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SUBJECT: RO:on 901120,4,800 gallons of borated water discharged into containment during full power operation.

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November 27, 1990

Mr. John B. Martin, Administrator
U. S. Nuclear Regulatory Commission, Region V
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596-5368

Dear Mr. Martin:

Subject: **Docket No. 50-361**
Actions Following Inadvertent Containment Spray Actuation
San Onofre Nuclear Generating Station, Unit 2

PURPOSE

On November 20, 1990, San Onofre Unit 2 experienced an inadvertent actuation of the Containment Spray System and other Engineered Safety Feature (ESF) systems during performance of the required monthly channel functional test. As a result, approximately 4,800 gallons of borated water were discharged into containment during full power operation.

The purpose of this letter is to describe actions taken by Southern California Edison (SCE) as a result of this discharge of the spray water into containment. It is submitted pursuant to discussions between SCE and NRC staff concerning the scope and sequence of these actions.

SUMMARY

Based on the evaluation of the results of a similar event at Unit 2 in 1984, SCE initially maintained the unit in stable power operation while conducting inspections and tests to determine if the spray had adversely affected any systems or equipment. This was done in a sequence which assigned the highest priority to safety systems.

Although no safety systems were affected by the spray, degraded electrical conditions were identified for a portion of the power supply to the Control Element Drive Mechanisms (CEDMs). Accordingly, Unit 2 was shut down on November 23, 1990, in order to correct these conditions.

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BACKGROUND

On March 9, 1984, Unit 2 experienced a similar inadvertent initiation of ESF systems during power operation which resulted in approximately 6,000 gallons of borated water, mixed with about 65 gallons of 42 weight percent sodium hydroxide, being discharged into containment. (Note: Sodium hydroxide is no longer injected into the containment spray flow.)

As a result of that event, SCE implemented a detailed inspection and testing program to evaluate the spray effects. The program and results are summarized in Enclosure A hereto. (In addition, containment spray was initiated inadvertently at Unit 1 during power operation in 1981.)

DISCUSSION

Based on SCE's prior experience following containment spray actuation at power, it was expected that the borated water would not have any immediate, adverse effect on safety-related systems or equipment within containment. Also, SCE considers that under many circumstances where the status of systems or equipment needs to be verified for any reason, such verification should be completed prior to undertaking a major change in plant status, including shutdown. This is consistent with Generic Letter 87-09 which notes in connection with shutdowns resulting from missed surveillance intervals that, "...it usually would be preferable to restore (the system or component) to service before making the change in plant operating conditions".

Immediate Actions

Accordingly, Unit 2 was maintained in stable power operation immediately following the event on November 20th while the following actions were taken:

- Verification of proper ESF actuation.
- Physical inspection of accessible areas inside containment. As expected, the containment was essentially dry with only light water spotting of equipment surfaces noted.
- Verification that trisodium phosphate used for recirculation flow pH control was not affected by the spray.
- Review of our Redundant Instrument Monitoring System to detect any deleterious effect on operational instrumentation. No degradation was noted in any of the 140 instruments monitored by this system.
- Review of ground alarm received on non-1E uninterruptible power supply. This alarm was cleared by opening the circuit breaker supplying power to the movable incore detectors.
- Walkdown of ESF piping and equipment outside containment. No evidence of damage was found.

Subsequent Actions

The immediate actions verified proper operation of safety related and environmentally qualified (EQ) equipment. Subsequent actions focused on longer term concerns, (such as possible corrosion of piping and pipe support members within containment) and effects of the spray on non-safety related, non-EQ equipment. On November 22, 1990, while performing monitoring of critical equipment which is considered to be a trip hazard, a ground indication on the output of the CEDM motor generator sets was detected. On November 23rd the unit was shut down to enable further troubleshooting and repair. These investigations identified unacceptable resistance readings on several CEDM circuits.

The cause of the unacceptable readings on these CEDMs was moisture intrusion into the connector assembly at the containment penetrations. These connectors and other CEDM connectors mounted in a similar manner have been disassembled, cleaned, and verified to be fully operable.

Coincident with the shut down of the unit an extensive inspection and testing plan was undertaken. Enclosure B provides a summary of the actions performed. These actions complete our prompt response to the event. Additional monitoring for potential long term effects, such as deterioration resulting from residual boric acid, are discussed in the enclosure.

CONCLUSION

Based on the inspections and testing performed it is concluded that there were no deleterious effects of the containment spray on safety-related equipment. The degraded electrical conditions on the CEDM circuits would not have affected the ability to safely shut down the unit, although it did have the potential for one or more dropped CEAs.

The actions described in this letter complete our prompt response to the event. Additional monitoring for long term effects will be performed.

If you have any questions or comments concerning this event and our follow-up activities, please let me know.

Sincerely,

Harold B. Ray

cc: Mr. J. M. Taylor, USNRC Executive Director for Operations
Mr. C. W. Caldwell, USNRC Senior Resident Inspector, SONGS
Mr. L. E. Kokajko, Project Manager, SONGS 2 and 3

Enclosure A

Inspection and Testing Program to Evaluate March 9, 1984 Inadvertent Containment Spray

The inspection and testing program to evaluate the March 9, 1984, containment spray included the following:

- inspection of junction boxes and connectors
- inspection and calibration of selected instrumentation
- inspection of selected electrical penetrations
- inspection of major equipment, including HVAC units, reactor coolant pumps, hydrogen recombiners, etc.
- stroking of selected valves
- inspection of safety injection tanks
- inspection of all snubbers (1/4 to 1/2k) and wipe down, if necessary, on elevation 45' and above in the spray path
- determination of the long term effects of spray on components; e.g. chemical effects on cable insulation

As a result of this program it was concluded that no component or system damage resulted from the containment spray.

Enclosure B

UNIT 2 POST-CONTAINMENT SPRAY STATUS AND ACTION PLAN

COMPLETED ACTIONS

I. Containment Area Inspection

Inspection of all accessible areas inside containment was performed to assess the impact of the containment spray. The containment was found to be essentially dry with only light water spotting of equipment noted. Structural members were determined to not likely be affected by the spray actuation. Where appropriate, isolated puddles inside containment were cleaned up.

II. Electrical Equipment Inside Containment

On November 22, 1990, degraded resistance was detected on the output of the control element drive mechanism (CEDM) motor generator sets. It was concluded that the degraded resistance was located in either the CEDMs, the CEDM Control System, or the Reactor Trip Breakers. As a result, Unit 2 was shutdown on November 23, 1990 in order to enable further troubleshooting and repair.

The investigation found degraded resistance on the five CEDM circuits associated with electrical penetration 94 and two CEDM circuits associated with penetration 97. The degraded resistance was found to be located inside of containment in multi-pin connectors which connect the containment penetration conductors to the remainder of the in-containment CEDM circuitry. These non-EQ connectors were all exposed to direct impingement of containment spray since they are mounted at the top of a cabinet with the wiring from the CEDM entering the top of the connector. Inspection of the internals of these connectors identified moisture intrusion and pre-existing corrosion. The corrosion is unrelated to this event. The moisture combined with the corrosion led to the degraded resistance.

There are a total of twelve electrical penetrations associated with the CEDM system. Of these penetrations, nine have the connectors mounted at the bottom of the connector cabinet and three have the connectors mounted at the top of the cabinet (penetrations 94 and 97 [discussed

above], and 95). All of the top mounted connectors for the CEDM system have been disassembled, cleaned and verified to be fully operable during this outage.

A containment walkdown was performed to identify any other penetration enclosures with top panel entry of cables. Although no other configurations similar to the CEDMs (i.e., with top mounted connectors) were found, 24 of the remaining 60 electrical penetration enclosures have cables passing through the top panel. To determine the acceptability of these configurations, a sample of 10 of these enclosures was examined for moisture intrusion. The termination conditions were found to be satisfactory in all cases.

In addition, a sample of non-EQ junction boxes inside containment were also opened and found to be dry with no evidence of being wetted by containment spray.

III. ESF Piping Inspections

A walkdown of ESF piping and mechanical equipment outside of containment was performed to ensure there was no damage due to water hammer or other causes. No evidence of damage was found.

IV. Mechanical Equipment Inside Containment

Inspection of the mechanical equipment inside of containment indicated that those components which were exposed to the containment spray were found to be dry and in satisfactory condition with only light water spotting noted. Components inspected included valves, reactor coolant pumps, the reactor vessel head area, safety injection tanks, sections of uninsulated piping, the CEDM coolers, the normal and emergency containment coolers and snubbers.

A thorough visual inspection of fourteen snubbers was performed (the snubbers were selected based an accessibility, exposure to the spray, and orientation, and are considered representative of the containment snubber population). Similar to observations of other equipment exposed to the spray, light water spotting was noted but there was no evidence of moisture accumulation or other indication of spray induced damage. Additional inspections and testing are planned for future outages as noted below in long term actions.

V. Instrumentation

Monthly surveillance testing of a sample of safety related instrumentation (Remote Shutdown and Post Accident Instruments) was accelerated. No anomalous conditions were noted. Accordingly, subsequent surveillances will be continued on the previously scheduled interval.

In addition to performing these accelerated surveillances, a review of the Redundant Instrumentation Monitoring System (RIMS) data was conducted following the containment spray actuation. RIMS provides a database which permits the trending of the output of selected instruments, many of which are located inside containment. The system records and stores the output of critical plant parameters (e.g., pressurizer pressure and level, RCS temperatures, containment pressure and temperature, etc.) and is equipped with the capability to construct graphs and charts which can indicate calibration drift or other anomalous conditions. There has been no indication from this review of an instrument malfunction as a result of the containment spray. The periodic engineering review of this data, which is currently performed monthly, is sufficient to identify gradual instrument degradation which may occur as a result of the brief exposure to the containment spray fluid.

VI. Equipment Which Has Been Operated

A substantial sample of components (estimated to be 75%) located inside containment, have been operated satisfactorily since the containment spray actuation (e.g., valves have been stroked, pumps and motors have been energized, etc.). The specific components which have been operated are:

<u>Reactor Coolant System</u>

Reactor Coolant Pumps
Pressurizer Spray Valves
Reactor Coolant Drain Tank (RCDT) Outlet Sample System Valve
Quench Tank Outlet Sample Valve
Quench Tank to Waste Gas Header Valve
Quench Tank Drain Valve to RCDT

Emergency Core Cooling System

Emergency Sump Outlet Valves
RCS Cold Leg Drain Valves
Safety Injection Tank (SIT) Drain Valves
RCS Hot Leg Drain Valves to RCDT
SIT/Cold Leg Drains to RCDT

Containment Normal Sump

Normal Sump Pumps
Nuclear Service Water Valves
Normal Sump Discharge Isolation Valve

Chemical Volume and Control System

Controlled Bleed-off to Quench Tank Isolation Valve
Letdown Isolation Valves

Reactor Coolant Drain Tank

RCDT Pumps
RCDT Pump Outlet Isolation Valves
RCDT Vent Isolation Valve

Sample System

PZR Surge Line Sample Valve
PZR Vapor Space Sample Valve
Hot Leg Sample Valves

Containment Normal HVAC

Containment Recirculation Unit and Heater
Containment Normal Coolers and Heaters
Containment Normal Cooler Valves
Containment Lower Area Fans
Containment Normal Chilled Water Supply/Return Valves
Containment Airborne Rad Monitor Isolation Valves
Containment Mini-purge Supply and Return Valves
Reactor Vessel Cavity Cooling Fans
Reactor Vessel Cavity Fans Discharge Dampers
Control Element Drive Mechanism (CEDM) Cooling Fans
CEDM System Cooling Water Supply/Return Valves
CEDM System Cooler Suction Dampers

Emergency HVAC

Hydrogen Recombiners
Hydrogen Monitor Isolation Valves
Dome Air Circulating Fans
Containment Emergency Coolers

VII. Effects of Spray on Lagging

UFSAR Section 6.2.2.1.2.6 and associated Table 6.2-32 describe the insulation used, its requirements, and the installation locations within containment. Metal reflective insulation is used exclusively on stainless steel primary components. Secondary side components use metal encapsulated non-metallic insulation. All insulation assemblies are designed to be self supporting (except for the reactor vessel) and are designed to remain intact during and after a LOCA. As only reflective insulation is used on the stainless steel primary components, chloride attack is not a concern.

VIII. Accounting of RWST Water Sprayed Into Containment

It has been determined that approximately 4800 gallons of water were introduced into containment. Factors which were used in this determination included containment sump level indication, volume flow rate and run time of the containment sump pumps, and losses due to evaporation and cleanup.

IX. Evaluation of Spray Effects on Trisodiumphosphate (TSP)

During the inspection of containment described above, all five TSP racks were inspected for evidence of borated water intrusion from the inadvertent containment spray actuation. A small amount of standing water was noted on top of one of the five racks (CR053). The remaining racks did not show evidence of being wetted. CR053 and another rack were opened and the TSP was visually inspected. Small drip holes were noted in the TSP in rack CR053; there was no evidence that the TSP in the other rack had been wetted. The small drip holes in the TSP in rack CR053 indicates that a negligible amount of water had entered the rack and removed an insignificant amount of TSP.

The average TSP level in the two TSP racks was observed to be approximately 0.25 to 0.50 inch above the minimum level mark in the racks. The TSP level in the remaining three racks were above the minimum level during the last surveillance; there is no reason to believe that their TSP level has changed. Based on these observations, a conservative calculation of the total TSP volume indicates a volume of approximately 18,275 pounds or 1264 pounds above the Technical Specification minimum of 17,461 pounds.

Based on the above observations and calculation, the amount of TSP removed from rack CR053 is considered insignificant and the present condition and quantity of TSP is considered acceptable.

LONG TERM ACTIONS

I. During the next refueling outage, scheduled for summer 1991, the following actions will be taken:

- o Snubbers

  Consistent with the normal refueling interval surveillance of mechanical snubbers, a 100% visual inspection and a functional inspection of a sample of snubbers which is determined in accordance with the Technical Specifications will be performed. In addition, all mechanical snubbers which may have been sprayed or show evidence of moisture, and which are oriented such that they could collect moisture in their inertia mass housings, will be manually stroked.

- o Carbon Steel Piping

  A sample of carbon steel piping will be inspected for indications of deterioration resulting from residual boric acid.

II. A review will be performed of industry experience with containment spray actuations. SCE will follow-up with plants having experienced containment spray to determine if there were any long term effects. A review will be conducted of industry information and NSSS suppliers to determine any other long term corrosion problems which may need to be addressed. The long term actions will be modified, if appropriate, based on this prior experience.