good communications with the operator at the pump and followed the

procedure. The inspectors noted that the procedure was clearly written, the acceptance criteria were met, and the test was performed without incident.

5.2 High Pressure Safety Injection (HPSI) Header B Test

On October 17, 1995, the inspectors observed portions of the HPSI Header B flow balance test in accordance with Procedure OP-903-108, concurrent with the inservice test of HPSI Pump B in accordance with Surveillance Procedure OP-903-030, "Safety Injection Pump Operability Verification," Revision 10. The inservice test of HPSI Pump B was satisfactorily completed. However, during conduct of the test, Hot Leg 2 Injection Flow Meter SI-IFI-0390 did not indicate any flow. The test director secured the test and restored the system to the pretest lineup.

Further investigation by the licensee revealed that the root isolation valves for the instrument were danger tagged closed in support of Design Change 3441, "Actuator Changeout for SI-502A and -502B." The inspectors questioned how the test director verified that the HPSI pump and supporting instrumentation were properly configured for the test, as required by Section 7.3.1 of Procedure OP-903-108. The test director indicated that he verified the system lineup on the previous day, but the operators in the shift support center had authorized the installation of clearance tags that closed the root valves subsequent to the verification of system readiness. The inspectors concluded that inadequate communications between the shift support center and control room operators was an example in which plant conditions were not fully known by the operators prior to a test or operation of a safety-related system.

5.3 EFW Pump Testing

On November 1, 1995, the inspectors observed the inservice testing of turbine-driven EFW Pump AB in accordance with Surveillance Procedure OP-903-046, "Emergency Feed Pump Operability Check," Revision 10. The test was performed at a steam generator pressure of 980 psia. The TS minimum pressure for the test was 750 psig.

When the test director commenced obtaining pump data, he noted that the differential pressure between the pump suction and discharge was higher than the acceptance criterion. The maximum allowable pressure was 1365.4 psid and the recorded value was 1389.4 psid. The expected turbine speed was 4450 rpm and the actual speed was 4500 rpm. The test director secured the test, contacted the system engineer, and initiated CR 95-1119.

The test gauges were checked and found to be accurate. The test was repeated using a strobe tachometer to verify the speed and the same results were obtained.

Maintenance technicians performed a speed loop calibration and set the governor for the required speed of 4450 ±25 rpm. They found an unrelated problem with the turbine governor not taking control at the correct speed on startup. After troubleshooting, the technicians concluded that the electronic

governor/regulator needed to be replaced. Retesting after replacement of the regulator showed the same response problem.

A vendor qualified to work with Woodward governors recommended that the licensee replace the remote servomechanism and bench test the regulator. The second retest identified the same governor response problem. The system engineer noted that the governor valve was not seating with the servomechanism in the fully retracted position and may not have been closing enough as the turbine accelerated during startup. The governor linkage was adjusted, the turbine was tested, and the response problem was corrected.

The operational test was repeated with satisfactory results and EFW Pump AB was declared operable. The licensee concluded that the linkage may not have been properly adjusted for an indeterminate time and was not noticed until the speed loop calibration was attempted. This condition did not effect the safety functions or operability of the pump as the flow produced by the pump would be greater than the minimum specified in the design basis.

The inspector questioned why the speed loop was not calibrated and the governor linkage not properly adjusted before the plant was heated up to the prerequisite steam generator pressure of 750 psig. The system engineer stated that the governor valve stem was replaced during RFO 7 and they did not think replacement of the governor valve stem would have affected the performance of the turbine. On that incorrect assumption, the system engineer provided the maintenance plan with detailed instructions to take a series of measurements to ensure that the governor valve would be restored to exactly the same configuration in which it was found.

The licensee stated that corrective actions to prevent a recurrence would be addressed in the CR response and that, as a minimum, the vendor manual would be revised to address the lessons learned from this issue for future reference.

6 PLANT SUPPORT ACTIVITIES (71750)

6.1 Plant Security

The licensee established a temporary vital area access point to the reactor auxiliary building to support maintenance activities for EDGs A and B. Because the temporary access point did not have an electronic card reader, the licensee assigned a security officer to verify the access level of each individual prior to entering the vital area.

10 CFR 73.55(d)(7)(i)(B) requires, in part, that the licensee positively control all points of personnel and vehicle access to vital areas. On October 25, the inspectors observed three personnel gain access to the reactor auxiliary building, a vital area, without their access being positively controlled. The security officer did not verify that the individuals gaining access to the vital area were authorized on a current authorization access

list, nor did the security officer record the entry of the individuals on the vital area access form. Failure to maintain positive access control is a violation of 10 CFR 73.55 (382/9509-02).

Security management agreed that adequate access controls had not been maintained. The licensee's immediate corrective actions consisted of training security officers to ensure that all personnel were familiar with the regulatory requirements for access controls. Additionally, the vital area access to the reactor auxiliary building for EDG maintenance was reconfigured to allow for passage of one individual at a time. The inspectors subsequently verified that the three individuals observed were authorized access to the vital area in question.

6.2 Radiation Protection

The licensee identified approximately 198 skin contamination and 345 clothing contamination events during RFO 7. The licensee's goals for personnel contamination events were 111 skin and 127 clothing. The increase in the number of contamination events were attributed, in part, to not using respirators, reducing radioactive waste generation by 50 percent, and reducing the use of multiple layers of protective clothing to minimize heat stress conditions. These were some of the planned actions to reduce exposures as low as reasonably achievable (ALARA).

Nevertheless, improved radiological controls continued to be pursued by the licensee during the outage to minimize the number of contamination events. These actions included altering the method of laundering used anticontamination clothing, performing additional prejob briefings, requiring the use of glove liners inside the noncontaminated areas of containment, and increased focus on improving radiological work practices. The net result of the licensee's efforts to reduce exposures ALARA was a reduction in the total outage man-rem to 124.7, compared with 174 in RFO 6.

One example of an effective achievement in reducing exposures ALARA was the core barrel lift. During the outage, the reactor vessel core support barrel was removed for the 10 year inservice inspection of the reactor vessel. The refuel group obtained a telescoping tripod lift rig from San Onofre Nuclear Station to install and remove the core barrel delta beam at a normal refueling water level. The refuel and health physics groups minimized personnel on the refueling floor and placed personnel behind shielded areas during core barrel movement. The exposure received for all personnel involved in removal of the core barrel was 19 mRem. The reinstallation of the core barrel resulted in a total exposure of 31 mRem. The 50 mRem total dose for the core barrel was substantially less than that of other nuclear power plants. The inspectors concluded that the low total dose indicated that the licensee effectively planned and performed the core barrel lift.

6.3 Radiological Postings

During tours of outside areas between October 23-25, 1995, the inspectors noted several temporary radiological rope boundaries that did not have postings between stanchions that were 20-30 feet apart.

During tours of Safeguards Pump Room A on October 24, the inspectors noted that one side of a four-sided temporary radiological rope boundary was not posted as HIGH RADIATION AREA and HIGH CONTAMINATION AREA. Additionally, one side of a scaffold located adjacent to the area only had one of the two ends of the scaffold, which could be accessed by personnel, posted as HIGH RADIATION AREA and HIGH CONTAMINATION AREA.

In response to the inspectors' observations, the licensee performed a review of temporary radiological area and scaffold postings and added postings where necessary. Although the posting anomalies did not represent a violation of NRC requirements, the inspectors considered the posting anomalies to be examples of inattention to detail by health physics personnel.

7 FOLLOWUP OF PREVIOUSLY IDENTIFIED ITEMS (92901, 92902, 92903, 92904)

7.1 (Closed) Inspection Followup Item 382/9418-01: EDG Turbocharger Control Air System Operability

The licensee was informed by the vendor that there was no documentation to confirm that the EDG could provide a 7-day, full-load run with a lower turbocharger lube oil pressure that could result from a loss of control air. The vendor indicated that control air may be necessary to maintain long term lubrication of the turbocharger.

The licensee's engineering evaluation, in response to the vendor notification, determined that the EDG would remain operable since, upon loss of control air, adequate lubrication would continue to be supplied to the turbocharger to allow time for appropriate operator actions to restore control air to the EDG. The inspectors reviewed the applicable drawings and discussed the design of the system with engineering and considered the evaluation reasonable.

Subsequently, the vendor supplied test results that demonstrated that the Model ET-18 turbocharger could be expected to operate for at least 7 days with a reduced oil supply pressure and that adequate time was available to take corrective action if control air was lost. Based on the vendor reports, the inspectors concluded that concerns regarding the turbocharger had been satisfactorily resolved.

7.2 (Closed) Violation 382/9504-01: Inadequate Procedures for Containment Fire Detection

This violation involved the failure of Procedure UNT-005-013, "Fire Protection Program," to provide adequate guidance to explain the purpose of compensatory measures for recording hourly containment fan cooler intake temperatures.

In response to this violation, the operations department added specific guidance to Procedure UNT-005-013 to caution operators that the supervisory air system would not provide indication of spray heads being open and required operator action if there was an unexplained increase in containment temperature or if containment temperature exceeded 120°F.

The inspectors reviewed the actions taken by the licensee to address this issue and found the actions to be comprehensive.

7.3 (Closed) Violation 382/9504-02: Improper Issuance of Security Badge/Key Cards

This violation involved the failure of security personnel to verify an individual's name and badge number prior to issuance of the badge/key card. The licensee initiated CR 95-0322 to ensure adequate corrective actions were implemented.

The security department retrained personnel by issuing a memorandum that addressed provisions for issuance of badge/key cards. In addition, the quality assurance department performed a surveillance of the access controls at the primary access point. A quality assurance review determined that during a 3-week period of random observations, the badge issuance officers properly verified the badge number and picture prior to issuance of the badge/key card. Additionally, quality assurance determined that security's actions should preclude inadvertent issuance of the incorrect badge.

The inspectors reviewed the actions taken to address this violation and determined that the actions were acceptable.

7.4 (Closed) Unresolved Item 382/9504-03: Improper Securing of Essential Chiller Control Panel Covers

This item involved a review of the licensee's evaluation to determine if the failure to secure the fasteners on the essential chiller control panel covers could affect the operability of the chiller.

The licensee's evaluation indicated that the control panel T-handle had a similar latching mechanism as was found on other safety-related components that had been seismically tested. The friction between the T-handle latch and the panel would prevent the T-handle from turning enough to cause the control panel cover to open. The gasket on the control panel would keep the door pushed out against the latching mechanism to prevent vibrations from affecting electrical components located on the panel door.

Based on a review of the evaluation, the inspectors concluded that the failure to secure the fasteners on the control panel would not impact the operation of the chiller during a seismic event and no violation existed.

7.5 (Closed) Inspection Followup Item 382/9505-03: RCS Flow Rate Calculations with Core Operating Limit Supervisory System (COLSS) Inoperable

This item involved a followup on the operations superintendent's commitment to review department procedures and practices to determine if any changes or revisions to procedures were needed to clarify when the RCS flow calculation should be performed following a loss of COLSS for greater than 2 hours. The inspectors were concerned because the results of an RCS flow calculation without COLSS available may require an additional reduction in reactor power to restore departure from nucleate boiling ratio and local power density to within allowable TS limits.

The inspectors discussed the TS requirements for COLSS and RCS flow verification with other NRC personnel and determined that even though an RCS flow calculation without COLSS would require a reduction in reactor power to maintain departure from nucleate boiling ratio and local power density within allowable TS limits, the licensee did not need to perform the RCS flow calculation following a loss of COLSS until the Technical Specifications required the once per 12 hour verification. Based on this determination, this issue is considered to be closed.

7.6 (Closed) Unresolved Item 382/9505-04: Evaluation of Essential Chilled Water System to Perform Design Function

The concern identified by this item was reviewed during the performance of a special inspection, as documented in NRC Inspection Report 50-382/95-16.

8 ONSITE REVIEW OF LICENSEE EVENT REPORT (92700)

(Closed) LER 382/94-016: Lube Oil Flow to Emergency Diesel Turbocharger Under Loss of Control Air

This item was closed during review of Inspection Followup Item 382/9418-01 (Section 7.1).

ATTACHMENT

1 PERSONS CONTACTED

1.1 Licensee Personnel

R. E. Allen, Manager, Operational and Engineering Experience
R. G. Azzarello, Director, Design Engineering
R. F. Burski, Director, Nuclear Safety
G. G. Davie, Quality Assurance Manager
J. G. Hoffpauir, Maintenance Superintendent
J. B. Houghtaling, Technical Services Manager
D. R. Keuter, General Manager, Plant Operations
D. F. Litolff, Licensing Engineer
D. C. Matheny, Operations Superintendent
J. A. Ridgel, Radiation Protection Superintendent
R. S. Starkey, Manager, Operations and Maintenance
C. J. Thomas, Licensing Supervisor
D. W. Vinci, Licensing Manager
G. S. Zetch, Security Coordinator

1.2 NRC Personnel

P. H. Harrell, Acting Chief, Branch D, Division of Reactor Projects

The personnel listed above attended the exit meeting. In addition to these, the inspectors contacted other personnel during this inspection period.

2 EXIT MEETING

An exit meeting was conducted on November 14, 1995. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee did not express a position contrary to the inspection findings documented in this report. The licensee did not identify as proprietary any information provided to, or reviewed by, the inspectors.