ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-361/95-28
50-362/95-28

Licenses: NPF-10
NPF-15

Licensee: Southern California Edison Co.
P.O. Box 128
San Clemente, California

Facility Name: San Onofre Nuclear Generating Station, Units 2 and 3

Inspection At: San Onofre, San Clemente, California

Inspection Conducted: November 19 through December 30, 1995

Inspectors: J. A. Sloan, Senior Resident Inspector
J. J. Russell, Resident Inspector
D. L. Solorio, Resident Inspector
D. G. Acker, Project Inspector
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Approved: for D. F. Kirsch, Chief, Project Branch F — Date 1/16/96

Inspection Summary

Areas Inspected (Units 2 and 3): Routine, announced resident inspection of operational safety verification, maintenance and surveillance observations, engineering and plant support observations, audits, and quality verification activities.

Results (Units 2 and 3):

Operations

- The licensee exercised a prudent and conservative decision to shut down Unit 2 to investigate potential reactor coolant pump stator cooler water leakage, which could have damaged the motor and challenged safety systems, even though no leakage was found (Section 2.1).

- Response to alarms and minor plant events was appropriate, including response to an inspector-identified packing leak on a pressurizer spray valve (Section 2.1), response to an inadvertent downpower transient

(Section 2.2), and response to a high temperature condition in the Unit 2 automatic voltage regulator room (Section 2.4).

- The inspector observed a minor problem with the functional recovery procedure that could have inappropriately and unnecessarily forced operators to charge the reactor coolant system solid while awaiting chemistry results. Although operators noted that the condition was generally known, they indicated that they would not allow the system to go solid while awaiting chemistry results. The licensee agreed to revise the procedure (Section 2.5).

- The licensee's self-assessment of the Operations Command and Control function was thorough and probing, resulting in numerous substantial, self-critical conclusions (Section 7.2).

Maintenance

- Generally, maintenance and surveillance activities observed were performed appropriately (Sections 3.3 and 4).

- The postmaintenance retest of emergency boration Valve 2HV9247 failed to identify that the closed limit switch was not properly set, due to a maintenance error, resulting in the valve leaking after it was returned to service and causing a downpower transient. The licensee's corrective actions, including resetting the limit switch and performing a leak check, were appropriate (Section 2.2).

- Inaccurate assessment, by Maintenance personnel, of a temperature trend in the automatic voltage regulator room represented a missed opportunity to allow Operations to take measures to avert a high temperature condition before the alarm setpoint was reached (Section 2.4).

- In response to the inspector's observation of a contract worker standing on a safety-related inverter, the licensee took appropriate actions, including stopping work and counseling the person, and reemphasizing the expectation that was an inappropriate treatment of safety-related equipment (Section 3.1).

- Maintenance personnel failed to notice and report that a caution tag had been burned off an auxiliary feedwater system valve during hot work (Section 3.2).

- Site Quality Assurance audits regarding Power Distribution Limits and Plant Systems were thorough, had well-founded conclusions, and confirmed compliance with all of the numerous audited surveillance requirements (Section 7.1).

Engineering

- The licensee's root cause determinations were generally sound, resulting in appropriate corrective actions. Positive examples included resolution of a reactor coolant pump moisture sensor deficiency (Section 2.1) and an erratic T-cold signal (Section 5.1). An exception involved the breaker for auxiliary feedwater Valve 2HV4715, in which a repeat failure demonstrated that the root cause determination following a similar September 1995 failure was not accurate (Section 2.3).

- The licensee demonstrated a high level of diagnostic and technical capability in determining the internal configuration of operational amplifier chips in the Unit 2 Channel D excore subchannel linear gain cards, allowing the licensee to continue directed troubleshooting of the cause of the card failures (Section 5.2).

Plant Support

- The licensee's implementation of hand-geometry biometrics access control system appeared to be well-controlled, with no problems noted (Section 6.1).

Summary of Inspection Findings:

There were no inspection findings.

Attachment:

- Persons Contacted and Exit Meeting

DETAILS

1 PLANT STATUS (71707)

1.1 Unit 2

The unit began this inspection period operating at 100 percent reactor power. On November 28, 1995, at 11:42 p.m., the unit was shut down due to failure of the leak detection system for the motor cooler for reactor coolant Pump 2P004. Upon completion of repairs, the unit was synchronized to the grid on November 30 at 2:15 p.m. Power ascension was halted at 80 percent reactor power on December 2, 1995, in order to perform a heat treatment of the circulatory water system. The unit returned to 100 percent operating power on December 3, with the first point heater bypass opened to maximize power generation. The unit opcrated at 100 percent power through the end of this inspection period.

1.2 Unit 3

The unit began this inspection period operating at 80 percent reactor power during performance of a heat treatment of the circulating water system. Following repair of a turbine high pressure stop valve on November 20, 1995, power ascension continued and the unit reached 100 percent of reactor power at 12 a.m. on November 21, 1995. The unit operated at 100 percent reactor power through the end of this inspection period.

2 OPERATIONAL SAFETY VERIFICATION (71707)

2.1 Reactor Shutdown - Unit 2

On November 28, 1995, the licensee decided to shut down the Unit 2 reactor to allow inspection of a moisture sensor on the stator cooler for reactor coolant pump Motor 2MM004. An assistant control operator noticed that the moisture sensor computer alarm had annunciated when the plant monitoring system had been returned to service following a brief computer outage, and followup investigation by the licensee prior to the shutdown did not eliminate the possibility of a component cooling water leak in the heat exchanger. The shutdown was completed on November 29. The inspector considered the licensee's decision, to shut down, conservative and prudent.

The inspector accompanied the licensee into containment for the inspection and repair activities. The licensee inspected the sensor and determined that tubing had become disconnected and had fallen onto the probe, shorting the probe contacts and providing a false reading. The licensee reattached the tubing, and reoriented the probe so that the tubing would not short the probe contacts if the tubing became disconnected in the future. The inspector considered the licensee's corrective actions appropriate.

While in the containment, the inspector performed a general walkdown. The inspector identified a significant active packing leak on pressurizer spray

Valve 2PV0100B. After unsuccessfully attempting to stop the leak by tightening the packing, the licensee isolated the spray valve and continued operation with only one spray valve in service. Nonconformance Report 1995110008500 was generated and dispositioned to "accept as-is" with the valve isolated, and to repack the valve. The licensee intended to repair the isolated spray valve during the next refueling outage. The inspector noted that the leakage had been only a very minor contributor to the unidentified leak rate from the reactor coolant system. The inspector considered the licensee's actions appropriate.

2.2 Inadvertent Downpower

On December 6, 1995, Unit 2 experienced an inadvertent downpower of about 1 percent power due to leakage past the emergency boration Valve 2HV9247 following its return to service from maintenance, after a boric acid makeup pump was started to recirculate a tank. Operators performed well by quickly noticing the power reduction and stopping the boric acid makeup pump, terminating the transient.

During the maintenance activity, the limit switch assembly in the motor operator had been replaced. The valve was a split disk, wedge type valve, designed to limit closed, and the closed limit switch was required to be set to open at 2-1/2 turns from the fully closed position. As part of the preparations for resetting the closed limit switch, maintenance personnel were to manually close the valve and then turn the handwheel in the open direction 2-1/2 turns. Three maintenance workers had checked the valve fully closed. The postmaintenance testing did not include a leak check since the safety requirement was for the valve to open. After the transient, a maintenance foreman determined that the valve had not been fully closed before counting the turns open for the setting of the closed limit switch, resulting in the valve being open about 3/4 of a turn more than desired, which resulted in borated water leakage into the reactor coolant system. The workers indicated that the valve felt closed, apparently because the increased drag of the disc contacting the seat, exacerbated by previous work on the valve, gave a false indication.

The inspector noted that the minor leakage through the emergency boration valve resulted in only a slow downpower transient that was quickly identified by operators. The leakage was an operational inconvenience, but the valve was still able to perform its safety function to open. The inspector concluded that the absence of a leak check in the postmaintenance functional test was not safety significant. The performance of a leak check was not a regulatory requirement, although it would have been prudent in this case.

As corrective action, the licensee adjusted the limit switch and performed a leak check of the valve before returning the valve to service. The licensee initiated an interdivisional investigation to review the methodology of setting the limit switches on motor operated valves that limit closed and to revise appropriate procedures. As part of that investigation, the licensee also intended to evaluate the postmaintenance functional testing of the motor

operated valves that limit closed. The inspector considered these corrective actions appropriate. Additionally, the operators' response to the transient demonstrated a good awareness of plant conditions and good diagnosis of effective corrective measures.

2.3 Failure of Motor-Operated Valve 3HV4715

On December 18, 1995, Unit 3 operators received annunciation in the control room, investigated, and found the breaker for Valve 3HV4715 (the direct current, motor-operated valve for auxiliary feed isolation and flow control to Steam Generator 3E089) in the trip free position. The valve was not being operated at the time. The licensee declared the valve inoperable and generated Nonconformance Report 951200384. The licensee was unable to find a specific cause for the breaker opening, but determined that the breaker itself appeared to be functioning normally. The only load on the circuit without valve operation was from motor limit switch space heaters. The licensee removed the heaters, replaced the breaker, and declared the valve operable.

The inspector reviewed electrical schematics and the nonconformance report generated, and visually inspected the motor and breaker. The inspector also noted that this same breaker location had spuriously tripped, with no valve operation, on September 19, 1995. At that time the licensee performed a failure analysis, documented by the Independent Safety Engineering Group in a report dated November 22, 1995. The report concluded the failure was probably due to weak spring design in the latching mechanism of the breaker. As a result, the licensee had replaced the breaker with a different vendor type.

Based on the above, the inspector concluded that, because the fault recurred after the corrective actions for the first spurious trip were implemented, the probable root cause, as identified in the report (weak springs), did not appear to be correct. However, since the fault did not remain locked in after the breaker trip, the inspector concluded that the first root cause, although not completely rigorous, was reasonable. Based on circuit analysis, the inspector also concluded that the action to remove the space heaters, as a result of the second failure, was prudent.

2.4 High Temperature in Unit 2 Automatic Voltage Regulator (AVR) Room

On December 28, 1995, while observing operations in the Unit 2 control room at approximately 2 p.m., the inspector noted an annunciation for main turbine AVR "A" trouble, the AVR in service. Operators responded to the AVR room and local annunciation revealed a high temperature of approximately 85°F. Temperature in the space was normally maintained around 60°F. The manufacturer recommended maintaining temperatures of less than 104°F for proper system operation. Operators started local portable air conditioning units and the temperature stabilized and dropped. Based on review of temperature traces of the space, the inspector concluded that the main air conditioning unit had failed and tripped off line at approximately 10 a.m. that morning. The licensee was in the process of performing a design change

to the ventilation in the room and had installed the local air conditioning units as a temporary measure. Based on conversations and observation, the inspector concluded that operator response was good, but that the possibility of overheating, as evidenced during this occurrence, could have been identified earlier when an electrical test technician took readings in the space that morning. Based on conversations, the inspector concluded that the test technician noted abnormal readings at approximately 8:30 a.m. that morning while performing normal rounds and felt that the space was hot. The technician repeated the readings with his supervisor at approximately 10:30 a.m. and determined that temperature and readings at that time were satisfactory. The condition continued until the annunciation was received. The inspector noted installed temperature traces indicated temperature rose steadily from 10 a.m. until 2 p.m., with the temperature at 10:30 a.m. approximately 65°F, and trending up. The inspector concluded that the maintenance personnel inaccurately assessed the temperature trend and consequently failed to notify Operations that the temperature was above normal.

2.5 Functional Recovery Requirements for Verifying Reactivity Control May Lead Operators to Approach a Solid Pressurizer Condition

The inspector reviewed portions of the licensee's Emergency Operating Procedures and noted that Step FS-7.e of Procedure SO23-12-9, Revision 11, "Functional Recovery," directed operators to maintain at least 40 gpm of emergency boration until Technical Specifications limits for shutdown boron concentration in the reactor coolant system were verified. The inspector had previously discussed this with operators and noted that this could lead to unnecessarily taking the pressurizer to a solid condition because the taking of the chemistry sample, which some of the operators assumed was necessary to verify boron concentration, could delay securing a charging pump. On December 19, 1995, the inspector met with licensee personnel and was informed that this concern was generally known, but that it was not incorporated into any formal process for emergency operating procedure revision. The inspector was concerned that the operators had not taken action to have the recognized procedural deficiency resolved. The licensee intended to either develop a standard calculation for Shift Technical Advisor use or to include a note that injection from the refueling water storage tank would satisfy this requirement. The licensee intended to incorporate this change by a planned March 1996 revision to the emergency operation procedures. The inspector considered this response adequate.

3 PLANT MAINTENANCE (62703)

During the inspection period, the inspector observed and reviewed selected documentation associated with maintenance and problem investigation activities listed below to verify compliance with regulatory requirements, compliance with administrative and maintenance procedures, required quality assurance/quality control department involvement, proper use of safety tags,

proper equipment alignment and use of jumpers, personnel qualifications, and proper retesting.

3.1 Standing on Class 1E Inverter to do Ventilation Work

On December 4, 1995, the inspector was touring Unit 2 vital electrical inverter rooms and observed a contract maintenance person standing on Inverter 2Y003 in order to access a ventilation duct in the overhead. The top of the inverter was approximately 6 feet high. The inspector questioned the prudence of this as Unit 2 was in Mode 1 and failure or sufficient physical agitation of the inverter could have resulted in a unit trip.

In response to the inspector's concern, licensee management stopped work in these areas, counseled the involved individual, and reemphasized the management expectation that safety-related equipment would not be used in this manner. Ladders and, if necessary, scaffolding only were to be used to access inaccessible areas. The inspector considered that licensee response to the inspector's concern was good.

3.2 Replace Flow Orifice (3FO8258) and Two Orifice Isolation Valves (MU 688 and MU 689) on Unit 3 Turbine Driven Auxiliary Feedwater Pump Main Steam Line From Both Steam Generators

On December 19, 1995, the inspector observed portions of this maintenance. Overall, the maintenance was performed adequately. The inspector did note that a caution tag on Valve 3MU690, a bypass valve around a strainer, had apparently been burned off by previous hot work. The inspector informed Operations personnel, who attached a new tag. The inspector considered that the Maintenance personnel should have made this observation and informed Operations at the time of occurrence.

3.3 Other Maintenance Observations

Other maintenance activities were observed:

Unit 2

- Troubleshoot failed Unit 2 excore Channel D amplification gain circuit card by performing testing via temporary diagnostic equipment inserted in core protection calculator Channel D

- Modify internal wiring in toxic gas isolation system Train A Panel 2/3L378 and remove instruments

These activities were performed adequately.

4 SURVEILLANCE OBSERVATIONS (61726)

Selected surveillance tests required to be performed by the Technical Specifications were reviewed on a sampling basis to verify that: 1) the surveillance tests were correctly included on the facility schedule; 2) a technically adequate procedure existed for performance of the surveillance tests; 3) the surveillance tests had been performed at the frequency specified in the Technical Specifications; and 4) test results satisfied acceptance criteria or were properly dispositioned.

The following surveillance activities were observed:

Unit 2

- SO23-II-1.15.1, Temporary Change Notice (TCN) 2-1, "Toxic Gas Isolation System Train B Channel Functional Test and Channel Calibration."

- SO23-3-3.60.3, TCN 0-1, Attachment 3, "Component Cooling Water Pump 2(3) MP-025 Train A Test."

Unit 3

- SO23-3-3-60.6, Attachment 2, Revision 0, "Auxiliary Feedwater Pump and Valve Testing."

- SO23-3-3.16, Temporary Change Notice 7-24, Attachment 1, "Auxiliary Feedwater System Monthly Surveillance."

- SO23-3-3.60.7, Revision 0, Attachment 5, "Containment Spray Pump 2(3) MP-013 and Valve Testing."

These surveillances were performed adequately.

5 ONSITE ENGINEERING (37551)

5.1 T-Cold Inputs to Core Protection Calculator

The licensee noted that the T-cold inputs to the Unit 2 Channel D core protection calculator were erratic, and Operations placed the associated plant protection system parameters in bypass. Engineering investigated the condition. After determining that the problem was inside the containment, the licensee used electrical characterization and diagnostics equipment and response time testing to establish that the dual-element resistance temperature detectors were grounded. The licensee determined that there were multiple grounds involved, and that the combination of the grounds was resulting in the observed erratic behavior.

While the unit was in Mode 3 to address an unrelated problem (see Section 2.1), the licensee inspected the connectors for the resistance

temperature detector inside containment. The licensee observed water and corrosion in the connector, which accounted for the grounds. The licensee replaced the terminal block in the connector and sealed the wiring inside a condulet. No path or source of water was identified, and the licensee did not find evidence that water had entered through the condulet.

The licensee determined that the wiring was configured in a manner consistent with its environmental qualification requirements. Additionally, the licensee determined that the T-cold inputs were only required to be functional up to 50 seconds following an accident, and that the seals present were adequate to provide assurance of that capability.

The inspector concluded that the licensee's investigation was appropriate.

5.2 Unit 2 Excore Nuclear Instrument Failures

The subchannel linear gain cards (A10) for the Unit 2 Channel D excore power range nuclear instrumentation have experienced several failures since July 1995. Although the licensee had not yet established the final root cause of the failures, the inspector noted that the licensee demonstrated excellent technical capability during the troubleshooting process. In particular, the licensee destructively examined the failed operational amplifier integrated circuit chips on the circuit cards and successfully determined the internal logic of the operational amplifiers. By observing the damaged portions of some of the failed chips, the licensee was able to determine that the failures were caused by voltage spikes from the high voltage power source. The licensee subsequently determined that the apparent cause of the spikes was a bad linear calibrate switch. The licensee replaced the switch and at the end of this inspection period was testing to confirm that the switch was the cause of the voltage spikes and that the problem was corrected. The inspector concluded that the licensee's ability to analyze the operational amplifier chips was excellent, and that the analysis contributed to the troubleshooting process.

6 PLANT SUPPORT ACTIVITIES (71750)

6.1 Security

During this inspection period, the licensee implemented a hand geometry access control system for protected area access. The inspector observed that the implementation of the new system, though not fully completed, was well-controlled.

7 AUDITS (40704)

7.1 Site Quality Assurance Audits

The inspector reviewed two recent audits performed by the Quality Assurance organization to assess the level of thoroughness and the degree of critical assessment.

Audit SCES-503-95, "Power Distribution Limits" (November 1995), consisted of a review of surveillance test records, a review of previous performance observations, and interviews with selected personnel. The audit confirmed compliance with Technical Specification surveillance requirements, and did not result in any significant negative findings. One minor finding was identified, related to transmittal of software development records to the records repository. The audit appeared to have been thorough in reviewing appropriate information on which to base its conclusions.

Audit SCES-508-95, "Plant Systems" (November 1995), consisted of records reviews, performance observations, and personnel interviews. The audit determined that Technical Specification surveillance testing had been performed as required. The audit also identified some strengths in Operations and Maintenance supervisory involvement. No weaknesses were identified.

7.2 Safety Engineering Report SEA 95-05, "Command and Control Evaluation" (July 1995)

The inspector reviewed the Command and Control Evaluation performed by the licensee in fulfillment of a commitment made to the NRC in response to problems identified following the April 6, 1995, flow diversion event in Unit 2, documented in NRC Inspection Report 50-361/95-06; 50-362/95-06. The evaluation consisted of extensive control room and simulator observations, benchmarking performance at other nuclear plants, interviews, evaluation of recent events, and review of documentation.

Report SEA 95-05 made several very self-critical and profound conclusions regarding Operations, to which the licensee was responding.

The inspector noted that the report contained prioritized recommended corrective actions to address the identified deficiencies. The report was clearly written, with the supporting details attached. The inspector concluded that the evaluation was thorough and probing, addressing difficult issues in an effective manner.

ATTACHMENT

1 PERSONS CONTACTED

1.1 Licensee Personnel

*D. Breig, Manager, Station Technical
*J. Fee, Maintenance Manager
*D. Franklin, Engineer, Compliance
*G. Gibson, Manager, Compliance
*R. Giroux, Engineer, Compliance
*D. Herbst, Manager, Quality Assurance
*H. Herschthal, Manager, Nuclear Systems Engineering
*R. Krieger, Vice President, Nuclear Generating Station
*R. Neal, Supervisor, Electrical Systems Engineering
*W. Marsh, Manager, Nuclear Regulatory Affairs
H. Newton, Manager, Site Support Services
*D. Nunn, Vice President, Nuclear Engineering and Technical Support
*G. Plumlee, Supervisor, Compliance
*J. Reilly, Manager, Nuclear Engineering & Construction
M. Short, Manager, Site Technical Services
*K. Slagle, Manager, Nuclear Oversight
T. Vogt, Plant Superintendent, Units 2/3
*R. Waldo, Operations Manager
*M. Wharton, Manager, Nuclear Design Engineering
*J. Wood, Supervisor, Nuclear Training
W. Zintl, Manager, Emergency Preparedness

1.2 Other Personnel

*R. Erickson, Site Representative, San Diego Gas and Electric

1.3 NRC Personnel

*J. Russell, Resident Inspector
*J. Sloan, Senior Resident Inspector
*D. Kirsch, Chief, Project Branch F

In addition to the personnel listed above, the inspectors contacted other personnel during this inspection period.

*Denotes personnel that attended the exit meeting.

2 EXIT MEETING

An exit meeting was conducted on January 4, 1986. During this meeting, the inspectors reviewed the scope and findings of the report. The licensee acknowledged the inspection findings documented in this report. The licensee did not identify as proprietary any information provided to, or reviewed by, the inspectors.