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Manager of
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October 13, 2004

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: **Docket Nos. 50-361 and 50-362**
NRC Bulletin 2003-01
Response To NRC Request For Additional Information
San Onofre Nuclear Generating Station Units 2 and 3

References: 1) Letter from A. E. Scherer (SCE) to the Document Control Desk (NRC) dated August 1, 2003; Subject: San Onofre Nuclear Generating Station Units 2 and 3, Docket Nos. 50-361 and 50-362, 60-Day Response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors"

2) Letter from Bo M. Pham (NRC) to Harold B. Ray (SCE) dated September 7, 2004; Subject: San Onofre Nuclear Generating Station (SONGS) – NRC Bulletin 2003-01 re: Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors (TAC NOS. MB9610 and MB9611)

Dear Sir or Madam:

By Reference 1, Southern California Edison (SCE) submitted a 60-day response to NRC Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors."

By Reference 2, NRC staff has requested additional information regarding our submittal in order for the staff to continue its review of the submittal.

Enclosed is the SCE response to the request for additional information.

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If you have any questions or require any additional information, please contact Mr. Jack Rainsberry at (949) 368-7420.

Sincerely,

Enclosure

cc: B. S. Mallett, NRC Region IV, Regional Administrator
B. M. Pham, NRC Project Manager, San Onofre Units 2 and 3
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 and 3

ENCLOSURE

SCE RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3

SOUTHERN CALIFORNIA EDISON COMPANY

NRC BULLETIN 2003-01

DOCKET NOS. 50-361 AND 50-362

The following questions are provided after a preliminary review of Southern California Edison's (SCE's) submittal dated August 1, 2003 (Reference 1), in response to NRC Bulletin 2003-01 of June 9, 2003.

1. **On page 5 of Attachment 1 of your Bulletin 2003-01 response, you state: "Licensed operator requalification training will be completed by November 30, 2003 to address loss of flow/loss of pump suction while in** [the] **recirculation mode of emergency core cooling. The training will address indications of sump clogging and subsequent Severe Accident management Guidelines." However, your response does not completely discuss the operator training to be implemented. Please provide a detailed discussion of the operating procedures to be implemented, the indications of sump clogging that the operators are instructed to monitor, and the response actions the operators are instructed to take in the event of sump clogging and loss of ECCS recirculation capability.**

Response to question number 1:

Licensed operator requalification training was conducted from October 7, 2003 through November 4, 2003. Acronyms used in this response include:

CS	Containment Spray
EOI	Emergency Operating Instruction
FS	Floating Step
HPSI	High Pressure Safety Injection
LOCA	Loss Of Coolant Accident
LPSI	Low Pressure Safety Injection
RAS	Recirculation Actuation Signal, or, in some contexts, Containment Emergency Sump
RWST	Refueling Water Storage Tank
SBLOCA	Small Break Loss Of Coolant Accident
SFSC	Safety Function Status Check
SI	Safety Injection
WOG	Westinghouse Owners Group

Operating Procedures

The training emphasized that at the time of the training, no changes to SONGS procedures had yet been made in response to NRC Bulletin 2003-01. Possible procedure changes then under consideration were discussed, including the 10 possible changes proposed by Westinghouse (PA-SEE-085):

1) Throttle / Stop Containment Spray, 1 or both trains.
2) Pre-align 1 train to RAS, other train to remain on RWSTs.
3) Terminate 1 train SI after RAS (assumes both are running).
4) Review LPSI early termination prior to RAS.
5) Refill RWST from all possible sources.
6) Injecting water from a refilled / dilute source.
7) Aggressive cooldown / depressurization for SBLOCA.
8) Add guidance on symptoms / identification of Sump blockage.
9) Add contingency actions in response to blockage.
10) Evaluate changing SI Throttle / Stop criteria (earlier termination)

At the time, the WOG was reviewing this information for possible impact and change to the EOIs. Simulator training re-emphasized these 10 items and allowed the operators to perform the " RAS Actuation"attachment.

Indications of Sump Clogging

The instructor reviewed generic Containment Emergency Sump concerns with the operators and solicited suggestions on recognition of sump degradation. The instructor was provided with key points that identified symptoms of cavitation on pumps taking suction from the sump, namely, low or oscillating pump flow and motor amps.

Response Actions

The lesson plan reemphasized that at the time of the training, no changes had been made to the SONGS EOIs in response to NRC Bulletin 2003-01. The lesson plan reviewed the following actions.

o The WOG is looking at possible procedure changes that might delay switchover to containment sump recirculation (e.g., shutting down redundant pumps that are not necessary to provide required flows to cool the containment and reactor core, and operating the Containment Spray System intermittently).

o Actions that already exist in the EOIs that could assist:
-FS-14, TERMINATE Containment Spray Operation (allows stopping CS Pumps and extends time to RAS)
-FS-20, MONITOR RWST Level (maintains awareness of RWST inventory)
-FS-21, VERIFY RAS Conditions Established (initiates Attachment 14, RAS Actuation, which includes HPSI Protection – flow requirement)

-Attachment 14, RAS Actuation (If inadequate Sump Level, evaluates need for RWST inventory)
-SFSC (Figure 1 provides minimum SI flow requirements during Cold Leg Injection and Figure 2 provides minimum HPSI flow during simultaneous hot/cold leg injections.)
-SFSC (LOCA) for Containment Pressure/Temperature (gives minimum CS flows with or without Emergency Cooling Units)

o SONGS already has proceduralized methods to refill the RWST or to otherwise provide inventory to inject into the reactor core and spray into the containment atmosphere (direction from Floating Step 20 "Monitor RWST Level" as well as SO23-12-9 main body Step 15 to initiate makeup as required):

- SO23-3-2.2 "Makeup Operations" (can fill at approximately 150 GPM)
- SO23-3-2.11.1 "SFP Level Change and Purification Crosstie Operations" (splits flow from a pump that has a capacity of about 150 GPM)

o SONGS already has Severe Accident Management Guidelines (SAMG) (Note that 10CFR50.54 (x) & (y) apply.)

- Allows for filling the Reactor Cavity using un-borated water (firewater system)
- Throttles SI flow

2. On page 1 of Attachment 1 of your Bulletin 2003-01 response you state: "Additionally, Westinghouse is evaluating potential changes to the guidance in CEN-152. SCE plans to review the potential changes after they become available and make procedural modifications as appropriate." The Westinghouse owners Group (WOG) has developed operational guidance in response to Bulletin 2003-01 for Westinghouse and Combustion Engineering type PWRs. Please provide a discussion of your plans to consider implementing this new WOG guidance. Include a discussion of the WOG recommended compensatory measures that have been or will be implemented at your plant, and the evaluations or analyses performed to determine which of the WOG recommended changes are acceptable at your plant. Provide technical justification for those WOG recommended compensatory measures not being implemented by your plant. Also include a detailed discussion of the procedures being modified, the operator training being implemented, and your schedule for implementing these compensatory measures.

Response to question number 2:

Background

- SONGS has performed an analysis for emergency sump operability in A-98-NM-002, "Post-LOCA Emergency Sump operability in presence of loose coatings and other

debris." The analysis shows that the containment emergency sump would be able to supply a sufficient amount of water to the Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) in the recirculation mode.

The maximum velocity through a large, unblocked passage toward the emergency sump would be 0.13 feet per second. The SONGS emergency sumps were tested and analyzed in full scale model testing and hydraulic model studies contained in two reports, SO23-611-1-7, "Final Report on Hydraulic Model Studies of Containment Emergency Sump Intakes," Western Canada Hydraulic Laboratories, 1979, and SO23-611-1-2, "Hydraulic Model Studies of Containment Emergency Sump Recirculation Intakes with Revised Operating Water Levels," Western Canada Hydraulic Laboratories, 1990.

The insulation of the Reactor Coolant System piping, the pressurizer, and the primary side of the steam generators at SONGS is Reflective Metal Insulation (RMI) as described in UFSAR Section 6.2.2.1.2.6. The secondary side of the steam generators is insulated in stainless steel encapsulated mineral wool also described in the same UFSAR section. NUREG-0897, "Containment Emergency Sump Performance", Revision 1, states in Section 3.3.1(5): "Both fibrous insulation and reflective metallic insulation (RMI) debris fragments transport at low velocities (0.2 to 0.5 ft/sec).". Since the maximum approach velocity to the sump is 0.13 feet per second it is unlikely that insulation debris generated by the LOCA will be transported to the sump.

The aforementioned Western Canada Hydraulic Laboratories studies performed two separate full-scale tests of SONGS emergency sumps in 1979 and 1990 to demonstrate that SONGS 2 & 3 containment emergency sump recirculating intakes will not be subjected to degrading effects on sump performance. The most recent and limiting test was performed in 1990, and the results were documented in SO23-611-1-2. The first two portions of this test were performed to identify blockage configurations that were most prone to vortex formation and air ingestion. The three worst-case configurations, which were used in third stage tests, had blockage ratios of 67%, 75.5% and 83.5%. The blockage in the third stage tests was simulated by fixing vertical metal plates to the trash rack surrounding the sump. These tests were performed at higher flow rates than those for LOCA conditions at SONGS. The tests examined the maximum water level where air bubble ingestion occurred. For each of the three scenarios, the water level was between 18.5 and 18.8 feet. Calculation CCN-4 to N-0240-006 gives the minimum post-LOCA water level inside of containment as 19.078 feet, which is greater than the maximum water level that caused air ingestion in the three scenarios.

Based on the preceding discussion it is considered unlikely (compared with LOCA events) that the SONGS emergency sumps will be prevented from performing their safety function following a LOCA.

CEN-152 Revision 5.3 Assessment

SONGS has determined that some of the procedural modifications recommended by the Westinghouse Owners Group (WOG) in Revision 5.3 to CEN-152 may be risk adverse at

SONGS. Qualitative risk assessments considered potential risk-negative aspects of procedural modifications that would reduce the Safety Injection flow during containment sump recirculation. Comparisons were made with potential risk-positive aspects of procedural modifications. Potential risk-negative aspects include the increase in the likelihood of operator error and the increase in the likelihood of failure of equipment that is redundant to equipment that experiences a random single failure. In some cases, the risk-negative aspects were judged to outweigh the risk-positive aspects.

In those cases, SONGS is not adopting the procedural steps recommended in Revision 5.3 to CEN-152. Technical justification is provided on a step-by-step basis later on in this Enclosure. The WOG-recommended measures that SONGS will be adopting and their supporting analyses are discussed below.

CEN-152 Revision 5.3 Steps That WILL Be Implemented

Loss of Coolant Accident Recovery Guideline

1. **LOCA Step 12B Containment Spray Termination Criteria**

   Action to be Taken: No action required to EOI *SO23-12-3, Loss of Coolant Accident.* The only change that will be required is in the bases document. CEN-152 addresses this step as a "Continuously Applicable Step or Non-Sequential Step" and moved it up to Step 12, from Step 37; SONGS has this incorporated as Floating Step ***FS-14, TERMINATE Containment Spray Operation*** and does not need to make any change.

   Supporting Analysis Required: None.

2. **LOCA Step 21A Line up for RWT Refill or alternate RCS Injection**
   a. [Initiate actions to makeup to the RWT]

   Action to be Taken: Will provide direction in the EOIs to commence lining up additional water sources to the Refueling Water Storage Tank (RWST).

   Supporting Analysis Required: None.

3. **LOCA Step 37B Refill RWT**

   Action to be Taken: Will add necessary steps to ensure refill of the RWST is commenced.

   Supporting Analysis Required: None.

4. **LOCA Step 37C. Monitor for loss of ECCS pump suction.**

Action to be Taken: This step will be added to the *SO23-12-11, EOI Supporting Attachments*, as a new floating step: *"Monitor ECCS Pump(s) Suction"*. Parameters to be used will follow CEN-152 guidelines. Contingency actions will address: 1) performing a rapid cooldown and depressurization of the RCS using the secondary system to reduce break flow (RCS mass loss), thereby reducing the need for ECCS makeup flow and 2) ensuring all available normal and emergency containment cooling units are in operation to maximize containment heat removal and support indirect cooling of the RCS and reactor core.

Supporting Analysis Required: None.

Functional Recovery Guideline – Inventory Control

1. **FR IC-2 Step 9A Refill RWT**
   a. [Initiate actions to makeup to the RWT]

   Action to be Taken: Will provide direction in the EOIs to commence lining up additional water sources to the RWST.

   Supporting Analysis Required: None.

2. **FR IC-2 Step 12B Refill RWT**

   Action to be Taken: Will add necessary steps to ensure refill of the RWST is commenced.

   Supporting Analysis Required: None.

3. **FR IC-2 Step 12C Monitor for loss of ECCS pump suction**

   Action to be Taken: Same as LOCA Step 37C.

   Supporting Analysis Required: Same as LOCA Step 37C.

Continuing Actions for Inventory Control

1. **Continuing Actions (CA) Step 2A Maximize RCS Cooldown**

   Action to be Taken: This step will be incorporated as a Response Not Obtained (RNO) [CEN-152 refers to this as a contingency action], in a new floating step: *"Monitor ECCS Pump(s) Suction"*.

   Supporting Analysis Required: None.

2. **Continuing Actions (CA) Step 2B Depressurize RCS**

   Action to be Taken: This step will be incorporated as a Response Not Obtained (RNO) [CEN-152 refers to this as a contingency action], in a new floating step: *"Monitor ECCS Pump(s) Suction".*

   Supporting Analysis Required: None.

3. **Continuing Actions (CA) Step 2C Maximize Containment Cooling**

   Action to be Taken: This step will be incorporated as a Response Not Obtained (RNO) [CEN-152 refers to this as a contingency action], in a new floating step: *"Monitor ECCS Pump(s) Suction".*

   Supporting Analysis Required: None.

4. **Continuing Actions (CA) Step 2D Refill RWT or lineup an Alternate Injection Source bypassing the RWT.**
   a. Ensure that the RWT is being refilled from ANY available source.

   Action to be Taken: Will provide direction in the EOIs to commence lining up additional water sources to the RWST.

   Supporting Analysis Required: None.

5. **Continuing Actions (CA) Step 2E Attempt to reestablish SI pump suction from Containment Sump**

   Action to be Taken: Will add step(s) to allow multiple HPSI pump starts to achieve chug flow if emergency sump screens are blocked.

   Supporting Analysis Required: None.

6. **Continuing Actions (CA) Step 2F Attempt to Discharge SITs**

   Action to be Taken: Will add the discharge of the SITs if ECCS sump blockage occurs.

   Supporting Analysis Required: None.

7. **Continuing Actions (CA) Step 2G Inject Refilled RWT to RCS.**

   Action to be Taken: Will provide direction in the EOIs to add additional volume of RWST to Containment.

Supporting Analysis Required: None.

8. **Continuing Actions (CA) Step 2l Establish minimum SDC Entry Requirements and initiate SDC.**

   Action to be Taken: This step changes the SDC entry conditions and allows the SDC to be placed in service if [Representative] CET temperature is [less than superheat] and Reactor Vessel level is greater than [center line of hot leg]. All other parameters remained the same. We will provide direction to allow earlier entry criteria for placing SDC in service.

   Supporting Analysis Required: None.

Long Term Actions

1. FR LTA Step 5 **SDC Entry Conditions Contingency Action**

   Action to be Taken: This step changes the SDC entry conditions and allows the SDC to be placed in service if [Representative] CET temperature is [less than superheat] and Reactor Vessel level is greater than [center line of hot leg]. All other parameters remained the same. We will provide direction to allow earlier entry criteria for placing SDC in service.

   Supporting Analysis Required: None.

   SCE will implement the aforementioned measures, including operator training, byJuly 1, 2005.

Justification of CEN152 Revision 5.3 Steps That Will NOT Be Implemented

Loss of Coolant Accident Recovery Guideline

1. LOCA Step 12A **[Early Termination of Containment Spray Pump(s)]**

Technical Justification: Securing a Containment Spray Pump requires manual operator action to override an automatic safety function. During normal operation, the pumps are in standby mode and aligned for emergency operation. The pumps automatically start upon receipt of a 2 out of 4 Safety Injection Actuation Signal (SIAS). The operators would be required to place the hand-switch in override and depress the stop button. In addition to securing the pump, the associated outside containment isolation valve would be required to be closed to ensure that containment integrity is maintained. During normal plant operations the outside containment isolation valves are closed and open on a Containment Spray Actuation Signal (CSAS) of 14 psig. Additionally, a restart of the Containment Spray Pump would introduce a distraction and require additional manual operator action to re-open these valves to initiate containment spray from the idle train. Shutting down a Containment Spray pump increases risk because, in the case of a failure of an operating pump, operator action would be required to restart the shut-down pump, and the pump

being restarted would be subject to the potential for another demand failure (subsequent to the initial demand in response to an engineered safeguards actuation). Hence, the operator failure probability in responding to a LOCA event could increase, given the short time available for operator intervention and performing additional manual actions. In summary, since the proposed procedural modification would benefit an unlikely event (i.e., SONGS emergency sump failure), and would adversely affect the equipment and the operators in mitigating a LOCA event, it has been determined that the net effect would be an increase in risk.

2. LOCA Step 21A **[Line up for RWT Refill or alternate RCS Injection]**
   [b. Initiate actions to lineup to inject directly to the RCS bypassing the RWT]

Technical Justification: Bypassing the Refueling Water Storage Tank (RWST) for alternate RCS injection would involve a complex valve lineup during an extraordinary event. The human failure probability in carrying out this complex task during a LOCA event would be high. Additionally, the distraction this activity represents during a LOCA would represent an error likely situation and should be avoided. The high human failure probability in performing this complex task and its negative impact on operators' timely response to a LOCA event, together with the unlikelihood of SONGS emergency sump failure, would make this procedure modification a net risk increase factor. RWST refill already covered in this step as Step 21A.a has already been addressed and will be incorporated.

3. LOCA Step 35 **RAS Initiation Criteria**
   [g. Ensure that the auto-start function for all idle CS pumps is disabled.]

Technical Justification: The Containment Spray pumps and associated containment isolation valves are not affected by RAS. SONGS can go to OVERRIDE and STOP on the Containment Spray pumps once a SIAS is received. However, we cannot go to OVERRIDE and CLOSE on the Containment isolation valves until after a CSAS is received. This would leave us in an undesirable condition of having to monitor for the initiation of CSAS or having to dispatch an operator to disable the outside Containment Isolation valve prior to CSAS initiation.

4. LOCA Step 37A **Post RAS HPSI stop criteria**

Technical Justification: Securing a High Pressure Safety Injection (HPSI) pump requires manual operator action to override an automatic safety function. During normal operation, the pumps are in standby mode and aligned for emergency operation. The pumps automatically start upon receipt of a 2 out of 4 Safety Injection Actuation Signal (SIAS) initiation to supply borated water to the Reactor Coolant System. The operators would be required to place the hand-switch in override while depressing the stop button. Shutting down a HPSI Pump increases risk because, in the case of a failure of an operating pump, operator action would be required to restart the shut-down pump, and the pump being restarted would be subject to the potential for another demand failure (subsequent to the initial demand in response to an engineered safeguards actuation). Additionally, the operator failure probability in responding to a LOCA event could increase, given the short time available for operator intervention and performing additional manual actions.

In summary, since the proposed procedural modification would benefit an unlikely event (i.e., SONGS emergency sump failure), and would adversely affect the equipment and the operators in mitigating a LOCA event, it has been determined that the net effect would be an increase in risk.

Functional Recovery Guideline – Inventory Control

1. FR IC-2, Step 3.A. **Early Termination of Containment Spray Pump(s)**
   Technical Justification: Same as LOCA Step 12A.

2. FR IC-2, Step 9A. **Line up for RWT Refill or alternate RCS Injection**
   [b. Initiate actions to lineup to inject directly to the RCS bypassing the RWT]

   Technical Justification: Same as LOCA Step 21A.b.

3. FR IC-2, Step 11 **RAS Initiation Criteria.**
   [g. Ensure that the auto-start function for all idle CS pumps is disabled.]
   Technical Justification: Same as LOCA Step 35.

4. FR IC-2, Step 12A. **Post RAS HPSI stop criteria**
   Technical Justification: Same as LOCA Step 37A.

Continuing Actions for Inventory Control

1. FR IC Continuing Actions (CA) Step 2D. **Refill RWT or lineup an Alternate Injection Source bypassing the RWT.**
   b. Ensure that ANY available source is being lined up for injection to the RCS.

   Technical Justification: This is very similar to LOCA Step 21A and the technical justification is the same.

2. **FR IC Continuing Actions (CA) Step 2H Inject Alternate Source to RCS**

   Technical Justification: This is very similar to LOCA Step 21A and the technical justification is the same.

Functional Recovery – Heat Removal

1. FR HR-2, Step 44 **RAS Initiation Criteria.**
   [g. Ensure that the auto-start function for all idle CS pumps is disabled.]

   Technical Justification: Same as LOCA Step 35.

2. FR HR-2, Step 45A **Post RAS HPSI stop criteria**

   Technical Justification: Same as LOCA Step 37A.

3. FR HR-3, Step 13 **RAS Initiation Criteria**.
   [g. Ensure that the auto-start function for all idle CS pumps is disabled.]

   Technical Justification: Same as LOCA Step 35.

4. FR HR-3, Step 14A **Post RAS HPSI stop criteria**

   Technical Justification: Same as LOCA Step 37A.

Functional Recovery – Containment Temperature and Pressure Control

1. FR CTPC-3, Step 1A **Early Termination of Containment Spray Pump(s)**

   Technical Justification: Same as LOCA Step 12A.

3. NRC Bulletin 2003-01 provides possible interim compensatory measures licensees could consider to reduce risks associated with sump clogging. In addition to those compensatory measures listed in Bulletin 2003-01, licensees may also consider implementing unique or plant-specific compensatory measures, as applicable. Please discuss any possible unique or plant-specific compensatory measures you considered for implementation at your plant. Include a basis for rejecting any of these additional considered measures.

Response to question number 3:

Southern California Edison did not consider any unique or plant-specific compensatory measures beyond those provided in NRC Bulletin 2003-01.