ATTACHMENT

To NRC IR 50-302/92-25 MAR 1 8 1991

MEMORANDUM FOR: Thomas T. Martin, Regional Administrator
Region I

Stewart D. Ebneter, Regional Administrator
Region II

A. Bert Davis, Regional Administrator
Region III

Robert D. Martin, Regional Administrator
Region IV

John B. Martin, Regional Administrator
Region V

FROM: Thomas E. Murley, Director
Office of Nuclear Reactor Regulation

SUBJECT: INADVERTENT CONTAINMENT SPRAY EVENTS AT COMMERCIAL NUCLEAR POWER PLANTS

The Division of Systems Technology (DST) recently completed an evaluation to determine the appropriate course of action for licensees to take following an inadvertent containment spray event. The staff's review was initiated following the most recent of these events which occurred at San Onofre Nuclear Generating Station, Unit No. 2, on November 20, 1990. It is interesting to note that 12 of these events have occurred over the past 10 years, six of which occurred during Mode 1 operation.

Based on its review, DST concluded that each containment spray event should be evaluated by the licensee and action should be taken as appropriate based on the results of that evaluation. Unless the specific circumstances of the event dictate otherwise, the licensee should recover from the containment spray event, perform an immediate assessment of existing plant conditions, and develop an action plan to fully address the consequences of the event. Any deficiencies identified should be evaluated in terms of generic implications and appropriate corrective actions should be taken, including reactor plant shut down if warranted.

Although the frequency of inadvertent containment spray events appears to be decreasing, it is likely that these events will continue to occur occasionally. Because an event of this nature can cause significant degradation of plant

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equipment, it is important that the Regions follow these events very closely to assure that licensee actions are appropriate for the circumstances involved. I have enclosed a copy of the staff's SE for your information and future reference.

Original signed by
Thomas E. Murley

Thomas E. Murley, Director
Office of Nuclear Reactor Regulation

Enclosure:
Safety Evaluation

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Enclosure

SAFETY EVALUATION BY THE DIVISION OF SYSTEMS TECHNOLOGY
REGARDING INADVERTENT CONTAINMENT SPRAY EVENTS AT COMMERCIAL
NUCLEAR POWER PLANTS

1.0 INTRODUCTION

On November 20, 1990, an inadvertent containment spray actuation occurred at San Onofre Nuclear Generating Station, Unit No. 2 (SONGS-2). The unit was operating at 100 percent power when approximately 5,000 gallons of borated water was sprayed into containment during surveillance testing. Southern California Edison Company (SCE or the licensee) opted not to shutdown SONGS-2 immediately following this event based on previous experience with a similar event that occurred in 1984 at SONGS-2. Following the 1984 event, SCE conducted a detailed inspection and testing program to evaluate the effects of containment spray on equipment and, based on the results of that evaluation, SCE judged that the borated water that was sprayed during the event did not have any immediate adverse effects on safety-related equipment. Therefore, SCE judged that SONGS-2 could continue to operate following the 1990 event while a thorough evaluation was completed. It was not until SCE found a ground indication associated with one of the control element drive mechanism (CEDM) motor generator sets that SCE decided to shutdown SONGS-2 in order to perform additional troubleshooting and repair of the CEDMs, and SONGS-2 was subsequently shutdown on November 23, 1990. The licensee provided a description of its actions following this event in a letter dated November 27, 1990, and Licensee Event Report (LER) No. 90-14 was submitted for SONGS-2 regarding this event on December 20, 1990.

Following the SONGS-2 event, the Division of Systems Technology (DST) was requested to evaluate whether the actions taken by SCE were appropriate and in general to determine the appropriate course of action for licensees to take following a containment spray event. Therefore, the purpose of this safety evaluation (SE) is to address these issues and to provide recommendations as appropriate.

2.0 REVIEW METHODOLOGY

In order to determine whether SCE's actions in response to the containment spray event of November 20, 1990, were acceptable and in developing a position regarding what the appropriate licensee response should be following a containment spray event, the staff reviewed information to determine what effects containment spray could have on plant systems and components. In this regard, DST reviewed information pertaining to previous containment spray events and other industry experiences that may have some relevance. DST also considered Technical Specification requirements and environmental qualification requirements during the review.

3.0 PREVIOUS CONTAINMENT SPRAY EVENTS

Following the containment spray event that occurred at SONGS-2 on November 20, 1990, the Office for Analysis and Evaluation of Operational Data (AEOD) performed

a study of previous containment spray events that have occurred. The results of that study were documented in a memorandum dated December 6, 1990. The AEOD study concluded that "...there was a limited amount of short term damage caused by these events. Some electrical equipment was degraded due to electrical shorts and corrosion. The fact that electrical equipment inside containment must be designed to operate during postulated accident environments (e.g., hot and wet) appears to have limited the damage to safety-related equipment..."

The data compiled by AEOD regarding containment spray events is represented in Table 1. A review of this data indicates that the containment spray events to date have had minimal impact on both safety-related and on nonsafety-related equipment. Of the six events that occurred during power operation, only one event was identified where the licensee decided to shut down the reactor to facilitate subsequent inspection and testing activities (Oyster Creek; December 21, 1983). Also, one event was identified where an inadvertent ECCS actuation initiated emergency boration which caused the reactor to shut down in addition to initiating containment spray (San Onofre 2; March 9, 1984). The amount of water sprayed during inadvertant containment spray events ranged typically from several hundred gallons to several thousand gallons.

For the most part, the LERs reporting previous containment spray events did not provide much detail regarding actions taken to identify and resolve equipment deficiencies resulting from these events and specific deficiencies identified during subsequent follow-up inspections were not described (the LERs for the Kewaunee event (305/85-01) and the Calvert Cliffs event (317/87-08) were a little better than the other LERs in this respect). Although the LERs were lacking in details of this nature, licensees typically concluded that safety-related equipment was not damaged as a result of the containment spray events.

4.0 RELEVANT INDUSTRY EXPERIENCE

DST performed an abbreviated review of relevant industry experience and NRC generic communications in order to identify potential effects that containment spray events could have on plant equipment. The review focused principally on moisture intrusion and corrosion problems.

Information Notice 84-57, "Operating Experience Related to Moisture Intrusion in Safety-Related Electrical Equipment at Commercial Power Plants," dated July 27, 1984, and Information Notice 89-63, "Possible Submergence of Electrical Circuits Located Above the Flood Level Because of Water Intrusion and Lack of Drainage," dated September 5, 1989, discuss potential electrical equipment problems that can occur as a result of moisture intrusion. In most instances, moisture intrusion will cause electrical components to short-circuit, corrode, and ultimately fail. Additional industry experience indicates that, given the proper circumstances, snubbers can become inoperable as a result of prolonged submergence and boric acid solutions can cause significant corrosion and degradation of carbon steel materials. However, DST believes that for the most part, these effects are either immediately obvious or occur over a prolonged period of time such that licensees may evaluate the effects of moisture intrusion on plant equipment without necessarily shutting down the reactor.

TABLE 1

COMPILATION OF CONTAINMENT SPRAY EVENTS

Facility	Event Date	Mode	Amount Sprayed	Comments
St. Lucie 1 (PWR)	11/3/78	5	2000 gal	No damaged equipment (LER 335/78-041)
NO 2 (PWR)	4/8/80	3	300 gal	Effect on equipment not specifically addressed (LER 368/80-24)
Sequoyah 1 (PWR)	2/11/81	5	100,000 gal	Effect on equipment not specifically addressed (LER 327/81-21)
San Onofre 1 (PWR)	9/25/81	5	400 gal	No damaged equipment (LER 206/81-23)
Oyster Creek (BWR)	12/21/82	1	2200 gal	Plant was shutdown for testing and inspection (no LER)
Kewaunee (PWR)	2/21/83	1	--	ICS operated for 15 sec. containment inspected, no damage (LER 305/83-06)
ANO 2 (PWR)	3/8/83	1	2450 gal	Visual inspection, no damage (LER 368/83-15)
San Onofre 2 (PWR)	3/9/84	1	6000 gal	ECCS actuation also caused emergency boration and plant shutdown, inspection and testing performed, no damage (LER 361/84-16)
Palisades (PWR)	7/19/84	4	3000 gal	Effect on equipment not specifically addressed (LER 255/84-11)
Pilgrim 1 (BWR)	9/29/84	6	10,000 gal	Damage to lagging (LER 293/84-15)

TABLE 1 CONTINUED

Facility	Event Date	Mode	Amount Sprayed	Comments
Kewaunee (PWR)	1/22/85	1	2500 gal	Plant shutdown on 2/8/85 for refueling, misc. spurious indications related to nonsafety-related equipment, battery ground alarms on A and B batteries, subsequent spurious start of RCP on 2/10/85 (LER 305/85-01)
Waterford 3 (PWR)	2/20/85	3	500 gal	Minor ground on polar crane, isolation of CCW caused degradation of RCP seals (LER 382/85-06)
Calvert Cliffs 1 (PWR)	4/14/87	5	4000 gal	Inspection and testing conducted, no damaged equipment (LER 317/87-08)
San Onofre 2 (PWR)	11/20/90	1	5000 gal	Inspection and testing, subsequent shutdown due to degraded CEDM electrical connectors (SCE letter 11/27/90; LER 361/90-14)

5.0 TECHNICAL SPECIFICATION AND ENVIRONMENTAL QUALIFICATION REQUIREMENTS

Technical Specification requirements specify limiting conditions for operation (LCOs) that must be satisfied during various modes of reactor operation. The Technical Specifications do not specifically require that reactors be shut down following containment spray events, but licensees must satisfy LCO requirements for equipment that becomes degraded as a result of these events. Additionally, depending on the specific circumstances involved, certain LCOs may be directly impacted following containment spray events and these LCOs deserve special consideration. For example, reactor coolant system leakage detection systems may become degraded, the ability to satisfy operational leakage surveillance requirements may be impacted, the inventory of trisodium phosphate (for iodine removal) may be affected, ice condenser performance capability may be degraded, refueling water storage tank level may be reduced, etc. Therefore, specific actions required by Technical Specifications following containment spray events will depend on the actual circumstances involved and licensees should proceed accordingly.

Safety-related equipment located inside containment must be environmentally qualified in accordance with 10 CFR 50.49 requirements and, to a large degree, this helps to minimize the adverse effects that containment spray will have on this equipment. However, environmental qualification (EQ) requirements vary depending on how long the component must function following an accident. Some components may only be qualified to function for a few minutes into an accident while others may be qualified to function for the duration of the accident. Depending on the circumstances, containment spray events could jeopardize the qualification status of components that are not required to operate post-accident. Therefore, the EQ status and operability of equipment located inside containment must be evaluated in detail following containment spray events and corrective actions must be taken as appropriate.

6.0 STAFF POSITION

The information reviewed by DST as discussed in this safety evaluation indicates that inadvertent containment spray events do not necessarily pose an immediate nuclear safety hazard and reactor shutdown following such events may not be necessary. In fact, an immediate reactor shutdown following a containment spray event could make it difficult to fully assess the effects of the event on plant equipment and could further confuse the situation if any complications occur while shutting down the plant. Additionally, Technical Specification requirements and EQ requirements do not impose restrictions on continued reactor operation following containment spray events. Therefore, unless the specific circumstances of the event suggest otherwise, continued reactor operation following containment spray events is acceptable. However, continued operation must be supported by an immediate assessment of plant conditions and an action plan must be developed to fully evaluate the consequences of the event on plant systems and components. Any deficiencies identified should be evaluated in terms of generic implications and corrective actions should be taken as appropriate, which could include subsequent reactor shutdown.

As a minimum, the licensee's immediate assessment of plant conditions should include the following considerations:

(a) Duration of the event and the amount of water sprayed.

(b) Spurious equipment actuations, ground indications, and alarms.

(c) Compliance with Technical Specification requirements.

The licensee's action plan to fully evaluate the consequences of the event on systems and components should include as a minimum the following elements and considerations:

(a) Personnel hazards.

(b) Duration of the event and the amount of water sprayed.

(c) Containment type and configuration of systems and components located inside containment.

(d) Appearance of accessible areas of containment.

(e) Control room indication and annunciation.

(f) Operability of safety-related equipment and compliance with Technical Specification requirements.

(g) Operability of nonsafety-related equipment and electrical interaction considerations.

(h) Containment spray system status and boron precipitation considerations.

(i) Status of snubbers and long term effects.

(j) Status of equipment qualification and long term effects.

(k) Status of materials and long term effects (i.e., accelerated corrosion of carbon steel, thermal shock, etc.).

(l) Development of short term and long term inspection, testing, and surveillance programs.

(m) Previous industry experience.

The actions taken by SCE in response to the SONGS-2 containment spray event of November 20, 1990, as described in their letter dated November 27, 1990, satisfies the staff's position on this issue and are therefore acceptable in most respects. However, in reviewing the November 27 letter, it is not apparent that SCE completed a detailed review of Technical Specification requirements following the event, and SCE's planned review of industry experience should not be narrowly focused on previous containment spray events but should also include a review of industry experience and

NRC generic communications that may be relevant (i.e., moisture intrusion problems, boric acid corrosion problems, etc.). SCE should take action as appropriate to correct these weaknesses.

As a comparison, DST would question the decision that was made by Wisconsin Public Service Corporation to continue reactor plant operation following the Kewaunee containment spray event of January 22, 1985 (see Table 1). The battery ground alarms could have been indicative of seriously degraded safety-related equipment, and the generic implications relative to EQ would have to be addressed. In this case, continued operation may not have been appropriate. Therefore, it is important to recognize that the Regions must play an important role in following events of this nature and in assuring that the actions taken by licensees are appropriate.

The staff's position is based in part on an abbreviated review of industry experience as discussed in Section 6.0 of this safety evaluation. SCE plans to complete a detailed review of industry experience as part of their continuing evaluation of the SONGS-2 containment spray event, and DST will review the details and results of SCE's study to assure that the staff's position on this matter remains valid.

7.0 CONCLUSION

Based on the foregoing evaluation, DST has concluded that continued reactor operation following inadvertent containment spray events is acceptable provided that the specific circumstances of the event do not warrant immediate reactor shutdown. In addition, the actions taken by SCE in response to the SONGS-2 containment spray event of November 20, 1990, are acceptable in most respects. However, some improvements should be made in SCE's evaluation as discussed in Section 6.0 of this SE.

Author: J. Tatum

Date: January 29, 1991

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HAROLD B. RAY
SENIOR VICE PRESIDENT

TELEPHONE
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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.

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 3 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
[redacted] Project Manager, SONGS 2 and 3

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.